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ENCYCLOPEDIA BRITANNICA

VOLUME 2

ANNUAL REGISTER TO BALTIC SEA

ANNUAL REGISTER, the title of an annual periodical begun with a volume giving "a view of the history, politicks and literature of the years 1758," by R. Dodsley, with Edmund Burke as editor. Burke had £100 a year for his services, but never acknowledged his relation to the *Annual* Register, and the extent of his contributions remains uncertain; he is thought to have continued in charge till about 1788, and to have inspired his successors (Dr. Walker King, afterwards bishop of Rochester, and Dr. Richard Laurence, afterwards archbishop of Cashel) till his death. The *Annual* Register was published by Dodsley's firm till 1790, when the copyright of already issued volumes was bought by Rivington and the stock by Otridge and others. In the earlier volumes the historical section was basically little more than an abridgment of parliamentary debates, but since 1863 this has given place to a more continuous and comprehensive type of narrative.

ANNUALS, in botany, the name applied to plants which complete their life-cycle in one year, in contradistinction to biennials (*q.v.*), which require two years and perennials (*q.v.*), which live for an indefinite number of years.

ANNUITY, in the simplest sense of the word, denotes a payment made yearly The term is also applied to any series of periodical payments which fulfil the essential condition that they are made at regular fixed intervals. Thus an annuity may be payable yearly, half-ycarly, quarterly, monthly, or even more frequently. It is, however, the total sum payable in the year, sometimes called the annual *rent,* which is adopted for the purpose of describing the magnitude of the annuity. Hence a person in receipt of a quarterly payment of £25 is said to possess an annuity of £100 payable by quarterly instalments.

In technical terminology an annuity is said to be payable during a given status, this being a word equally appropriate when the annuity is payable for a definite term of years and when the duration is dependent upon some contingency. The most general definition of an annuity is therefore a series of payments made at regular intervals during the continuance of a given status.

The word annuity is sometimes used to denote an individual payment of a series, particularly in such phrases as "the first year's annuity." This usage, which has come into prominence in connection with the settlement of obligations contracted during the World War, is inaccurate and should be avoided.

There are two main classes of annuities: — annuities-certain, in which the payments are to continue during a fixed term of years, and **life** *annuities,* in which the duration of the payments is contingent upon the survivance of a given life or combination of lives. If the word annuity is used alone, unaccompanied by another word or qualifying phrase a life annuity generally is meant.

Within these two main classes there are various types of annuities to which special technical designations have been allotted. Unless otherwise stated, the first payment of an annuity is assumed to be made at the end of the first year in the case of a yearly annuity and at the end of the first interval in the case of an annuity payable by instalments. This form of annuity is called an immediate annuity. An annuity of which the first payment is made at the beginning of the first interval is called an *annuity-due;* if the annuity is not to be entered upon until the lapse of a certain number of years it is called a deferred annuity; if the payments are to continue for ever, it is called a perpetuity.

A continuous annuity is one which is assumed to be paid momently by infinitely small instalments. It would be impossible in actual experience to discover a series of payments precisely conforming to these conditions, but it is obvious that the value of such a series would not differ appreciably from that of a series of payments made daily or even weekly. The conception of continuous payments has permitted the application of the processes of the differential and integral calculus to the computation of annuity values. It has, therefore, been of great practical utility in facilitating the calculations of bodies, *e.g.,* industrial insurance companies, whose revenue and expenditure consist largely of numerous small daily or weekly payments.

The person to whom an annuity is payable is called the *annuitant,* and the life involved is called the nominee. A person who purchases an annuity on his own life is himself at once both annuitant and nominee.

Annuities-certain. — In an annuity-certain the status is a definite term of years, and thus the value of a given series of payments is dependent only upon the operation of interest.

The sum of the amounts of the successive payments accumulated to the end of the period during which the annuity is payable is technically called the *amount* of the annuity, and the sum of the present values of the successive payments is similarly termed the present *value* of the annuity.

The value of an annuity may be regarded as a loan or investment of money whereby the lender or investor becomes entitled

to receive a series of uniform payments consisting partly of interest and partly of repayment of capital. Such a transaction may be considered from two points of view. In the first instance the successive instalments of principal may be at once applied to diminish the amount outstanding at the end of each interval, which will thus be gradually reduced until with the final payment of the annuity the total capital invested is repaid. As the principal is repaid the interest diminishes and, since the combined annual payment is uniform in amount, the liquidation of the debt proceeds at an accelerating pace. Alternatively a uniform portion of each annuity payment may be regarded each year as interest on the original capital and the balance must be set aside and invested, together with all accumulations of interest on it, from time to time at the assumed rate in order that the proceeds may be available to replace the capital at the end of the period when the annuity expires. Such a sum, periodically applied to the redemption of capital, is called a *sinking fund.* If the sinking fund were invested at a rate lower than that assumed, its accumulations at the end of the period would not be sufficient to replace the invested capital. The periodical payments of the annuity are therefore sometimes calculated on the basis that the investor will obtain a specified rate of interest on his capital but will be able to replace the capital only by investing the instalments of sinking fund at a lower rate. The latter rate is technically known as the *reproductive rate,* and the rate realized as the *remunerative rate.* In periods of high income tax the distinction is of importance. The investor must be careful in arranging the transaction to secure that the reproductive rate is the net rate on which he can rely after deduction of tax.

Life Annuities. — A life annuity is a series of payments made during a status dependent upon the survivance of one or more nominees. Its value is governed by the combining of an interest and a mortality factor in each successive payment. If it could be shewn that the rate of mortality at successive ages followed a law which could be represented by means of a mathematical formula, the computation of the value of a life annuity could be effected by the direct application of mathematical processes. Attempts have been made by De Moivre, Gompertz, Makeham, and others to discover such a "law of mortality," hut no simple formula has been found capable of representing rates of mortality with sufficient accuracy. Recourse must, therefore, be had to a table of rates derived from the experience of the particular class of lives to which the nominee belongs.

The simplest form of life annuity, denoted a_x, is that in which a unit is payable at the end of each year so long as the nominee aged x survives. The value of a unit certainly payable at the end of n years is denoted v^n, and the probability of its being received by a person now aged x is ${}_np_x$ where ${}_np_x = \frac{l_{x+n}}{l_x}$, l_{x+n} being the number of survivors at age $x+n$ according to the mortality table out of the l_x persons of present age x. a_x is therefore the sum of the series $\frac{vl_{x+1}}{l_x} + \frac{v^2 l_{x+2}}{l_x} + \ldots$ etc. The computation of even a single value of this simple form of annuity clearly demands a considerable amount of arithmetical work. If, however, the numerator and denominator of each of the terms of the series be multiplied by v^x, $a_x = \frac{v^{x+1}l_{x+1}}{v^x l_x} + \frac{v^{x+2}l_{x+2}}{v^x l_x} + \ldots$ etc. the product $v^x l_x$ may be represented by the symbol D_x and in this notation $a_x = \frac{D_{x+1} + D_{x+2} + \ldots \text{ etc.}}{D_x} = \frac{N_x}{D_x}$. By the device of preparing columns of D and N, technically known as *commutation columns,* not only the derivation of the value of an annuity at one age, but also the construction of a complete table of annuity values is abbreviated and facilitated.

It is a popular misconception that the value of a life annuity is obtained by ascertaining the *expectation of life* of the nominee and calculating the value of an annuity-certain for the resulting term of years. This method is wrong in principle and can easily be shewn mathematically to yield too large a value. This result may, however, be explained thus: — If the expectation of life be n years, the annuity-certain is an annuity of n payments of 1 each, whilst the life annuity consists of a series of payments, ${}_1p_x$ at the end of the first year, ${}_2p_x$ at the end of the second year . . . etc. to the end of life, also amounting in the aggregate to n. In each case the total amount payable is on the average the same, but in the case of the life annuity the payments are spread over a longer period of time and consequently are more affected by discount and have a smaller present value.

It will be apparent as regards a life annuity that the lighter the mortality the greater will be the number of payments to be made and the greater the value of the annuity; similarly the lower the rate of interest the greater will be the discounted value of each payment, with the result that again the value of the annuity is increased.

The value of an annuity payable by instalments throughout the year is greater than that of a yearly annuity owing to the chance of one or more extra payments being received in the course of the year in which the life fails, and to the increased discounted value of the sums paid earlier than at the end of each year. By the Apportionment Act of 1870 all life annuities are *complete* or *apportionable,* i.e., a proportionate pnrt of the payment for the period between the last payment and the date of death is to be paid on that event occurring, unless a special stipulation to the contrary is inserted in the deed creating the annuity. The value of such an annuity therefore exceeds the value of the ordinary or *curtate* annuity, as it is technically called, by, on the average, the value of one-half of an instalment due at the moment of death.

There are numerous varieties of annuities involving more than one life. An annuity to continue so long as all of the nominees survive is called a *joint life annuity;* one to continue so long as any one survives is called a *last-survivor annuity;* one to commence on the failure of a specified life or status and to continue during the existence of another life or status is called a *reversionary or survivorship annuity.* There are also *compound survivorship annuities* payable in certain contingencies such as the failure of specified lives in an assigned order. *Annuities on successive lives* are sometimes required, *e.g.,* in the valuation of advowsons. In the valuation of pension funds and other problems an actuary has to employ annuities involving, in combination with interest and mortality, other elements such as withdrawal, retirement, remarriage, etc. The discussion of these special forms of annuity would introduce technicalities which are beyond the scope of the present article.

The earliest known reference to any estimate of the value of a life annuity arose out of the provisions of the Falcidian Law of the Roman empire; but the tables of values were the result of conjecture rather than of statistical investigation, and the element of interest was not taken into consideration.

Dr. Edmund Halley, in a paper read before the Royal Society of London in 1693, was the first to give an approximately accurate mortality table, and to shew how it should be applied to deduce the values of annuities.

The results of Halley's researches do not appear to have received general recognition, for conjectural annuity values were in general use until the publication of Dr. Price's Northampton Table in 1785. The basis and methods of construction of this and other tables are described elsewhere. (*See* LIFE TABLES.) Early in the 19th century actuarial science began to be developed, and improved methods of preparing and applying mortality tables have since been devised. In the present connection reference need be made only to those investigations which relate exclusively to annuitant lives.

Investigations of Annuitants' Mortality Experience. — By the Life Annuity Act of 1808 the British Government through the National Debt Commissioners were empowered to grant life annuities. The duration of the lives of nominees of both sexes was assumed to be correctly measured by the Northampton Table of mortality. This table, apart from the fact that it was practically the only one available, had been found to yield substantial profits in the case of the Equitable and other companies which had adopted it for life assurance business, but this fact, so far

from suggesting its unsuitability for granting annuities, only confirmed its reputation. John Finlaison, subsequently appointed actuary to the National Debt Commissioners, appears to have been the first to realize that the country was sustaining considerable loss by the use of the table for the grant of annuities and must inevitably incur further loss unless the mortality basis were altered. As a result of his representations the issue of annuities was suspended in 1828.

In 1829 a new scheme was introduced. The mortality tables adopted were those constructed by Finlaison from an observation up to the end of 1822 of the duration of the lives of Tontine and National Debt Office annuitants. This was the first investigation of the mortality of Government annuitants. Two main facts emerged from this investigation, and have been confirmed by subsequent experience — (a) that annuitants as a class are remarkable for their longevity and (b) that the vitality of females is appreciably superior to that of males, so that separate mortality tables must be prepared for each sex.

The second investigation of the mortality of Government annuitants was carried out by **A.** G. Finlaison and published in 1860. The variations between the old and the new tables were found to be so insignificant that the Treasury did not consider it necessary to alter the charges made for annuities.

The next investigation was made by A. J. Finlaison and published in 1883. The data consisted of the records relating to the annuities granted by the National Debt Commissioners from 1808 to 1875. This investigation is notable because of the fact that it was the first in which the effect of "selection" was taken into consideration in deducing the rate of mortality amongst annuitants. It may be assumed that an annuity will not be purchased on the life of a person known to be suffering from a disease likely to impair his vitality. This discrimination exercised by the purchaser must clearly influence the rate of mortality for several years after the date of purchase, in much the same way as the medical examination does in the case of assured lives, and allowance should be made for this fact in settling the selling price of annuities. A. J. Finlaison found that the effects of selection were discernible for four years following the date of purchase, and recommended that revised tables based on the resulting select rates of mortality should be adopted.

With the approval of Thomas Bond Sprague, then president of the Institute of Actuaries, whom the Treasury had consulted before sanctioning rates based on what was then a novel theory, the new tables were introduced in 1884, in substitution for those which had been in force since 1829.

In 1893 the Institute of Actuaries and the Faculty of Actuaries resolved to undertake the compilation of a new collective mortality experience of assured lives, and separately of annuity nominees, in the United Kingdom during the period 1863–93. Forty-three companies contributed to the experience of annuitants, and 9,700 contracts in respect of male lives and 24,300 in respect of female lives were brought under review, the whole constituting a more detailed and authoritative investigation of annuitants' mortality than any that had previously been attempted. The tables, officially designated O^{am} and O^{af} for males and females respectively, were published in 1902. In the construction of these tables the duration of selection was taken to be five years.

The fourth investigation of the experience of National Debt Office annuitants carried on the observations from 1875 to 1904, and was published in 1912. The methods adopted in the construction of the tables and the results of the investigation were very similar to those of the British Offices, O^{am} and Oaf tables. The vitality of both sexes was shown to have increased, the difference between the new and the previous tables being most marked in the case of females.

Shortly after the War investigations of the recent mortality experience, both of life office and Government annuitants, were undertaken. In each case the observations related to the years 1900–20, and the mortality of each of the three constituent periods 1900–7, 1907–14 and 1914–20 was also separately examined. The two investigations proceeded almost simultaneously, that of the life offices, however, being begun and completed several months in advance of the other.

The life office annuitants investigation was again carried out under the auspices of the Institute and Faculty. The numbers of contracts examined were 19,946 of males, and 51,892 of females. The first section of the report of Messrs. Elderton and Oakley, the actuaries in charge of the investigation, was published in 1923. This proved to be a document of first-class importance in the history of actuarial science. The authors discussed the question of selection in all its aspects and suggested, both on theoretical and on practical grounds, that its effects could be ignored after the first year following purchase. Even more notable was their recommendation that annuity values should be based not on the rates of mortality derived directly from the observed experience, but on these rates modified to allow for progressive future improvement in vitality. The principle of allowing for progressive decrease in the death-rate had been previously applied in special circumstances, such as the commutation of the life interests of incumbents under the Welsh Church act of 1914, but this was the first instance of its application to a general investigation the results of which were destined to be a recognized standard for many years. These recommendations were adopted by the Institute and Faculty, and the volume of tables which were officially designated a(m) and a(f) was published in 1925 and gave only "projected" rates of mortality and annuity values derived from them. These rates of mortality are naturally lighter than those recorded in any of the previous investigations and the values of annuities are correspondingly increased.

The examination of the mortality experience of Government life annuitants was carried out by Sir Alfred W. Watson, K.C.B., the Government actuary, and Mr. H. Weatherill, actuary to the National Debt Commissioners, whose report was published in 1924. On that occasion the scope of the investigation was extended to include not only the annuities granted directly by the National Debt Commissioners, but also those issued through the agency of Trustee Savings Banks and the Post Office Savings Bank. The number of contracts brought under observation was 23,230 in respect of males and 57,551 in respect of females. The mortality experienced during the period was found to be appreciably lighter in the case of both sexes than that of the 1875–1904 investigation, the decline being again more significant amongst women than amongst men. It was ascertained also that the mortality experience of the Savings Bank annuitants was lower than that of the lives concerned in the National Debt Office annuities. The difference is presumably due to the fact that annuities purchased under wills in circumstances in which there is no element of self selection are proportionately more numerous among transactions with the National Debt Office than with the Savings Banks. In an appendix to the report several questions of theoretical and practical importance were discussed at length. It was concluded that the effects of selection were traceable for at least five years, but as a measure of practical convenience it was decided to employ a select rate of mortality in respect of only the first year after the date of purchase, and to provide for the selection thus excluded by a subsequent adjustment of the annuity values. Progressive improvement in vitality was found to be exhibited not only in the experience of annuitant lives but also in that of other special classes of lives and of the population generally. To provide for its persistence in the future the actuaries, as a result of extensive experiments, recommended that appropriate selling prices for annuities granted in the immediate future would be the values of select annuities derived directly from the 1900–20 experience increased by 3% in the case of male lives and by 4% in the case of female lives.

Government Life Annuity Business. — Government life annuities were first granted in 1808. The scheme was revised in 1829 by the Act 10 Geo. iv., c. 24. The object of the scheme is the acceleration of the reduction of the National Debt (*q.v.*), by the substitution of terminable for perpetual annuities.

Annuity Values. — The following table gives specimen annuity values according to successive investigations. The differences in the principles and methods adopted in the construction of the several tables are briefly indicated in the headings of the columns.

SPECIMEN ANNUITY VALUES (a_x) AT 4% INTEREST

Age x	Northampton table. a_x (Selection ignored.)	Government annuitants to 1822. a_x (Selection ignored.)	Government annuitants 1808–75. $a[x]$ (Selection for 4 years.)	British offices annuitants 1863–93. $a[x]$ (Selection for 5 years.)	Government annuitants 1900–20. $a[x]$ (Full selection and allowance for future improvement.)	British offices annuitants 1900–20. $a[x]$ (Selection for one year, and allowance for future improvement.)
			MALES			
50	11·265	12·430	12·451	12·962	14·173	14·036
55	10·201	11·039	11·224	11·529	12·541	12·521
60	9·040	9·721	9·783	10·027	10·781	10·937
65	7·762	8·216	8·309	8·502	9·062	9·317
70	6·362	6·775	6·886	7·011	7·408	7·686
75	4·963	5·410	5·535	5·614	5·886	6·080
80	3·644	3·812	4·376	4·358	4·567	4·709
			FEMALES			
50	11·265	14·161	13·669	13·855	15·675	15·420
55	10·201	12·790	12·328	12·620	14·218	14·098
60	9·040	11·261	10·818	11·190	12·555	12·575
65	7·762	9·577	9·204	9·573	10·768	10·874
70	6·362	7·858	7·520	7·882	8·866	9·052
75	4·963	6·264	6·048	6·272	7·055	7·204
80	3·644	4·936	4·735	4·840	5·432	5·454

Life Office Annuity Business.—Almost all the offices transacting life assurance business in the United Kingdom grant annuities on lives, but in only a few cases does the annuity business attain any great magnitude or represent a significant proportion of the total financial liabilities of the office. The continuous improvement in vitality which has contributed so largely to the success of life assurance undertakings has operated in the opposite direction in the grant of annuities, and it is probable that this class of business so far from being a source of profit may not infrequently have resulted in actual loss.

The charges made by offices for the grant of annuities have generally been revised in conformity with the 1900–20 tables, and are consequently less favourable to purchasers than was formerly the case. The amount of business transacted has steadily increased. From 1906 to 1914 the average annual amount received by offices established within the United Kingdom for the purchase of immediate annuities did not greatly exceed £2,000,000. During the war period it fell, the minimum of £920,000 being reached in 1916. In 1919 the consideration money again exceeded £2,000,000, and after a decline to £1,500,000 in 1921 it increased to £3,000,000 in 1923, and remained at about that figure in each of the two following years. It is noteworthy that a considerable share of the annuity business transacted within the United Kingdom has been obtained by Dominion and Foreign companies. From 1910 to 1922 the average amount received annually by these offices was more than £400,000, in 1923 it approached £650,000, and has subsequently exceeded £1,000,000 a year. (P. G B.)

IN THE UNITED STATES

While annuities have generally been issued by life insurance companies in the United States, it is only in recent years that there has been a considerable demand for them. For example, in the year 1900 the considerations received for annuities by companies operating in New York State amounted to $6,600,000 which increased to $8,900,000 in 1920 and to $355,000,000 in 1937. Life annuities are not issued by the United States Government as they are by the British Government.

Until the publication of the McClintock table of mortality in 1899, the basis for the determination of premiums for annuities was a British experience. Emory McClintock, then actuary of the Mutual Life Insurance Company of New York, published the data on annuities issued throughout the world by the principal American companies.

In 1920 the writer of this article prepared an experience based on the material of 20 of the principal American companies under annuities issued in the United States. It is called the American Annuitants Table of Mortality and was used with various modifications as a basis of premiums by American companies until 1938. While the Combined Annuity Table was published in 1928 and the 1937 Standard Annuity Table in 1938, each of these was based on the American Annuitants Table, with allowances for decreases in mortality.

The rates of mortality of a British experience compiled for the years 1900–20, a(m) and a(f), are now compared with the 1937 Standard Annuity rates for quinquennial ages commencing with age 50, the average age at which annuities are issued in America being 63. The British rates are on an ultimate basis (excluding the experience of the first annuity year) and the American rates on an aggregate basis (including all annuity years).

Age	Males		Females	
	1937 Standard annuity	1900–20 a(m)	1937 Standard annuity	1900–20 a(f)
50	·00929	·00970	·00636	·00846
55	·01355	·01415	·00929	·01003
60	·01975	·02078	·01355	·01288
65	·02875	·03047	·01975	·01814
70	·04176	·04461	·02875	·02770
75	·06046	·06861	·04176	·04507
80	·08716	·10902	·06046	·07624
85	·12484	·15891	·08716	·13150
90	·17714	·22842	·12484	·20461
95	·24806	·32194	·17714	·29746
	·36212	·44129	·24806	·41042

The 1937 Standard Mortality for women was taken as five years younger than for men since actual experiences gave such results approximately and as this artifice saved a great deal of labour in calculating premiums.

It must not be inferred from the above table that the rate of mortality among annuitants is higher in Great Britain than in America. As vitality has shown a tendency to increase with calendar year the above tables represent an attempt to make allowance for this improvement. The British table is a forecast of the mortality to be experienced under issues of 1925 and the American table is an estimate of the improvement in mortality as of 1937. Most American companies made further allowance for a probably lower mortality by setting back the ages an additional year or two.

In order to develop annuitant mortality tables and keep in close touch with current experience, the Joint Committee on Mortality, consisting of representatives of the Actuarial Society of America and the Association of Life Insurance Medical Directors, commenced in 1936 to make a continuous mortality study, based on annuities issued in 1931 and subsequent years.

Twenty large companies are contributing their data to this study, which is published each year in the *Transactions* of the Actuarial Society of America.

The decreasing mortality among annuitants has led to a lower annuity in return for a given amount of purchase money. In addition the lowered yields on investments have accentuated this process. As a result several American companies are issuing participating annuities under which the guaranteed return may be increased by annual dividends. The great majority of the companies have continued to issue non-participating annuities under which a fixed yield is specified.

In addition to the ordinary annuities which are payable throughout life on an annual, semi-annual, quarterly or monthly basis and which cease at death, many American companies issue annuities providing for a return of the excess of the consideration over annuity payments made, if any, or for guaranteed payments over a specified period whether the annuitant dies or survives. Deferred annuities with payments to begin at a specified age are also commonly issued, and in event of death during the period of defer-

ment a return of premiums with or without interest may be granted.

A variation of this form gives the annuitant the privilege of electing a smaller annuity before the specified age in accordance with a table inserted in the policy. Premium rates distinguish between men and women applicants according to age last birthday and are adjusted to completed quarter-years of age.

One of the outstanding features since 1930 has been the develop ment of group annuities which cover an annuity payable at the retirement age. Reports of the life insurance companies transacting business in New York State showed 530 group annuity contracts on different employers or corporations on Dec. 31, 1937, covering more than 500,000 individual certificates and representing an annual income at maturity of more than $89,000,000.

The mortality is lower among annuitants than among holders of life insurance policies on account of the psychology which enters into the transactions. A man buying an annuity hopes to live long enough to receive in payments from the company more than the single premium paid by him and he therefore would not purchase the annuity if, in his own judgment, he were a poor risk. On the other hand, the applicant for a life insurance policy knows that his beneficiaries would have a larger return for the premiums if he died in the early rather than the later years of the policy. The lower experience among annuitants is largely the result of "self-selection" through the discrimination exercised by the purchaser. The mortality is partly due to the attractiveness of annuities compared with investments — the more remunerative the latter the greater the "self-selection" against the company — and partly due to the conditions in the various countries, such as that of leaving annuities to servants and to persons who are not able to look after their financial interests. The fact that the mortality among persons who take annuities ceasing at their death is distinctly lower than among those who apply for an annuity with a refund at death of the single premium less annuity payments is evidence of the power of "self-selection" among groups of individuals.

Under the 1936 regulations of the United States Internal Revenue Department a sum equal to 3% of the consideration paid is taxable income from an annuity; the excess above such 3% is excluded from gross income until the aggregate amounts excluded equal the consideration paid. All payments received thereafter are taxable as income for the year in which they are received.

BIBLIOGRAPHY.—The standard text-books are: R. Todhunter, *Compound Interest and Annuities-Certain* (rev. by *R.* C. Simmonds and T. P. Thompson) and E. F. Spurgeon, *Life Contingencies.* There are numerous papers of historical, theoretical and practical interest in the volumes of the *Journal of the Institute of Actuaries,* which was first published in 1850 as the *Assurance Magazine,* but has continued under the present name since 1866. The results of the British life offices annuitants investigations are contained in the volumes *British Offices Annuity Tables 1893, Mortality and Monetary Tables,* and *Mortality of Annuitants 1900–20.* The *Report on the Mortality Experience of Government Life Annuitants, 1900–1920,* appeared as a Stationary Office publication in 1924.

The following are among the more valuable papers on annuities published in the *Transactions* of the Actuarial Society of America: — R. W. Weeks. *Mortality on Annuitants in Anzerican Life Insurance Companies* (iv, 275); Emory McClintock, *Tables for the Estimation of Mortality Among Annuitants* (vi, 13); C. C. Ferguson, *Participating Annuities* (xv, 354); Arthur Hunter, *Mortality Anzong American Annuitants and Premiums Based Thereon* (xxi, 157); C. D. Rutherford, *An Annuity Table Complying with the Requirements of the New Canadian Valuation Standard* (xxviii, p. 54); F. D. Kinecke, *A New Annuity Mortality Table* (xxxix, p. 8); *Report of Joint Committee on Mortality Under Annuity Issues* (xxxviii, 221; xxxix, 111 and xl, 238). These are to appear yearly. Other papers on annuities may be found through the Index to the *Transactions.* The *Transactions* of *the Faculty of Actuaries,* and the *Record of the American Institute of Actuaries* also contain important papers. (A. HU.)

ANNULAR (ANNULATE), ringed. "Annulate" is used in botany and zoology in connection with certain plants, worms, etc. *(see* ANNELIDA). The word "annulated" is also used in heraldry and architecture. An annulated cross is one with the points ending in an "annulet" (an heraldic ring, supposed to be taken from a coat of mail), while the annulet in architecture is a small fillet round a column, which encircles the lower part of the Doric capital immediately above the neck or trachelium. The word "annulus" is itself used technically in geometry, astronomy, botany, etc., and the adjective "annular" corresponds. In botany among the fungi the term annulus is applied to the membranous ring that surrounds the stipe of certain agarics after the expansion of the cap, and in ferns to the thick-walled ring of cells that surrounds the sporangium and by contraction causes the rupture of the latter when mature. An *annular space* is that between an inner and outer ring. The *annular finger* is the ring finger. Certain nebulae having the form of a ring are also called "annular" *(see* NEBULA). For *annular eclipse see* ECLIPSE.

ANNUNCIATION, the announcement made by the angel Gabriel to the Virgin Mary of the incarnation of Christ (Luke i. 26–38). The Feast of the Annunciation in the Christian Church is celebrated on March 25. The first authentic allusions to it (apart from the Gelasian and Gregorian sacramentaries, in both of which it is mentioned) are in acts of the council of Toledo (656) and of the Trullan council (692). *(See* further, LADY *DAY.)*

ANNUNZIO, GABRIELE D', prince of Monte Nevoso (1863–1938), Italian novelist, poet and soldier, of Dalmatian extraction, was born at Pescara (Abruzzi) in 1863. While still at school he published *Primo Vere* (1879), a volume of verse nhich was highly praised by Giuseppe Chiarini. The young poet then went to Rome, where he was received as one of their own by the *Cronaca Bizantina* group. Here he published *Canto Nuovo* (1882), *Terra Vergine* (1883), *L'Intermezzo di Rime* (1884), *11 Libro delle Vergini* (1884), and the greater part of the short stories that were afterwards collected under the general title of *San Pantaleone* (1886).

Meanwhile Gabriele d'Annunzio joined the staff of the *Tribuna.* For this paper, under the pseudonym of "Duca Minimo," he did some of his most brilliant work. To this period of greater maturity and deeper culture belongs *Il Libro d'Isotta* (1886), a love poem, in which for the first time he drew inspiration adapted to modern sentiments and passions from the rich colours of the Renaissance.

D'Annunzio's first novel *Il Piacere* (1889), Eng. trans., *The Child of Pleasure* (1898), was followed in 1892 by *L'Innocente* (Eng. trans., *The Intruder,* 1899), and by *Giovanni Episcopo.* These three novels created a profound impression. His next work, *Il Trionfo della Morte* (1894), Eng. trans., *The Triumph* of *Death* (1896), was followed by *Le Vergini delle Rocce* (1896) and *Il Fuoco* (1900), which in its descriptions of Venice is perhaps the most ardent glorification of a city existing in any language. D'Annunzio's poetic work of this period, in most respects his finest, is represented by *Il Poema Paradisiaco* (1893), the *Cdi Navali* (1893), a superb attempt at civic poetry, and *Laudi* (1900).

During these years he began to write for the stage. *Il Sogno di un mattino di primavera* (1897) is a lyric fantasia in one act; *Città Morta* (1898), written for Sarah Bernhardt, has its scene laid in Mycenae, and is inspired by Greek tragedy. In 1898 he wrote his *Sogno d'un tramonto d'autunno* and *La Gioconda,* which provided Eleonora Duse with one of the most poignant of her rôles; in 1899 *La Gloria,* a contemporary political tragedy with many audacious personal and political allusions; and then *Francesca da Rimini* (1902), a magnificent reconstruction of mediaeval atmosphere and emotion. All of these, splendid as they are in texture and in the gorgeous imagery of the verse, miss great tragedy, perhaps because of the poet's excessive preoccupation with sensation, with colour and sound and movement. *La Figlia di Jorio,* a powerful peasant tragedy of his own wild home in the Abruzzi, rooted in the primitive fears, passions and superstitions of his countrymen, was published at Milan in 1904.

The years 1908–21 were of great importance in d'Annunzio's career, not only in the field of literature, but also in that of war and politics. In 1908 he produced *La Nave,* a vivid presentation of the early history of Venice, setting forth his aspiration for Italy's destiny as a great sea power and as the mistress of the Adriatic — a curious forecast of his future political action. The following year, *Fedra,* a classical drama, appeared; and in 1911 *Le martyre de St. Sébastien,* a dramatic mystery play in French

verse with musical interludes by Debussy, was first performed in Paris. Though a remarkable tour de force and appreciated as such by French critics, this play was hardly one of his greatest achievements. Other plays of this period were La *Pisanella* ou la *mort parfumée* (1914), written in French, and *Parisina* (1914), with music by Massenet. D'Annunzio did not, however, abandon the field of fiction, and in 1910 he published Forse *che si,* forse *che* no, a powerful, but somewhat long-winded novel, in which aviation played a considerable part. La Leda senza cigno (1913), consisting partly of essays and partly of fiction, originally appeared in the Corriere *della Sera,* and was afterwards issued in three volumes with a *licenza* in 1916. His purely poetic output was limited to the *Canzoni della* gesta *d'Oltremare* (1912), which dealt with the Libyan War and contained some admirable verse, as well as violent invectives against the Powers which were, in his opinion, hampering Italy in her Mediterranean policy.

On the outbreak of the World War d'Annunzio was living in France, having had to leave Italy on account of financial difficulties; but the moment the conflict began he became convinced of the necessity for Italy's intervention, in order to attain complete unity and to establish her sovereignty in the Adriatic. In the spring of 1915 he returned to Italy, and his addresses to the Italian people, full of eloquent and inspiring patriotism, were afterwards published in a volume Per la *più* grande *Italia* (1915). From the moment Italy declared war d'Annunzio's career became one of the most romantic of modern times; for the man who had hitherto been regarded merely as a sensuous aesthete and a decadent, and whose claim to distinction had been his exquisite sense of beauty and his mastery of the language, now proved himself to be a man of action and a politician who for many months defied powerful governments. He volunteered for active service. He served successively in the cavalry, the infantry and the navy; finally he joined the air service in the hope of achieving immortality even at the cost of his life. His exploits in the air were of the most fantastic nature. In one of his flights he lost an eye, in another was wounded in the wrist, and on several occasions his aeroplane was riddled with bullets. In Aug. 1918 he led a flight over Vienna, dropping propaganda pamphlets over the city. During the first period of the World War he published ten war poems, some of them of great beauty.

After the Armistice the attitude of the Allied Powers, and especially that of President Wilson towards Italy, aroused d'Annunzio's bitter indignation, and his letters and articles in this connection, collected in the volume *Contro* uno *è contro* tutti (1919), occupy a place in the literature of invective. The extreme violence of his language helped to embitter the relations between Italy and President Wilson. During the Nitti régime d'Annunzio personified the patriotic reaction against the Government's policy. The Fiume dispute symbolized in his mind the conflict between Italy's aspirations and the counter claims of her neighbours. When, as a result of the commission of enquiry into the anti-French riots at Fiume, it was decided considerably to reduce the Italian garrison and to police the town with Maltese or U. S. gendarmes, a movement was planned by Major Reina of the Granatieri brigade to re-occupy the town with regular troops and volunteers. D'Annunzio accepted the leadership of the expedition, and on the night of Sept. 11–12 he marched from Ronchi at the head of detachments of grenadiers and other troops triumphantly and re-entered Fiume.

For 15 months he defied the Italian Government, and, indeed, the whole of Europe with success. He assumed the style of ruler or commandant of Fiume and made of the town a new state. His "reign" was characterized by a picturesque mysticism, with Italian patriotism as the first article of his creed; and enthusiasts flocked to his standard. But his language and action became more exaggerated. When the Rapallo Treaty was concluded in 1920 he refused to recognize it, as he disapproved of its provisions regarding Fiume and Dalmatia. The Government was finally obliged to resort to force in order to carry out the Rapallo Treaty, and d'Annunzio, after vowing to hold Fiume to the bitter end, finally submitted in Jan. 1921, and left the city. He then went to live at Gardone on the lake of Garda.

In 1921 he published *Notturno,* an analysis of his sensations during the blindness which resulted from an aeroplane accident; and in 1924 the first volume of Le *faville* del Maglio appeared. While at Gardone he was seriously injured in the head by a fall. He was from the first a strong supporter of the Fascist movement, and helped to organize the Fascist seamen's federation. In the spring of 1925 the premier, Mussolini, spent three days with him at Gardone, a visit which aroused a good deal of curiosity. In 1924 the King conferred on him the title of prince of Monte Nevoso, in recognition of his successful efforts to secure Italy's new eastern frontier, of which that mountain is the highest point. In 1927 the Italian Government undertook the publication of a special edition of his collected works. He died on March 1, 1938.

For bibliography of d'Annunzio's earlier works see R. Forcella, *d'Annunzio 1863–83,* a Bibliography (1926). Appreciation of his literary work is to be found in a lecture by Prof. C. H. Herford, printed in 1920. Several of his plays, including The Child of Pleasure (1898), La Cittb Morta (1900), La Gioconda (1901) and Francesca da *Rimini* (1902), have been translated by A. Symons. For the Fiume adventure *see* FIUME.

ANOA, the small wild buffalo of Celebes island, Anoa de*pressicornis,* which is the most diminutive of all wild cattle. It is nearly allied to the larger Asiatic buffaloes. The horns are peculiar for their upright direction and comparative straightness, although they have the same triangular section as in other buffaloes. White spots are sometimes present below the eyes, and there may be white markings on the legs and back. In habits the animal resembles the Indian buffalo.

ANODE, the metallic conductor or electrode through which an electric current enters an electrolyte (*q.v.*). The direction of the current is considered that in which a positive charge would move, and is the opposite of the direction of travel of a stream of electrons, which are negative charges, in a rarefied gas. (*See* ELECTROLYSIS; and ELECTRICITY, CONDUCTION OF: *In* Gases.)

ANODYNE, anything which relieves pain. The term is commonly applied to medicines which lessen the sensibility of the brain or nervous system, such as morphia, etc.

ANOINTING, or greasing with oil, fat or melted butter, a process employed ritually in all religions and among all races, civilized or savage, partly as a mode of ridding persons and things of dangerous influences and diseases, and partly as a means of introducing into things and persons a sacramental or divine influence, a holy emanation, spirit or power. The Australian natives believed that the virtues of one killed could be transferred to survivors who rubbed themselves with his caul-fat. The Arabs of East Africa anoint themselves with lion's fat in order to gain courage and inspire the animals with awe.

From immemorial antiquity, among the Jews as among other races, kings were anointed or greased, doubtless with the fat of the victims which, like the blood, was too holy to be eaten by the common votaries. Butter made from the milk of the cow, the most sacred of animals, is used in the Hindu religion.

In the Christian religion, especially where animal sacrifices, together with the cult of totem or holy animals, have been given up, it is usual to hallow the oil used in ritual anointings with special prayers and exorcisms; oil from the lamps lit before the altar has a peculiar virtue of its own, perhaps because it can be burned to give light, and disappears to heaven in doing so. In any case oil has ever been regarded as the aptest symbol and vehicle of the holy and illuminating spirit.

The holy oil, chrism or μύρον, as the Orthodox call rt, was prepared and consecrated on Maundy Thursday. In various churches the dead are anointed with holy oil, to guard them against the vampires or ghouls which ever threaten to take possession of dead bodies and live in them. In the Armenian church, as formerly in many Greek churches, a cross is not holy until the Spirit has been formally led into it by means of prayer and anointing with holy oil. A new church is anointed at its four corners, and also the altar round which it is built; similarly tombs, church gongs, and all other instruments and utensils dedicated to cultural uses. In churches of the Greek rite a little of the old year's chrism is left in the jar to communicate its sanctity to that of the new.

ANOKA, a city of Minnesota, U.S.A., on the Mississippi river and federal highways 10, 52 and 169, 27 mi. N.W. of St. Paul; seat of Anoka county. It is served by the Great Northern, the Northern Pacific, and the Minneapolis, Anoka and Cuyuna Range (electric) railways.

The population was 4,851 in 1930 and 6,426 in 1940 by federal census.

Anoka is the trade centre of a farming region and the seat of the state hospital for the insane. Its manufactures include shotgun ammunition, sashes and doors, cheese, dried milk, flour, farm implements and fibre furniture.

The city was founded about 1844 and incorporated in 1878. At one time Anoka vied with Minneapolis as a candidate for becoming Minnesota's principal city, since it is well located at the junction of the Mississippi and Rum rivers, but it was superseded when water transportation became less important.

ANOMALY, in astronomy, is a technical term used in describing the position of a planet in its orbit. The true anomaly is the angle between the radii drawn from the sun to the planet and to the perihelion point—or the angle turned through by the line joining sun and planet since the planet was last in perihelion.

The *mean* anomaly is the angle which this line would have turned through in the time if the turning had been at a uniform rate corresponding to the period of revolution of the planet.

The eccentric anomaly is the same as the eccentric angle defined in elementary conics.

ANOMOEANS, a religious sect of the 4th century, one of the groups into which Arianism (see ARIUS) was divided. The Anomoeans, who believed that Christ was unlike God in essence, took their name from the Greek word ἀνόμοιος (unlike), and were opposed within the Arian sect by the Homoeans, who believed that the Father and the Son were alike.

Aetius (*q.v.*), the founder of the sect, reasoned that the doctrine of Arianism carried to its logical conclusion must mean that God and Christ could not be alike. Arianism held that the essential difference between Them was that God had always existed while Christ was created by God. Aetius therefore argued that ἀγεννησία (innascibility) was part of the essence of God and that Christ could not be like God because He lacked this necessary quality.

Aetius' chief convert and the second great leader of the Anomoeans was Eunomius (*q.v.*), after whom the Anomoeans are sometimes called Eunomians.

After his death (c. 393), however, the sect, which had been condemned in 381 by the first council of Constantinople was never again important and soon became defunct.

ANONYMOUS, usually abbreviated to ANON., a term to indicate unnamed authorship of any composition. The earliest published researches into the subject of anonymous literature were those of Fredericus Geisler (Leipzig, 1669). The first comprehensive work was that of Vincent Placcius (1642–69), developed by Matthias Dreyer into the *Theatrum anonymorum et pseudonymorum* (1708).

An immense advance was made by the French bibliographer Antoine-Alexandre Barbier in his *Dictionnaire* (1806–08), of which a new edition with over 23,000 entries was issued in 1822–27, and which in 1872–79 was made a continuation of the valuable *Superchéries littéraires* of Quérard. Nothing of value, except casual contributions to Notes and Queries, was done in England till in 1856 Samuel Halkett, keeper of the Advocates' library, Edinburgh, began the labours continued by John Laing (1882–88).

The most ambitious dictionaries of national literatures other than English and French are the Deutsches anonymenlexicon begun by M. Holzmann and H. Bohatta, of Vienna in 1902 and Gaetano Melzi's *Dizionario di opere anonime* e *pseudonime di scrittori italiani* (1848–59).

Religious tolerance, political liberty and social change have affected the motives of anonymity, but it remains common, partly because it is hoped in certain cases that anonymity will excite a profitable curiosity or lend weight to dogmatism which would not have any if the author's name were known. The commonest of those pseudonyms which are in effect anonyms in English has been "A Lady," about 1,000 works, "By A Lady" being on record. Anonymity and pseudonymity were astonishingly common in English literature between 1688 and 1800—Defoe, Chatterton, Macpherson, and earlier Dryden, being cases in point. Among modern English writers who have at least once resorted, or have been required by serial publications to resort, to these devices are Beddoes, Robert Bridges, Bulwer-Lytton, Samuel Butler, Hardy and Meredith.

See W. Cushing, Anonyms (1890); W. P. Courtney, Secrets of our National Literature (1908).

ANOPHELES, a genus of mosquitoes (*q.v.*), including the species that transmit malaria, yellow fever and other diseases. (See DIPTERA; ENTOMOLOGY: Medical.)

ANORTHITE, the calcium end member of the plagioclase (*q.v.*) group of felspars (from the Gr. ἀν, privative and ὀρθός, upright, in allusion to its oblique crystals). Anorthite crystallizes in the triclinic system, and has the chemical composition $CaAlSi_2O_8$. Perfectly pure anorthite is unknown in nature, but is readily synthesized. The name is usually reserved for those solid solutions ranging in composition from pure anorthite to a mixture containing 10% of the albite molecule. Such anorthite occurs in some gabbros and basalts, and also in contact metamorphosed limestones.

ANORTHOCLASE, the name given by Rosenbusch in 188; to include triclinic potash-soda felspars having cleavage angles varying but slightly from 90° (87°–89° 30′). The form development is variable, like that of orthoclase (*q.v.*), but the best known crystals have a characteristic habit in which only the forms (110), (1$\bar{1}$0) and ($\bar{2}$01) are developed, giving rise to lozenge or rhomb-shaped individuals. Anorthoclase is probably to be regarded as a solid solution of the molecules $NaAlSi_3O_8$ and $KAlSi_3O_8$ with small amounts of $CaAlSi_2O_8$, in which the sodium compound predominates. Most crystals fall within the composition limits Or_2Ab_3 and Or_1Ab_6 (Or=orthoclase Ab=albite).

Like the plagioclases, anorthoclase is twinned on the Carlsbad, albite and pericline laws, but in the case of the multiple twins the lamellae are characteristically very narrow. Optically anorthoclase is distinguished by its moderate optic axial angle ($2V=43°-53°$), and is separated from all plagioclases but albite by its low refractive indices, and from albite by its optically negative character. The mineral is confined to alkaline igneous rocks; in the larvikites and foyaitic rocks of Norway and Madagascar, and as a prominent constituent of the rhomb-porphyry lavas of Norway, of the alkaline lavas of the island of Pantelleria (south of Sicily), in the Kenyte lavas of Mt. Kenya (British East Africa) and Mt. Erebus (Antarctica). (C. E. T.)

ANOSMIA is lack of the sense of smell. This deficiency may be due to nasal obstruction or to disease of the nerves concerned in smelling. It is sometimes a manifestation of hysteria. In the first category, the common cold in the head is the most usual cause. Other frequent causes are adenoids, deviated septum and inflammation of the nasal passages.

Of nervous diseases causing anosmia brain tumours are the most frequent. Any nasal obstruction or brain lesion must be on both sides of the cortex in order completely to obliterate the sense of smell.

ANOXAEMIA is a general term comprising those conditions of the body under which the tissues are starved of oxygen. There are three main types: (1) The anoxic type, in which the blood going to the tissues carries oxygen at too low a pressure and consequently the haemoglobin is only partially charged with oxygen. (2) The anaemic type in which though the haemoglobin is fully charged there is too little of it, and hence the capacity of the blood to carry oxygen is too low. (3) The ischaemic type in which the blood is or may be normal but in which the quantity of blood running through the organ is too small.

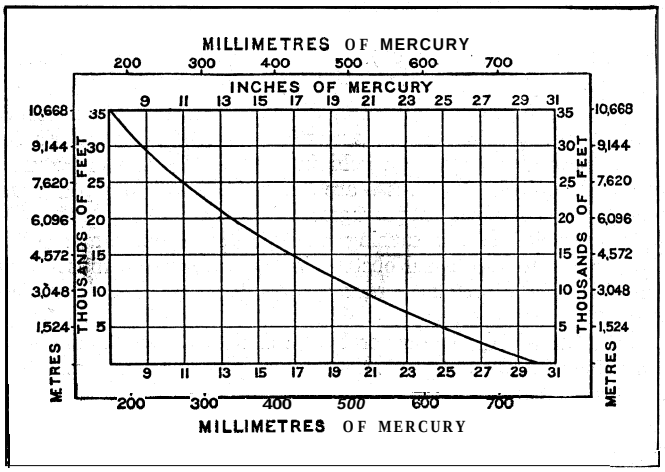
There are some other conditions, less common, which may or may not be regarded as forms of anoxaeniia. Such, for instance, is cyanide poisoning. In this the supply of oxygen is adequate but the mechanism in the tissues for acquiring and using it is faulty.

(1) Anoxic Anoxaemia.—Apart from cases of disease the conditions under which anoxic anoxaemia is most frequently met with are in high aeroplane ascents and on high mountains. Between the two there is this distinction—the aviator reaches the rare air suddenly; the mountaineer gradually. Moreover, the aviator reaches it without effort to himself, the mountaineer usually as the result of considerable muscular effort. For these reasons the symptoms from which the two classes suffer are different.

The airman loses his faculties if he goes too high. The loss may amount merely to a loss of judgment, or a loss in manipulative power, or it may extend to complete loss of consciousness. Because the brain symptoms are the first and the most baffling. the British air force direct not that an aviator should commence breathing oxygen when he reaches an altitude at which he judges himself to need it (by that time his judgment may be impaired) but if he is going to a high altitude he is directed to breathe oxygen from the start. (See AVIATION.)

The mountaineer suffers from a somewhat different train of symptoms which comprise the condition known as "mountain sickness," or in the Andes "Seroche." In the case of a person travelling by train up to the mining districts about Cerro de Pasco, or up Pike's Peak in Colorado (both 14,000–15,000ft.), the symptoms usually appear some hours after arrival not improbably during the night. They are generally a selection from the following: (1) symptoms of the brain—headache, lassitude, fatigue, sleeplessness, visual and auditory impairment; depression; (2) cardiac symptoms—pain in the chest, palpitation, sinus arrhythmia; (3) circulatory symptoms—cold hands and feet, blueness, throbbing; (4) respiratory symptoms—shortness of breath, periodic breathing, sighing; (5) gastro-intestinal symptoms—nausea, vomiting. anorexia. After a residence of two to three days these symptoms usually pass off in their acute form, but no amount of acclimatization makes the human frame at 14,000ft. as efficient as at the sea level. Exercise induces undue breathlessness and quickening of the heart; mental fatigue follows upon severe intellectual work; and the lack of oxygen makes for depression and irritability. The severest work performed at high altitudes falls far short of what could be done at sea-level.

The hurtful results of ascent to high altitudes whether on the mountain or in aircraft are governed by the condition of the blood. The processes of oxidation on which life and health depend take place within the tissues of the actual organs concerned —the heart, the brain, the muscles, the glands. etc. Of these undoubtedly the most vulnerable is the brain. It not only carries



BY COURTESY OF THE CONTROLLER OF H.M. STATIONERY OFFICE

FIG. 1.—CHART SHOWING MEAN ATMOSPHERIC PRESSURE AT DIFFERENT ALTITUDES

The ordinate and abscissa are given both in the metric system and in feet and inches. Ordinate is altitude. Abscissa is atmospheric pressure

out the processes of thought, but governs the condition of the rest of the body, *e.g.*, the rate of the pulse, the depth of respiration and so forth Therefore the study of the conditions which produce trouble at high altitudes resolves itself into a study of the adequacy of the oxygen supply of the brain.

Oxygen is transported from the lungs to the brain by the blood. The haemoglobin or red pigment has the power of forming a loose compound with oxygen. Of each 100gram. of haemoglobin which leave the lung, the number of grammes which transport oxygen depends upon the pressure of oxygen in the air cells of the lung. which in turn depends upon the pressure of oxygen in in the air. As this latter at any altitude is 21% of the local atmospheric pressure, it follows that the higher the subject ascends the lower will be the oxygen pressure in the air cells of his lung. At ordinary pressures there is a margin, the air pressure being more than enough to saturate his haemoglobin sufficiently. Fig. 2, A, shows the percentage of the total haemoglobin leaving the lung, which would be charged with oxygen at different altitudes if the subject made no alteration in the rate and depth of his respiration.

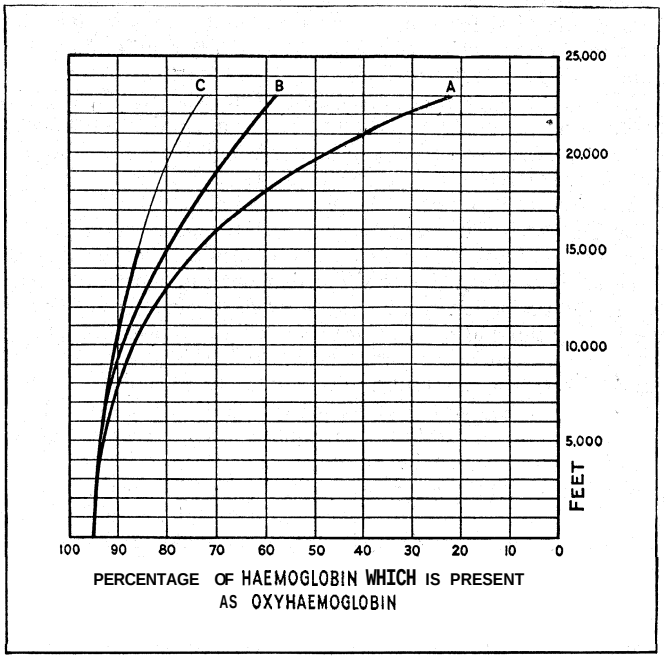


FIG. 2.—CHART SHOWING THE EFFECT OF THE COMBINATION OF THE TWO FORMS OF ACCLIMATIZATION

A. Theoretioal effect if deeper respiration is not made with increasing altitude

B. Probable maximal degree to which blood can be charged with oxygen on deeper respiration, as altitude rises

C. Greater adaptability to atmospheric conditions of people born and living in high altitudes

During the ascent of mountains a certain amount of acclimatization takes place almost from the start, the subject tends to breathe more deeply and to pass more air through the lungs in a given time; this process raises the quantity of oxygen in the air cells (alveoli) of the lung to a higher percentage than it would otherwise attain; the mountaineer at a given height, therefore, has more oxygen in his lungs that the aviator. Curve B fig. 2 shows the probable maximal degree to which the blood can become charged with oxygen as the result of the increase of lung ventilation occurring at the altitudes indicated. These figures are the results of measurement, made by expeditions to the Andes (Cerro de Pasco) and the Alps (Monte Rosa) and Everest.

Somewhere in between curves A and B would be the oxygen in the blood of the airman according to his individual idiosyncrasy. The airman reaches a high altitude in a time measured in minutes. Experiments carried out by Schneider and his associates on 7,000 aviators for the American Government show that there is little or no increase in the amount of air passed through the lungs until oxygen pressures are reached which correspond to 4,000 feet. At higher altitudes different persons respond in different degrees. In more than 50% of all men examined the first respiratory response occurred at from 580 to jzomm pressure and in 25% the change took place at an even lower percentage. while a few gave no evidence of an increase up to the time of uncon-

sciousness. Most physiologists believe that increased pulmonary ventilation is almost the only form of acclimatization of which persons exposed to high altitudes for short times only are capable. Dr. J. S. Haldane and his school regard the lungs as having in addition a special power of secreting oxygen into the blood.

The mountaineer can claim a much higher degree of acclimatization than the aviator, several factors becoming modified in his favour: (1) His pulmonary ventilation increases as already stated. (2) The number of red corpuscles in each cubic millimetre of his blood increases almost in proportion to the altitude. The following figures are given by Maj. Hingston I.M.S. (*1924 Everest* Expedition) for the natives of the Pamir plateau:

Altitudes in thousands of feet .	·7	8	12	15·6	18·2
Corpuscles in millions per cubic mm. of blood	4.5	6·0	6.8	7.8	8.3

The increase in the number of corpuscles is associated with a corresponding increase in the quantity of haemoglobin. At first probably the increase is wrought by some sort of emergency mechanism, such as the abstraction of some water from the blood, the contraction of the spleen and so forth. Shortly there is evidence of increased blood formation, a type of immature cell known as the reticulated corpuscle being formed in the blood. The whole quantity of haemoglobin in the body is increased as was found by the Pike's Peak expedition of 1911. (3) Less well attested is the character of the change in the nature of the corpuscles described by the 1921–22 expedition to Cerro de Pasco. They found that the haemoglobin in the red corpuscle acquired an increased chemical affinity for oxygen such as would occur if the interior of the corpuscle became more alkaline. The effect of this alteration superimposed on the increased ventilation is shown in fig. 2 curve C.

Fig. 2 therefore represents the effects of the combined effect of the two forms of acclimatization which affect the limiting maximal quantity of oxygen which the blood in the arteries can acquire as compared with what the same blood could unite with at the sea level. This limit is perhaps not quite reached, but it is most nearly attained when the subject is at rest. The more active the exercise the greater is the discrepancy between the oxygen actually in the arterial blood, and the limiting value as shown in the figure., The handicap of exercise looms very large at the highest altitudes to which man climbs, as in Everest, for exercise is the only way of securing warmth. In the aeroplane heat is obtained by electrical appliances.

(2) Anaemic **Anoxaemia.**—Entailing too small a quantity of functional haemoglobin in each cubic millimetre of blood. The most obvious form is anaemia in which the actual quantity is too small (see ANAEMIA). Three important forms exist in which the haemoglobin present is temporarily put out of action. Of these the two most important are carbon monoxide (or coal gas) poisoning and methaemoglobin poisoning.

Coal gas contains percentages of carbon monoxide which range from about 7% to about 20% in Great Britain. In the United States the percentage is often greater owing to the large admixture of water gas which is legally possible. Carbon monoxide has the advantage of giving a clear hot flame and therefore is an efficient constituent whether the object of this gas is to heat mantles, to cook or to provide power. Owing to the great precautions taken by the gas companies and the general intelligence of the public accidental cases of coal-gas poisoning are singularly rare.

Very small quantities of carbon monoxide are, however, capable of producing fatal results if breathed for a long enough time. Fig. 3, based on the observations of Haldane shows the percentage of carbon monoxide in the air which if breathed indefinitely is capable of saturating the blood to any given degree. The effect on different persons varies greatly but speaking in very rough terms a saturation of 30–40% means a headache afterwards, 50–60% means unconsciousness and 75% is probably fatal.

Carbon monoxide in the blood is gradually eliminated when air free from it is breathed and eliminated at a much greater rate if pure oxygen is inhaled. Best of all is a mixture of oxygen and carbon dioxide. The latter causes panting which tends to wash out the poison from the blood.

Carbon monoxide is met with in many other places besides coal gas. It is a frequent source of danger in mines galleries, both of coal and of other mines. To discover the presence of the gas, advantage is taken of the fact that small warm-blood creatures, such as mice, rats and canaries succumb to it much more rapidly than man. If these, therefore, be taken into a suspect atmosphere they will drop while as yet man has time to escape. Indeed, it is the time factor which saves man from being asphyxiated in small concentrations of carbon monoxide. In order to lose consciousness over half of all the haemoglobin in his body must be united with

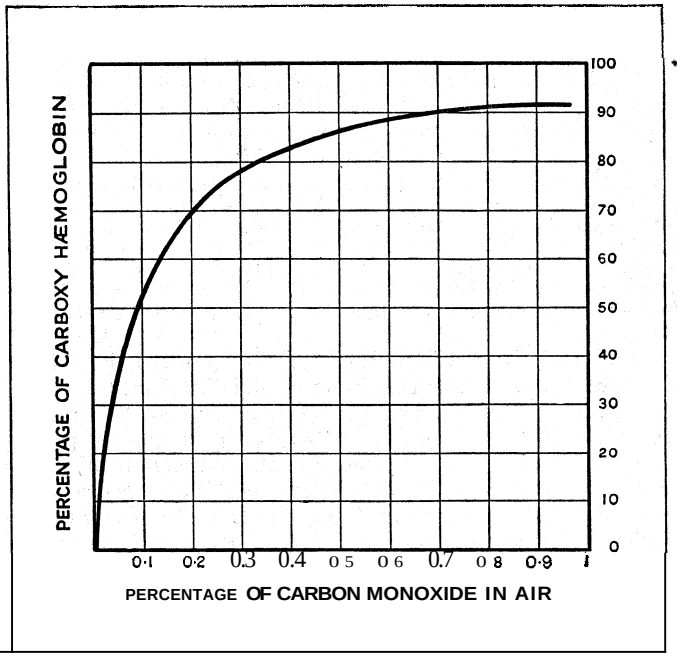


FIG. 3.—CHART SHOWING EFFECTS OF CARBON MONOXIDE SATURATION
Curve shows the percentage of carbon monoxide in the air which, if breathed indefinitely, is capable of saturating the blood to any given degree. The effect on different persons varies, but it may be said generally, that a saturation of 30–40% means headache; 50–60% means unconsciousness; and 75% is probably fatal

carbon monoxide—that can be accomplished in a concentration of less than 0·1% of the gas in the atmosphere but it requires the absorption of an absolute volume, about 500c.c. of CO, which would require perhaps 100 minutes.

The incompletely combusted gas which comes from the exhaust of internal combustion engines has been a cause of numerous fatalities. A 20 h.p. automobile engine is estimated as being capable of emitting a cubic foot (28 litres) of carbon monoxide per minute. "This is sufficient to render the atmosphere of a single car garage deadly within five minutes if the engine is run while the garage doors are closed." (Y. Henderson.)

Methaemoglobin poisoning is another condition in which a part of the haemoglobin is thrown out of action. The simplest form is such as is produced by the inhalation of aniline volatile nitrites, nitrobenzene, etc., causing a conversion of oxyhaemoglobin into methaemoglobin (which has no respiratory value) within the blood, with injury to the corpuscles. The conversion is only temporary if the impure air ceases to be inhaled and if the poisoning is not too severe. Some other drugs such as chlorates and bromates in addition to producing methaemoglobin in the blood, cause an actual destruction of corpuscles—a much graver condition.

(3) Ischaemic **Anoxaemia.**—This may be general or local. If general it may result from very different. causes: (1) In cases of heart disease the heart may be unable to pump the blood round the body at the required rate; or again back-pressure may prevent the blood circulating as it should. (2) After severe bleeding there may not be enough blood left in the body adequately to supply its needs. Under such circumstances the body makes the effort to maintain the blood supply to the brain, and for that purpose other organs are in a measure denied their share. The body is not, however, without resources from which to draw in case of severe

haemorrhage. One store of blood is in the spleen. This organ is ordinarily distended, but when the organism makes a call for an extra supply of blood the spleen contracts and expels considerable quantities into the circulation. (3) Following on severe abdominal wounds, or surgical operations which have entailed considerable exposure of the internal organs, a condition known as surgical shock may supervene. This condition appears to be due to a decrease in the quantity of blood plasma so great that the blood no longer properly fills the vessels. The blood pressure therefore falls and the organs are starved of blood. Light was shed on the cause of surgical shock during World War I by the researches of Dale, Richards and Laidlaw, which indicate that it is due to poisoning by a particular material shed into the body by damaged tissue. The material is called "histamine" or β-iminazolylethylamine. This poison, among other things, makes the walls of the blood capillaries much more permeable to fluid. The plasma of the blood therefore oozes out through them.

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ANQUETIL, LOUIS PIERRE (1723-ISOS), French historian, was born in Paris Feb. 21 1723, and died Sept. 6 1808. He became director of the seminary at Reims, where he wrote his *Histoire civile et politique de Reims* (3 vol., 1756–57), perhaps his best work. He was then director of the college of Senlis, where he composed his *Esprit de la Ligue ou histoire politique des troubles de la Fronde pendant le XVIe et le XVIIe siècles* (1767). During the Reign of Terror he was imprisoned at St. Lazare; there he began his *Précis de l'histoire universelle*, afterwards published in nine volumes. The *Histoire de France* (14 vol., 1805), written in collaboration with de Mézeray and P. F. Velly, has little value, but is, nevertheless, better known than his more serious work. It is said to have been undertaken at the instance of Napoleon.

ANQUETIL-DUPERRON, ABRAHAM HYACINTHE (1731–1805), French orientalist, brother of Louis Pierre Anquetil, the historian, was born in Paris. He was educated for the priesthood in Paris and Utrecht, but his taste for Hebrew, Arabic, Persian and other languages of the East, developed into a passion, and he discontinued his theological course to devote himself entirely to them. With the idea of reaching India to search for the works of Zoroaster he enlisted as a private soldier, on Nov. 2 1754, in the Indian expedition which was about to start from the port of L'Orient. His friends procured his discharge, and he was granted a free passage, a seat at the captain's table, and a salary, the amount of which was to be fixed by the governor of the French settlement in India. After a passage of six months, Anquetil landed, on Aug. 10 1755, at Pondicherry. Here he remained a short time to master modern Persian, and then hastened to Chandernagore to acquire Sanskrit.

War began between France and England, Chandernagore was taken, and Anquetil-Duperron returned to Pondicherry by land. He found one of his brothers at Pondicherry, and embarked with him for Surat; but, with the idea of exploring the country, he landed at Mahé and proceeded on foot. At Surat he succeeded, by perseverance and address in his intercourse with the native priests, in acquiring a sufficient knowledge of the Zend and Pehlevi languages to translate the liturgy called the *Vendidad Sade* and some other works. Thence he proposed going to Benares, to study the language, antiquities, and sacred laws of the Hindus; but the capture of Pondicherry obliged him to quit India.

Returning to Europe in an English vessel, he spent some time in London and Oxford, and then set out for France. He arrived in Paris on March 14 1762, in possession of 180 oriental manuscripts. In 1763 he began to arrange for the publication of the materials he had collected during his eastern travels. In 1771 he published his *Zend-Avesta*, containing collections from the sacred writings of the fire-worshippers, a life of Zoroaster, and fragments of works ascribed to him. In 1778 he published at Amsterdam his *Législation orientale*. His *Recherckes historiques et géographiques sur l'Inde* appeared in 1786, and formed part of Thieffenthaler's *Geography of India*. The Revolution seems to have greatly affected him. During that period he abandoned society, and lived in voluntary poverty on a few pence a day. He died in Paris on Jan. 17 1805.

See the *Biographie universelle;* Sir William Jones, *Works* (vol. x., 1807); and the *Miscellaaies* of the Philobiblon Society (vol. iii., 1856–57). For a list of his scattered writings *see* Quérard, *La France lltteratre. See* also his *Oupanishads* (1804).

ANSA, in astronomy, one of the apparent ends of the rings of Saturn as seen in perspective from the earth; so-called because, in the earlier telescopes, they looked like handles projecting from the planet. In anatomy the word is applied to nervous structures which resemble loops. In archaeology it is used for the engraved and ornamented handle of a vase, which has dften survived when the vase itself, being less durable, has disappeared.

ANSBACH, a town in Bavaria, Germany, originally Onolzbach, 27 mi. S.W. of Niirnberg by rail. Pop. (1939) 25,838. The palace of the margraves is celebrated for its fine gardens. In 1791 the last margrave sold his principality to Prussia and in 1806 it was transferred to Bavaria. In Gumbertus Kirche are the graves of members of the local 15th century order of the Swan. Kaspar Hauser died here. Cardboard, buttons, brushes, combs, mats, carts and motors are made.

ANSDELL, RICHARD (1815–1885), English painter, was born in Liverpool. He was a popular painter of genre, chiefly animal and sporting pictures. His "Stag at Bay" (1846), "The Combat" (1847), and "Battle of the Standard" (1848), represent his best work.

ANSELM (1033?–1109), who has been called the greatest thinker that ever adorned the throne of Canterbury, was born at Aosta in Piedmont. At an early age he crossed the Alps, and finally settled in the famous abbey of Bec where in 1056 he was elected prior, and in 1078, abbot. Under his rule Bec became the first seat of learning in Europe, a result due not more to his intellectual powers than to the great moral influence of his noble character and kindly discipline. It was during these quiet years at Bec that Anselm wrote the dialogues on Truth and Freewill, and the two celebrated treatises, the *Monologion* and *Proslogion.*

Anselm several times visited England, where his convent had great estates, and had so won the love of the people that they expected him to succeed Lanfranc in the see of Canterbury. But when Lanfranc died (May 28 1089) William Rufus seized the possessions and revenues of the see, and made no new appointment. In 1093, William fell ill and thinking his death near at hand, in a fit of remorse forced Anselm to accept the vacant see. After his consecration, Anselm demanded of the king, as the conditions of his retaining office, that he should give up all the possessions of the see, accept his spiritual counsel, and acknowledge Urban II. as pope in opposition to the anti-pope, Clement. The last involved him in a serious difficulty. It was a rule of the church that the consecration of metropolitans could not be completed without their receiving the *pallium* from the hands of the pope. Anselm, accordingly, insisted that he must proceed to Rome to receive the pall. But William would not acknowledge Urban, and maintained his right to prevent any pope being acknowledged by an English subject without his permission. A council of churchmen and nobles, held to settle the matter, advised Anselm to submit to the king, but Anselm remained firm. The matter was postponed, and William meanwhile privately sent messengers to Rome, who acknowledged Urban and prevailed on him to send a legate to the king bearing the archiepiscopal pall. A partial reconciliation was then effected, and the matter compromised. The pall was not given by the king, but was laid on the altar at Canterbury, whence Anselm took it.

Little more than a year after, fresh trouble arose with the king, and in October 1097 Anselm set out for Rome to consult the pope. William immediately seized on the revenues of the see, and retained them to his death. Anselm was received with high honour by Urban, and at a great council held at Bari, he was put forward to defend the doctrine of the procession of the

Holy Ghost against the representatives of the Greek Church. But Urban would not embroil himself with the king of England, and Anselm withdrew from Rome to the village of Schiavi, where he finished his treatise on the atonement, *Cur Deus Homo,* and then retired to Lyons.

In 1100 William was killed, and Henry, his successor, at once recalled Anselm. But Henry demanded that he should again receive from him in person investiture in his office of archbishop. Now, the papal rule in the matter was plain; all homage and lay investiture were strictly prohibited. The long dispute that followed continued until 1107, when the king resigned his formal rights. The remaining two years of Anselm's life were spent in the duties of his archbishopric, He died on April 21 1109. He was canonized in 1494 by Alexander VI.

Anselm's works, which contrast with the elaborate syntheses of some of his successors, exhibit that recognition of the relation of reason to revealed truth, and that attempt to elaborate a rational system of faith, which form the special characteristics of scholastic thought. But in Anselm, as in all Scholastics writing previous to the introduction of the works of Aristotle and the Arabians into the West, there is no sharp distinction between natural and revealed theology. For him, the starting-point of all theological speculation must be faith, *Credo ut intelligam.* "He who does not believe will not experience, and he who has not experienced will not understand." And once confirmed in faith it is our duty to demonstrate by reason the truth of that which we believe.

The groundwork of Anselm's theory of knowledge is contained in the tract *De Veritate,* in which, from the consideration of truth as in knowledge, in willing, and in things, he rises to the affirmation of an absolute truth, in which all other truth participates. This absolute truth is God Himself, who is therefore the ultimate ground or principle both of things and of thought. The notion of God comes thus into the foreground of the system. The demonstration of God's real existence is the substance of the *Monologion* and *Proslogion.* In the first of these, the proof rests on the ordinary grounds of realism, and the Platonic notion that the use of a common predicate to cover a number of instances can only be justified if that predicate refers to an identical nature which is exhibited in all the instances. Things, Anselm says, are called good in a variety of ways and degrees; this implies some absolute standard, some good in itself, in which all relative goods participate. Similarly with such predicates as great, just, they involve a certain greatness and justice. The very existence of things is impossible without some one Being, by whom they are. This absolute Being, this goodness, justice, greatness, is God.

In the *Proslogion,* as the author himself tells us, the aim is to prove God's existence by a single argument. This argument is the celebrated ontological proof. God is that Being than whom ncne greater can be conceived. Now, if that than which nothing greater can be conceived existed only in the intellect, it would not be the absolutely greatest, for we could add to it existence in reality. It follows, then, that the Being than whom nothing greater can be conceived, *i.e.,* God, necessarily has real existence. This reasoning, in which Anselm partially anticipated the Cartesian philosophers, has rarely seemed satisfactory. It was opposed at the time by the monk Gaunilo, in his *Liber pro Insipiente,* on the ground that we cannot pass from idea to reality. The same criticism is made by Aquinas, and in substance by Kant. Anselm replied to the objections of Gaunilo in his *Liber Apologeticus.* Finally, in his greatest work, *Cur Deus Homo,* he undertakes to make plain, even to iniidels, the rationall necessity of the atonement. The theory rests on three positions: that satisfaction is necessary on account of God's honour and justice; that such satisfaction can be given only by the peculiar personality of the God-man; that such satisfaction is really given by the voluntary death of this infinitely valuable person. The demonstration is, in brief, this: All the actions of men are due to the furtherance of God's glory; if, then, there be sin, *i.e.,* if God's honour be wounded, man of himself can give no satisfaction. But the justice of God demands satisfaction; and as an insult to infinite honour is in itself infinite, the satisfaction must be infinite, *i.e.,* it must outweigh all that is not God. Such a penalty can only be paid by God Himself, and, as a penalty for man, must be paid under the form of man. Satisfaction is only possible through the God-man. Now this God-man, as sinless, is exempt from the punishment of sin; His passion is therefore voluntary, not given as due. The merit of it is therefore infinite; God's justice is thus appeased, and His mercy may extend to man.

Anselm's speculations did not receive, in the middle ages, the respect and attention justly their due. This was probably due to their unsystematic character, for they are generally tracts or dialogues on detached questions, not elaborate treatises like the great works of Albert, Aquinas and Erigena. They have, however, a freshness and philosophical vigour, which more than make up for their want of system, and which raise them far above the level of most scholastic writings.

BIBLIOGRAPHY.—The best edition of St. Anselm's complete works is that of Gerberon (1675), reprinted 1721 and incorporated in Migne's *Patrologia Latina,* v. 158–9. Migne's reprint contains many errors. The *Cur Deus Homo,* the *Monologion,* the *Proslogion,* the *Liber pro Insipiente* and the *Liber Apologeticus* have been translated into Eng. by S. N. Deane (Chicago, 1903).

The main sources for the history of St. Anselm and his times are the *Vita Anselmi* and *Historia Novorum* by Eadmer, Anselm's chaplain. These were edited by M. Rule in the *Rolls Series* (1884). Also Dean Church, *St. Anselm,* and M. Rule, *Life and Times of St. Anselm (1883).*

The best expositions of Anselm's philosophy are to be found in Domet de Vorges, S. *Anselme* (1901); A. Daniels, *Quellenbeitriige und Untersuchungen zur Geschichte der Gottesbeweise* (1909); J. Fischer, *Die Erkentnisslehre Anselms* v. *Canterbury* (1911); F. Baemker, *Die Lehre Anselms v. Canterbury über den Willen* (1912); C. C. J. Webb, *Studies in the History of Natural Theology* (1915); M. Grabmann, *Dze Grundgedanken d. hl. A. uber Seele u. Gott* (1916); C. Folliatre, *La Philos. de S. Anselme* (1920); C. Boyer, *La Vérité dans S. Anselme* (1921). *See* Überweg, *Grundriss der Geschichte der Philosophie,* Teil ü. (1928).

ANSELM, of Laon (died 1117), French theologian, was born of very humble parents at Laon before the middle of the 11th century. He is said to have studied under St. Anselm at Bec. About 1076 he taught with great success at Paris, where, as the associate of William of Champeaux, he upheld the realistic side of the scholastic controversy. Later he removed to Laon, where his school for theology and exegetics became famous. His greatest work, an interlinear gloss on the Scriptures, was one of the great authorities of the middle ages. Other commentaries apparently by him have been ascribed to various writers, principally to the great Anselm. A list of them, with notice of Anselm's life, is contained in the *Histoire littéraire de la France,* x. 170–89.

See for his collected works Migne's *Patrologia Latina,* tome 162; some unpublished *Sententzae* were edited by G. Lefèvre (1894).

ANSELME (Father Anselme of the Virgin Mary) (1625–94), French genealogist, was born in Paris in 1625, and died on Jan. 17 1694 at the Couvent des Petits Pères, Paris. As a layman his name was Pierre Guibours. He entered the order of the barefooted Augustinians in 1644. Honoré Caille, seigneur du Fourny (1630–1713), persuaded him to publish his *Histoire généalogique de la maison royale de France, et des grands officiers de la couronne* (1674, 2 vol.); after Father Anselme's death, Honoré Caille collected his papers, and brought out a new edition of this highly important work in 1712.

The task was taken up and continued by two other friars of the Couvent des Petits Pères, Father Ange de Sainte-Rosalie (François Raffard, 1655–1726), and Father Simplicien (Paul Lucas, 1683–1759), who published the first and second volumes of the third edition in 1726. This edition consists of nine volumes folio; it is a genealogical arid chronological history of the royal house of France, of the peers, of the great officers of the crown and of the king's household, and of the ancient barons of the kingdom. The notes were generally compiled from original documents, references to which are usually given, so that they remain useful to the present day. The work of Father Anselme, who spent his whole life in the study of genealogy, his collaborators and successors, is even more important for the history of France than is Dugdale's *Baronage of England* for the history of England.

ANSON, GEORGE ANSON, BARON (1697–1762), British admiral, was born April 23 1697. His mother was the sister-in-law of Lord Chancellor Macclesfield. George Anson entered the Navy in Feb. 1712, and received rapid promotion. He commanded the squadron which was sent to attack the Spanish possessions in South America in 1740. Anson's squadron sailed later than had been intended, and was very ill-fitted. It consisted of six ships, which were reduced by successive disasters to his flagship the "Centurion." The lateness of the season forced him to round Cape Horn in very stormy weather, and the navigating instruments of the time did not allow of exact observation.

By the time Anson reached the island of Juan Fernandez in June 1741, his six ships had been reduced to three, while the strength of his crews had fallen from 961 to 335. In the absence of any effective Spanish force on the coast he was able to harass the enemy, and to capture the town of Paita Nov. 13–15 1741. He was compelled at last to collect all the surviving personnel of the squadron in the "Centurion." He rested at the island of Tinian, and then made his way to Macao in Nov. 1742. After considerable difficulties with the Chinese, he sailed again with his one remaining vessel to cruise for one of the rich galleons which conducted the trade between Mexico and the Philippines, and captured an immensely rich prize, the "Nuestra Señora de Covadonga," which was met off Cape Espiritu Santo June 20 1743. Anson took his prize back to Macao, sold her cargo to the Chinese, keeping the specie, and sailed for England, which he reached by the Cape of Good Hope on June 15 1744.

To the world at large Anson is known as the commander of the voyage round the world, in which success was won by indomitable perseverance, unshaken firmness, and infinite resource. But he was also the severe and capable administrator who during years of hard work at the Admiralty did more than any other to raise the Navy from the state of corruption and indiscipline into which it had fallen during the first half of the 18th century. As subordinate under the duke, or Lord Sandwich, and as first lord himself, Anson was at the Admiralty with one short break from 1745 till his death in 1762. The naval administration was thoroughly overhauled. The dockyards were brought into far better order, and though corruption mas not banished, it was much reduced. The Navy board was compelled to render accounts. A system of regulating promotion to flag rank, which has been in the main followed ever since, was introduced. The Navy Discipline act was revised in 1749, and remained unaltered till 1865. Courts martial were put on a sound footing; inspections of the fleet and the dockyards were established, and the corps of marines was created in 1755. The progressive improvement which raised the Navy to the high state of efficiency it attained in later years dates from Anson's presence at the Admiralty.

In 1747 he, without ceasing to be a member of the board, commanded the Channel fleet which on May 3 scattered a large French convoy bound to the East, and West Indies, in an action off Cape Finisterre. In society Anson seems to have been cold and taciturn. The sneers of Horace Walpole, and the savage attack of Smollett in *The Adventures of an Atom,* are animated by personal or political spite. His title of Baron Anson of Soberton was given him in 1747, but became extinct on his death. There is a fine portrait of the admiral by Reynolds. He died June 6 1762.

See a life of Lord Anson, inaccurate in some details but valuable and interesting, published by Sir John Barrow in 1839. The standard account of his voyage round the world is that by his chaplain Richard Walter (1748), often reprinted. A share in the work has been claimed on dubious grounds for Benjamin Robins, the mathematician. Another and much inferior account was published in 1745 by Pascoe Thomas, the schoolmaster of the "Centurion."

ANSON, SIR WILLIAM REYNELL, BART. (1843–1914), English jurist, was born in Walberton, Sussex, son of the second baronet. Educated at Eton and Balliol College, Oxford he became in 1874 Vinerian reader in English law at Oxford, a post which he held until he became in 1881 warden of All Souls College. He identified himself both with local and university interests, becoming an alderman of the city of Oxford (1892), chairman of quarter sessions for the county (1894), vice-chancellor of the university (1898–99), and chancellor of the diocese of Oxford (1899). In that year he was returned, without opposition, as M.P. for the university in the Liberal Unionist interests, and consequently resigned the vice-chancellorship.

In Parliament he preserved an active interest in education, being a member of the newly created consultative committee of the board of education in 1900, and in 1902 he became parliamentary secretary. He took an active part in the foundation of a school of law at Oxford, and his volumes on *The Principles of the English Law of Contract* (1884), and on *tlze Law and Custom of the Constitution* in two parts, "The Parliament" and "The Crown" (1886–92, pt. i. vol. ii.) are standard works.

ANSONIA, a city of New Haven county, Conn., U.S.A., at the foot of the Berkshire hills, on the Naugatuck river, immediately north of Derby, and about 10 mi. N.W. of New Haven. It is served by the New York, New Haven and Hartford railroad. The land area is about 5·4 sq. miles. The population in 1930 was 19,898, in 1940, 19,210 by the federal census. The city has extensive manufactures, including heavy machinery, electric supplies, brass and copper products, eyelets and eyelet machinery and novelties. Ansonia, Derby and Shelton form one of the important industrial communities of the State. Ansonia was settled in 1840. and named in honour of the merchant and philanthropist, Anson Green Phelps (1781–1853). Originally it was part of the township of Derby. It was chartered as a borough in 1864 and as a city in 1893.

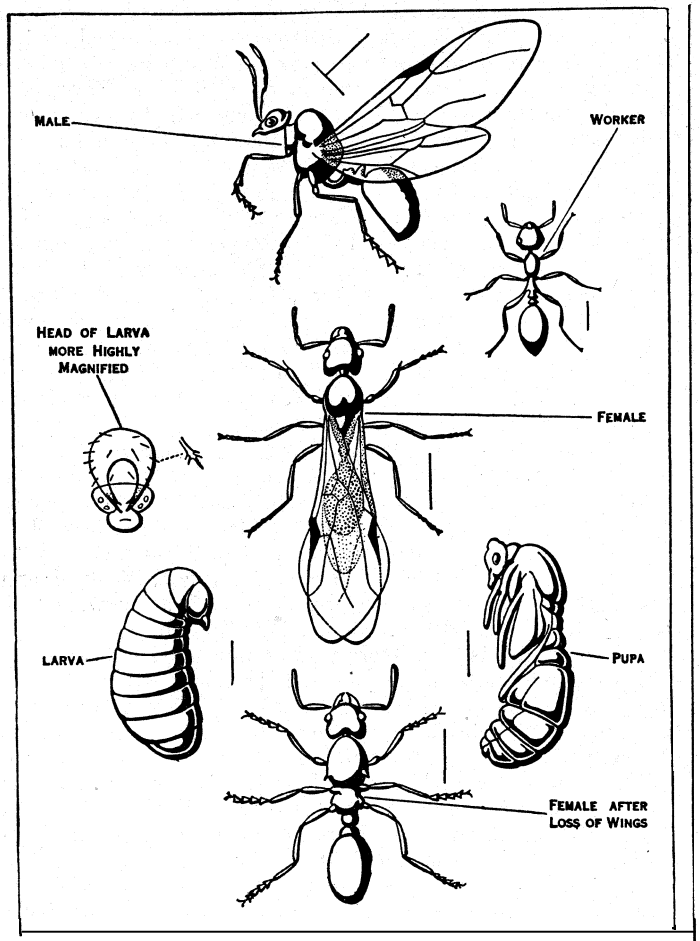
ANSTEY, CHRISTOPHER (1724–180j), English poet, was born at Brinkley, Cambridgeshire, on Oct. 31, 1724. He was educated at Eton and King's College, Cambridge, where he distinguished himself for his Latin verses and became a fellow of his college (1745). Anstey belonged to the school of satirical and social verse founded by Swift and Gray. *The New Bath Guide* or *Memoirs of the B . . . r . . . d (Blunderhead) Family . . .*, a series of rhymed letters published in 1766, had immediate success, and was enthusiastically praised for its original kind of humour by Walpole and Gray. The *Election Ball, in Poetical Letters from Mr. Inkle at Bath to his Wife at Gloucester* (1776) sustained the reputation won by the Guide. Anstey died on Aug. 3, 1805.

His Poetical Works were collected in 1808 (2 vols.) by the author's son John (d. 1819), himself author of ***The Pleader's Guide*** (1796), in the same vein as the *New Bath Guide.*

ANSTRUTHER (locally pronounced *Anster),* seaport, Fifeshire, Scotland. It comprises the royal burghs of Anstruther Easter (pop. in 1931, 682), Anstruther Wester (593), and part of Kilrenny (2,357), and lies gm. S S.E. of St. Andrews, having a station on the L.N.E.R. The town's chief industries include coast and deep-sea fisheries, manufactures of shipping and gear, shipbuilding, the making of cod-liver oil and fish-curing. The two Anstruthers are divided by a small stream called Dreel Burn. James Melville (1556-1614), a nephew of the more celebrated reformer, Andrew Melville, who was minister at Kilrenny, has given in his *Diary* a graphic account of the arrival at Anstruther of a weather-bound ship of the Armada, and the tradition of intermixture of Spanish and Fifeshire blood still survives. Little more than a mile to the west lies the royal and police burgh of Pittenweem (Gaelic for "the hollow of the cave"), a quaint old fishing town (pop. 1938, 1,703) with remains of a priory. About two miles still farther westward is the fishing town of St. Monan or Abercromby (pop. 1938, 1,671), with a fine Gothic church, picturesquely placed on the rocky shore.

ANSWER: *see* PRACTICE AND PROCEDURE.

ANT. In the zoological sense ants are a very natural group of insects which forms the superfamily *Formicoidea* of the order HYMENOPTERA (*q.v.*). They are easily recognized by the elbowed antennae, the conspicuous "waist" formed by a constriction of the abdomen where it unites with the thorax, and generally by the absence of wings. Ants live in societies which inhabit nests of varied kinds: each society consists of numerous wingless, sterile, worker individuals together with males and egg-laying females The fertile males and females are commonly winged and they eventually leave the nest, often in great swarms: mating takes



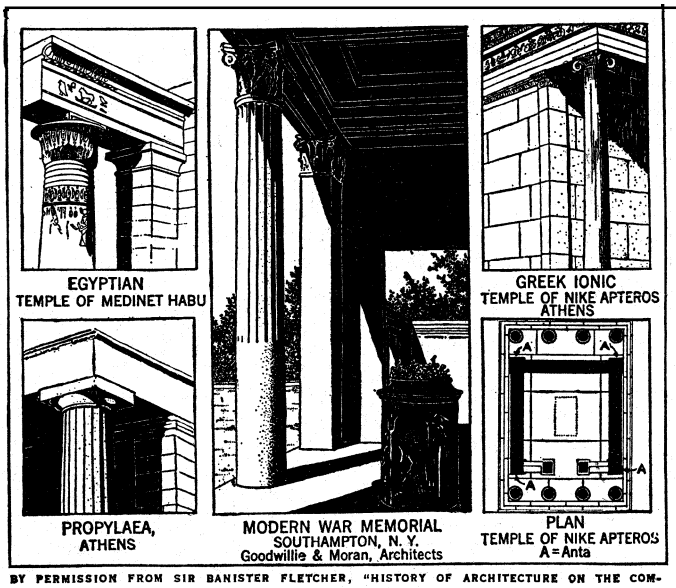
AFTER MORLATT

METAMORPHOSES AND CASTES OF THE ANT (TETRAMORIUM CESPITUM)

place in the open, and the fertilized females (queens) cast their wings and proceed to found new colonies. Ants exhibit a great variety of food preference: many are carnivorous, others feed upon nectar and honey-dew, some gather in seeds, etc., and some live on fungi which they cultivate. (See SOCIAL INSECTS.)

ANTACIDS, medicines which cure acidity by decomposing or neutralizing, and therefore eliminating, an excess of free acid. Those most generally used are salts, *e.g.,* sodium bicarbcnate.

ANTAE (singular, anta), in architecture, the slightly projecting pilaster strips at the extremity of walls which flank a porch or part of a porch in the temples of ancient Greece. They are masonry developments from early wooden structural posts, used, as in the Heraeum at Olympia, to reinforce the brick walls. The term is also used in modern work to describe any pilaster whose detail resembles that of a true anta. Columns set between antae are termed "in antis." (See GREEK ARCHITECTURE.)



BY PERMISSION FROM SIR BANISTER FLETCHER, "HISTORY OF ARCHITECTURE ON THE COMPARATIVE METHOD," EIGHTH ED. (1928), BATSFORD; BUHLMANN, "CLASSIC AND RENAISSANCE ARCHITECTURE" (NEFF & HELBURN)

ANTAEUS, in Greek mythology, a giant of Libya, the son of Poseidon and Ge. He compelled all strangers who were passing through the country to wrestle with him, and as, if thrown, he derived fresh strength whenever he touched his mother earth, he proved invincible. Heracles, in combat with him, discovered the source of his strength, and lifting him up from the earth, crushed him to death. His tomb was shown at Tingis (Tangier).

ANTALCIDAS (ăn-tăl-kē-dăs), Spartan soldier and diplomatist. In 393 (or 392) B.C. he was sent to Tiribazus, satrap of Sardis, to undermine the friendly relations then existing between Athens and Persia by offering to recognize Persian claims to the whole of Asia Minor. The Athenians sent a counter-embassy under Conon. Tiribazus, who was favourable to Sparta, threw Conon into prison, but Artaxerxes II. (Mnemon) disapproved and recalled his satrap. In 388 B.C. Antalcidas, then commander of the Spartan fleet, accompanied Tiribazus to the Persian court and secured the assistance of Persia against Athens. The success of his naval operations in the neighbourhood of the Hellespont was such that Athens was glad to accept terms of peace (the "Peace of Antalcidas"), by which (1) the whole of Asia Minor, with the islands of Clazomenae and Cyprus, was recognized as subject to Persia, *(2)* all other Greek cities—so far as they were not under Persian rule—were to be independent, except Lemnos, Imbros, and Scyros, which were to belong, as formerly, to the Athenians. The terms were announced to the Greek envoys at Sardis in the winter 387–386, and were finally accepted by Sparta in 386 B.C. Antalcidas continued in favour with Artaxerxes until the annihilation of Spartan supremacy at Leuctra diminished his influence. A final mission to Persia, probably in 367 B.C., was a failure, and Antalcidas, deeply chagrined and fearful of the consequences, is said to have starved himself to death. (See SPARTA.)

ANTANANARIVO, the capital of Madagascar, situated about 90m. from the eastern coast of the island, in 18° 55′ S., 47° 30′ E. It is 135m. W.S.W. of Tamatave, the principal seaport of the island, with which it is connected by railway. The town, picturesquely built on a basaltic ridge which rises to 690ft. above the fertile rice plain of the Ikopa to the west (4,060ft. above sea-level), owes its importance to its defensive site and to its rich environs. For long only the principal village of the Hova chiefs, Antananarivo advanced in importance as those chiefs made themselves sovereigns of the greater part of Madagascar, until it became a town of some 80,000 inhabitants. Until 1869 all buildings within the city proper were of wood or rush, but it possesses several timber palaces which crown the summit of the central portion of the ridge; and the largest palace, 120ft. high, with its lofty roof and towers, is the most conspicuous object from every point of view. Since the introduction of brick and stone, and especially since the French conquest (1895), handsome public buildings, including the French residency, the royal palaces, the Anglican and Roman Catholic cathedrals, schools and comfortable houses of brick or stone have been erected alongside indigenous huts of straw or wood. Excellent avenues have been made and flights of steps constructed up the steeper hill-slopes. Antananarivo also possesses a library, an experimental garden and an observatory. Water is obtained from springs at the foot of the hill and from the river Ikopa, which skirts the capital to the south and west. The population, including that of the suburbs, is 119,800 (1936). Two forts on hills, east and south-west, guard the city.

ANTARAH IBW SHADDĀD, Arabian poet and warrior of the 6th century, was famous both for his poetry and his adventurous life. His chief poem is contained in the Mo'allakdt. His father, Shaddād, was a soldier, and his mother, Zabiiba, a negro slave. He took part in the great war between the related tribes of Abs and Dhubyān, which began over a contest of horses and was named after them the war of Dāhis and Ghabrā. He died in a fight against the tribe of Ṭai.

His poems, which are chiefly concerned with fighting or with his love for Abla, were edited by Muhammad-al-'Inānī (1911); they are also included in W. Ahlwardt's *The Diwans of the six ancient Arabic Poets* (1870). As regards their genuineness, *cf.* W. Ahlwardt's *Bemerkungen uber die Aechtheit der alten arabiscken Gedichte* (Greifswald, 1872) *50 seq.* ***The*** *Romance of 'Antar* (Sīrat 'Antar ibn Shaddād), a work which was long handed down by oral tradition only, has grown to immense proportions and has been published in 32 volumes at Cairo, 1307 A.H. (A.D. 1889), and in 10 volumes at Beirūt, 1871. It was partly translated by Terrick Hamilton under the title *'Antar, a kedoueen Romance* (4 vol., 1820), and there is a French translation by L. Marcel Devic (2nd ed., 1878).

For an account of the poet and his works *see* H. Thorbeckes, *Antarah ein vorislamischer Dichter* (Leipzig, 1867), and *cf.* the *Book of Songs (see* ABULFARAJ), vol. vii., p. 148–153.

ANTARCTIC, the epithet applied to the region, including both the ocean and the lands, round the South Pole (Gr. *ἀντί*, opposite, and *ἄρκτος*, the Bear, the northern constellation of *Ursa Major)*. The Antarctic circle is drawn at 66° 30′ S., but polar conditions of climate, etc., extend considerably north of the area thus enclosed. (See ANTARCTIC REGIONS.)

ANTARCTIC REGIONS. The remoteness of the antarctic regions from the centres of civilization delayed their exploration until comparatively modern times. The existence of zones of climate similar to those in the northern hemisphere had been predicted by the Greek philosophers, but it was not until Prince Henry the Navigator began in 1418 to encourage the penetration of the torrid zone in the effort to reach India by circumnavigating Africa that the exploration of the southern hemisphere began. Successive explorations set a southern limit to the great known continents without approaching the true antarctic regions. The rounding of Africa by Bartholomew Diaz, in 1487; of South America by Magellan, in 1520, and of Tierra del Fuego by Schouten and Lemaire in 1615 established the main objects of the day by finding routes to the east, and there was, therefore, no inducement to further search towards the south. Nevertheless, the geographers of the time sketched in imagination a vast southern continent just beyond these known routes, and the history of further exploration is largely that of the diminution of this great south land by minor discoveries, until Captain Cook's voyage led the world to the opposite extreme of doubting whether there was any south land at all.

HISTORICAL

The search for this great south land or third world was a leading motive of explorers in the 16th and the early part of the 17th centuries, and no illusion ever died a harder death. Voyagers round the Horn frequently met with contrary winds and were driven southward into snowy skies and ice-encumbered seas; but so far as can be ascertained none of them before 1770 reached the Antarctic Circle, or knew it, if they did. It may safely be said that all the navigators who fell in with the southern ice up to 1750 did so by being driven off their course and not of set purpose. An exception is the determined effort on the part of the French naval officer, Pierre Bouvet, to discover the south land, which resulted in the discovery of Bouvet island in 54" 10′ S., and in the navigation of 48" of longitude of ice-cumbered sea in 55° S. in 1739. In 1771 Yves Joseph Kerguelen-Trémarec sailed from France with instructions to proceed south from Mauritius in search of "a very large continent." He lighted upon a land in 50° S. which he called South France, and believed to be the central mass of the southern continent. He was sent out again to complete the exploration of the new land, and found it to be only an inhospitable island which he renamed in disgust the Isle of Desolation; posterity has recognized his courageous efforts by naming it Kerguelen Land.

James Cook.—Sailing in 1772, under the orders of the British Admiralty, with the "Resolution," a vessel of 462 tons, under his own command, and the "Adventure," of 336 tons, under Captain Tobias Furneaux, Cook first searched in vain for Bouvet island, then sailed for 20° of longitude to the westward in lat. 58° S., and then 30° eastward for the most part south of 60° S., a higher southern latitude than had ever been voluntarily entered before by any vessel. On Jan. 17, 1773, the Antarctic Circle was crossed for the first time in history and the two ships reached 67" 15′ S. in 39° 35′ E., where their course was stopped by ice. There Cook turned northward to look for South France, of the discovery of which he had received news at Cape Town, but from the rough determination of his longitude by Kerguelen, Cook reached the assigned latitude 10° too far east and did not see it. He turned south again and was stopped by ice in 61° 52′ S. and 95° E. and continued eastward nearly on the parallel of 60° S. to 147° E., where on March 16 the approaching winter drove him northward for rest to New Zealand and the tropical islands of the Pacific. In Nov. 1773 Cook left New Zealand, having parted company with the "Adventure," and reached 60° S. in 177° W., whence he sailed eastward keeping as far south as the floating ice allowed. The Antarctic Circle was crossed on Dec. 20 and Cook remained south of it for three days, being compelled after reaching 67° 31′ S. to stand north again in 135° W. A long detour to 47° 50′ S. served to show that there was no land connection between New Zealand and Tierra del Fuego, and turning south again Cook crossed the Antarctic Circle for the third time in 109° 30′ W., and four days later his progress was blocked by ice in 71° 10′ S., 106° 54′ W. This point, reached on Jan. 30, 1774, was the farthest south attained in tile 18th century. In Nov. 1774 Cook started from New Zealand and crossed the South Pacific without sighting land between 53" and 57° S. to Tierra del Fuego; passing Cape Horn on Dec. 29 he discovered the Isle of Georgia and Sandwich Land, the only iceclad land he had seen, and crossed the South Atlantic to the Cape of Good Hope between 55° and 60° S., thereby exploding the myth of a habitable southern continent. Cook's most southerly discovery of land lay on the temperate side of the 60th parallel, and he convinced himself that if land lay farther south it was practically inaccessible and of no economic value.

Soon after Cook's return sealers set out on voyages to South Georgia both from England and America. In Feb. 1819, William Smith of the brig "Williams," rounding the Horn with a wide sweep to the south, saw land in 62° 40′ S. Repeating the voyage in October he saw the land distinctly, and named it New South Shetland. The "Williams" was chartered by the British naval commander on the Pacific station, and in 1820 Edward Bransfield, master, R.N., surveyed the group and went as far as 64° 30′ among the islands. Meanwhile American sealers from Stonington, Conn., had begun operations on the newly discovered land, and one of these, N. B. Palmer, discovered the mountainous archipelago still farther south which bears his name. In 1821–22 George Powell, apparently a British sealer, discovered and surveyed the South Orkney islands which, though typical antarctic lands, lie outside the Antarctic Circle.

Bellingshausen.—A voyage only second in importance to that of Cook was planned in Russia and sent out by the emperor, Alexander I., under the command of Fabian von Bellingshausen in the "Vostok," with Lieutenant Lazareff in the "Mirni" in company, both vessels being about 500 tons. The object of the expedition was to supplement that of Cook by circumnavigating the antarctic area, taking care to keep as far south as possible in those longitudes where Cook had made his northward detours. Bellingshausen entered on his exploring work by sighting South Georgia at the end of Dec. 1819, discovered the Traverse islands, sighted the Sandwich group and met a solid ice-pack in 60° S., to get round which he made a wide detour, sailing east to the south of Cook's tract, and getting south of the 60th parallel in 8" W. On Jan. 26 he crossed the Antarctic Circle in 3" W. and by Feb. 1 had reached 69° 25′ in 1" 11′ W., a latitude which has never been surpassed on that meridian. Being stopped by ice, Bellingshausen turned northward and then continued to the east well to the south of Cook's track, getting south again as the ice permitted and reaching 69° 6′ S. in 18° E. On this occasion he was able to sail for 3" of longitude within the circle before being forced north of it by a succession of heavy gales. He still kept eastward south of 65° S. and crossed the circle once more in 41° E., where the number of birds seen suggested the proximity of land, and, in fact, Enderby Land was not very far off, though out of sight. A storm of unexampled violence drove the ships

northward, but they still held to the east south of 60° S. as far as 87° E., having followed the edge of the ice through those meridians south of Kerguelen Land where Cook had made a great detour to the north. Bellingshausen now made for Sydney, and there heard of the discovery of the South Shetlands; leaving early in November, he reached the 60th parallel a month later in long. 143° W., and sailing eastward kept south of that parallel through 145° of longitude during 65 days, never out of sight of the ice, keeping close along the pack edge through the great gap ieft by Cook south of New Zealand. He managed to cross the circle three times more, in 164° 30' W., in 120° W. and in 92° 10′ W., where he reached 69° 52′ S., the culminating point of the voyage. On Jan. 22, 1821, the day after reaching his highest Latitude, Bellingshausen sighted the first land ever seen within the Antarctic Circle, the little island named after Peter I. A week later another and larger land, named after Alexander I., was seen at a distance of 40m. and sketches made of its bold outline in which the black rock stood out in contrast to the snow. Bellingshausen then made for the South Shetlands, where he met the American sealers, and thence returned to Russia.

Weddell, Biscoe and Balleny.—During the next few years, several determined attempts were made to penetrate farther to the south. Most of these had as their first object the discovery of areas suitable for whaling or sealing, and must be intimately connected with the name of the famous firm of Enderby of London, which was always ready to encourage their whaling and sealing masters to take every opportunity that offered for exploration. In 1823 James Weddell, a retired master, R.N., in command of the "Jane," a brig of 160 tons, with the cutter "Beaufoy," of 65 tons, sailed into the sea which now bears his name and on Feb. 20 he reached the highest latitude yet attained, 74° 15′ S. in 34" 17 W. In 1830 John Biscoe, R.N., in command of one of the Enderby brigs, sailed to the eastward from the South Sandwich islands and found himself forced to coast along the impenetrable ice-pack, until he crossed the Antarctic Circle in 1° E. He remained south of the circle for over four weeks, and was rewarded by the discovery of land in 49° 18' E., which he saw, but was unable to reach. This land is now known as Enderby Land. Biscoe recruited his crews in Tasmania and New Zealand, and again sailed for the south, crossing the whole of the southern Pacific in a high latitude in Feb. 1832, and discovering the islands and main land south of South America, since known as the Biscoe islands and Graham Land. In 1833 another of the Enderby captains, named Kemp, reported the discovery of land about 10° E. of Enderby Land, while in 1839 John Balleny, sailing south from New Zealand, crossed the Antarctic Circle in 178° E., and discovered the Balleny islands, one of which rises to a height of 12,000 feet.

Dumont **d'Urville.**—About 183j the importance of obtaining magnetic observations in the far south, and the scientific interest of the study of the south polar regions led to plans being put forward for expeditions in the United States, France and Great Britain. The French were first in the field; an expedition, equipped in the frigates "Astrolabe" and "Zelée" under Jules Dumont d'Urville for ethnological research in the Pacific islands, was instructed to make an attempt to surpass Weddell's latitude in the South Atlantic ocean, and this d'Urville tried to do with conspicuous ill-success; he never reached the Antarctic Circle. Two years later. after fulfilling the main purpose of his expedition in the Pacific, d'Urville resolved for the glory of France to attempt to reach the magnetic pole. He left Hobart Town on Jan. 1, 1840, and on the 20th he crossed the 66th parallel in 140° E. and discovered land 3,000 or 4,000ft. high, which he named Adélie Land. Ten days later in 64" 30′ S. d'Urville cruised westward along a high ice-barrier, which he believed to be connected with land, from longitude 131° E. and he named it the Clarie coast. A few days later he left the Antarctic regions for the Pacific.

Wilkes.—As early as 1836 the United States Congress had authorized an American exploring expedition in the programme of which antarctic exploration had a leading place. Lieutenant Charles Wilkes was appointed to command the expedition of five vessels in Aug. 1838, and his instructions, dated in that month, required him amongst other things (1) to follow Weddell's route as far as possible; (2) to visit the most southerly point reached by Cook in the antarctic; and (3) to make an "attempt to penetrate within the antarctic region, south of Van Diemen's Land, and as far west as long. 45° E., or to Enderby Land." In spite of great difficulties Wilkes fulfilled his programme. In following Weddell's route Wilkes, in March 1839, fared no better than d'Urville in the previous year, but the "Flying Fish," of 96 tons, under Lieutenant Walker reached 70° S. in 105° W., thus nearly reaching Cook's position of 1774. The third item of the antarctic programme was made the subject of the most strenuous endeavour. Wilkes sailed from Sydney in the "Vincennes" on Dec. 26, 1839, accompanied by the "Peacock," the "Porpoise" and the "Flying Fish." They went south to the west of the Balleny islands, which they did not see, and cruised westward along the ice-barrier or as near it as the ice-pack allowed towards Enderby Land nearly on the Antarctic Circle. The weather was bad with fogs, snowstorms and frequent gales, and although land was reported (by each of the vessels) at several points along the route, it was rarely seen distinctly. There can be no doubt that Wilkes saw land along the line where Adélie Land, Kemp Land and Enderby Land are known to exist, even if the positions he assigns are not quite accurate. It seems no more than due to a gallant officer, who did his best in most difficult circumstances, to leave the name of Wilkes Land on the map of the region he explored.

Ross.—Unlike the other two expeditions, that equipped by the British Government in 1839 was intended solely for antarctic exploration and primarily for magnetic surveys in the south polar seas. There were two ships, the "Erebus," of 370 tons, and the "Terror," of 340, stoutly built craft specially strengthened for navigation in the ice. Captain J. Clark Ross, R.N., was in command of the "Erebus" and of the expedition; Commander F. R. M. Crozier of the "Terror." A young surgeon, J. D. Hooker, joined the royal navy in order to go on the expedition, and he lived to take a keen interest in every subsequent antarctic expedition down to that of Captain Scott in 1910. Ross had intended to make straight for the meridian of the magnetic pole, but, finding that d'Urville and Wilkes had already entered on those seas; he determined to try to make a high latitude farther east, and leaving Hobart Town on Nov. 12, 1840, he crossed the Antarctic Circle on Jan. 1, 1841, and entered the pack ice on the 5th in 174° E., which they penetrated in five days and reached open water. Sailing towards the magnetic pole they found a chain of great mountains rising from a coast which ran due south from a prominent cape (Cape Adare) in 71° S. The continent was taken formal possession of for Queen Victoria by landing on Possession island, the mainland being inaccessible, and the ships continued southward in sight of the coast of Victoria Land, where the loftiest mountain was named Mt. Melbourne after the prime minister, until the twin volcanoes, named Erebus and Terror, were sighted in 78° S. on Jan. 28. From Cape Crozier, at the base of the mountains, a line of lofty cliffs of ice ran eastwards, the great ice-barrier, unlike any object in nature ever seen before, rising perpendicularly from the water to the height of 200 or 300ft. and continuing unbroken for 250 miles. Along the barrier the highest latitude of 78" 4′ S. was attained, and the farthest point to the east was 167° W., whence Ross turned to look for a winter harbour in Victoria Land, being desirous to winter near the south magnetic pole. As he could not reach the land on account of ice extending out from it for 1j or 16m., after sighting the Balleny islands at a great distance, on March 2 the ships returned to Hobart. For striking discoveries this was the most remarkable antarctic voyage ever made.

In Nov. 1841 the "Erebus" and "Terror" returned to antarctic waters, steering south-east from New Zealand and entering the ice-pack in about 60° S. and 146° W., the idea being to approach the great barrier from the eastward. After much severe weather the barrier was sighted on Feb. 22, 1842, and the ships reached, 78" 10′ S. in 161° 27′ W., the highest latitude attained for ***60*** years. To the eastward the barrier surface rose to a mountainous

height, but although Ross believed it to be land, he would only treat it officially as "an appearance of land," leaving the confirmation of its discovery as King Edward Land to the next century. No more work was done in this quarter; the "Erebus" and "Terror" turned the edge of the pack to the northward and on getting into clear water sailed eastward to Cape Horn.

After wintering in the Falkland islands, Ross made his third and last attack on the southern ice, and for six weeks he cruised amongst the pack off Joinville island and Louis Philippe Land trying in vain to reach the Antarctic Circle. Failing in this attempt he turned to follow Weddell's route and skirted the pack eastward in 65° S., crossing Weddell's track on Feb. 14, 1843, more than a degree farther south than d'Urville in his attempt four years before, but on the edge of an equally impenetrable pack. Coasting it eastward to 12° W. the "Erebus" and "Terror" at last rounded the pack and found the way open to the south, crossing the circle on March 1. Four days later the pack was met with again and the ships were forced into it for 27m. to lat. 71° 30′ S. in 14° 51′ W., 19° east of Weddell's farthest south.

"Challenger."—No further attempt at south polar exploration was made for nearly 30 years, except a short cruise by Tapsell in the "Brisk," one of Enderby's ships which in Feb. 1850, after passing the Balleny islands, proceeded eastward to 143° E. at a higher latitude than Wilkes without sighting land. The first steamer to cross the Antarctic Circle was H.M.S. "Challenger," on Feb. 16, 1874; she penetrated only to 66° 40′ S., in 78° 30′ E., south of Kerguelen Land; but she continued her course to Australia for some distance in a high latitude, passing within 15m. of the position assigned to Wilkes's Termination Land without seeing any sign of land. Her dredgings and soundings yielded evidence as to the nature of the unknown region farther south. Sir John Murray believed that the soundings showed a general shoaling of the ocean towards the antarctic ice, indicating the approach to a continent. By collecting and analysing all samples of deep-sea deposits which had been secured from the far south, he discovered a remarkable symmetry in the arrangement of the deposits. The globigerina ooze, or in deeper waters the red clay, carpeting the northern part of the southern oceans, merges on the southward into a great ring of diatom ooze, which gives place in turn, towards the ice, to a terrigenous blue mud. The fine rock particles of which the blue mud is composed are such as do not occur on oceanic islands, and the discovery of large blocks of sandstone dropped by icebergs proved the existence of sedimentary rocks within the Antarctic Circle.

Lamen.—A Norwegian sealer, the "Jason," Captain Larsen, visited those seas in 1892; the captain landed and collected fossils at several points north of 65° S. In 1893–94 the "Jason," accompanied by two other Norwegian vessels, the "Hertha" and the "Castor," returned to the antarctic and entered the ice-laden waters in November at the very beginning of summer. Captain Larsen in the "Jason" made his way as far south as 68° 10′ in 60° W. on the eastern side of Graham Land, but several miles from the coast, which was bordered by a high ice-barrier. The "Hertha," Captain Evensen, reached the South Shetlands on Nov. 1, 1893, and worked her way southward along the west side of Palmer Land and past the Biscoe islands reaching the Antarctic Circle on Nov. 9 without meeting ice. This was the first time the Antarctic Circle had been crossed since the "Challenger" did so 20 years before. Captain Evensen sighted Alexander Land, and without experiencing any trouble from ice-floes he reached his farthest south, 69" 10′ S. in 76° 12′ W. (*Mitteilungen* der *Geographischen Gesellschnft*, Hamburg, 1895, pp. 245–304.)

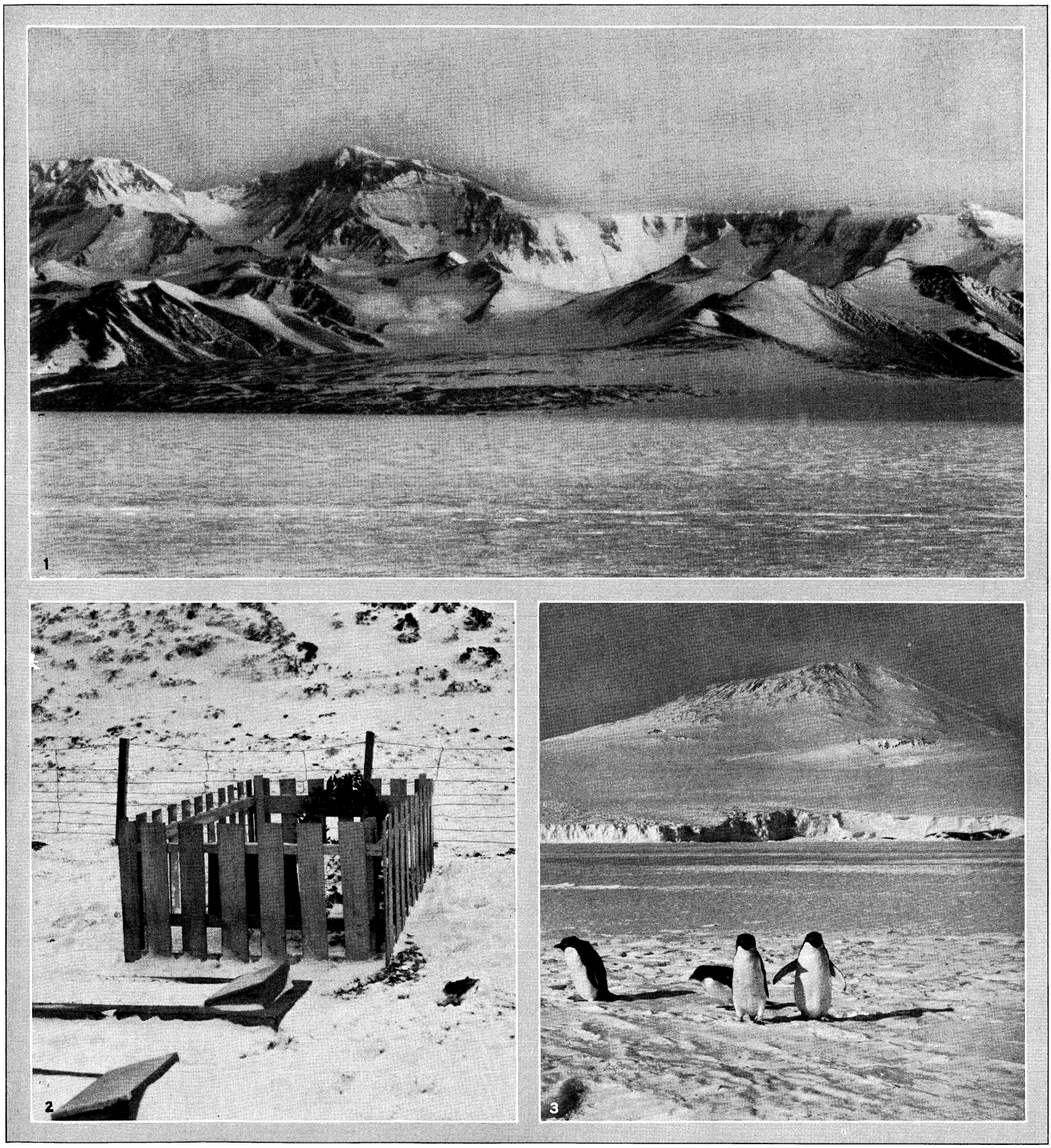
In 1894 the well-known Norwegian whaler, Svend Foyn, sent out one of his vessels, the "Antarctic," Captain Christensen, to try his luck off the coast of Victoria Land. The "Antarctic" sailed from Melbourne in September, having on board Carstens Egeberg Borchgrevink, a young Norwegian resident in Australia. The "Antarctic" entered the pack in 62° 45′ S, 171° 30' E., on Dec. 8, 1894. The Balleny islands were sighted on Dec. 14, and Cape Adare on Victoria Land two days later. On Jan. 22, 1895, the farthest point was reached at Coulman island in 74" S.; the sea was then easily navigable to the south. On Jan. 23 a small party, including the captain and Borchgrevink, landed on the mainland near Cape Adare, the first people to set foot on the Antarctic continent.

Gerlache: **"Belgica."**—Efforts had been made from time to time by Prof. Georg von Neumayer in Germany and by Sir John Murray and others in Great Britain, to induce learned societies to inaugurate a new era of scientific antarctic research under Government or at least under national auspices. In 1895 Sir Clements Markham, as president of the Royal Geographical Society and of the International Geographical Congress, also took the matter up, and interest in the antarctic regions began to be aroused in every civilized country. Captain Adrien de Gerlache organized and led a Belgian expedition, for which he raised the funds with difficulty. Their ship was named the "Belgica," and amongst the members of the expedition were Roald Amundsen and Dr. F. A. Cook. The "Belgica" crossed to the west of Graham Land and made surveys of the archipelago there. It finally penetrated the pack as far south as 71" 30′, where it had the misfortune of being frozen in. For more than a year the ship drifted with the ice, and although scientific work of great importance was carried out, the members suffered severely from depression and one member died. Though it made few discoveries of land, its scientific collections were of unique value, and it was one of the first antarctic expeditions to have its results published in a suitable form.

Borchgrevink.—The first expedition to spend a winter on the antarctic continent was that of Borchgrevink, which left England in 1898, and landed a party at Cape Adare, the north-east point of Victoria Land. The choice of headquarters was an unlucky one, as no sledge journeys to the south were possible, but the land party made observations and collections of considerable value during their stay, though they had the misfortune to lose their biologist. Before returning, Borchgrevink sailed south to the Ross barrier and discovered that the edge of the ice was considerably farther south than it had been when visited by Ross in 1842.

Discovery.—In the autumn of 1901 three well-equipped expeditions left Europe for antarctic exploration. The British national antarctic expedition was organized by a joint committee of the Royal Society and the Royal Geographical Society, and equipped under the superintendence of Sir Clements Markham. For this expedition a new departure was taken, in that a ship, named "Discovery," was specially built for the work. She was of 700 tons register, and was made entirely non-magnetic amidships. The expedition sailed under the command of Commander R. F. Scott, R.N., and included in the expedition were Lieutenant Shackleton, R N R., and Dr. E. A. Wilson. It mas decided that the ship should remain south for one winter in the ice, for which purpose Scott, after cruising along and surveying the edge of the Ross barrier, selected McMurdo sound at the south-west corner of Ross sea, as his headquarters. Before laying up for the winter, he cruised to the eastward of the farthest point reached by Ross, and discovered land of a continental character, which he named King Edward Land.

The winter quarters proved to be suitable, but it was some time before the party were able to develop a technique for their sledging journeys and commence a series of explorations from their base. The expedition initiated a new phase of exploration in the antarctic in working from a settled base. Symptoms of scurvy appeared during the winter, but with early spring a series of sledging journeys were commenced. The main journey was that of Captain Scott, with Shackleton and Wilson, who travelled with dogs over the surface of the barrier towards the south, in which journey, after many vicissitudes, caused chiefly by the failure and death of the dogs, they reached, on Dec. 30, their farthest south in 82° 17' S. During the return march Shackleton broke down and had to be invalided home in the relief ship which visited the "Discovery" in the summer. Meanwhile, Armitage had pioneered a route to the plateau to the west of the headquarters. By the end of the summer it was obvious that the "Discovery" would not be able to get clear of the ice, and it was determined to spend a second winter in the south.



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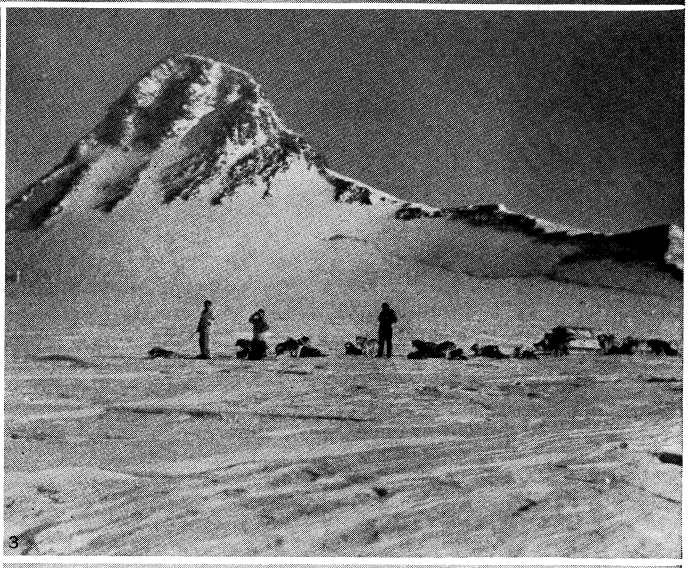
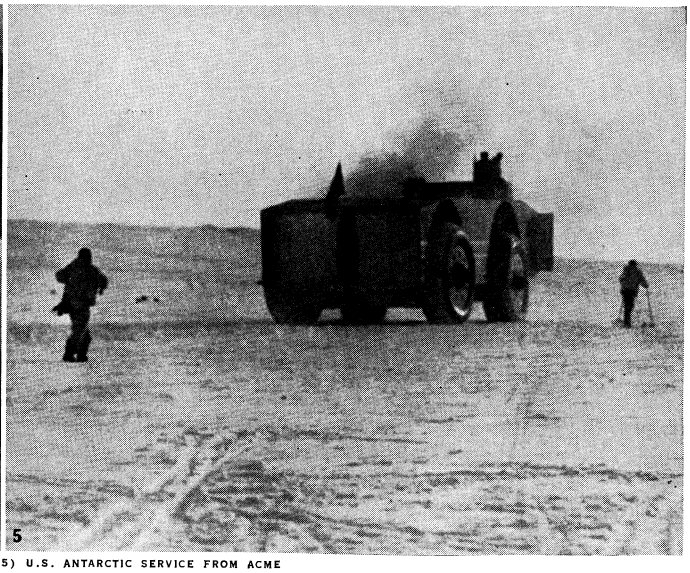
SCENES IN THE FROZEN ANTARCTIC REGIONS

1. Mount Lister, **12,995** feet high, in south Victoria Land
2. The grave of Sir Ernest Shackleton, the Antarctic explorer, at Grytviken, on South Georgia island. His death occurred in January, 1922, off South Georgia island, on his third Antarctic expedition.
3. Mount Erebus, approximately **13.000** feet high, on Ross island, in the Ross sea, photographed at a distance of 16 miles. The birds in the foreground are penguins

ANTARCTIC REGIONS





BYRD'S EXPEDITIONS TO LITTLE AMERICA

1. Mount Helen Washington in the Edsel Ford range, seen from one of the expedition's planes on a fiight from Little America
2. View of Little America
3. Dog team, with Edsei Ford mountains in background
4. Admiral Byrd conferring at Little America with the men who made the aeroplane flights of exploration over the Antarctic during the second expedition (1933–35)
5. Giant snow cruiser rolling over the snow wastes of Little America during the third expedition, begun in 1939

The second year's work was chiefly remarkable for a great journey led by Scott, in which without dogs he reached a point 300m. west of the ship having penetrated over 250m. inland and finding it to be a high plateau averaging 8,000ft. above sea level. The ship was reached again on Dec. 25, and on Jan. 5 the "Morning" arrived accompanied by a larger vessel, the "Terra Nova," sent out by the Admiralty with orders to Captain Scott to abandon the "Discovery" and return at once. Fortunately, although all the stores and collections had been transferred to the relief ships, the "Discovery" broke out of the ice on Feb. 16, 1904, and Captain Scott had the satisfaction of bringing her home in perfect order. The relief ships had provided so little coal that a most promising voyage to the westward of the Balleny islands had to be abandoned in 155° E.; but it showed that the land charted by Wilkes east of that meridian did not exist in the latitude assigned.

Drygalski: "Gauss."—Simultaneously with the "Discovery" expedition and in full co-operation with it as regards simultaneous meteorological and magnetic observations, the German Government equipped an expedition in the "Gauss" which was specially built for the occasion. The expedition was under the charge of Prof. Erich von Drygalski. A supplementary expedition set up a station for simultaneous observation on Kerguelen Land. The "Gauss" crossed the parallel of 60° S. in 92" E. early in Feb. 1902 and got within 60m. of the charted position of Wilkes's Termination Land, where a depth of 1,730 fathoms was found with no sign of land. The pack made it necessary to turn south-westward and land was seen to the eastward on Feb. 1902 on the Antarctic Circle in the direction of Termination Land. Soon afterwards the "Gauss" was beset and spent the winter in the ice. Land of considerable extent was seen to the south and was named Kaiser Wilhelm II. Land; the most conspicuous feature on it was a hill of bare black rock with an elevation of about 1,000ft., which was called the Gaussberg, and was situated in 67° S., go° E. This was the only bare land seen, and its neighbourhood was thoroughly investigated by sledge parties, but no distant journey was undertaken.

Nordenskjold and Bruce.—Two private expeditions organized by men of science were in the antarctic region simultaneously with the British and German national expeditions, and the synchronous meteorological and magnetic observations added to the value of the scientific results of all the parties. Dr. Otto Nordenskjold, nephew of the discoverer of the north-east passage, led a Swedish party in the "Antarctic," with Captain C. A. Larsen in command of the ship, and reached the South Shetlands in Jan. 1902. The "Antarctic" succeeded in penetrating the pack in the Weddell sea almost to the circle in jo° W., where d'Urville and Ross had failed to get so far south. A second winter was spent at the base on Snow Hill island, and, the ship having been lost in the ice on her way to take them off, the party was rescued by a brilliant dash of the Argentine gunboat "Uruguay," under Captain Irizar, before the relief ship sent from Sweden arrived.

Meanwhile Dr. W. S. Bruce equipped a Scottish expedition in the "Scotia," with Captain Thomas Robertson in command of the ship, and a large scientific staff. The "Scotia" made valuable oceanographical investigations in the Weddell sea in 1903 and returning again the next summer she sighted the land now known as Coats Land. In addition to her very thorough exploration of the eastern side of the Weddeil sea her oceanographical work throughout the southern ocean was of very great value in the solution of a number of disputed points.

Charcot.—In Jan. 1904 Dr. Jean B. Charcot, a man of science and an accomplished yachtsman, left the Fuegian archipelago for the antarctic in the "Français," in commdnd of a French exploring expedition equipped at his own instance. He cruised along the western side of Graham Land to 67° S. A mishap to this ship caused him to return from this point but he returned again in 1908 in the "Pourquoi Pas" wintering in 1909 on Petermann Island, 65° S. In the next summer he pushed further south and west and established the continuity of Graham Land with Alexander Land and its general trend to the westward to more thnn half the distance from Graham Land to King Edward Land

Shackleton.—After his return invalided from the "Discovery," Lieutenant Shackleton planned a fresh expedition, and started in the small whaler "Nimrod" from Lyttelton, New Zealand, on Jan. 1, 1908, being towed by a steamer to the Antarctic Circle, in order to save coal. The expedition established itself at Cape Royd on Ross island, some 2om. north of Scott's winter quarters of 1904, a hut being built and the ship returning to New Zealand for the winter. A new departure in antarctic sledging was initiated by the use of Manchurian ponies. Before the winter set in a party under Prof. T. W. E. David reached the summit of the active volcano, Mt. Erebus. In the succeeding summer the same leader made a very notable sledge journey to the south magnetic pole, situated in lat. 72° 25′ S., 155° 16′ E. at an altitude of over 7,000 feet.

The greatest achievement of this remarkable expedition was the journey made by Shackleton himself with three companions who reached the latitude of 88" 23′ S., discovering a route on to the plateau by way of the gigantic Beardmore glacier, and pioneering the way to the Pole itself. This must rank as the greatest sledge journey ever made without the help of supporting parties. The party narrowly escaped disaster from causes somewhat similar to those which destroyed the Scott party four years later, but it reached the ship just in time and the whole expedition returned without losing a man.

Scott.—Captain R. F. Scott left England in 1910 with a new expedition, promoted by his own exertions, in the "Terra Nova," manned by a carefully selected crew and a large scientific staff. The main objects of the expedition were a journey to the South Pole and a very comprehensive programme of scientific investigation of the Ross sea area. The main party established itself on the west side of Ross island between Scott's former winter quarters and Cape Royd. A subsidiary party of six men, led by Lieutenant Campbell, were sent to the east in the ship to establish a base in King Edward Land. Steaming along the face of the barrier, carrying out a survey the party entered a deep bay and were amazed to find the "Fram" of north-polar fame, with a Norwegian party under Captain Roald Amundsen. This expedition, intended for the north-polar regions, had changed its plans and decided to attempt to reach the South Pole instead. Secrecy was deemed necessary and the "Fram" made an extraordinary voyage from Madeira to Ross sea without calling at any port, landed the party and returned for the winter to Buenos Aires.

Amundsen relied entirely on his dogs and after some very successful depot-laying journeys he set out on Oct. 20, 1911, for the Pole, accompanied by four companions on ski with 52 dogs. They found a new route up to the polar plateau by way of the Axel Heiberg glacier in 85° S. and reached the Pole on Dec. 14. The return journey took but 38 days and they arrived at their winter quarters with 12 dogs and ample food supply in hand. No attempt was made at any serious scientific work by the expedition, but it performed the journey at by far the fastest rate of any sledge party yet in the antarctic, the dogs doing all the transport work.

Meanwhile Scott had sent his subsidiary party to Cape Adare where they wintered in the hut of Borchgrevink's expedition of 1899–1900. They were compeiled to make a hazardous land journey of 300m. back to Cape Evans along the coast of Victoria Land, wintering on the way with improvised equipment. A very remarkable winter journey to Cape Crozier was carried out by Dr. E. A. Wilson, Lieutenant Bowers and Cherry-Garrard in conditions of unprecedented severity, and unique specimens of the eggs of the emperor penguin were secured. The Pole party started from Cape Evans on Oct. 24, 1911, in three divisions using respectively motor-sledges, ponies and dogs. The motors broke down before the journey was well begun, the last of the ponies was shot before reaching 83" 30′ S., here also the dog-teams were sent back to the base, and on Dec. 10 Scott with 11 others began the ascent of the Beardmore glacier, following Shackleton's route of 1909, with three man-hauled sledges. On Dec. 21 four men with one sledge were sent back from 85° 7′ S., and on the 31st the last supporting party of three under Lieutenant E. R. G. R. Evans returned from 86° 56′ S. and reached the base after narrowly escaping death from scurvy.

The Polar party — Scott, Wilson, Bowers, Captain Oates and Petty-Officer Edgar Evans — with one sledge and equipment originally designed for four men, reached the Pole on Jan. 18, 1912, where they found a tent left by Amundsen. All were tired out by their 69 days' march and bitterly disappointed to find that they had been forestalled. The weather on the return journey was worse than it had ever been known before, and disasters followed one another. Edgar Evans broke down on the Beardmore glacier and after delaying the march died on Feb. 17. Oates, at the end of his strength, and resolved not to be a burden, sacrificed himself on March 17 in 79° 50′ S., by walking out into the blizzard. The supply of fuel oil at the last depot had been deficient and 20m. remained, to reach the next. The three survivors struggled on heroically for 10m., raised their tent for the last time and, being bound to their camp by a blizzard which lasted for nine days, nothing remained but to await death with quiet fortitude. Lieutenant Evans, the second in command, had been invalided home on the "Terra Nova," and the search parties sent out to meet Scott had been unfortunate, so that it was not until after another winter that Dr. Atkinson, then in command at the base, found the tent with the frozen bodies on Nov. 12, 1912.

Douglas Mawson. — Dr. Douglas Mawson organized the Australian antarctic expedition which set out in the "Aurora" in Dec. 1911. The main base was established in Adélie Land and a wireless mast erected. Here Mawson with 17 companions built a hut on the shore of Commonwealth bay (67° S., 142° 4′ E.) while the ship under the command of Captain J. K. Davis proceeded 1,500m. to the westward where Queen Mary Land was discovered and Frank Wild landed with a party of seven men and a hut to form the western base in 66° S., 94° E. His climatic observations are quoted below in the section on climate. Sledge parties started from the main base in Nov. 1912, diverging to explore inland towards the magnetic pole and eastward and westward near the coast. The sledge parties made their way for 300m. or more from the base. All got back without disaster except the leader, whose two companions, B. B. S. Ninnis and X. Mertz, perished, leaving him with scant stores 100m. from Commonwealth bay. He reached the hut on Feb. 10, 1913, by an effort of almost superhuman endurance and found that the "Aurora" had just sailed to relieve Wild, leaving a volunteer rescue party with whom he awaited the return of the ship in Dec. 1913. Sir Douglas Mawson was knighted in 1914. He revisited the Antarctic, rediscovering Kemp Land (reported in 1833) in December 1929, and making further discoveries in Enderby Land region (1929–31).

Shackleton. — Sir Ernest Shackleton planned the Imperial Trans-Antarctic expedition in 1914, intending to cross the antarctic continent from the Weddell sea to the Ross sea by way of the South Pole. On board the "Endurance" he entered the ice-pack in the Weddell sea early in Dec. 1914 and worked his way in adverse climatic conditions southward between 15° and 20° west. He discovered the Caird coast between Coats Land and Luitpold Land on Jan. 11, 1915, but he found no landing-place. The ship, beset in the ice on Jan. 18, drifted northward. She was crushed in a terrific ice pressure and abandoned on Oct. 27, in 69° 5′ S., and the 28 men camped on the ice-floe, which continued to move northward until April 9, 1916, when the floe broke up in 62° S., 54° W. after a drift of 457 days. The party took to their three small boats and landed six days later after extraordinary hardships on Elephant island where they camped on a narrow beach below vertical ice cliffs. Shackleton with five men succeeded in reaching South Georgia, 750m. distant, in a 22ft. boat and after three unsuccessful attempts to return to Elephant island through the ice-floes he succeeded with the Chilean trawler "Yelcho" in rescuing all his men on Aug. 30, 1916. The expedition had a section in Ross sea for the purpose of laying depots for the transcontinental party. This party, under Captain Macintosh, executed their task but the ship "Aurora" was carried off in the pack ice in which she drifted for 315 days before getting free. The leader and two others perished.

Sir Ernest Shackleton's last expedition sailed on the "Quest," a small and defective vessel, in Sept. 1921 to explore the Enderby quadrant of the antarctic (0° to 90° E.). The leader died at South Georgia on Jan. 5, 1922, but Frank Wild, second in command, carried on the voyage as far as the lateness of the season permitted. He reached 69° 17′ S. in 17° E., in spite of great difficulties, and got important soundings in a little-known area.

The royal research ship "Discovery" was commissioned in 1925 by the Colonial Office with funds supplied by the Falkland islands Government to study the life history of whales with a view of regulating and perpetuating the industry in sub-antarctic waters and returned in 1927. (See CETACEA; WHALE FISHERIES.)

Later Exploration. — Results of exploration since the beginning of the century have been the attainment of the South Pole, the discovery of the general configuration of the antarctic continent and the perfecting of methods of polar travel and residence.

During the summer of 1928 two aeroplane expeditions to the Antarctic were planned. Commander Byrd proposed to form a base on the Ross barrier due south of New Zealand and to explore by aeroplane to the south and east, seeking to discover the course of the great mountain ranges which border the Ross sea and to reach the South Pole. Sir Hubert Wilkins planned to start from the same base and to fly eastward about 3,000 miles over entirely unknown parts of the ice-sheet of Antarctica to Graham Land due south of Cape Horn. Sir Hubert Wilkins arrived at his base on Deception island, Nov. 7, and made a successful flight a fortnight later. Commander Byrd later established a base in the region about 165° W., which he named Little America, and made successful explorations. On Nov. 28, 1929, Byrd set out in the tri-motored plane "Floyd Bennett" for the South Pole with Bernt Balchen, Captain A. C. McKinley and Harold June, successfully reached the pole and returned to his base on Nov. 29, using the sun compass and completing the flight in slightly under 19 hours. On a second expedition, 1933–34, Byrd extended his explorations over what he called Marie Byrd Land, wintering alone at a post 123 miles south of his base. His third expedition (1939–41) was under the auspices of the U.S. Antarctic service.

NATURE OF ANTARCTIC REGIONS

The Antarctic region is roughly that part of the globe encircled by the 60th south parallel, which for reference purposes is customarily divided into quadrants, reckoned eastward from Greenwich meridian under the names Enderby, Victoria, Ross and Weddell. More useful to the reader, if less precise, is the division into African, Australian and American sectors respectively according to the continents below which each sector lies.

Contrast Between Northern and Southern Regions. — Considering the 60th parallel as a boundary we are at once impressed with a marked contrast between the amenities of the northern and southern polar regions. Within the area poleward of 60° north latitude live more than 1,000,000 human inhabitants and countless land animals. Some of the largest and most valuable timber forests are north of 60°, and not a few industries connected with lumber, mining and fishing flourish. In the similar area in the southern hemisphere, there is not a single permanent human inhabitant, nor a single land animal larger than an insect. There are no trees and very few plants of any kind at all. The sole industry which can be said to exist in the antarctic regions is that of whaling, which is now carried on during a few months in each year in the American and Australian sectors. These contrasts naturally depend largely upon temperature. The explorations of the 20th century have shown us that the south polar region, again in complete contrast to the north, is largely occupied by a continent of more than 5,000,000 sq.m. in extent, that is to say, equivalent in size to Australia and Europe without Russia. The South Pole is placed centrally in this continent, which, though far from being symmetrical, may for general purposes be considered as bounded by the 70th parallel.

Characteristics of Antarctica. — The most noticeable feature about the continent is its unique isolation. It is possible to traverse all the other continents without crossing more than about 60m. of shallow sea, but to reach the antarctic continent one must voyage over at least 600m. of practically oceanic depths and that across the roughest seas exposed to the fiercest winds in the world. Between 55° and 65° S. lat. there is no land to interfere with the west to east circulation of sea and air, and that zone

is therefore the home of the permanent west winds, the westerly drift and the wandering albatross, all of which encircle the antarctic continent ceaselessly. There are, in short, none of the interchanges of warm and cold air and water between temperate and polar regions which in the northern hemisphere lead to such curious anomalies as an almost ice free Spitsbergen in 79° N. and an almost ice-bound Labrador coast 20° farther south.

In this fact we have an explanation of the contrasts in climate, and consequently in habitability, between the opposite polar regions, and the remainder of the explanation is forthcoming when we consider the relief of this vast deserted continent. The South Pole itself is situated on a plateau nearly 10,000ft. in height, and there is every reason to suspect that the greater part of the continent is continuous plateau. Allowing for the incomplete nature of the data we can with some fairness compute the average height of the continent as of the order of 6,000 feet, which is just twice as high as Asia, the next in order of magnitude. When we add to this conception of a high and isolated continent the fact that, of its 5,000,000 sq.m. probably less than 100 sq.m. is free from a permanent covering of ice we can well understand that here there is no attraction for man or beast or plant. The continent is thus in the grip of an ice age, more rigorous than that which has left its marks upon Europe and North America, and naturally the study of such a region resolves itself largely into a study of its manifold ice forms.

Of these the least known and the most impressive is the ice-cap, whose lateral dimensions are those of the continent itself and which supplies the myriad glaciers which everywhere fringe the coast, sometimes in ice-worn valleys, but more often as a continuous glacier-front running down into the sea for hundreds of miles along the coasts. The thickness of the inland ice is probably not so great as its extent would suggest. No direct measurements have been made, but from an examination of the outlet glaciers it appears unlikely that the sheet is ever more than 2,000ft. thick except in basins, and in general is much thinner, a conclusion which is confirmed by the fact that many hundreds of miles inland from the coast the ice sheet appears to follow closely the form of the underlying ground.

The Barrier. — The general features of the antarctic ice-cap are reproduced on a smaller scale in Greenland, but the floating ice sheets which are to some extent derivatives of the ice-cap are met with nowhere else in the world. When Ross in 1841 first penetrated the pack ice into the ice-free Ross sea he sailed due south until he was brought up in about 77" S. by an ice wall from 50 to 200ft. high, barring his way to the south. He sailed along the greater part of its 400m. seaward face. The Ross barrier, as it is now called, is the greatest of these floating ice sheets, but is typical of many others to be met with in the antarctic. It is roughly the size of France and consists of a sheet of ice varying from 500 to 1,500ft. in thickness, the outer end being open to the ocean and the inner end held fast to the continent by the glaciers which act as feeders and by being aground close to the actual coast. Its surface is smooth, and it forms the easiest approach to the Pole itself, since it reaches to within 300m. of that spot. The tabular icebergs so typical of the southern hemisphere, with their flat tops and stratified appearance, are obviously derived from this and similar barriers, and their immense size, up to 30m. in length of side, is only natural considering the size of the parent masses. Each summer, when the break up of the winter sea ice has allowed the full force of the ocean swell to reach the face of the barriers, large fragments are broken off, or "calved," and these float away to the northward until they reach warmer and stormier waters where they disintegrate.

Sea Ice. — The sea ice itself is comparatively temporary. It begins to form in sheltered bays as early as the end of January and by the beginning of March any ship is liable to be frozen in unless its harbour is a windy one. There are large variations from year to year in the area of sea solidly frozen over, since strong winds, and such are very irequent, will prevent sea ice from forming, or will blow out any which is not of considerable thickness, but in sheltered bays the ice will continue to increase in thickness until October or November, by which time it will be anything up to 7ft. through. This will begin to break up and float northward from the beginning of December onwards, but the innermost bays may not lose their ice until late in February, or occasionally not at all for two years in succession. The belt of drifting pack ice which rings the continent is made up of the ice from this summer break-up.

The Continent. — The continent, thus hidden or protected, is formed for the most part of old rocks amongst which the most prominent are of Permo-Carboniferous age and bear coal, which is found in the Australian sector up to within 300m. of the Pole. In this sector the rocks have been above sea level since Palaeozoic times, except where the Ross sea area has broken and sunk below it, giving rise to a series of volcanic centres, of which the largest, the Ross island group, still has an active volcano, Mt. Erebus, 13,000ft. high. Palaeozoic rocks have not been discovered so far in this region, although a graptolite fossil, probably of Ordovician age, shows that they occur in the South Orkneys. Mesozoic rocks have been found in various parts of the archipelago, a very rich Jurassic fossil flora of ferns, conifers and cycads having been studied by Nordenskjold, some of the genera found being represented also in the rocks of South America, South Africa, India and Australia. Cretaceous ammonites have also been found, and Tertiary fossils, both of land and of marine forms, bring the geological record down probably to Miocene times, the fauna including five genera of extinct penguins. Raised beaches show an emergence of the land in Quaternary times, and there is evidence of a recent glacial period when the inland ice on Graham Land was 1,000ft. higher than it is now. The most prominent features of the scenery are due to eruptive rocks, which have been identified as belonging to the eruptive system of the Andes, suggesting a geologically recent connection between South America and the antarctic lands. Volcanic activity is not yet extinct in the region. As regards Kaiser Wilhelm II. Land, the Gaussberg is a volcanic cone mainly composed of leucite-basalt, but its slopes are strewn with erratics presumably transported from the south and these include gneiss, mica-schist and quartzite, apparently Archaean.

Much more is known as to the geology of Victoria Land, which has been visited by four well-equipped expeditions. From Cape North (71° S.) to 86° S. *a* grand mountain range runs south curving to south-eastward, where it vanishes into the unknown in lat. 86" S.; it is built up of gneiss and granite, and of horizontal beds of sandstone and limestone capped with eruptive rock, the peaks rising to heights of 8,000, 10,000 and even 15,000ft., the total length of the range so far as known being at least 1,100 miles. This range rises abruptly from the sea, or from the ice of the Great Barrier, and forms a slightly higher edge to the vast snow plateau. About 78° S. the archipelago of volcanic islands, of which Ross island, with the active Mt. Erebus is the largest, rise from the sea in front of the range, and at the northern extremity the volcanic peaks of the Balleny islands match them in height. The composition of the volcanic rocks is similar to that of the volcanic rocks of the southern part of New Zealand. The oldest rocks of Victoria Land are apparently banded gneiss and gneissic granite, which may be taken as Archaean. Older Palaeozoic rocks are represented by greenish-grey slates from the sides of the Beardmore glacier and by radiolarian cherts; but the most widespread of the sedimentary rocks occurring in vast beds in the mountain faces is that which Ferrar named the Beacon sandstones, which are of Permo-Carboniferous age. The coast-line appears to be of the Atlantic, not the Pacific type, and may owe its position and trend to a great fault, or series of faults, in the line of which the range of volcanoes, Mt. Melbourne, Mt. Erebus and Mt. Discovery, stands. Boulders of gneiss, quartzite and sandstone have been dredged at so many points between the Balleny islands and the Weddell sea that there can be no doubt of the existence of similar continental land along the whole of that side, at least within the Antarctic Circle.

Climate. — A vast mass of meteorological observations has now been accumulated so that for the parts of the continent most visited, that is to say, the South American and the Australian sectors, it is possible to summarize the climate with some degree

of certainty. The mean temperature appears to be about 5°F. lower in the southern latitudes than in the corresponding northern ones, and the phenomenon of rain is practically unknown within the Antarctic Circle. The lowest temperature yet recorded is that of −77°F., but since this was experienced within a few miles of the sea it is probable that the inland plateau temperatures in the winter are considerably lower. Later expeditions have confirmed the indications of earlier ones that the pressure of the atmosphere increases from the polar circle to the Pole itself, though it is clear that this is due in some part to the form of the continent itself. It has also been made clear by the work of Dr. G. C. Simpson that the weather experienced on the outskirts of the continent is the result of the passage of pressure waves and the turbulent motion due to them.

Such pressure distribution, together with the shape of the land, produces the most prominent feature of the antarctic climate, excessively strong winds, which when accompanied by snow or thick drift are known as blizzards. The most windy spots appear to be on the coast near the circle itself. Phenomenal records of wind velocity were recorded at Mawson's headquarters in Adélie Land, where not only was the mean annual velocity the surprising figure of 50m. an hour, but on occasions there were prolonged winds of considerably over 100m. per hour. The winds experienced in Graham Land and in the Ross were less extraordinary but still excessive. The frequency and strength of these winds has the effect of preventing the formation close to the coast of permanent ice, which is continually being blown off shore, and besides being responsible for the perilous drifts of the "Endurance," "Aurora" and other ships, they cause the dense belt of pack ice which circumscribes the continent in the spring and early summer. There are no reliable figures for the amount of precipitation in the form of snow, but it appears probable that even in favoured parts the net precipitation on a surface at sea level is little more than a foot of snow per annum. A small calculation shows further that the net addition of snow to the ice-cap must be very much less than that.

Flora and Fauna. — Recent expeditions have discovered that, despite the low temperature of the summer, in which no month has a mean temperature appreciably above the freezing point, there are on the exposed antarctic land patches of ground with a sparse growth of cryptogamic vegetation consisting of mosses, lichens, fungi and fresh-water algae. No flowering plants occur within the Antarctic Circle or in the immediately adjacent lands.

The marine fauna is very rich and abundant. All the expeditions obtained many new species, and the resemblance which occurs between many of the forms and those which inhabit the arctic seas has given rise to the hypothesis that certain species have been able to pass from one frigid zone to the other. Bird life on sea and land is fairly abundant, the most common forms being the skua gull, snow petrels and the various species of penguins. The penguins are specially adapted for an aquatic life, and depend for their food entirely on marine animals. The largest species, the emperor penguin, inhabits the most southerly coast known on the edge of the Great Barrier, and there it breeds at mid-winter, very interesting specializations of structure and habit making this apparently impossible feat practicable. The social organization and habits of the various species of penguins have been carefully studied, and show that these birds have arrived at a stage of what might almost be called civilization worthy of the most intelligent beings native to their continent. The only mammalian life in the antarctic is marine, in the form of various species of whales (but not the "right whale"), and a few species of seals which live through the winter by keeping open blow-holes in the sea ice. There is no trace of any land animal except a few species of minute wingless insects of a degenerate type.

Products of the Continent. — Since there are no land animals or flowering plants the resources of the region are limited to the products of the sea. Of these the most striking are the various species of penguins, which inhabit all zones of the region. Fortunately for the preservation of such harmless and delightful birds their blubber-coated skins do not possess a marketable value. The seals also, not being of the fur-bearing kind, are more or less immune from human exploitation. There remain the whales which in large numbers frequent antarctic seas to feed on the minute animals there to be found which in their turn ultimately depend for their food upon diatoms, the typical marine plants of the region, microscopic in size but so countless in number as to colour the sea ice. The rorqual, the humpback and the huge blue whale are now all hunted in these seas by modern methods and the annual value of the products obtained exceeds £3,000,000 sterling. (See WHALES AND WHALING.) Until the rise of the whaling industry the antarctic can be said to have had no political significance, but since the beginning of the century the territorial waters of the continent, if not the land itself, have acquired a value and, as will be seen from the map, two sectors are now portions of the British empire and are known as the Ross dependency, administered by New Zealand, and the Falkland islands dependency, administered by the Falkland islands.

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ANTARES, *a* Scorpii (*a* Scorpionis), the brightest star in the Constellation Scorpio (*q.v.*), is of a reddish hue and appears at the heart of the Scorpion. It is a giant star of low density, having a diameter of 360,000,000 miles, according to measurements taken on Mt. Wilson.

ANTE, the name of a stake in certain card games. (See FANTAN; POKER.)

ANT-EATER, a term applied to several mammals that live mainly upon ants. For the Cape ant-eater, see AARD-VARK; for scaly ant-eater, *see* PANGOLIN; for banded ant-eater, see MARSUPIALIA, and for spiny ant-eater see MONOTREMATA and ECHIDNA.

The great ant-eater or ant-bear (*Myrmecophaga jubata*) is the largest representative of the tropical American family *Myrmecophagidae* (see also EDENTATA). It measures 4 ft in length, exclusive of the long bushy tail, which is usually carried bent over the back, and reaches a height of 2 ft. at the shoulder.

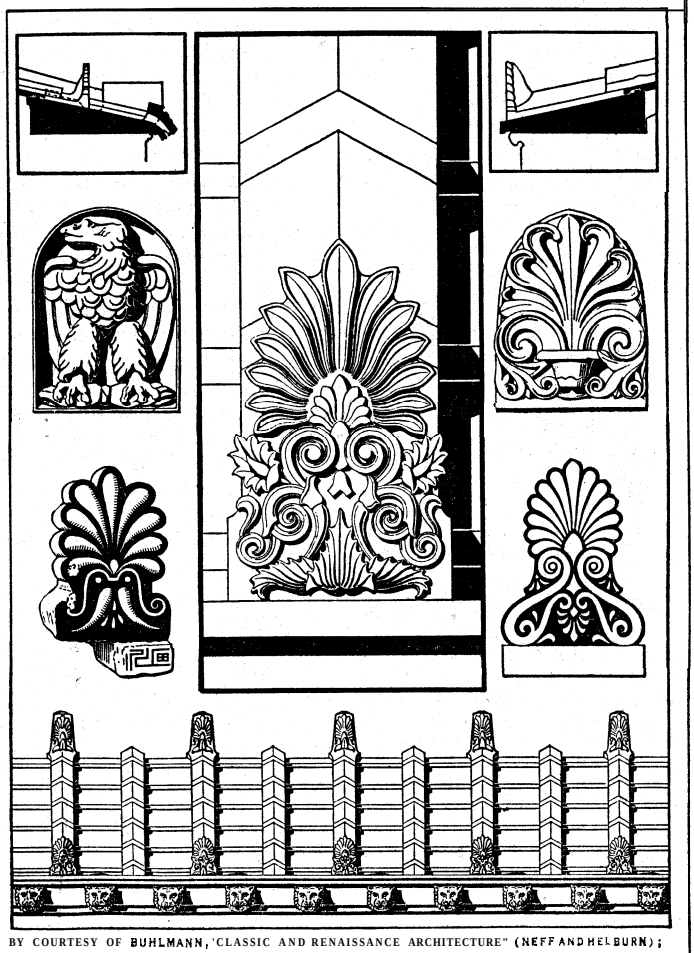
It inhabits the swampy savannas and humid forests of S. and Central America, but is nowhere common. Characteristic features are the long, tapering snout and the strong curved claws on the fore feet. With the latter it not only defends itself effectively but also tears holes in the dwellings of ants and termites, capturing the inhabitants by means of its long, sticky tongue. The female produces a single young at a birth. The tamandua ant-eaters, typified by Tamandua tetradactyla, are smaller and arboreal, inhabiting the primeval forests of S. and Central America. Also arboreal is the little or two-toed ant-eater (Cyclopes *didactylus*) of the same region, about the size of a rat and yellowish in colour.

BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE GREAT ANT-EATER (MYRMECOPHAGA JUBATA), OF SOUTH AND CENTRAL AMERICA, WHOSE STRONG CLAWS ENABLE HIM TO PLUNDER ANTHILLS

ANTE-CHAPEL, the term given to that portion of a chapel which lies on the western side of the choir screen. In some of the colleges at Oxford and Cambridge the ante-chapel is carried north and south across the west end of the chapel, constituting a western transept or narthex. This model, based on Merton college chapel (13th century), of which only chancel and transept were built though a nave was projected, was followed at Wadham, New and Magdalen colleges, Oxford, in the new chapel of St. John's college, Cambridge, and in Eton college. In Jesus college, Cambridge, the transept and a short nave constitute the ante-chapel; in Clare college an octagonal vestibule serves the same purpose; and in Christ's, Trinity and King's colleges, Cambridge, the ante-chapel is a portion of the main chapel.

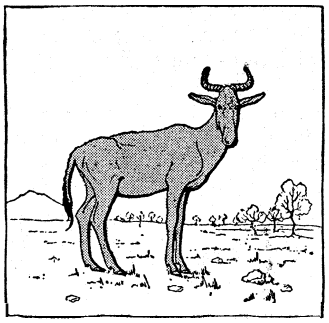
ANTE-FIXAE, in architecture, the vertical blocks terminating, at the eaves, each row of the covering tiles of a roof in a classic building, and forming a cresting along the cornice. They were often decorated with the anthemion (*q.v.*) ornament, and made of either tile or marble.



BY COURTESY OF BUHLMANN, "CLASSIC AND RENAISSANCE ARCHITECTURE" (NEFF AND HELBURN); D'ESPOUY, "FRAGMENTS D'ARCHITECTURE ANTIQUE" (MASSIN ET CIE)

VARIOUS EXAMPLES OF PAINTED AND CARVED ANTE-FIXAE

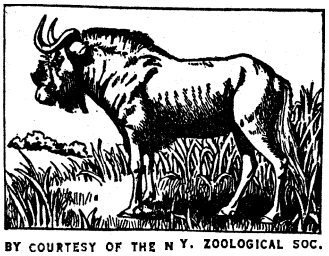
ANTELOPE, a zoological name which was applied by the earlier English naturalists, and afterwards by Buffon, to the Indian blackbuck, which is thus entitled to rank as *the* antelope. No true antelopes are American, the prongbuck (Antilocapra), which is commonly called "antelope" in the United States, representing a distinct group; while the Rocky mountain or white goat stands on the borderland between antelopes and goats.



BY COURTESY OF THE N.Y. ZOOLOGICAL SOC.

FIG. 1.—THE LELWEL HARTEBEEST (BUBALIS LELWEL), ONE OF THE SEVERAL SPECIES OF LARGE ANTELOPE CONFINED TO AFRICA

The first group or subfamily, the *Bubalinae,* includes four distinct genera, *Bubalis* the hartebeests, *Damaliscus* the hirola or Hunter's hartebeest, bontebok, blesbok, sassaby, and tiang, *Connochaetes* the gnu, and *Gorgon* the brindled gnu or blue wildebeest. The subfamily is confined to Africa; the members of this group are large antelopes, with horns in both sexes. The hartebeests are characterized by their long faces, ungainly bodies, and high horn-pedicle; the horns, which are ringed, lyrate and more or less strongly angulated, rise almost vertically from the cylindrical pedicle. The neck is unmaned and the tail is moderately long; the height of the withers (43 to 54in.) greatly exceeds that of the hindquarters. Eight species of hartebeest are now recognized, the most important of which are the following: the bubal hartebeest (B. *buselaphus*) from north Africa, the western hartebeest (B. major) from west Africa, Coke's hartebeest (B. cokci) from east Africa, the Cape hartebeest (B. caama), the lelwel hartebeest (B. *lelwel*) (fig. 1) from west and east Africa, and Lichtenstein's hartebeest (B. *lichtensteini*) from south-central and east Africa. In *Damaliscus,* the bastard hartebeests, the withers are generally less elevated and the horns arise directly from the head. The hirola or Hunter's hartebeest (D. *hunteri*) has a white chevron-like marking on the forehead; it is found only on the north side of the Tana valley in Jubaland, east Africa. The bontebok (D. *pygargus*) and blesbok (D. *albifrons*) are two closely allied south African species which once existed in countless thousands, but are now reduced to a few herds preserved on various farms in south Africa. The sassaby, or tsesebe (D. *lunatus*), originally from Cape Colony, where it is now extinct, is distributed over a large area of south-eastern Africa, from the Orange river to northern Rhodesia and Nyasaland. The gnu or black wildebeest (Connochaetes gnu) (fig. 2) differs from the hartebeests and their allies in the presence of tufts of hair on the face, a well-developed mane, a horse-like tail, and a very broad muzzle. The horns are smooth, not ringed, and the teats four in number, not two as in the hartebeests. As a truly wild animal this species no longer exists; formerly it was widely distributed over the plains of Cape Colony and the Orange Free State. The brindled gnu or blue wildebeest (*Gorgon taurinus*) may be distinguished from the typical gnu by the smaller hindquarters and higher withers, and the horns, instead of curving forwards over the face as they do in Connochaetes, spread out laterally. The various races of brindled gnu range over a large part of Africa from Kenya Colony to south of the Zambezi.



BY COURTESY OF THE N.Y. ZOOLOGICAL SOC.

FIG. 2.— WHITE-TAILED GNU South African antelope known to the Boers as the black wildebeest

The second group, the subfamily *Cephalophinae,* contains the duikers, or duikerboks, of Africa; the species, which are very numerous, are all of small or medium size and are characterized by their spike-like horns, which are generally present in both sexes,

their naked muzzles, large face glands, and well-developed lateral hoofs; the female has four teats. The subfamily includes three genera: (1) *Cephalophus,* the forest duikers, distinguished by the short, comparatively stout horns and the uniform colour of the coat. The majority of the species and subspecies, some 34 of which are now recognized, inhabit the great equatorial forests. This genus contains the largest members of the group, the yellow-backed duiker (C. sylvicultrix) and Jentink's duiker (C. jentinki), both of which stand about 30 to 34in. at the shoulder; otherwise the species are of medium size (height 16–24in.). (2) Guevei, the blue duikers, are the smallest members of the subfamily, and have very small horns, usually present in both sexes. The colour of the coat varies from grey to dark brown. About 16 different forms have received names, and they inhabit the same forests as the forest duikers. (3) *Sylvicapra,* the bush duikers, have long and slender horns, directed upwards so as to form an obtuse angle with the line of the face. The genus contains a single species (S. *grimmia*), which is widely distributed over south, central, east and west Africa.

The third subfamily, Oreotraginae, the klipspringers, contains but a single genus and species (Oreotragus oreotragus), distinguished from all other antelopes by the coarse, pithy hair, and by the narrow and cylindrical hoofs. The horns, usually present only in the males, are short and spike-like, rising almost vertically above the eyes. The various races are widely distributed over the more mountainous parts of Africa, from Abyssinia southwards to Cape Colony.

The fourth subfamily is the Neotraginae, which contains six distinct types of antelope, the oribis (Ourebia), the grysbok (Nototragus), the steinboks (Raphicerus), the sunis (*Nesotragus*), the pygmy antelopes (*Hylarnus*), and the royal antelope (*Neotragus*). The subfamily is widely distributed over a great part of Africa, from Cape Colony to Abyssinia, and from Kenya Colony to Liberia and Gambia. The oribis have a bare, glandular patch beneath each ear; lateral hoofs are present and the horns are slender and ringed in the basal half. The grysbok (*Nototragus* melanotis) and remaining members of the subfamily are distinguished from the oribis by the absence of the bare patches below the ears. The grysbok is further characterized by the presence of small lateral hoofs and a speckled coat. Typically from Cape Colony, the grysbok extends as far north as the Zambezi and Mozambique. The steinbok (Raphicerus *campestris*) is very similar to the grysbok but differs in the absence of lateral hoofs. The members of this genus are found over a large part of south Africa, and spread as far north as Mount Elgon. The three groups of dwarf antelopes are all very closely allied; the sunis (Nesotragus) stand about 13 or 14in. at the shoulder and possess relatively long (3 to 5in.) and strongly ringed horns. The various species and races are confined to east Africa and Zanzibar. In the pygmy antelopes (*Hylarnus*) the shoulder height is about equal to that of the sunis, but the horns are smaller and nearly smooth; the genus is confined to west and equatorial Africa. The royal antelope (*Neotragus pygmaeus*), the only member of the genus, is only about 10in. high, being the smallest of all true ruminants; the horns are very small and unringed. This species inhabits the west coast from Liberia to southern Nigeria.

The fifth subfamily, the Madoquinae, contains three genera, the dik-diks, representing two distinct types, *Madoqua* and *Rhynchotragus,* and the beira, the sole member of the genus *Dorcotragus.* The dik-diks are distinguished from the last subfamily and the beira by a more or less marked elongation of the muzzle and the presence of a tuft of long hair on the crown. The various species are confined to east Africa, from Abyssinia to Tanganyika Territory, with the exception of one isolated form from Angola and Damaraland. The beira (D. melanotis), which was formerly considered to belong to the subfamily Antilopinae, is considerably larger than the dik-diks (which stand only 13 or 14in. at the shoulder), measuring about 23in. in height. The ears are of great size, and the horns, which are spike-like and ringed basally, measure from 4 to 5in. in length. This species is found only in Somaliland and Abyssinia.

In the sixth subfamily, the *Reduncinae,* we again meet with antelopes of large size; the five types constituting the group are as follow: waterbucks (Kobus), lechwes (*Onotragus*), kobs (Adenota), reedbucks (Redunca), and the Vaal rhebok (Pelea). Horns are present only in the male sex and the muzzle is naked. The waterbucks, lechwes and kobs, the largest members of the subfamily, may be distinguished by their long, lyrate horns, the absence of a bare patch below the ears, and the full development of the lateral hoofs. The typical waterbuck (K. *ellipsiprymnus*) is found over a large area of east Africa from Somaliland to Lake Ngami. The lechwes (*Onotragus*) are intermediate in size between the waterbucks and kobs; they range over south-central, central and east Africa as far north as the Sudan, whereas the kobs inhabit equatorial Africa, the Sudan and Rhodesia. The reedbucks (*Redunca*) are distinguished by their short tails, small lateral hoofs, and the presence of a bare patch of skin below each ear. The shoulder height varies from 28 to 37in., and the species is widely distributed over the greater part of Africa south of the Sahara. The Vaal rhebok (Pelea *capreolus*) is distinguished by its upright, spike-like horns and woolly hair; it is essentially a south African animal. The dibatag (Ammodorcas *clarkei*) is now considered as related to the waterbucks and impala as well as to the gazelles and gerenuk; its exact systematic position is not yet determined. In general shape this animal resembles a long-necked gazelle, with horns rather like those of a reedbuck; it is found only in Somaliland.

The seventh subfamily, the Aepycerotinae, contains the impala, or palla (Aepyceros melampus), characterized by the lyrate horns of the males and the absence of lateral hoofs. It ranges over a considerable part of Africa, as far north as Angola in the west and Kenya Colony in the east.

The *Saiginae,* the eighth subfamily, contains the saiga (*Saiga* tartarica) of the Kirghiz steppes; it is a sheep-like antelope with a curiously inflated and trunk-like nose with the nostrils opening downwards.

Closely allied to the saiga is the chiru (*Pantholops* hodgsoni), the only living representative of the ninth subfamily, *Pantholopinae*; this species is remarkable for its long, graceful horns, which are strongly ringed on their front surfaces. The chiru is confined to the plateau of Tibet.

The tenth subfamily, the Antilopinae, contains the typical antelope or blackbuck (*Antilope* cervicapra), the gazelles (*Gazella*), the gerenuk (Lithocranius *walleri*), and the springbuck (Anti*dorcas marsupialis*). The blackbuck, confined to the Indian peninsula, is easily recognized by its long, spirally twisted horns, which are normally developed only in the male sex. The gazelles are widely distributed over western and central Asia, peninsular India and northern and eastern Africa. Horns are usually present in both sexes, but certain Asiatic gazelles have hornless females. Some of the African species, such as Grant's gazelle (G. granti) and Soemmerring's gazelle (*G. soemmerringi*) are of fairly large size, standing 34 to 35½in. at the shoulder. The springbuck is distinguished from the gazelles by the presence on the middle line of the loins of an evertible pouch lined with long white hairs capable of erection. The range includes south Africa, as far north as the Zambezi and Mossamedes. The gerenuk is at once distinguishable from the other members of the subfamily by the great elongation of the neck and limbs. This species is found only in Somaliland and adjacentparts of east Africa.

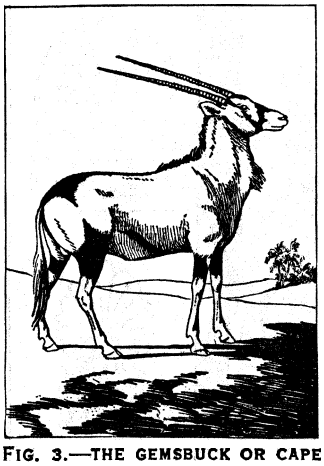
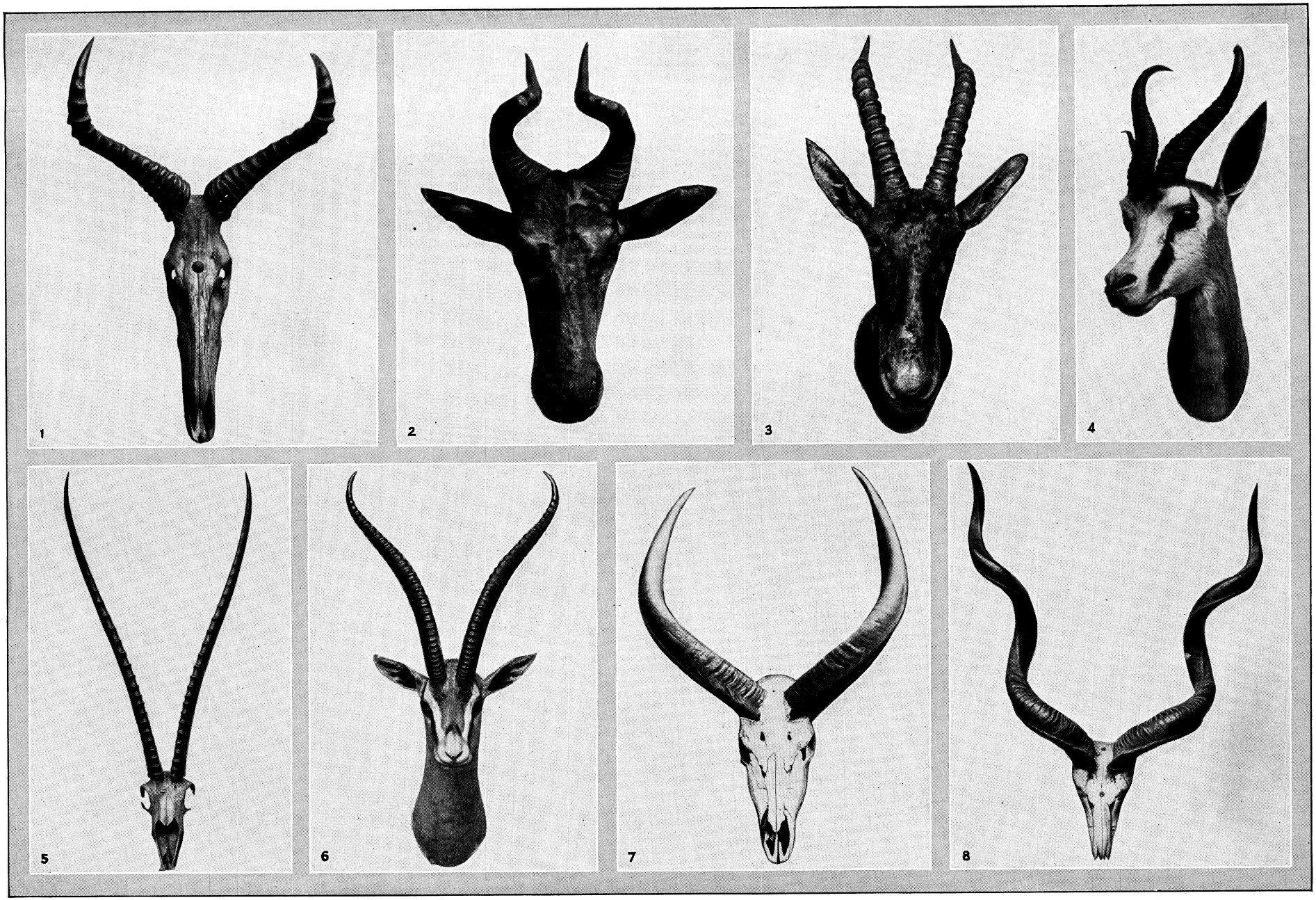


FIG. 3.—THE GEMSBUCK OR CAPE ORYX (ORYX GAZELLA), AN ANTELOPE WITH ALMOST STRAIGHT HORNS, FOUND ONLY IN THE MOUNTAINS OF SOUTH AFRICA

The eleventh subfamily, the Oryginae, is composed of a series of large antelopes which have long, either straight, backwardly curved, or spirally twisted horns, which are present in both sexes.



ANTELOPES

1. Tora hartebeest (*Bubalis tora*)
2. Lichtenstein's hartebeest (*Bubalis lichtensteini*)
3. Tiang hartebeest (*Damaliscus jamela tiang*)
4. Springbuck (*Antidorcas marsupialis*)
5. Tibetan antelope (*Pantholops hodgsoni*)
6. Grant's gazelle (*Gazella granti*)
7. Mountain Nyala (*Tragelaphus buxtoni*)
8. Kudu (*Strepsiceros*)

Three genera are distinguishable, Oryx including the gemsbuck, beisa, white oryx, and Arabian oryx; *Hippotragus* including the extinct blaaubok, the roan antelope, and the sable antelope; and *Addax* with but a single species, the addax. The horns are nearly straight in the gemsbuck (*O. gazella*) (fig. 3), the beisa (0. beisa) and Arabian oryx (0. leucoryx); in the white oryx (O. *algazel*) they bend backwards in a sabre-like sweep. The gemsbuck inhabits south-west Africa and Angola, while the beisa is found in the country from Suakin, on the Red sea, southwards through Somaliland to Kilimanjaro. The white oryx ranges across the desert from west Africa to the eastern Sudan, and the Arabian oryx extends from southern Arabia to Mesopotamia. In the genus Hippotragus the horns rise nearly vertically above the eyes, after which they sweep backward in a bold scimitar-like curve. The roan antelope (H. equinus) is a very large species, with stout and comparatively short horns. Roan antelopes are widely distributed over the greater part of Africa south of the Sahara, excluding the equatorial forest zone. The sable antelope (*H. niger*) is rather smaller, but the horns are sometimes of great size, in the Angolan race the record horn-length being as much as 64 inches. The range includes a large part of south, south-central and east Africa. The addax is easily distinguished by its long, spirally twisted horns; it is distributed over the deserts of northern Africa as far south as Senegal in the west and Dongola in the eastern Sudan.

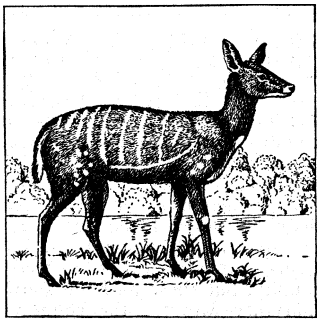


FIG. 4.— BUSHBUCK (TRAGELAPHUS SCRIPTUS), FEMALE. AFRICA, DIFFERING FROM MALE IN LESS BRILLIANT MARKINGS AND NO HORNS

The twelfth and last subfamily of the antelopes is the Tragelaphinae, which includes the bushbucks (Tragelaphus), situtungas (Limnotragus), kudus (Strepsiceros), bongo (*Boöcercus*), elands (*Taurotragus*), four-horned antelope (*Tetracerus*), and nilgai (Boselaphus). The members of this group are large, medium or small-sized antelopes with the horns, except in the bongo and elands, present only in the males. The harnessed antelopes, or bushbucks, are frequently brilliantly coloured, the body being bright rufous or orange, with a white nasal chevron, and longitudinal and transverse stripes on the body. The true bushbucks (T. *scriptus*) (fig. 4) are widely distributed over south, central, east and west Africa. The nyala (T. angasi) is a much larger species with larger horns. The male nyala is slaty grey in colour, while the female is bright chestnut with the white markings of a bushbuck. The distributional area is restricted to south-east Africa. The mountain bushbuck (*T.* buxtoni) is the largest member of the genus, standing nearly as high as the kudu. This fine species hails from the Sahatu mountains in Gallaland. The situtungas (L. spekei) are about equal to the nyala in general dimensions; they are distinguished by their elongated hoofs, a special adaptation to enable them to walk on the soft mud. The range extends throughout a large area of south-central and central Africa to as far north as the Sudan, and westwards through the Congo to west Africa. The kudus are represented by two very distinct species, S. strepsiceros, the greater kudu (fig. 5), standing nearly 5ft. at the shoulder and possessing exceptionally fine, spirally twisted horns, and the lesser kudu (S. *imberbis*) which is only 41in. in height, and carries much smaller horns. The former is widely distributed over the greater part of Africa south of the Sahara, while the latter is restricted to Abyssinia, Somaliland, Kenya Colony and Tanganyika Territory. The bongo (B. *euryceros*) is a large antelope and has very massive horns. It is bright chestnut in colour, with from ten to thirteen white vertical stripes on the body. The distributional area includes a large part of equatorial Africa, spreading southwards to Katanga. The elands are the largest of all the antelopes, adult bulls standing nearly six feet at the shoulder. Two well-marked species can be distinguished, T. oryx, the common eland, and T. *derbianus*, Lord Derby's eland. The latter is distinguished by the larger and heavier horns and the broader ears. *T.* oryx is distributed over the greater part of Ethiopian Africa, while T. derbianus spreads across Africa from Senegambia to the Sudan and southwards to the Congo. The four-horned antelope, or chousingha (T. *quadricornis*), is distinguished from all other antelopes by the presence of two pairs of horns in the males, of which the front pair are the smaller; it is found only in peninsular India. The nilgai (B. tragocamelus) is easily recognized by the bluish-grey tint of the adult bulls and the single pair of comparatively small horns; the range is confined to peninsular India.

FIG. 5.—GREATER KUDU (STREPSICEROS STREPSICEROS), MALE, NEARLY 5 FEET HIGH AT SHOULDERS, WITH FINE TWISTED HORNS

Extinct Antelopes — Only a few lines can be devoted to extinct antelopes, the earliest of which apparently date from the European Miocene. An antelope from the Lower Pliocene of northern India known as *Bubalis,* or Damaliscus palaeindicus, indicates the occurrence of the hartebeest group in that country. Kobus also occurs in the same formation, as dues likewise *Hippotragus*. Palaeoryx from the corresponding horizon in Greece and Samos is to some extent intermediate between Hippotragus and Oryx. Gazelles are common in the Miocene and Pliocene of both Europe and Asia. Elands and kudus appear to have been represented in India during the Pliocene; the European Palaeoreas of the same age seems to be intermediate between the two, while *Protragelaphus* is evidently another European representative of the group.

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(J. G. D.)

ANTEMNAE, ancient village of Latium, west of the Via Salaria, 2m. north of Rome, where the Anio falls into the Tiber. It is said that Romulus took it after the rape of the Sabine women, and that it helped the Tarquins. Certainly it soon lost its independence, and in Strabo's time was a mere village. The site is very strong; traces of outer walls and huts, wells and a cistern have been found.

ANTENATAL CLINICS. The first clinic in Great Britain providing supervision and advice for expectant mothers with a view to securing normal health during pregnancy and safe delivery of a healthy child was established by Dr. J. W. Ballantyne at the Royal Maternity Hospital, Edinburgh, in 1902. Other hospitals and maternity centres followed suit; by 1915 antenatal clinics were recognized as an important factor in the prevention of infant and maternal mortality, and under the Maternity and Child Welfare Act, 1919, such measures became a responsibility of local authorities, whose public health departments have increasingly met the need. Clinics now form part of all maternity hospitals and of the maternity and child welfare programs of practically every local authority.

The part played by antenatal care in the reduction of maternal mortality is now generally recognized, and in 1932 the departmental committee on maternal mortality, after consideration of 5,000 deaths, estimated that its lack was a primary factor in maternal mortality. Many departures from a normal physical condition, if discovered in time, can be remedied before child-birth is due, and both the physical and mental health of mother and unborn child are largely affected by such matters as diet, sleep, exercise, fresh air, and other general conditions of life during pregnancy.

The actual service provided by an antenatal clinic is therefore twofold, medical and social. Every clinic is attended by a fully qualified medical practitioner, whose function is to make a physical examination, to continue physical observation as needed, and to

advise upon and arrange for any special treatment that may be necessary; a midwife, if engaged in the case, usually assists the doctor by visiting the woman and keeping her under observation.

The social side is generally the province of the health visitor of the local authority. She, or sometimes the midwife, gives talks on cradles, baby clothes, maternity garments, etc., and on hygiene and management of pregnancy, and satisfies herself that suitable arrangements have been made for the confinement and that the necessary equipment is available. Provision is made for the supply of either milk or meals, or both, free or at low cost to necessitous mothers and also, in many cases, for dental treatment, frequently much needed at this time. In an increasing number of districts maternal supervision is completed by medical examination at a postnatal clinic.

Traditions of shyness and reticence are not easily overcome, and many mothers still hesitate to accept the help and advice offered; but the increasing appreciation of the antenatal clinics is indicated by the following figures supplied by the Ministry of Health:

Year	No. of Clinics	Women Attending
1917	No information	No information
1927	869	No information
1930	1,101	170,606
1937	1,701	337,672
1938	1,796	384,865

United States.—In the United States the first antenatal work, or prenatal as it is known there, was begun in June, 1907, by the Association for Improving the Condition of the Poor in connection with the Caroline rest and pediatric department of the New York outdoor medical clinic. As early as 1901, however, the Visiting Nurses association of Boston had begun to instruct expectant mothers in suitable care and hygiene, and the Visiting Nurses association of Chicago in 1906 was also definitely engaged in the same task. In 1909 the Women's Municipal league of Boston sponsored the first antenatal measures deliberately designed to decide their effect upon supervised mothers and their children.

The Federal children's bureau came into existence in April, 1912, but at first antenatal clinics organized under its direction were merely sporadic. Realization that many of the 23,000 estimated deaths in childbirth in 1918 were preventable led to the introduction in 1919 of the Act which has done more to establish antenatal clinics in the United States than anything else, "An Act for the promotion of the Welfare of Maternity and Infancy." It was modelled closely upon the English Maternity Act and, after two attempts, was passed in 1921 with the weight of public opinion behind it created by the National League of Women Voters, the General Federation of Women's Clubs, the National Congress of Mothers and Parent-Teachers associations, some 15 other national agencies and many State and local organizations. It is popularly known as the "Sheppard-Towner Act" after the senator and congressman who respectively introduced it. (*See* MATERNITY AND INFANT WELFARE.) The funds released by this Act made possible permanent antenatal clinics. The number conducted at the end of the fiscal year 1927 by the Federal Bureau, in co-operation with the various States was about 290, of which 205 were combined prenatal and child health centres. Despite the increase in the number of prenatal clinics conducted throughout the United States, maternal mortality statistics from 1915 to 1929 show a very definite rise This is probably due to the fact that the earlier returns were very incomplete; only 12 States reported in 1915, following which there was a gradual increase to 46 in 1929. It can be assumed that the more progressive States, tfiat is those which had prenatal stations, were among the ones reporting in 1915 to 1929.

That prenatal care is a definite factor in the reduction of maternal mortality is well illustrated by the reports of various clinics. As an example, the privately supported Maternity Center Association, New York City, which was established in May 1918 in response to a call issued by the Commissioner of Health to various official and other representatives, reported a maternal mortality rate of 24 per 10,000 live births in a group of 5,000 women, as compared with 62 per 10,000 live births for a similar number of patients, in a similar environment, who failed to receive any prenatal care. Furthermore, the Cleveland Child Health Association, which is also one of the earliest prenatal clinics formed in this country, reports a rate of 7·7 maternal deaths per 10,000 live births or 2 deaths in a group of 2,595 women who received prenatal care. The city of Cleveland had a maternal mortality rate of 38 per 10,000 live births or five times that of the prenatal clinic. The State of Maryland in 1928 established prenatal clinics in as many counties as possible. In the year 1935, 949 women who had received prenatal care in these clinics were delivered with a maternal mortality rate of 0 as compared with the

Maternal Mortality (United States Birth Registration Area)

Year	Deaths, per 10,000 live births	States reported	Year	Deaths, per 10,000 live births	States reported	Year	Deaths, per 10,000 live births	States reported
1915	61	12	1923	67	32	1931	66	46
1916	62	13	1924	66	35	1932	63	47
1917	66	22	1925	65	34	1933	62	48
1918	92	22	1926	66	36	1934	59	48
1919	74	24	1927	65	41	1935	58	48
1920	80	25	1928	69	44	1936	57	48
1921	68	29	1929	70	46	1937	49	48
1922	66	32	1930	67	46	1938	43.5	48

rate, for the State as a whole, of 50 per 10,000 live births. These reports demonstrate that supervised prenatal care had a great influence in reducing maternal mortality.

In 1935 the Federal Government included in the Social Security Act of that year the provision for the establishment of prenatal clinics throughout the country, the funds of which were to be administered by the individual states. By Nov. 1936 plans had been approved for the establishment of prenatal clinics in all 48 States. The reduction of maternal mortality in the years 1936 to 1938 definitely showed the effect of this act—1936, 57 maternal deaths per 10,000 live births; 1938, 43.5 deaths per 10,000 live births. The figures for the year 1939 were not (in 1940) as yet available in totality, but those on hand showed a further decrease in the maternal mortality rate for the country as a whole. Due to the fact that most large communities had established prenatal clinics prior to the passage of the Social Security Act, it must be assumed that this legislation had great influence in rural communities where little or no prenatal facilities had previously been available.

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ANTENNA, a device for radiating or absorbing radio waves. There are two general classes of antennae, the condenser and the coil. The condenser type consists of an elevated horizontal aerial, together with a connection to the ground or to a network of wires near the ground, called a counterpoise. The coil type consists of a few turns of wire wound around a vertical frame which, for broadcast reception, may be 2 or 3ft. square.

ANTENNA RESISTANCE, in radio transmission, an effective resistance which is numerically equal to the average power in the entire antenna circuit divided by the square of the effective current at the point of maximum current. Antenna resistance includes radiation resistance, ground resistance, radio-frequency resistance of conductors in antenna circuit, equivalent resistance due to corona, eddy currents, insulator leakage, dielectric loss and so on.

ANTENOR, an Athenian sculptor, of the latter part of the 6th century B.C. He was the author of the group of the tyrannicides Harmodius and Aristogeiton, set up by the Athenians on the expulsion of the Peisistratidae, and carried away to Persia by Xerxes. A basis with the signature of Antenor, son of Eumares, has been shown to belong to one of the dedicated female figures of archaic style which have been found on the Acropolis of Athens.

See E. A. Gardner's *Handbook of Greek Sculpture,* i. p. 182.

ANTENOR, in Greek legend, head of the peace-party in Troy during the Trojan War. Because of this, he was spared when the city fell. A late legend makes him betray the city. Afterwards, he either rebuilt Troy or settled at Cyrene, or became the founder of Patavium.

Homer, *Iliad* iii. 148, vii. 347; Horace, *Epp.* i. 2, 9; Livy i. 1; Pindar, *Pythia,* v. 83; Virgil, *Aen.* i. 242.

ANTEQUERA (anc. *Anticaria*), a city in southern Spain, province of Malaga. Pop. (1930) 32,974. A fortress town of the Muslim period, taken by the Christians in 1410, it occupies a commanding position overlooking the structural depression followed by the river Guadalhorce (*see* ANDALUSIA). The Sierra de las Torcales, on the south side of this depression, is celebrated for its scenery and is quarried for marble: the Peña de los Enamorados, or "Lovers' Rock," a crag rising from the flat of the *vega,* owes its name to the legend adapted by Robert Southey in his *Laila and Manuel.* In the east suburbs of Antequera is the

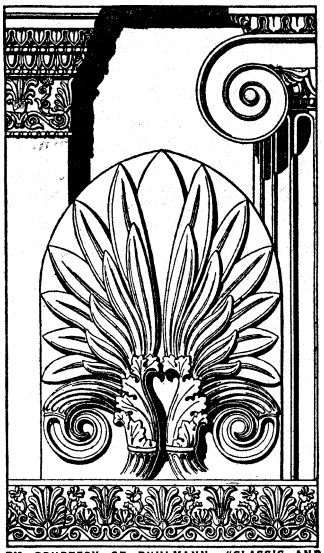
Cueva de Merja, one of the most important dolmens of the Peninsula. Woollen fabrics are manufactured, and the sugar industry (est. 1890) employs several thousand hands.

ANTEROS, pope for some weeks at the end of 235. He died on Jan. 3 236. According to the *Liber Pontificales,* he was martyred for having ordered a collection of the acts of the martyrs to be made, and included in the archives of the Church. His original epitaph was discovered in the Catacombs in 1854.

ANTHELION, the luminous ring or halo sometimes seen in Alpine or polar regions surrounding the shadow of the head of an observer cast upon a bank of cloud or mist. The halo diminishes in brightness from the centre outwards, and is probably due to the diffraction of light. Under favourable conditions four concentric rings may be seen round the shadow of the observer's head, the outermost, which seldom appears, having an angular radius of 40°.

ANTHELMINTICS are remedies used either to kill or to cause the expulsion of intestinal worms, in the former case being known as vermicides, in the latter as vermifuges. Cathartics, since they cause the expulsion of worms, are vermifuges. Used alone, however, they are rarely wholly effective, it being necessary to weaken, narcotize or kill the parasite first. For this purpose the vermicides are used. The chief characteristic of the latter drugs is that they have a more profound effect on the parasite than on the host, since they are absorbed only very slowly by the intestinal canal. The vermicides produce their best results when taken on a fasting stomach, preceded by purgation and a very light diet and followed by thorough purgation within a few hours to remove the dead or weakened worms. Drugs frequently used in the treatment of hookworm are chenopodium oil, thymol and carbon tetrachloride; in the treatment of tapeworm, aspidium and pelletierine; in the treatment of roundworm, santonin and spigelia.

ANTHEM, derived from the Gr. *ἀντίφωνα,* through the Saxon *antefn,* a word which originally had the same meaning as antiphony (q *v.).* It is now, however, generally restricted to a form of church music, particularly in the service of the Church of England, in which it is appointed by the rubrics to follow the third collect at both morning and evening prayer, "in choirs and places where they sing." It is just as usual in this place to have an ordinary hymn as an anthem, which is a more elaborate composition than the congregational hymns. Anthems may be written for solo voices only, for the full choir, or for both, and according to this distinction are called respectively *Verse, Full,* and *Full with Verse.* Though the anthem of the Church of England is analogous to the *motet* of the Roman Catholic and Lutheran Churches, both being written for a trained choir and not for the congregation, it is as a musical form essentially English in its origin. Tallis, Tye, Byrd and Farrant in the 16th century; Orlando Gibbons, Blow, and Purcell in the 17th, and Croft. Boyce, James Kent, James Nares. Benjamin Cooke, and Samuel Arnold in the 18th were composers of anthems. *(See* also NATIONAL ANTHEMS)



BY COURTESY OF BUHLMANN, "CLASSIC AND RENAISSANCE ARCHITECTURE (NEFF & HELBURN); ARCHITEKTORISCHEN ORDNUNGEN DER GRIECHEN UND ROMERN (ERNST UND KORN); SIR BANISTER FLETCHER, "HISTORY OF ARCHITECTURE ON THE COMPARATIVE METHOD"

ANTHEMION (pl. ANTHEMIA). a conventional design consisting of a number of radiating petals, developed by the Greeks from the Egyptian and Asiatic form known as the lotus palmette. One of the most fertile sources of decorative ornament, it was not only used widely by the Greeks and Romans but occurs also in Byzantine and Romanesque examples and is common in modern work. Used first by the Greeks as a decoration on painted pottery, it was later combined into bands painted on architectural mouldings, and in the 5th century B C. these painted forms came to be carved in relief. It is used especially in bands as a decoration for the cymatium of a cornice and singly for acroteria *(see* ACROTERIUM), ante-fixae (*q.v.*) and the top of vertical stele (*q.v.*).

ANTHEMIUS, son of Stephanus of Tralles, Greek mathematician and architect. He produced, under the patronage of Justinian, the original and daring plans for the church of St. Sophia in Constantinople. The building was finished in 537, but in 558, after the death of Anthemius, it had to be restored, owing to the collapse of the dome. Anthemius wrote a treatise on burning glasses, where in the course of constructions for surfaces to reflect to one and the same point, (1) all rays in whatever direction passing through another point, (2) a set of parallel rays, he assumes a property of an ellipse not found in Apollonius (the equality of the angles subtended at a focus by two tangents drawn from a point), and (having given the focus and a double ordinate) he uses the focus and directrix to obtain any number of points on a parabola—the first instance on record of the practical use of the directrix.

A fragment of the treatise, entitled *Περὶ παραδόξων μηχανημάτων,* was published by L. Dupuy (1777) and in *Hist. de l'Acad. des Inscr.,* vol. xlii. (1786); revised ed. by A. Westerman, *Scriptores rerum mirabilium Graeci* (1839). On Anthemius generally *see* Procopius, *De Aedific.* i. 1; Agathias *Hist.* v. 6–9. Gibbon's *Decline and Fall* chap. xl.; Bury, *Later Roman Empire* (1923) p. 98 ff.

ANTHESTERIA, one of the four (or five) Athenian festivals in honour of Dionysus, held annually for three days (11th–13th) in the month of *Anthesterion* (Feb.-March). Its object was to celebrate the maturing of the wine stored at the previous vintage, and the beginning of spring. On the first day, called *Pithoigia* ("opening of the casks"), libations were offered from the newly opened casks to the god of wine, all the household joining in the festivities. The rooms and the drinking vessels in them were adorned with spring flowers, as were also the children over three years of age. The second day, named *Choës* ("feast of beakers"), was a time of merry-making. The people dressed themselves gaily, some in the disguise of the mythical personages in the suite of Dionysus, and paid a round of visits to their acquaintances. Others poured libations on the tombs of deceased relatives. On the part of the State, this day was the occasion of a peculiarly solemn and secret ceremony in one of the sanctuaries of Dionysus in the Lenaeum, in which the *basilinna,* wife of the *archon basileus* ("king-archon"), went through a ceremony of marriage to the wine god. The days on which the *Pithoigia* and *Choes* were celebrated were both regarded as ill-omened, necessitating expiatory libations; on them the souls of the dead came up from the underworld and walked abroad; people chewed leaves of whitethorn and smeared their doors with tar to protect themselves from evil. The third day was named *Chutroi* (feast of pots), a festival of the dead. Cooked pulse was offered to Hermes, in his capacity of a god of the lower world, and to the souls of the dead. It is uncertain whether the name is connected with Gr. *anthos,* flower.

See F. Hiller von Gartringen in Pauly-Wissowa's *Realencyklopädie* (s.v.); *J.* Girard in Daremberg and Saglio, *Dictionnaire des Antiquitts* (s.v. "Dionysia"); and F. A. Voigt in Roscher's *Lexikon der Mythologie* (s.v. "Dionysos"); A. W. Verrall, *Journal of Hellenic Studzes,* xx. 1900; A. Mommsen, *Feste der Stadt Athen* (1898); *M.* P. Nilsson, *Studia de Dionyszis Atticis* (1900) and *Griechische Feste* (1906); G. F. Schomann, *Griechische Alterthumer,* ii. p. 516, ed. J. H. Lipsius (1902); J. E. Harrison, *Prolegomena to the Study* of *Greek Religion* (1903); *E.* Rohde, *Psyche,* p. 237, 4th ed. (1907).

ANTHIM THE IBERIAN, a notable figure in the ecclesiastical history of Rumania. A Georgian by birth, he came to Rumania early in the second half of the 17th century, as a simple monk. He became bishop of Rbmnicu in 1705, and in 1708 archbishop of Wallachia. Taking a leading part in the political movements of the time, he came into conflict with the newly appointed Greek hospodars, and was exiled to Rumelia. But on his crossing the Danube in 1716 he was thrown into the water and drowned, as it is alleged, at the instigation of the prince of Wallachia. He was a man of great talents and spoke and wrote many Oriental and European languages. He acquired a thorough knowledge of Rumanian, and helped to introduce that language into the church as its official language.

He was a master printer and an artist of the first order. He cut the wood blocks for the books which he printed in Tîrgovishtea, Râmnicu, Snagov and Bucharest. He was also the first to introduce Oriental fonts of type into Rumania, and he printed there the first Arabic missal for the Christians of the east (Râmnicu, 1702). He also trained Georgians in the art of printing, and cut the type with which under his pupil Mihail Ishtvanovitch they printed the first Georgian Gospels (Tiflis, 1709). Some of his pastoral letters are models of style and of language as well as of exact and beautiful printing. He also completed a whole *corpus* of lectionaries, missals, gospels, etc.

See M. Gaster, *Chrestonzathie roumaine* (1881), and "Gesch. d. ruinanischen Litteratur," in Groeber, *Grundriss* d. *rom. Philologie,* vol. ii. (1899); and E. Picot, *Notice sur Anthim d'Ivir* (Paris, 1886).

ANTHOCYANINS AND ANTHOXANTHINS. The term anthocyanin has been employed to denote all the water-soluble pigments of flowers, fruits and leaves, but with new knowledge of the chemical nature of these colouring matters a more exact classification has become possible and the expression is now applied to particular substances which are responsible for the red, blue, mauve, purple and violet colours of flowers. The anthoxanthins are a chemically related class of water-soluble yellow or orange pigments possessing relatively feeble tinctorial power. The bright yellow, orange and green colours in plants are usually due to the presence of one or other of the plastid pigments (carotenols or xanthophyll, carotene, chlorophyll, etc.), insoluble in aqueous media but soluble in fats and oils. These do not occur, as do the anthocyanins, in the cell-sap, and there is no visible chemical link connecting the plastid and anthocyanin pigments.

The water-soluble pigments are largely responsible for much of the spring colouring of buds and young shoots, and the fall colouring of leaves, especially the purples and purple-reds. These are unmasked when the green chlorophyll decomposes with the approach of winter. Intense light and low temperatures favour the development of anthocyanin pigments.

It has been suggested that these pigments may act as oxygen carriers in the physiology of the plant, since they are easily oxidized and reduced. They may also serve to protect some plants from injurious ultraviolet radiation, as it has been observed that alpine plants are highly coloured. When grown at lower altitudes, much of the colour is lost. Distinction between cause and effect is often difficult in such cases. Absorption of radiant energy from sunlight by these pigments may raise the internal temperature of the leaf several degrees.

Some leaves normally lose anthocyanins on reaching maturity and others gain in pigment content during development. Often an excess of sugars exists in leaves when anthocyanins are abundant. Injury to individual leaves may be instrumental in such cases.

The development of characteristic colourations in parts of plants is often useful in the diagnosis of mineral deficiencies in the plant nutrient supply. This is particularly true for phosphorus, potassium, magnesium and boron deficiencies. Insufficient phosphorus supply induces a pronounced development of purple colouration in the leaves and stalks of those strains of corn which possess the genetic factors which are also necessary for this pigment production. Development of brown, bronze, red, or purple areas in leaves is characteristic of potassium deficiencies in potato, cotton, cabbage, apple, and orange plants. Boron deficiency causes development of a red colouration in alsike and alfalfa leaves. Magnesium deficiency in cotton gives rise to the production of leaves which are coloured a beautiful purplish-red between the veins, which remain dark green. These changes are due to the production of large quantities of anthocyanin pigments, probably followed by destruction of chlorophyll. An early symptom may be an unusual darkening of the normal green appearance.

One of the most interesting and obvious properties of the anthocyanins is the change of colour which they exhibit when treated with acids or alkalis. It is said that Yorkshire children turn bluebells red by placing them in anthills; the formic acid produced by the insects is responsible for this curious result. In 1664 Robert Boyle wrote "Take good Syrrup of Violets, Impraegnated with the Tincture of the flowers, drop a little of it upon a White paper . . . and on this Liquor let fall two or three drops of Spirit either of Salt or Vinegar, or almost any other eminently Acid Liquor and upon the Mixture of these you shall find the Syrrup immediately turn'd Red. . . . But to improve the Experiment, let me add what has not been hitherto observ'd, namely, that if instead of Spirit of Salt, or that of Vinegar, you drop upon the Syrrup of Violets a little Oyl of Tartar per *Deliquium* or the like quantity of Solution of Potashes, and rubb them together with your finger, you shall find the Blew Colour of the Syrrup turn'd in a moment into a perfect green."

It is probable that the green colour resulted from the production of a bright yellow colour by the action of the alkali on an anthoxanthin in solution, the anthocyanin retaining its blue colour. Many colourless flowers, for example jasmine and *Antirrhinum,* develop bright yellow colourations in ammonia. A typical anthocyanin is bluish-red in acid solution, violet in neutral solution and blue in alkaline solution. Thus the blue cornflower, the bordeaux-red cornflower, the deep red dahlia, and the red rose contain one and the same anthocyanin, the variation in colour being simply due to the different degrees of acidity and alkalinity of the cell-sap. More than one anthocyanin may be present in a flower or blossom, and the colours of many flowers are due to the presence of both anthocyanins and plastid pigments in the tissues. Yellow wallflowers contain a plastid pigment and an anthoxanthin that coniributes very little to the total tinctorial effect; the different shades of red wallflowers are due to varying proportions of anthocyanin and plastid colouring matters. Moreover, very small changes, botanically, in varieties or species may be associated with the development of different anthocyanins.

Colour in flowers is often inherited according to single-factor Mendelian inheritance laws. In more complicated cases, factors for both enzymes and chromogens are necessary for colour development.

In 1905, Molisch demonstrated the existence of anthocyanin crystals in the living plant, and showed that crystals of these pigments could be readily prepared on a small scale by simple methods. For example, petals of the scarlet pelargonium are flattened and bruised on a glass surface, covered with a few drops of 75% acetic acid and then with a cover-glass and the whole placed under a clock-glass to ensure slow evaporation. At the edges of the cover-glass or round the petals, crystals gradually make their appearance. Grafe, a few years later, carried out this experiment on a larger scale and for the first time isolated an anthocyanin pigment in quantity and in a fairly pure condition. Our knowledge of the chemistry of the anthocyanins is, however, chiefly due to Willstatter who, in a series of masterly researches, opened and all but completed a new chapter of organic chemistry. In 1913, Willstatter and Everest published an account of an investigation of the pigment of the blue cornflower. They found that the colouring matter "cyanin" exists in the plant as its blue potassium salt, but that the substance can also combine with acids to form red salts and that advantage may be taken of this property in the isolation of the pure substance. In this case the work involved was difficult, the dried blue cornflower petals contained only 0.75% of their weight of colouring matter. It was later found that dried, deep red dahlia petals contain 20% of their weight of the same colouring matter and about 50% of this may be readily isolated in the following manner. The fresh flowers were extracted with acetic acid and methyl-alcoholic hydrochloric acid. One and a half volumes of ether were then added. This precipitated the chloride, which is insoluble in ether, and the salt was then separated and re-crystallized from a solution in 7% hydrochloric acid. It should be added that this process is unusually simple and straightforward owing to the high percentage of colouring material in the flowers. The work of the florists in developing garden flowers rich in pigment content has been extraordinarily successful.

Cyanin chloride has the composition $C_{27}H_{31}O_{16}Cl$ and, like all the other anthocyanins yet examined, contains sugar in a combined form. This is readily detached by the action of boiling 20% hydrochloric acid, leaving a salt, termed cyanidin chloride, which tinc-

torially and in many other properties closely resembles cyanin chloride. The sugar so detached is glucose, $C_6H_{12}O_6$, each molecule of cyanin chloride giving rise to one of cyanidin chloride and two of glucose:

$$C_{27}H_{31}O_{16}Cl + 2H_2O = C_{15}H_{11}O_6Cl + 2C_6H_{12}O_6$$

Cyanin chloride is thus a diglucoside of cyanidin chloride. Mecocyanin chloride from the poppy (*Papaver rhoeas,* purple scarlet variety) has the same composition as cyanin chloride and, like it, is degraded to cyanidin chloride and glucose (2 molecules). The solution of cyanin in aqueous sodium carbonate is blue, whereas that of mecocyanin is violet, and there are other divergencies. The explanation must be sought in the different mode of the molecular attachment of the cyanidin and glucose complexes in the two substances. Chrysanthemin, the pigment of the deep red garden chrysanthemum, resembles mecocyanin, but its molecule gives rise to only one molecule of glucose to each molecule of a cyanidin salt; it is monoglucosidic. One of the pigments of the aster very closely resembles chrysanthemin, while the colouring matters of the sweet cherry and of the sloe are apparently allied to mecocyanin, but contain rhamnose as one of the sugar components. Very careful treatment of mecocyanin with hydrochloric acid causes the loss of only one glucose molecule, and the result is chrysanthemin chloride. It will be observed that several anthocyanins may be regarded as derived from cyanidin and that their differences may be traced to the varying nature of the sugars, to the number of sugar molecules attached to one of cyanidin, and to the position of such attachment.

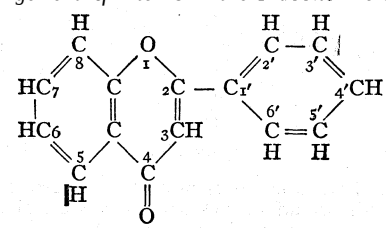
The further work of Willstatter and his colleagues brought to light the curious fact that, despite the existence in nature of a range of colour unrivalled by art, the number of fundamental sugar-free pigments of the type of cyanidin chloride, termed *anthocyanidins,* is very limited.

Glucosides derived from pelargonidin chloride, $C_{15}H_{11}O_5Cl$, have been found in many plants, for example in *Pelargonium zonale,* the purple-red summer aster, scarlet-red dahlia, the scarlet *Salvia,* and in the skins of radishes. Glucosides and complex glucosides derived from delphinidin chloride, $C_{15}H_{11}O_7Cl$, occur in the wild purple larkspur *(Delphinium consolida)* and in the viola. The anthocyanin of the peony, peonin, is a diglucoside of peonidin, which is simply related to cyanidin and may be converted into it. Peonidin chloride has the composition $C_{16}H_{13}O_6Cl$, that is, CH_2 more than cyanidin chloride, and the action of hydriodic acid on peonidin, furnishes CH_3I and cyanidin iodide. Similar derivatives of delphinidin chloride are obtained by decomposition of the anthocynnins from the bilberry, wild mallow, grape-skins, the petunia and *Primula hirsuta.* These all contain one or more $-OCH_3$ groups instead of the $-OH$ groups of delphinidin chloride. Apart from these cases, in which the molecules are slightly modified, there are but three known fundamental anthocyanidins, and these in turn have been found to be built upon one and the same molecular plan. Before considering this, however, it is necessary to pay some attention to the anthoxanthins, the main features of the chemistry of which were well established before any real insight into the nature of the anthocyanins had been obtained. The anthoxanthins are also glucosides, diglucosides or rhamnoglucosides, although owing to the processes of extraction and isolation adopted, they are frequently decomposed and obtained in the sugar-free condition. These substances are more widely distributed in different plants and in different parts of plants than are the anthocyanins. They have a limited but definite utility as mordant dyestuffs, giving in many cases bright, fast dyeings owing to their capacity for the formation of lakes with certain metallic oxides. A typical anthoxanthin is quercitrin, $C_{21}H_{20}O_{11}$, which is found in quercitron bark, an extract of which was introduced by Bancroft as a colouring matter in 1775. This hark is derived from a species of oak, *Quercus velutina,* a native of the middle and southern United States. The colouring matter is deposited in the inner bark and may be obtained by extraction with dilute ammonia. On boiling the solution with hydrochloric acid the quercitrin is hydrolyzed to the products quercetin, $C_{15}H_{10}O_7$, and the sugar, rhamnose, $C_6H_{12}O_5$. Quercetin is a bright yellow, feebly acid substance; it combines with strong acids to form orange salts, but these are not very stable and are readily dissociated by water. Nevertheless, this property of salt formation in a non-nitrogenous substance is a weaker manifestation of the basic character exhibited by the anthocyanins, and it is due to a structural peculiarity common to both types. Quercetin is a strong polygenetic mordant dyestuff. On wool, with a chromium mordant it gives a reddish-brown shade, with an aluminium mordant a brownish-orange shade, with a tin mordant a bright orange shade and with an iron mordant an olive-black shade. Many representatives of this group have been isolated and closely investigated by A. G. Perkin, St. von Kostanecki and others. As with the anthocyanins, different glucosides yield the same fundamental colouring matter, and moreover the $-OH$ groups are sometimes replaced by $-OCH_3$. Derivatives of quercetin have been obtained from rue, capers, buckwheat, clover flowers, *Eucalyptus macrorhyncha,* cotton flowers, onion skins, Persian berries, wallflowers, tea leaves, may blossom, horse chestnut, bark of the apple tree, and also from wings of certain insects and many other sources. Although significance must be attached to this remarkably wide distribution of quercetin, it is to be noted that nature provides more variety among the anthoxanthins than among the anthocyanidins. They are already a numerous clan and fresh representatives are constantly being discovered.

Among the better known of these colouring matters the following may be mentioned (in all cases, excepting possibly chrysin, the substances occur in the plant in combination with sugars). Chrysin, $C_{15}H_{10}O_4$, is contained in the leaf buds of the poplar; apigenin, $C_{15}H_{10}O_5$, in the leaves, stem and seeds of parsley, and also in camomile flowers; galangin, $C_{15}H_{10}O_5$, in galanga root; luteolin, $C_{15}H_{10}O_6$, in weld. This latter dried herbaceous plant, *Reseda luteola,* an extract of which formed the oldest known European dyestuff, is said to have been used by nations north of the Alps in the time of Julius Caesar. Weld gives a beautiful and fast yellow on silk mordanted with alumina and still finds a limited application in the dyeing of certain materials used in military uniforms. Kaempferol, also $C_{15}H_{10}O_6$, occurs in *Delphinium consolida;* and a third isomeride, fisetin, is the colouring matter of the wood of *Rkus cotinus* which comes into commerce as "young fustic." Old fustic is the wood of the tree *Chloroplzora tinctoria* and contains morin, $C_{15}H_{10}O_7$, which is the most important of the natural dyestuffs of this group. Myricetin, $C_{15}H_{10}O_8$, is found in the box-myrtle of China and in numerous other plants; its isomerides, gossypetin and quercetagetin, are the colouring matters of cotton flowers and the African marigold respectively.

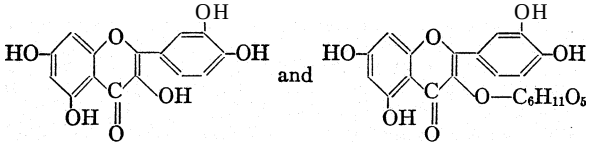
Constitutional Relationships.—The results of the investigations made with the object of unravelling the molecular structure of these substances have demonstrated that they are all based on a single type, and actually the molecules of each of these colouring matters can be constructed from those of a substance called flavone, $C_{15}H_{10}O_2$, by replacing one or more hydrogen atoms by hydroxyl (—OH) groups. This fact was recognized in some of the above cases at a time when flavone itself was unknown, and on account of the interest attaching to the simplest representative of an important group of naturally occurring compounds, Kostanecki prepared it artificially in 1898. Muller in 1915 made the remarkable discovery that the "meal" or "farina" of *Primula pulverulenta* and *P. japonica* consisted largely of flavone identical with the synthetic preparation of Kostanecki. The atoms in the molecule of flavone are connected in the manner shown in the annexed figure and the various anthoxanthins are substances the molecules of which may be imagined to be derived from those of flavone by replacing a number of the hydrogen atoms (H) by —OH groups, sometimes by $-OCH_3$ groups and then attaching sugar molecules through some of the —OH groups.

Arrangement of Atonzs in the Flavone Molecule

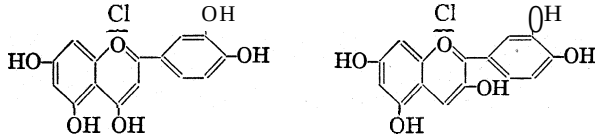


Two of the rings in the flavone molecule are benzene rings and the third, containing an oxygen atom, is a pyrone ring. (The precise mode of linkage between carbon atoms is irrelevant to the present discussion.) The various positions in the flavone nucleus are denoted by numerals, and the positions of hydroxyl groups in some of the above-mentioned anthoxanthins are as follows:—chrysin, 5:7; apigenin, 4′:5:7; galangin, 3:5:7; luteolin, 3′:4′:j:7; kaempferol, 4′:3:5:7; fisetin, 3′:4′:3:7; quercetin, 3′:4′:3:5:7; morin, 2′:4′:3:5:7; myricetin, 3′:4′:5′:3:5:7. The nine representatives just cited and several others have been synthesized by methods such as to leave no doubt in regard to their molecular constitution, and in all cases the natural and synthetic products have been found by careful comparison to be identical. The occurrence of a hydroxyl group in position 3 has a considerable influence on the properties of the colouring matters; those that contain it are called "flavonols" and are usually characterized by more powerful tinctorial properties and greater strength as bases than isomerides not hydroxylated in this position. It has been found that

the sugar molecules are usually attached through oxygen atoms in positions 3 or 7. Thus quercetin and quercitrin (see above) have the following respective structural formulae.

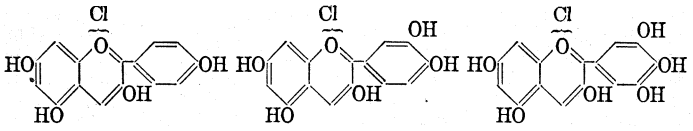


These were determined by modifying the free —OH groups in quercitrin, subsequently detaching the sugar group and detecting the situation of the free —OH groups thus produced. A comparison of the composition of the flavones and flavonols with that of the anthocyanidins, discloses a simple relation. Cyanidin chloride, $C_{15}H_{11}O_6Cl$, is just HCl more than luteolin, $C_{15}H_{10}O_6$. Cyanidin chloride is not, however, luteolin hydrochloride, although the relation between the substances is very close, and on treatment with hot aqueous alkali, cyanidin and luteolin give identical fission products. These have the benzene rings intact so that cyanidin and luteolin, if the former is based on the flavone ring system, can differ only in the pyrone ring portion of the molecular structure. In accordance with modern conceptions, the formation of ammonium chloride from ammonia and hydrogen chloride involves the passage of the positively-charged hydrogen atom (proton) to the ammonia forming a positively-charged complex. This leaves a negatively-charged chlorine atom and the process may be represented by the scheme: NH_3 and $\overset{+-}{H}Cl \rightarrow \overset{+}{N}H_4 \; \} \; \bar{C}l$. Similarly, the pyrone salts are formed by the proton of the acid passing to an oxygen atom, and we can formulate luteolin hydrochloride on the probable assumption that the proton combines with oxygen in position 4.



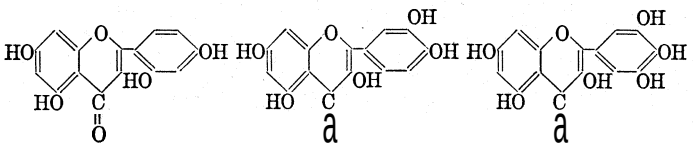
Luteolin hydvochloride — *Cyanidin* chloride

The constitution figured for cyanidin chloride was suggested by, rather than deduced from, these facts, but it has been conclusively proved to be correct by synthesis in several different ways. Pelargonidin chloride is similarly constructed, but lacks the —OH group in position 3′, while delphinidin chloride is cyanidin chloride with an additional —OH group in position 5′. Pelargonidin chloride and delphinidin chloride have also been artificially prepared. The formulae of the three anthocyanidins (chlorides) are given below.



Pelargonidin chloride — *Cyanidin* chloride — *Delphinidin* chloride

These may be compared with certain flavonols expressed similarly.



Kaempferol — Quercetin — Myricetin

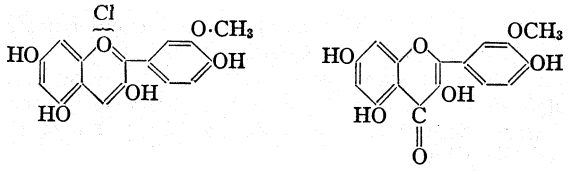
Evidently if we were able to remove the oxygen in position 4 in presence of HCl it would be possible to convert the flavonols into the anthocyanidins as shown in the example -

$$\underset{\text{Quercetin}}{C_{15}H_{10}O_7} + HCl + H_2 = \underset{\textit{Cyanidin}\text{ chloride}}{C_{15}H_{11}O_6Cl} + H_2O$$

and thus the close relationship of the individuals in the two groups would be established. Actually the transformation is most difficult to effect, and although numerous workers claim to have been successful, the experimental control has not always been satisfactory. The authentic example is furnished by the work of Willstätter and Mallison, who converted quercetin into cyanidin chloride by means of magnesium in methyl-alcoholic aqueous hydrochloric acid solution. The yield was very poor, since most of the quercetin underwent a different transformation. Nature may have at command a more effective method of reduction, anthocyanins being produced in the plant by deoxygenation (reduction) of the anthoxanthins, considered to be the primary products.

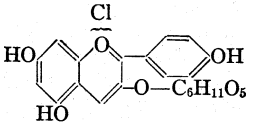
Against this hypothesis, it seems equally probable that the anthocyanins and anthoxanthins represent end-products obtained by divergent processes from a common parent. It is the exception rather than the rule to find the most closely related anthocyanins and anthoxanthins occurring together in a plant. Thus Delphinium *consolida* gives kaempferol and a delphinidin derivative, and there is no evidence that the facile changes in anthocyanin production in passing from one garden variety to another are echoed by changes in the anthoxanthins. Furthermore the range of anthocyanidins is much more restricted than that of anthoxanthins.

In favour of the hypothesis may be counted the circumstance that, so far as we know at present, the groups such as $—OCH_3$ and sugar groups that are attached to the fundamental nuclei occupy corresponding positions in the anthoxanthins and anthocyanins. We may compare, for example, the formulae of peonidin chloride, the anthocyanidin from the peony and isorhamnetin from yellow wallflowers. Both have been synthesized.



Peonidin chloride — iso*Rhamnetin*

The sugar residue of monoglycosides is frequently attached to position 3 in both anthoxanthins and anthocyanins. The second sugar residue of the dimonogiycosides usually occupies position 5. It is generally recognized that the diglycosides in both series contain disaccharide units. That is, the attachment involves only one hydroxyl group of the anthocyanidin. One anthocyanin has been artificially prepared, namely, callistephin from the aster, and in this substance the sugar is beyond question in position 3.



Callistephin chloride

Betanin, responsible for the red colour of beets, is an unusual anthocyanin in that it contains nitrogen, probably as ornithine or some similar nitrogenous base. This basic group is attached to the anthocyanidin molecule in addition to a sugar group. Such pigments are very unstable when extracted.

Some characteristic properties of the anthocyanins are the following:

Chemical Reactions. — Amy1 Alcohol-Dilute Hydrochloric Acid Distribution Ratio. — The anthocyanidins, the monoglycosidic anthocyanins and the diglycosidic anthocyanins can be roughly distinguished by their behaviour in presence of a mixture of amyl alcohol and very dilute hydrochloric acid. The anthocyanidins pass completely to the amyl alcohol layer; the diglycosidic anthocyanins remain largely in the aqueous layer, unless one of the sugar groups is rhamnose, when the behaviour tends to be monoglycosidic; the monoglycosides distribute themselves more evenly between the two layers.

Ferric Chloride Reaction. — Anthocyanins or anthocyanidins with free —OH groups in positions 3′ and 4′ (*e.g.*, cyanidin, delphinidin) give an intense blue colouration in alcoholic solution on the addition of ferric chloride. The colour becomes violet on the addition of water. The fact that all the anthocyanins derived from cyanidin exhibit this reaction proves that the sugar is not attached to positions 3′ and 4′ in any of them. Characteristic colour reactions have been developed for both anthocyanins and anthoxanthins.

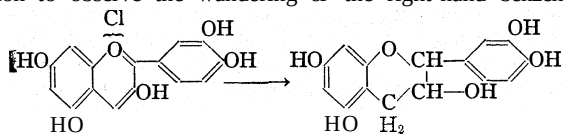
Colour Bases and Pseudo-bases. — In most cases the addition of sodium acetate to an aqueous solution of an anthocyanin (idin) produces a violet or purple precipitate of a colour base. Again, the addition of water to an alcoholic solution of cyanidin chloride causes the slow separation of the colour base in a form exhibiting a characteristic green colour. Addition of acid reproduces the cyanidin salt. These colour bases have been more closely investigated in other related series and have a quinonoid nature. They absorb water, giving colourless compounds also convertible by acids to the anthocyanin salts, and these so-called pseudo-bases are often formed on the great dilution of the aqueous or alcoholic solutions of the anthocyanin salts. Decolourization of the solutions of natural pigments and subsequent reappearance of the colour was a puzzling phenomenon encountered by some of the earlier workers in the group.

Cyanidin colour-base (Deep violet) — *Cyanidin* pseudo-base (*Colourless*)

It remains to be added that anthocyanins and anthoxanthins have a close relation to certain colourless plant constituents, and among

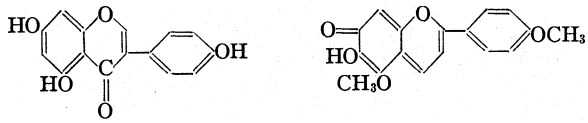
these catechin occupies an important position. Freudenberg has shown that both quercetin and cyanidin on treatment with hydrogen and a catalyst yield one of the naturally occurring catechins shown below.

In the course of his experiments on catechin, Freudenberg has had occasion to observe the wandering of the right-hand benzene ring



Cyanidin chloride *dl-Epicatechin*

from position 2 to position 3. It is therefore interesting to notice that genistein, an anthoxanthin of dyers broom, has been definitely proved to have the following structure.



Genistein *Carajurin*

The blue colour of some flowers is not due to the effect of alkaline cell sap on anthocyanins but to the presence of a colourless or slightly coloured co-pigment as an addition compound. Tannins and flavones often act in this capacity. The principal chemical factors affecting the colours in cell sap are: (1) the nature and concentration of anthocyanins, (2) the state of aggregation of the anthocyanins, which is affected by the pH and by protective colloids such as pentosans, (3) the presence of co-pigments, and (4) possibly the presence of alkaloids and metallic complexes.

The chemistry of anthocyanin pigments is of considerable practical importance in the canning industry. Anthocyanins of fruits form insoluble salts of tin and iron, after these metals are made available by corrosion of the cans initiated by fruit acids. Thus, high anthocyanin content may greatly increase the corrosion over that which could be attributed to the acid alone. Fruit quality is thereby lowered.

Finally, it may be remarked that carajurin, a crystalline constituent of "carajura," is related to the anthocyanin group. Carajura, a bright red pigment, is prepared by the Indians of the Rio Meta and Orinoco for use as a flesh paint, since it is a very effective colouring agent.

BIBLIOGRAPHY.—A. G. Perkin and A. E. Everest, *The Natural Organic Colouring Matters* [chiefly chemical]; M. W. Onslow, *The Anthocyanin Pigments of Plants* [chiefly biochemical and botanical]; Julius Springer, *Handbuch der Pflanzenanalyse,* III2, chapter "Flavone, Flavonone, Isoflavone und Xanthone, gelbe Blutenfarbstoffe" by H. Rupe and M. Schaerer, and chapter "Anthocyane" by P. Karrer (1932); Henry Gilman, *Organic Chemistry,* 2nd ed., vol. ii, chapter "The Anthocyanins and the Flavones" by K. P. Link; F. Mayer and A. H. Cook, *The Chemistry of Natural Coloring Matters* (1943).

(R. ROB.; F. P. Z.)

ANTHOLOGY, a term literally denoting a garland or collection of flowers (Gr. *ἀνθολογία,* Lat. *florilegium*), hence a collection of short pieces or extracts, especially in verse, and in particular:

The Greek Anthology.— The art of occasional poetry had been cultivated in Greece from an early period, especially for short inscriptions *(epigrammata)* of all kinds. These must necessarily be brief, and Greek taste prescribed that they should also be well expressed and pointed. The term *epigram* was soon extended to any piece by which these conditions were fulfilled, and the favourite metre for such compositions was the elegiac couplet. The transition from the monumental to the purely literary epigram was favoured by the conditions of the Alexandrian era *(see* ALEXANDRIAN SCHOOL). About 60 B.C. the sophist and poet, Meleager of Gadara, made an important collection, drawing on various earlier ones. This he entitled *The Garland,* and in an introductory poem each poet is compared to some flower. The arrangement of his collection was alphabetical, according to the initial letter of each epigram.

In the age of the emperor Tiberius (or Trajan, according to others) the work of Meleager was continued by another epigrammatist, Philippus of Thessalonica, who first employed the term *anthologia.* His collection, which included the compositions of thirteen writers subsequent to Meleager, was also arranged alphabetically, and contained an introductory poem. Somewhat later, under Hadrian, another supplement was formed by the sophist Diogenianus of Heracleia (2nd century A.D.), and Straton of Sardis compiled or composed his Μοῦσα Παιδική, *Musa Puerilis.* No further collection is recorded until the time of Justinian, when epigrammatic writing experienced a great revival at the hands of Agathias of Myrina, the historian, Paulus Silentiarius, and other classicizers. Agathias then drew up a new anthology, entitled *The Circle;* it was the first to be divided into books and arranged with reference to the subjects of the pieces.

These, and other collections made during the middle ages, are now lost. The partial incorporation of them into a single body, classified according to the contents in 15 books, was the work of a certain Constantinus Cephalas, (before 917). He appears merely to have made excerpts from the existing anthologies, with the addition of selections from Lucillius, Palladas, and other epigrammatists, whose compositions had been published separately. His arrangement, to which further reference will be made, is founded on a principle of classification, and nearly corresponds to that adopted by Agathias. This collection more or less corresponds to the contents of a ms. formerly the property of the Elector Palatine, now partly at Heidelberg, partly at Paris. It is often called the *Palatine Anthology.* The last anthology is the *Planudean,* named after its editor, Maximus Planudes (1320), who not merely grievously mutilated the anthology of Cephalas by omissions, but disfigured it by interpolating verses of his own. We are, however, indebted to him for the preservation of the epigrams on works of art, which seem to have been accidentally omitted from the Palatine ms.

The Planudean anthology (in seven books) was first published at Florence, by Janus Lascaris, in 1494. It long continued to be the only accessible collection, for although the Palatine ms. was discovered and copied by Saumaise (Salmasius) in 1606, it was not published until 1776, in Brunck's *Analecta Veterum Poetarum Graecorum.* Brunck's edition was superseded by that of Friedrich Jacobs (1794–1814, 13 vols.), the text of which was reprinted in a more convenient form in 1813–17. The best edition for general purposes is still that of Diibner and Cougy (Didot, 1864–92; 3 vols.), which contains the Palatine Anthology, the epigrams of the Planudean anthology not comprised in the former, an appendix of pieces derived from other sources, notes, and Latin versions. The best edition of the Planudean anthology is the splendid one by van Bosch and van Lennep (1795–1822). There is also an incomplete text by Stadtmiiller in the Teubner series.

Arrangement.— The Palatine ms., the archetype of the present text, was transcribed by different persons at different times, and the actual arrangement of the collection does not correspond with that signalized in the index. It is as follows: Book 1. Christian epigrams; 2. Christodorus's description of certain statues; 3. Inscriptions in the temple at Cyzicus; 4. The prefaces of Meleager, Philippus, and Agathias to their respective collections; 5. Amatory epigrams; 6. Votive inscriptions; 7. Epitaphs; 8. The epigrams of Gregory Nazianzen; 9. Rhetorical and illustrative epigrams; 10. Ethical pieces; 11. Humorous and convivial; 12. Strato's *Musa Puerilis;* 13. Metrical curiosities; 14. Puzzles, enigmas, oracles; 15. Miscellanies. The epigrams on works of art, as already stated, are missing from the *Codex Palatinus,* and must be sought in an appendix of epigrams only occurring in the Planudean anthology.

Style and Value.--One of the principal claims of the anthology to attention is derived from its continuity, its existence as a living and growing body of poetry throughout all the vicissitudes of Greek civilization. Four stages may be indicated:— 1. The Hellenic proper, of which Simonides of Ceos (c. 556–469 B.C.), the real or supposed author of most of the sepulchral inscriptions on those who fell in the Persian wars, is the characteristic representative. This is characterized by simple but impressive phraseology, suited to a real inscription. 2. The Alexandrian era, when epitaphs and votive inscriptions were composed on subjects often imaginary. Point, wit, and ingenuity—in short, the qualities we call epigrammatic—often joined to genuine emotion, mark these compositions. The great exponents are Callimachus, Leonidas of Tarentum, a contemporary of Pyrrhus, and, later, Antipater of Sidon, about 140 B.C. 3. The later Hellenistic, or Roman period, of which Meleager himself is an excellent representative. A less severe taste in style, occasional grossness in subject, and a lavish, often very happy, use of epithet mark him and his imitators. At a later period of the empire another *genre,* hitherto comparatively in abeyance, was developed, the

satirical. Lucillius, who flourished under Nero, and Lucian (perhaps Lucian of Samosata) have left us a number of witty lampoons and pasquinades on persons real or imaginary. Palladas, an Alexandrian grammarian of the 4th century, may be taken as closing this epoch. 4. The fourth or Byzantine style of epigrammatic composition was cultivated by the *beaux-esprits* of the court of Justinian. To a great extent this is merely imitative, but the circumstances of the period operated so as to produce a species of originality. The writers, moreover, were men of genuine poetical feeling, ingenious in invention, and capable of expressing emotion with energy and liveliness; the colouring of their pieces is sometimes highly dramatic.

While it contains a certain amount of dull, puerile, or indecent trash, mostly late, the value of the Greek Anthology is high on the whole, both as literature and for the light it throws on Greek life, thought, and feeling during some 1900 years. Its influence on modern European literatures is enormous.

Translations, Imitations, **etc.**—The best versions of the Anthology ever made are the Latin renderings of select epigrams by Hugo Grotius. They are most easily accessible in the Didot edition and in Dr. Wellesley's *Anthologia Polyglotta* (1849). The best literal and complete English translation is that in the Loeb series (W. R. Paton); a few pieces, however, are rendered into Latin, for obvious reasons. Of selections with prose or verse translations may be mentioned J. W. Mackail, *Select Epigrams from the Greek Anthology,* 1890, revised 1906; Graham R. Tomson (Mrs. Marriott Watson), *Selections from the Greek Anthology* (1889); W. H. D. Rouse, *Echo of Greek Song* (1899); *L.* C. Perry, *From the Garden of Hellas* (New York, 1891); W. R. Paton, *Love Epigrams* (1898); *H.* Macnaughten, *Little Masterpieces from the Anthology* (1924); Humbert Wolfe, *Others Abide* (1927). For critical discussion besides the histories of Greek literature, we may mention J. A. Symonds, *Studies of the Greek Poets* (3rd ed., 1893).

The Latin Anthology. — A modern collection of fugitive Latin verse, from the age of Ennius to about A.D. 1000. Nothing corresponding to the Greek Anthology is known to have existed among the Romans. The first general collection was Scaliger's *Catalecta veterum Poetarum* (1573), succeeded by the more ample one of Pithoeus, *Epigrammata et Poemata e Codicibus et Lapidibus collecta* (1590). Numerous additions, principally from inscriptions, continued to be made, and in 1759–73 Burmann digested the whole into his *Anthologia veterum Latinorum Epigrammatum et Poematum.* This, occasionally reprinted, was the standard edition until 1869, when Alexander Riese commenced a new and more critical recension. The first volume (in two parts) appeared in 1869–70; the second volume, *Carmina Epigraphica* (in two parts), in 1895–97, edited by Biicheler. An *Anthologiae Latinae Supplementa,* in the same series, followed. A new edition (Riese-Biicheler-Lommatzsch: Teubner 1894–1926) has now replaced it. (R. G.; H. J. R.)

Modern Anthologies. — The representative modern anthology is, in intention at least, a critical selection designed to give the reader the very best in the verse or prose of a particular literature; the earlier, however, are mostly miscellanies with less critical ambition, like the numerous English compilations of the 16th and early 17th centuries. Among the most notable of these last are: *Tottel's Miscellany* (1557), rich in Wyatt and Surrey; *The Paradise of Dainty Devices* (1576); *The Phoenix Nest* (1593), containing a dozen till then unpublished pieces by Lodge; the popular ill-selected *England's Parnassus* (1600); *England's Helicon* (1602), representing Sidney, Spenser, Greene among others; Davison's *Poetical Rhapsody* (1602). Percy's *Reliques of Ancient English Poetry* (1765) had an immense influence on the poets of the next generation, and Allan Ramsay's *Tea-table Miscellany* (1724–40) gave Burns models. Later selections of verse include Southey's *Select Works of the British Poets* (1831); Campbell's *Specimens of the British Poets* (1841); *F.* T. Palgrave's *Golden Treasury* (1861), a classic; Locker-Lampson's *Lyra Elegantiarum* (1867, revised 1891); T. H. Ward's *English Poets* (1883); Quiller-Couch's *Oxford Book of English Verse* (1900); *W.* B. Yeats's *The Oxford Book of Modern Verse* 1892–1935 (1936). English prose has never been anthologized with great success, but the works, edited by Craik, Saintsbury, Galton, and Quiller-Couch's *Oxford Book of English Prose* may be mentioned.

Noteworthy American anthologies include:

The Columbian Muse (1794); Edmund Clarence Stednian, *An American Anthology, 1787–1899* (Boston, 1900); Walter Cochrane Bronson, *American Poems, 1625–1892* (Chicago, 1916); Harriet Monroe and Alice Corbin Henderson, *The New Poetry: An Anthology* (1917); Louis Untermeyer, *Modern American Poetry* (1919, revised and enlarged 1936); James Welden Johnson (ed.), *The Book of American Negro Poetry* (1922); Marguerite Ogden Wilkinson, *Contemporary Poetry* (1923); Bliss Carman (ed.), *The Oxford Book* of *American Verse* (1927); Conrad Aiken, *American Poetry* (1929); Alfred Kreymborg, *Lyric America* (1930); Louis Untermeyer, *American Poetry from the Beginning to Whitman* (1931); H. H. Clark, *Major American Poets* (1936).

Of foreign anthologies may be noted: For French, E. Crepet, *Poètes français* (4 vols., 1861), and G. Walch, *Anthologie des poètes français contemporains* (5 vols., 1906, etc.); for German, the works edited by Bartsch, Goedeke and Tiltmann (1867–83), H. Fiedler; for Italian, the works by Carducci and Mamiani; for Spanish, the anthologies of Menéndez y Pelayo. Oriental anthologies are very numerous but mostly uncritical.

ANTHON, CHARLES (1797–1867), American classical scholar, was born in New York city Nov. 19 1797. After graduating with honours at Columbia college in 1815, he began the study of law, and in 1819 was admitted to the bar, but never practised. In 1820 he was appointed assistant professor of Greek and Latin in his old college and later full professor, becoming also headmaster of the grammar school attached to the college, which post he held until near the end of his life. He died at New York July 29 1867. He produced for use in colleges and schools annotated editions of many classical works, which delighted the students by the assistance they afforded and various classical handbooks.

ANTHONY, SAINT (c. A.D. 250–350), the first Christian monk, was born in middle Egypt. At the age of 20 he began to practise an ascetic life, and after 15 years of this life, he withdrew for solitude to a mountain by the Nile, called Pispir, now Der el Memum, opposite Arsinoe in the Fayum. In the early years of the 4th century, he emerged from his retreat to organize the monastic life of the monks who imitated him. After a time, he again withdrew to the mountain by the Red sea, where now stands the monastery that bears his name (Der Mar Antonios). Shortly before his death, he ventured to Alexandria to preach against Arianism.

Anthony is noted for his combats with the hosts of evil. Athanasius tells us that he was first tempted by thoughts of family joys and duties, and of the difficulty of his chosen life, but the devil finding argument of no avail, and hoping to arouse in him the pride of success, appeared as a cringing black boy admitting that he had been defeated by the saint. At other times he appeared under the guise of a monk bringing him bread during his fasts, or under the form of wild beasts, women or soldiers, sometimes beating the saint and leaving him as dead.

Anthony is also recognized as the father of Christian monachism. The monastic rule which bears his name was not written by him, but was compiled from writings and discourses attributed to him in the *Life* and the *Apophthegmata Patrum.* The rule is still observed by a number of Coptic Syrian and Armenian monks. (*See* MONASTICISM.)

BIBLIOGRAPHY.—The Greek *Vita* is among the works of St. Athanasius; for the almost contemporary Latin trans. *see* Rosweyd's *Vitae Patrum* (Migne, *Patrol Lat.* lxxiii.); English trans. in the Athanasius volume of the "Nicene and Post-Nicene Library." Accounts of St. Anthony are given by Card. Newman, *Church of the Fathers* (Historical Sketches) and Alban Butler, *Lives of the Saints* (Jan. 17). Discussions of the historical and critical questions will be found in E. C. Butler, *Lausiac History of Palladius* (1898, 1904), part i., pp. 197, 215–228; part ii., pp. 9–12; and Contzen, *Die Regel des hl. Antonius* (Melten, 1896).

ANTHONY, SUSAN BROWNELL (1820–1906), American reformer, was born at Adams (Mass.), on Feb. 15, 1820. After being a school-teacher for 15 years she organized in 1852 the first woman's state temperance society in America, and in 1856 became the agent for New York state of the American

Anti-slavery Society. After 1854 she devoted herself almost exclusively to the agitation for woman's rights. From 1868 to 1870 she was the proprietor of a weekly paper, The Revolution, published in New York, edited by Mrs. Elizabeth Cady Stanton, and having for its motto, "The true republic—men, their rights and nothing more; women, their rights and nothing less." She was vice-president-at-large of the National Woman Suffrage Association from the date of its organization in 1869 until 1892, when she became president. For casting a vote in the presidential election of 1872, as, she asserted, the 14th Amendment to the Federal Constitution entitled her to do, she was arrested and fined $100, but she never paid the fine. In collaboration with Mrs. Elizabeth Cady Stanton, Mrs. Matilda Joslyn Gage, and Mrs. Ida Husted Harper, she published The History of Woman *Suffrage* (4 vols., New York, 1884–87). She died at Rochester (N.Y.), on March 13, 1906.

See Mrs. Ida Husted Harper's Life and Work of *Susan* B. *Anthony* (Indianapolis, 1898–1908).

ANTHONY OF PADUA, ST. (1195–1231), Franciscan monk and saint, was born at Lisbon Aug. 15 1195. In his 15th year he entered the Augustinian order, and joined the Franciscans in 1220. He taught theology at Bologna, Toulouse, Montpellier and Padua, and won a great reputation as preacher throughout Italy. He was the leader of the rigorous party in the Franciscan order against the mitigations introduced by Elias, general of the order. His death took place at the convent of Ara Coeli, near Padua, June 13 1231. He was canonized by Gregory IX. in the following year, and his festival is kept on June 13. He is regarded as the patron saint of Padua and of Portugal.

BIBLIOGRAPHY.—The most trustworthy modern works are by A. Lepitre, St. *Antoine* de Padoue (Paris, 1902, in Les Saints series: good bibliography; Eng. trans. by Edith Guest, London, 1902), and by Léopold de Chérancé, St. Antoine de Padoue (Paris, 1895; Eng. trans., London, 1896). His works, consisting of sermons and a mystical commentary on the Bible, were published in an appendix to those of St. Francis, in the Annales *Minorum* of Luke Wadding (Antwerp, 1623), and are also reproduced by Horoy, Medii aevi bibliotheca *patristica* (1880, vi. pp. 555 et seq.); see art. "Antonius von Padua" in Herzog-Hauck, *Realencyklopädie.*

ANTHOZOA (*i.e.*, "flower-animals"), a group of animals belonging to the phylum Coelenterata (*q.v.*). Many of them form a strong skeleton known as "coral" (*q.v.*). The term "coral" is applicable to the hard parts of any Coelenterate which secretes a firm skeletal support, but most of these forms are Anthozoa, and amongst them the term "true coral" is applied to the group Madreporaria only. The flower-like shape and brilliant colouring of the soft parts of many of these creatures has attracted attention for hundreds of years, and the discovery that they are indeed animals instead of being plants, minerals, or intermediate organizations, did not gain acceptance for some time after it was first made, in connection with the precious red coral of commerce, by J. A. de Peyssonel in 1727.

Not all the Anthozoa produce a skeleton. A hard support is quite lacking in the Sea Anemones, and among the other kinds of Anthozoa although it is present more often than not it does not necessarily form a mass sufficiently compact to retain its shape after the death of the soft parts.

An Anthozoan may consist of a single polyp (this term is defined in the article COELENTERATA), as it does in the case of a Sea Anemone; but more frequently a colony is formed, containing a number of polyps permanently united together; and it is the skeletons built up by certain of these colonies which constitute the most characteristic "coral."

The Anthozoa as a class are distinguished from the other groups of the Coelenterata not only by the structure of the individual polyps, but also by the fact that none of them at any time during their life-history assumes the form of medusae ("jellyfish," see COELENTERATA). The Anthozoan individual or colony therefore corresponds to the polyp-generation of any Coelenterate which exhibits both polyp and medusa alternately during its life-cycle. The Anthozoan polyps themselves, though often small, tend to be more muscular and substantial than those of other Coelenterates. They are characterized by the possession of a body which is in principle a cylinder, closed in above and below by two discs of tissue. The upper disc or peristome is encircled by a corona of hollow tentacles, and is perforated in the centre by a more or less slit-shaped mouth. Leading inwards from the mouth is a flattened tube, the throat, which opens directly into the main cavity of the body (coelenteron). The latter cavity is partially subdivided into alcoves by a series of radially arranged membranous partitions, the mesenteries, some or all of which are inserted along the upper part of their inner edge into the outer wall of the throat. The mesenteries bear along their free edge a marginal thickening of epithelium known as the *mesenterial filament*, and also carry reproductive organs and muscles. The number and arrangement of the mesenteries as well as the structure of throat, mesenteries, and filaments, varies from one group of Anthozoa to another.

The symmetry of the Anthozoan body presents to the casual observer a radial appearance, in common with that exhibited by the Coelenterata in general. Underlying this radial symmetry, there becomes revealed on closer inspection a fundamental bilateral symmetry, which is so definite that it is actually possible to divide a polyp into two perfectly equivalent halves along one plane of cleavage only. Much discussion has been aroused by this fact since there is no obvious reason why such a symmetry should exist at all. The probable explanation of the matter is that the Anthozoa were not always the sedentary radially arranged creatures which they are to-day. There may have been a phase in their history when they were small creeping animals with definite head and tail ends, upper and lower sides, and general bilateral symmetry. When such animals adopted a sedentary life and assumed a radial symmetry in correlation therewith, the former bilateral condition would remain as a vestige of the former state of affairs. The bilateral arrangement of parts is very prominent during the early development of a polyp.

An important fact in the development of many Anthozoa is that the wall of the cylindrical body appears to become marked out after the early stages are passed, into vertical strips of which some are zones in which active differentiation of new parts takes

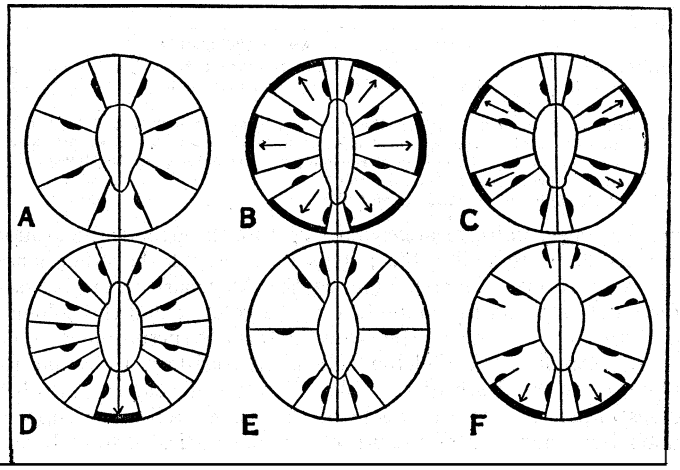


FIG. 1.— ARRANGEMENT OF THE MESENTERIES AND OF THE ZONES OF GROWTH IN VARIOUS ANTHOZOA

Each diagram represents a transverse section of a polyp. The outer circle is the body-wall, the central oval the throat, with siphonoglyphs indicated as small bays. The radiating lines are the mesenteries, the black thickening of each being its retractor. The vertical line in the centre on each figure in the illustration represents the axis of symmetry, and growth-zones on the body-wall are indicated by thick black lines. A. An Alcyonarian; B. An ordinary Sea Anemone; C. An Endocoelactid; D. A Cerianthid; E. An Antipatharian; F. A Zoanthid

place, others being zones in which, after a stated amount of structure has been formed, no new parts are added (fig. 1). In various groups of Anthozoa the arrangement of the mesenteries in the adult polyp depends on the relationship which the zones of active growth in the body-wall bear to those in which only a certain amount of differentiation of parts will take place. In other cases no new growth takes place after the early stages, and here a simpler plan of structure consequently prevails.

The axis of symmetry sometimes possesses a distinct significance with regard to the regeneration of parts of an adult polyp

which have been separated from the whole. In the Sea Anemones this axis coincides with a non-growing zone, and if in a suitable anemone a fragment of reasonable size be cut away from the edge of the animal's base, in such a way that the lower ends of the two "directive" mesenteries which flank the axis lie in its centre, the piece will in many cases regenerate an animal with two heads instead of one. A similar piece containing no directives will regenerate an ordinary one-headed adult.

The living Anthozoa fall into six principal series, the Alcyonaria, Actiniaria, Madreporaria, Zoanthinaria, Ceriantharia, and Antipatharia. These sub-classes are distinct from one another. Space forbids consideration of the three last groups mentioned, which contain relatively few and aberrant representatives. The three large groups will now be described.

I. ALCYONARIA

The Alcyonaria contrast sharply with the two other main groups (Actiniaria and Madreporaria). Alcyonarians almost invariably construct colonies. Their polyps are usually small and

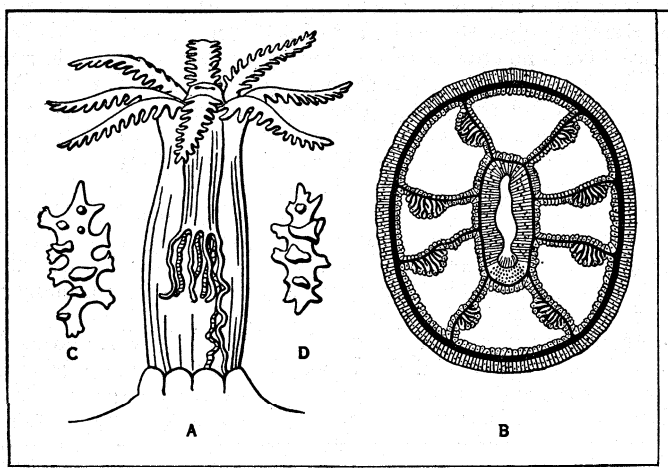


FIG. 2.—THE STRUCTURE OF AN ALCYONARIAN POLYP

A. Enlarged view of single polyp showing 8 pinnate tentacles surrounding mouth. and. below, the throat and mesenterial filaments (seen by transparency)

B. Transverse section of polyp showing the throat in centre and bodywall outside, each comoosed of three layers. The 8 mesenteries are also visible, the thickenings on these being the retractors. At the lower end of the throat is the siphonoglyph

C. and D. Spicules, greatly magnified

are extremely uniform in general structure throughout the group; in this they are unlike the polyps of either of the other large series of forms. Diversity among the Alcyonaria therefore affects not so much the individual as the colony; and the colonies constructed vary most extensively in form, structure, and mode of development. A skeleton sufficiently resistant to retain its shape after the death of the colony is often developed; in other cases either part or the whole of the colony relies for support upon large numbers of minute calcareous bodies, which abound in its tissues, and which are known as *spicules*. Thus the Alcyonaria include a number of creatures which produce "coral." They are a group of corals which in the main inhabit the shore and the coastal waters down to 550 fathoms. Speaking generally the great depths of the sea as well as considerations of temperature and salinity limit their occurrence. Their centre of distribution is the Indo-Pacific littoral and they form an important element in coral-reefs.

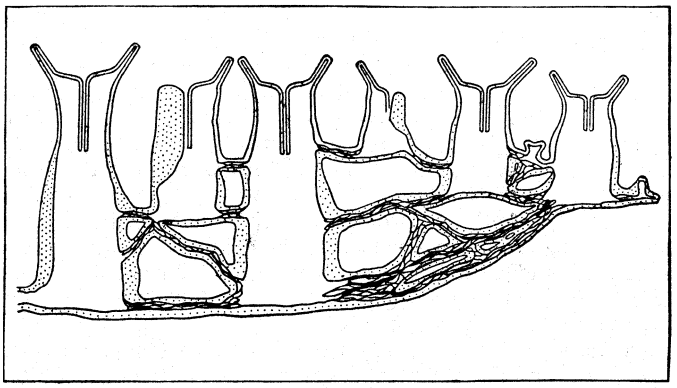
A typical Alcyonarian polyp (fig. 2) is simpler in structure, as well as being less variable from one genus to another than that of most other Anthozoa. It possesses eight, and only eight, tentacles, and these are feathered by the presence of a paired series of lateral branches on each; *i.e.*, they are *pinnate*. Down one angle of the flattened throat runs a groove lined by strongly ciliated epithelium. This is the *siphonoglyph*, and it creates a downward current of water into the coelenteron of the polyp. There are eight mesenteries, which alternate in position with the eight tentacles. These mesenteries possess each a special strip of muscle down one side, the fibres in the strip being supported by ridges or lamellae of mesogloea and running in a longitudinal direction. The whole strip of muscle is known as a *retractor*. By their contraction these muscles pull the upper parts of the polyp downwards and inwards during the act of retraction. Each mesentery also possesses a filament; but the filaments of all the mesenteries are not alike. Those which belong to the tw6 mesenteries farthest away from the siphonoglyph are very long.. Each has a groove along its free edge, lined by cells with long cilia; it is Y-shaped in a transverse section. The function of these filaments is circulatory. The filaments of the other six mesenteries are shorter and consist of an epithelial cord containing many glandular cells; these filaments are digestive organs. The six last-mentioned mesenteries also contain concentrations of sex-cells *(gonads)*.

The eggs of Alcyonaria usually develop into free-swimming planulae *(see* COELENTERATA) which in due course settle down, either upon a hard support or in sand or mud, become transformed into polyps and by budding begin to construct a colony. The process of budding has this peculiarity, however, that no bud is produced direct from a polyp itself; the polyps give off hollow root-like structures, lined by endoderm *(see* COELENTERATA) and known as *solenia*, and from these the new buds arise.

The Alcyonaria offer almost the only examples to be found among the Anthozoa of that phenomenon known as *polymorphism*, which is discussed in the articles COELENTERATA and HYDROZOA. In certain Alcyonarian colonies there are two kinds of polyps; the ordinary ones such as those already described, and another kind known as *siphonozooids*. These latter are polyps whose parts are more or less reduced, with the exception of the siphonoglyph, which is large and strongly ciliated. These individuals act as creators of water-currents which circulate through the system of solenial canals penetrating the colony. In cases where a single original polyp becomes transformed into the axis of a colony this constitutes a further differentiation of individuals.

The Alcyonaria are divided into three orders, and since the structure and mode of formation of the colonies, in which rests the main interest of the group, is different in the three cases, it will be convenient from this point onwards to consider them separately.

Order 1. Alcyonacea.—The numerous Alcyonaria which belong to this class possess this in common; that although the



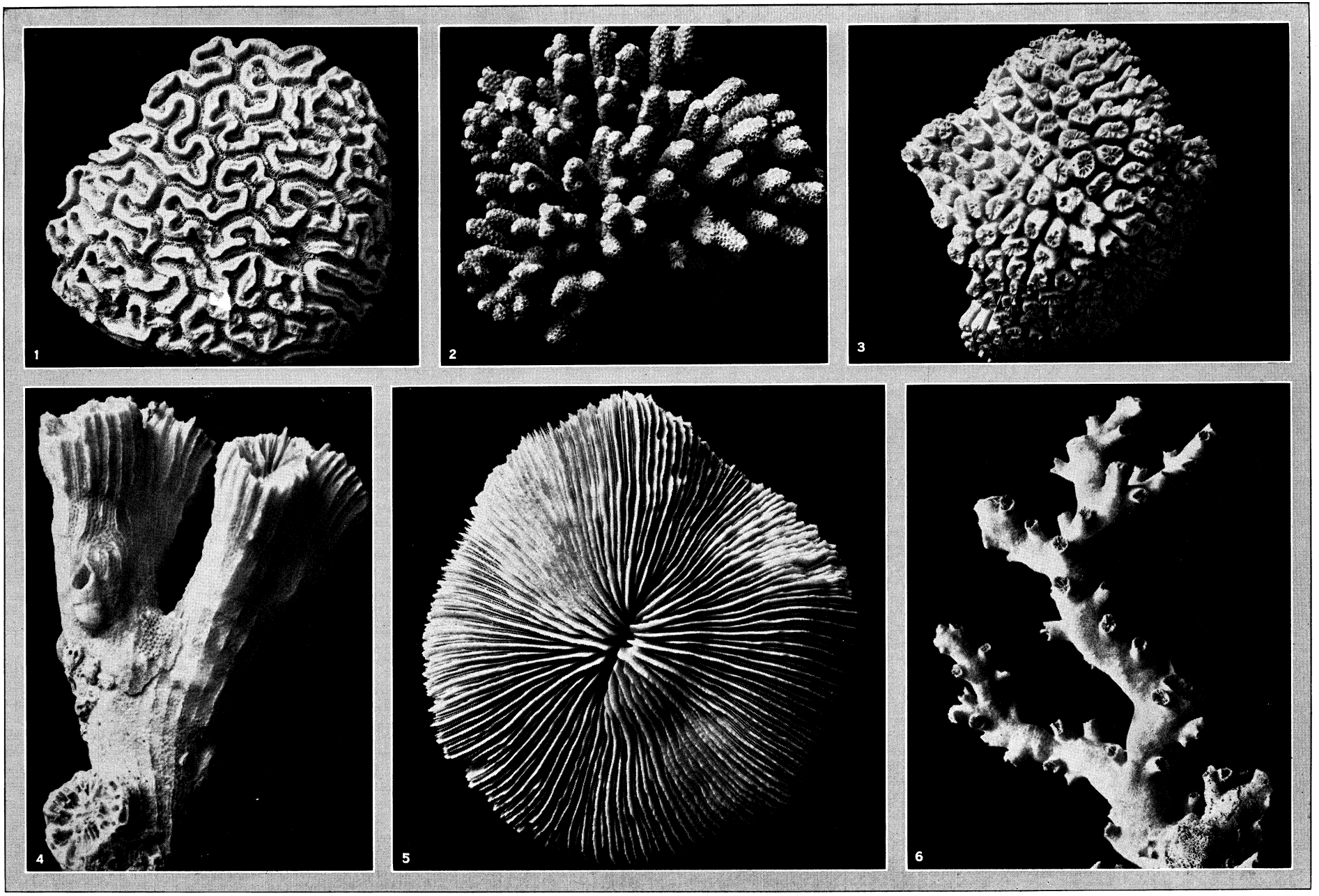
AFTER KÜKENTHAL, BY COURTESY OF WALTER DE GRUYTER AND CO.

FIG. 3.—DIAGRAM OF A COLONY OF HICKSONIA OR TUBIPORA

The polyps are represented as if seen in longitudinal section but their mesenteries are omitted. The internal cavities of the polyps are continuous with the system of fine canals (shown as a network of black lines) which penetrate the common flesh of the colony

colonies which they form are extremely various, there is never an axial skeleton forming a central support. A conception of the colony-forming activities of the polyps can be gained only by the study of a series of actual colonies. Figs. 3–5 will serve to illustrate the following remarks.

In the simplest colonies the polyps are attached to a foreign surface and connected with one another simply by a few creeping rootlets (solenia) arising from their bases. Such a condition exists in *Cornzrlaria*. Somewhat more elaborate are colonies such as those of certain species of *Clavularia* in which the meshes of

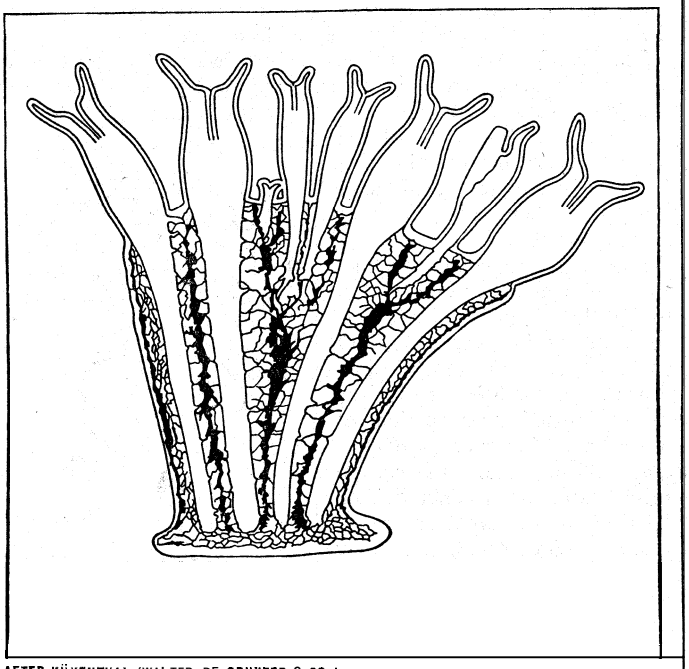


SKELETONS OF SOME TYPICAL SPECIES OF MADREPORE CORALS

1. Meandra cerebrum (brain coral) of the West Indian seas
2. Acropora, a genus of many species, found in all tropical seas
3. *Galaxea* cespitosa, of the eastern seas
4. *Eusmilia* fastigiata, a West Indian species
5. Fungia patella, found only in the Pacific and Indian oceans
6. *Dendrophyllia*, a genus of various species, widely distributed

the network of solenia have been filled up by solid mesogloea, and the network of rootlets has so been converted into a continuous mat, with ramifying endodermal tubes inside it, and covered externally both above and below by ectoderm. In neither of these colonies is there any firm skeleton; the support consists simply of an external horny layer covering the rootlets and the lower parts of the polyps *(Cornularia)* or of spicules *(Clavularia)*.

A different grade of organization appears in certain genera whose polyps tend to grow very tall, and are at the same time not



AFTER KÜKENTHAL (WALTER DE GRUYTER & CO.)

FIG. 4.— DIAGRAM OF A COLONY OF XENIA

Similar in general principle to Alcyonium described in the text. See also fig. 3

unduly close to one another. In such a case bridges containing solenia may grow across from one polyp to another well above the level of the bases of the polyps *(Hicksonia)*. This process goes a stage farther in *Tubipora*. In this the polyps become inordinately long and narrow and diverge from one another as they grow up; and instead of throwing out isolated bridges across the gaps between them they develop a series of plate-like horizontal platforms which run at stated intervals one above the other across the colony. These platforms consist of mesogloea containing solenia, and are covered externally by ectoderm. From each successive platform new polyps arise. The original polyps grow upwards until a considerable number of platforms have been formed; they then stop, the other polyps continuing the colony. *Tubipora* produces a skeleton composed of firmly compacted spicules, which lies in the mesogloea of the polyps and platforms during life and is therefore truly internal. The tentacles of the polyps are bright green, the skeleton is crimson; and after the death of the soft parts it remains as a brightly coloured mass of tubes, often of considerable size, and is known as "Organ-pipe coral."

Colonies of different type are formed by other genera possessing long polyps. In *Alcyonium* for instance there is formed a massive colony with a small number of stout, unwieldy lobes. Each lobe consists of a number of polyps which are inordinately elongated vertically; but here, instead of producing platforms, the polyps have filled in the whole space between them with solid mesogloea, so that only the head-end of each polyp projects beyond the general mass. Consequently ectoderm occurs only on the exposed parts of the polyps and on the external surface of the mass connecting these; the inner parts consist of mesogloea with solenia ramifying through it and connecting the deeper parts of the polyps with each other. New polyps arise from solenia at various levels between the old ones, as the colony grows. In this instance the skeleton consists entirely of scattered spicules; these occur not only in the mesogloea of the massive portion of the colony but also in the projecting upper ends of the polyps, which are retractile into the solid part. The common British *Alcyonium* is known as "Dead Men's Fingers" from the suggestive appearance presented by the colony when removed from the water or stranded by the tide, suspended from the undersides of overhanging rocks. Its appearance when under water with the transparent glassy polyps fully expanded is as delicate and beautiful as its retracted state is repulsive.

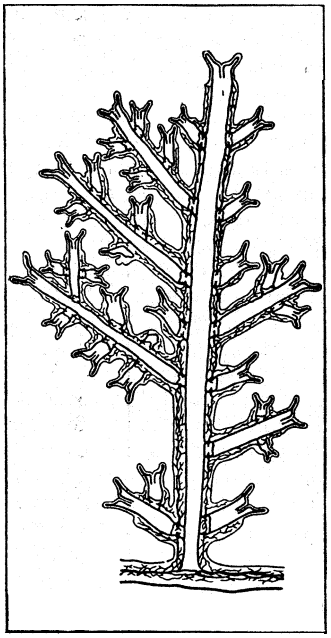


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FIG 5 — DIAGRAM OF A COLONY OF TELESTO

The tree-like branching colonies of other Alcyonacea may be produced in more than one way. In *Telesto* for example, lateral polyps are budded off from solenia lying in the walls of single original polyps, which become extremely elongated. Since each secondary polyp grows out at an angle from its parent, and itself produces further lateral polyps, it constitutes in time a branch of the main stem formed by the original polyp. A number of such branching systems may be connected with one another by basal stolons.

Lastly in *Heliopora*, the Blue Coral of tropical Indo-Pacific shores, a massive calcareous skeleton is produced.

Order **2. Gorgonacea.**—In these animals the skeleton, except in a few unusual genera which appear to be transitional in status between a mat-like colony and a tree-like one, forms a definite axis running up the centre of a tree-like colony. The soft tissues by which the axis is surrounded contain spicules.

A typical example of the Gorgonacea is *Gorgonia verrucosa*, one of the Sea Fans (fig. 6). This forms a tree-like colony attached by a narrow base and with slender twig-like branches. Each branch has an axis of blackish horny skeleton, clothed on all sides by bright pink flesh containing solenia, and studded with numerous small translucent pink polyps. In certain relatives of *Gorgonia* the horny skeleton contains calcareous inclusions.

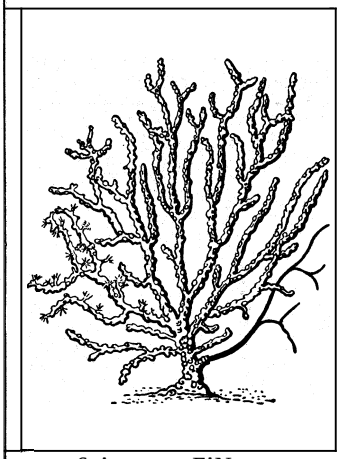


FIG. 6.—A SEA FAN, GORGONIA VERRUCOSA

A tree-like Alcyonarian. In the branch on the right the flesh of the colony has been removed revealing the dark twig-like skeleton

In *Corallium*, the well known Precious Coral of commerce, the "coral" is an axial skeleton similar to that of *Gorgonia*, but in this case it is stouter and less twig-like, and is formed by the fusion of innumerable spicules into a solid calcareous mass. In *Corallium rubrum* the flesh of the colony as well as the axis is scarlet, but the polyps are white.

The skeleton of the Gorgonacea, although it varies considerably in structure from one form to another, is secreted by cells of ectodermal origin which are either embedded in the mesogloea or form a distinct layer round the axis itself; this is a communal internal skeleton and does not represent an elongated axial polyp. The colony is started by a polyp which gives rise to solenia in the basal part of its body and from these new polyps arise.

Order **3. Pennatulacea.**—The colonies included in this group are of a nature very unlike anything hitherto described, and in-

clude those animals popularly known as Sea Pens. In a typical case (Pennatula) (fig. 7) the colony possesses a straight central axis developed from the body of a single greatly attenuated original polyp. This axis is complicated in structure and contains a supporting rod of calcified horny material. It bears laterally-arranged leaflets each consisting of a row of close-set polyps, and is itself provided with siphonozooids. The latter occur in a number of cases among the Alcyonacea and rarely among Gorgonacea; but among Pennatulacea they are universal. Moreover the Pennatulacea are not attached at the base to a firm support, but possess a contractile lower portion which anchors the colony in sand or mud.

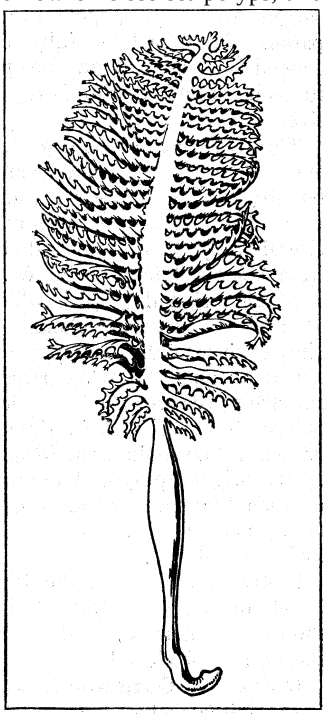


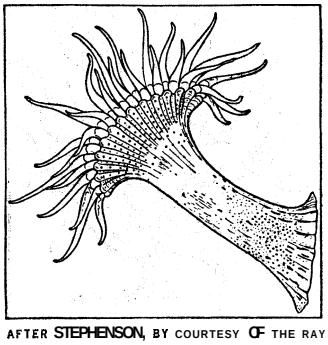
FIG. 7.—A SEA PEN, PENNATULA PHOSPHOREA
An Alcyonarian with a stem which is buried, during life, in sand or mud

In other Pennatulids the form of the colony varies. In *Kophobelemnon*, instead of lateral leaflets the stem bears large isolated polyps; in *Virgularia* leaflets are present but reduced in size; in *Umbellula* a few large polyps occur in a rosette at the top of a long stem which is otherwise bare; whilst in *Renilla* the basal peduncle is succeeded by a flat kidney-shaped expansion bearing radially-arranged polyps on its upper side.

General Note on the **Skeleton.**—Alcyonaria as a whole provide an extremely good example of the diversity which may exist in the skeleton within the limits of a single group Instances have been quoted of both internal and external skeletons; of horny covering skeletons, horny axial skeletons, tubular skeletons, and solid ones; skeletons formed of diffused spicules, of interlocked spicules, and of fused spicules; cases in which spicules and a solid skeleton co-exist, and in which horny and limy material co-exist in the skeleton, not to mention the massive calcareous support of *Heliopora*. Whatever the nature of the skeleton however, it is formed either by the ectoderm (Cornularia), or by cells of ectodermal origin which have penetrated the mesogloea.

II. ACTINIARIA

The Actiniaria or Sea Anemones (fig. 8) constitute a large and varied group of Anthozoa which are closely related to the true corals (Madreporaria) but which contrast with the latter in a number of ways. No sea anemone forms any skeleton; none produces a colony, so that the polyp which results from the development of an egg remains a single individual all its life except when it undergoes fission (see below). The polyps are of very variable dimensions, but the average order of size is relatively large, and certain giant species in which the individual may reach two feet in diameter are the largest Anthozoan polyps in existence.

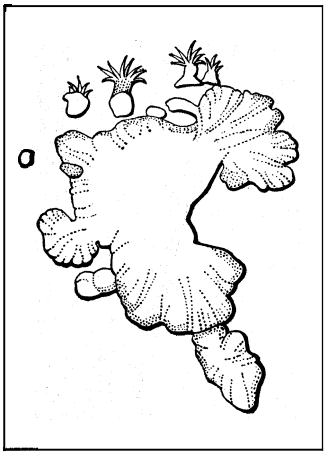


AFTER STEPHENSON, BY COURTESY OF THE RAY SOCIETY
FIG 8.—A TYPICAL SEA ANEMONE

The life of an anemone is rarely completely sedentary and the animal, although spending periods of varying length attached by its base to a foreign support, can readily creep away; or by inflating itself with water it becomes buoyant, and is moved elsewhere by the motion of the sea No other series of Coelenterata, taken as a whole, offers a parallel to this creeping habit of the anemones

The general build of many anemones is stronger and more muscular than that of most other Anthozoan polyps, and in particular the retractor muscles of the mesenteries and the circular muscle of the body-margin (sphincter) frequently attain a high degree of development. The variation in the external form of the polyp is very wide; but even greater is that of the internal organs. The number of mesenteries, their arrangement, their relation to one another with respect to size, and the degree of specialization of their musculature, vary to such an extent that within limits imposed by certain fundamental principles, almost any combination may be represented among them. No anemones possess the characters of Alcyonarian polyps, however.

The distribution of anemones is worldwide. They occur at very varying levels from the littoral zone to depths such as 2,900 fathoms. None occurs in fresh water, but a few are able to colonize brackish areas. Little is known of their geological range except that they must be of very great antiquity.



FROM STEPHENSON, MONOGRAPH ON ANEMONES," BY COURTESY OF THE RAY SOCIETY
FIG. 9.—A SEA ANEMONE IN PROCESS OF LACERATION
An anemone which had attached itself to a piece of glass, seen through the glass from below the base. Islands of tissue are becoming separated from the edge of the base. Some of these have acquired tentacles and become small anemones

Since sea anemones do not form colonies, one would expect to find that the habit of budding, so prevalent in some groups of Coelenterata, is not much in evidence here. Such is actually the case. Asexual reproduction of other kinds, however, is of frequent occurrence. In certain species rapid longitudinal division (fission) of the whole anemone into two more or less equal parts is a regular habit; the animal literally tears itself in two, the throat being cleft as well as the other parts; and by the regeneration of a new piece of tissue at the torn edge a new individual is formed from each half. In other species fission of another kind takes place. Here a small fragment becomes separated from the edge of the parent's base (sometimes as the result of an actual tear, sometimes as the more gradual product of a process of constriction) and this, although it contains no tentacles, peristome or throat, develops into a perfect new anemone (fig. 9). In a few species the direction of fission is transverse.

The classification of anemones is complicated, and the quotation of it in this connection would be uninstructive.

III. MADREPORARIA

The Madreporaria, zoologically known as "true corals," form a large group of Anthozoa which are characterized by their power of secreting a massive limy skeleton. The formation of a skeleton is not absolutely universal among them, but the number of species which have no hard parts is extremely small. The Madrepores contrast with the other Coelenterata which secrete a massive calcareous skeleton, in that although the actual size of individual polyps varies greatly, the average order of size is large; moreover the structure of the polyps is distinctive. The Madreporaria tend to form colonies containing few or many polyps; but in addition to the colonial species there is a large number of solitary forms in which a single polyp produces a single coral skeleton.

The polyps are similar in general build to Sea Anemones; but in their finer structure are recognizably different from the latter. Moreover, their life is necessarily a purely sedentary one since after they have once secreted a skeleton they are permanently anchored to it, and in correlation with this fact and with other of their characteristics, they are less muscular than anemones and exhibit in particular a less marked development of the retractor muscles. The variation of structure among coral-polyps is wide; but it hardly parallels the extraordinary diversity found among

the anemones. In the latter, diversity of the individual reaches its height, whereas in the colonial corals equally great diversity affects the relations of the polyps to one another, and consequently the form of the colony which they build up.

Corals are widely distributed in the seas of the world and both solitary and colonial forms may occur either on shore or in deep water. The true reef-building corals, however, which are in the main colonial forms, are restricted to the tropical and sub-tropical zones; they flourish best in shallow water and their depth-limit is about 50 metres. It is significant that rapid deposition of calcium by marine animals is favoured by high temperatures.

The Madreporaria are an ancient group geologically, dating from Triassic times, and vast numbers of fossil forms are known. Many other corals which may or may not have been ancestral to them (the Tetracorallia, etc.) are known from much earlier times. Corals form the largest bulk of fossils belonging to the Coelenterata and some limestones are composed almost entirely of their remains. In certain past epochs reef-corals had a far wider distribution than is now the case, their remains being plentiful in latitudes at which they cannot now maintain themselves.

The skeleton of a solitary coral-polyp such as *Caryophyllia* (a genus represented even in Great Britain by C. *smithii*, the "Devonshire Cup-coral") is illustrated in fig. 10. It consists of a number of parts which together build up a shape definitely related to the soft parts which have secreted it. There is a basal plate attaching the whole structure to the substratum, a circular wall (theca) arising from this, and a number of radially arranged vertical partitions (septa) which project inwards from the inner surface of the theca towards the centre, and which partially subdivide its cavity. The septa are not all equal but belong to definite grades of size, which alternate regularly.

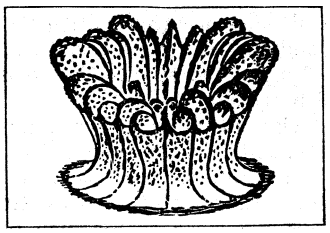
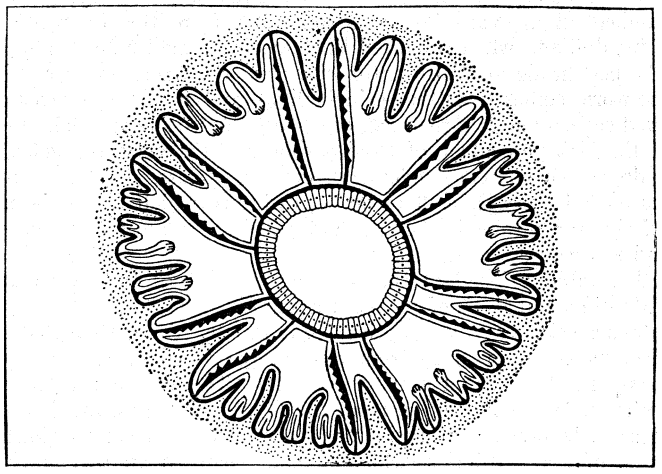


FIG. 10.—SKELETON OF A SIMPLE CORAL

A cup-like formation containing vertical partitions, the septa, radially arranged within it

The polyp is seated in the cup of skeleton, and during life its body extends well above and beyond the latter, overlapping also down the outside of the theca. If the polyp desires to swallow any considerable mass of food, it must necessarily extend itself above the skeleton in order to make room in its coelenteron for the food. The tissues of its column and base line the skeletal cup, and its mesenteries alternate with the septa; the septa, however, merely push the whole thickness of the polyp's column-wall inwards, they nowhere penetrate into the coelenteron and are entirely external to the tissues of the animal. It will thus be understood (fig. 11) that although there is deep inter-penetration between skeleton and soft parts, morphologically speaking the skeleton is entirely an external structure. The skeleton is produced as a secretion of cells known as calicoblasts, which are formed by the ectoderm of the base and sides of the polyp.



AFTER DUERDEN

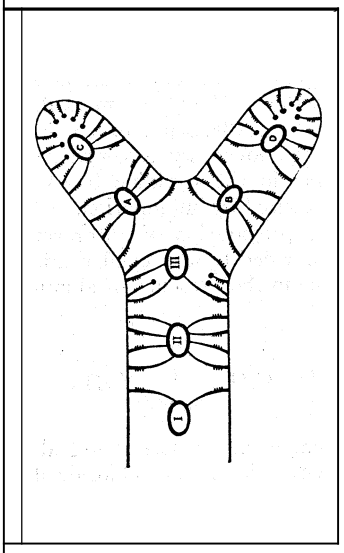
FIG. 11.— TRANSVERSE SECTION OF A CORAL POLYP

In the centre lies the throat, and radiating from this are six pairs of mesenteries (the N. and S. pairs being the directives). Round the edge are smaller mesenteries which do not reach the throat, and alternating with both these and the large mesenteries are septa. The stippled part represents the region occupied by the skeleton and the figure illustrates the relation between skeleton and soft parts

The eggs of corals develop into planulae which attach themselves after a time to a foreign surface, assume the form of miniature polyps and begin to build up a skeleton, which first appears between the base of the polyp and its support. A few corals lie unattached and are anchored simply by the weight of their skeleton.

For an account of the formation of coral-reefs see CORAL **REEFS**. Some idea of the variety which the skeletons exhibit may be derived from the Plate. It must be understood that the growth of a colony is due to the continued deposition of calcareous material by the polyps, and as more and more is added the skeleton must necessarily increase in size, growing upwards or outwards or both. The form which any skeleton assumes is dictated by a number of factors affecting the polyps—by the way in which new polyps arise with relation to those already in existence; by their rate of formation and growth; by the relation between growth in height and growth in width; by the angle and plane of divergence between the polyps as the colony grows; by the presence or absence of a secretion of skeleton in the intervals between the polyps, and similar considerations. Each species of coral has inherent within its polyps the ability to develop in a given manner, and the form of the colony is also affected by the degree of its exposure to wave-action.

Little is known about the details of colony-formation from actual observation, although measurements of the growth-rate, affecting increase in size of the colony regarded as a whole, have been taken. The older accounts concerning the processes by which the polyps increase in number should be read with reserve, since the ideas in vogue on this subject have until recently been largely speculative, and theories of colony-formation have been too much based on the study of the skeleton. It is obvious that the skeleton is merely an imperfect if permanent record of the activities of the polyps, and study of the latter reveals the fact that in some cases at least conclusions as to the manner of growth, drawn from the skeleton, may be entirely erroneous. A recent study by Matthai of the soft parts of a number of corals from which the calcareous matter had been dissolved away, leads to the conclusion that in the cases investigated (and probably in the group in general) polyps are formed in two ways.



FROM MATTHAI, BY COURTESY OF THE ROYAL SOCIETY

FIG. 12.— INTRA-TENTACULAR BUDDING

Structure of part of a compound coral-polyp which is in the process of intra-tentacular budding. I-III and A-D are throats. The outside line represents the body-wall and stretching between this and the various throats are mesenteries. C and D are the throats last formed

I. Intra-tentacular **Budding.**—By this method a polyp itself becomes compound. It has originally one mouth and throat surrounded by a peristome and a circlet of tentacles, and within the ring of tentacles, at given points on the peristome one or more new mouths and throats arise. The outline of a polyp with two or more mouths will become modified, and this process may reach an extraordinary degree of development, ending up in one or several branching polyps each with a number of mouths arranged in a linear row and producing the type of colony illustrated in Plate, fig. 2, and in text-fig. 12. The skeleton in such a case consists of a series of winding ridges

alternating with valleys containing septa, and is known as a *meandriform* coral. In other colonies formed by intra-tentacular budding, portions of the growing polyps, each containing a newly-formed mouth, become separated from the rest of the polyp as growth proceeds; but this process is to be distinguished from true fission, which involves the cleavage of a polyp through its original mouth and throat, and not the gradual separation of a portion of its tissues associated with a newly-developed throat.

II. Extra-tentacular Budding. — By this method a new polyp is formed de *novo* from tissues lying entirely outside the circlet of tentacles of any pre-existing polyp. The polyps in such colonies have each one mouth, and are therefore relatively easily recognized as entities. Extra-tentacular budding sometimes takes place at the periphery of colonies in which the other method is the characteristic one; and in colonies formed by extra-tentacular budding occasional polyps with two throats may arise by the opposite method.

The classification of Madreporaria is a vexed question. The vital parts of the organisms are the polyps, and as yet too little is known of the structure and potentialities of these throughout the group to make possible the construction of a satisfactory system.

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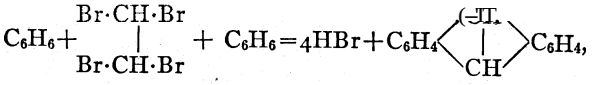
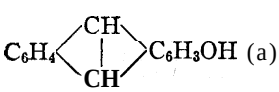
(T.A.S.)

ANTHRACENE, $C_{14}H_{10}$, a hydrocarbon obtained from the fraction of the coal-tar distillate boiling between 270° and 400° C. (from the Greek ἄνθραξ, coal). This high boiling fraction is allowed to stand for some days, when it partially solidifies. It is then separated in a centrifugal machine, the more fusible impurities are removed by means of hot water, and the residue is finally hot-pressed. The crude anthracene cake is purified by treatment with the higher pyridine bases, the operation being carried out in large steam-jacketed boilers. The whole mass dissolves on heating, and the anthracene crystallizes out on cooling. The crystallized anthracene is then removed by a centrifugal separator and the process of solution in the pyridine bases is repeated. Finally the anthracene is purified by sublimation.

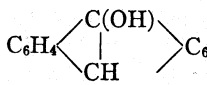
Many synthetical processes for the preparation of anthracene and its derivatives are known. It is formed by the condensation of acetylene tetrabromide with benzene in the presence of aluminium chloride:—



and similarly from methylene dibromide and benzene, and also when benzyl chloride is heated with aluminium chloride to 200° C. Anthracene crystallizes in colourless monoclinic tables which show a fine blue fluorescence. It melts at 213° C. and boils at 351° C. It is insoluble in water, sparingly soluble in alcohol and ether, but readily soluble in hot benzene. It unites with picric acid to form a picrate, $C_{14}H_{10}\cdot C_6H_2(NO_2)_3\cdot OH$, which crystallizes in needles, melting at 138° C. On exposure to sunlight a solution of anthracene in benzene or xylene deposits para-anthracene $(C_{14}H_{10})_2$, which melts at 244° C. and passes back into the ordinary form. Chlorine and bromine form both addition and substitution products with anthracene; the addition product, anthracene dichloride, $C_{14}H_{10}Cl_2$, being formed when chlorine is passed into a cold solution of anthracene in carbon bisulphide. On treatment with potash, it forms the substitution product, monochlor-anthracene, $C_{14}H_9Cl$. Nitro-anthracenes are not as yet known. The mono-oxyanthracenes (anthrols), $C_{14}H_9OH$ or



(a) and (β), resemble the phenols, whilst



(γ) (anthranol) is a reduction product of anthraquinone. β-anthrol and anthranol give the corresponding amino compounds (anthramines) when heated with ammonia.

Numerous sulphonic acids of anthracene are known, a monosulphonic acid being obtained with dilute sulphuric acid, whilst concentrated sulphuric acid produces mixtures of the anthracene disulphonic acids. By the action of sodium amalgam on an alcoholic solution of anthracene, an anthracene dihydride, $C_{14}H_{12}$, is obtained, whilst by the use of stronger reducing agents, such as hydriodic acid and amorphous phosphorus, hydrides of composition $C_{14}H_{16}$ and $C_{14}H_{24}$ are produced.

Methyl and phenyl anthracenes are known; and β-methyl anthracene has been identified in tar produced by low-temperature carbonisation. Oxidizing agents convert anthracene into anthraquinone (*q.v.*); the production of this substance by oxidizing anthracene in glacial acetic acid solution, with chromic acid, is the usual method employed for the estimation of anthracene. See E. de B. Barnett, Anthracene and *Anthraquinone,* 1921.

ANTHRACITE. The word "Anthracite" is derived from the Greek ἄνθρακες used in connection with the first mention of coal about 371 B.C., when Theophrastus, a pupil of Aristotle, mentions in his treatise "On Stones" fossil substances (λιθός ἄνθρακος) "that are called Coals which kindle and burn like wood coals. . . . These are found in Liguria and in Elis, in the way to Olympias over the mountains; they are used by the smiths."

The word is now applied to that class of coal which contains the highest percentage of fixed carbon, and belongs to the division **A** (1) in the classification adopted by the International Geological Conference held at Toronto, Canada, in the year 1913 (see COAL AND COAL-MINING); a class of coals the mean composition of which is:

Carbon	93 to 95%
Hydrogen	2 to 4%
Oxygen and nitrogen	3 to 5%

with a calorific value ranging from 14,500 to 15,000 B.T.U. or 8,000 to 8,330 calories.

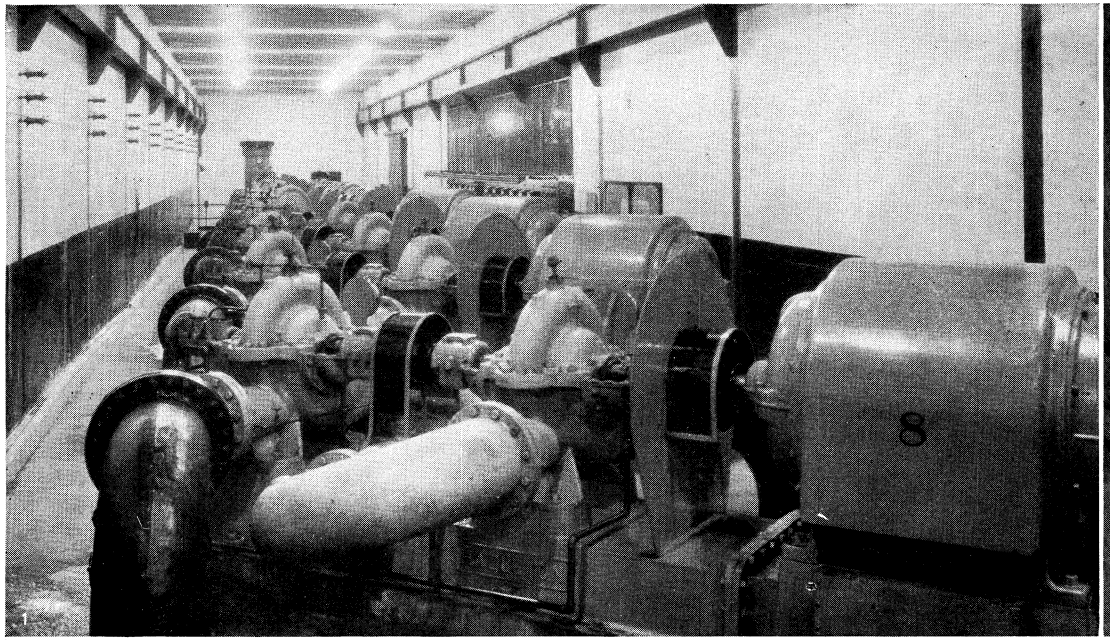
Anthracite is usually a hard compact coal having a sharp conchoidal fracture, in colour black with a brilliant lustre, and, unlike other coals, except cannel, does not usually soil the fingers when handled. Some varieties differ somewhat from this description, being dull and when fractured breaking into small cubical lumps. The best grade of Welsh anthracite (and the finest anthracite in the world comes from that principality) contains 93% or over of fixed carbon and less than 8% of volatile hydrocarbons. The fact of the high percentage of fixed carbon and the very low volatile hydrocarbon content renders the coal smokeless. For the same reason it is very difficult to ignite, owing to which fact it is unsuitable for burning in the open grate and for steam raising unless under forced draught.

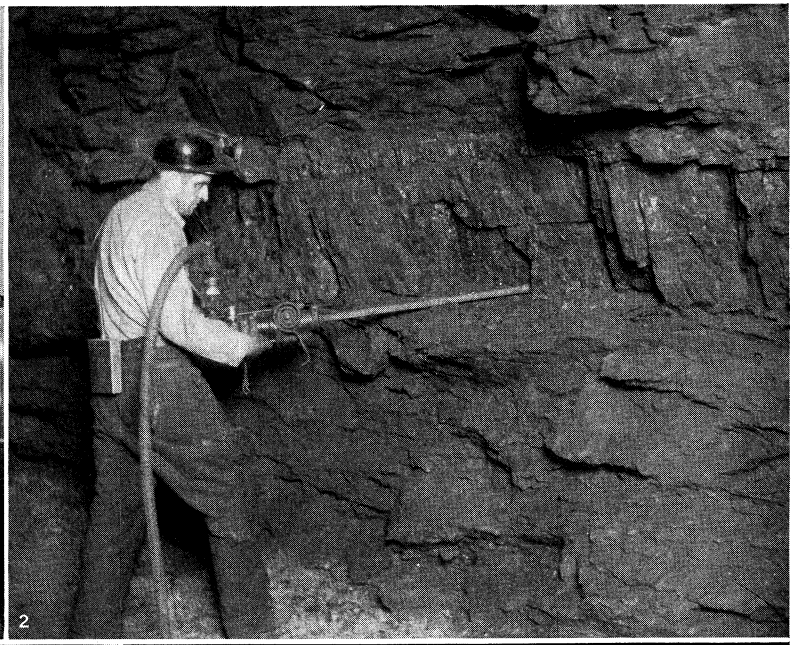
The table at head of the opposite page gives the proximate and ultimate analysis of some anthracites.

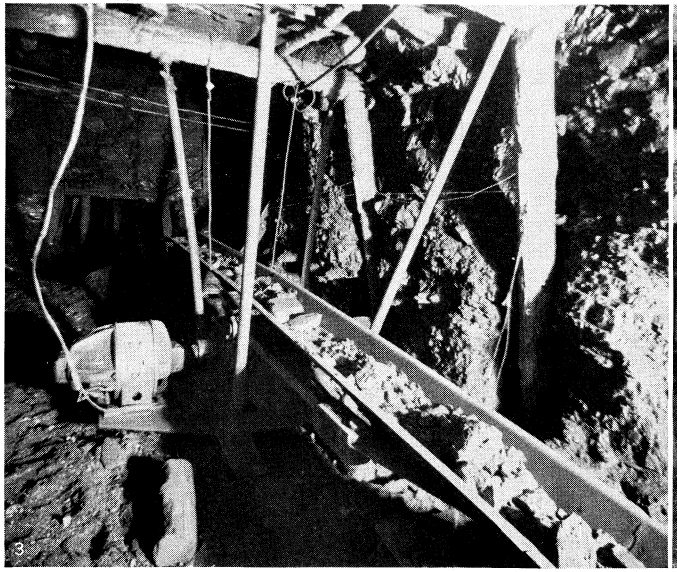
The specific gravity of anthracite is usually higher than that of bituminous coal, ranging from 1·36 to 1·84 as compared with 1·2 to 1·5 in the case of bituminous coal. The calorific value of anthracite is, as is evident from the figures already quoted, very high. A high-class anthracite may, for instance, have a calorific value of 8,624 calories, which is equivalent to an evaporative power of 16·06 lbs., that is to say, 16·06 lbs. of water would be evaporated by the combustion of 1 lb. of such anthracite. The volatile hydrocarbon in anthracite, including under that term semi-anthracites, as well as pure anthracite, ranges from 12 to 4%.

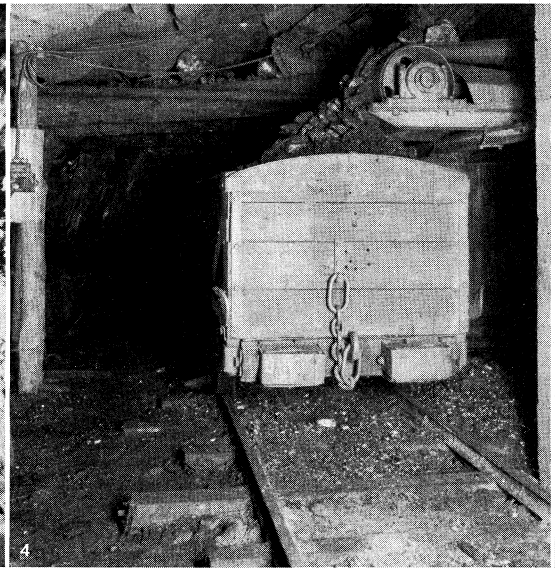
Taking the ratio $\frac{\text{C}}{\text{Vol. H.C.}}$: 1 the proportion in the case of semi-anthracite is from 12:1 to 8:1; hard dry anthracite from 5:1 to 10:1.

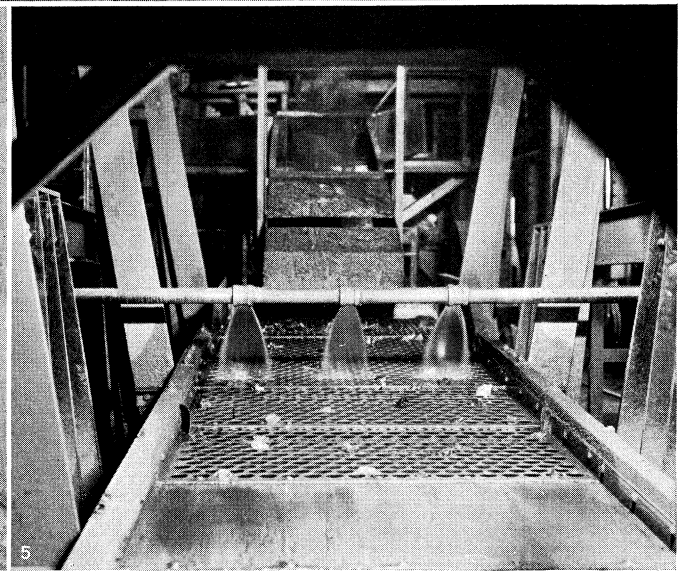
Origin of Anthracite. — It was generally considered by geologists that anthracite was metamorphosed bituminous coal, that is, coal from which the greater part of the volatile hydrocarbon had been driven off by heat, occasioned by the pressure resulting











BY COURTESY OF "COAL AGE," THE MC GRAW-HILL PUBLISHING CO.

MINING AND HANDLING ANTHRACITE IN THE UNITED STATES

1. Underground centrifugal pump room in anthracite mine
2. Drilling a hole in bottom of coal seam before charging and shooting
3. Shaking conveyor with jack posts holding down drive
4. Electrically driven conveyor belts loading mine cars
5. Water sprays washing fine coal through screen

COMPOSITION OF ANTHRACITES

Country.	Proximate Analysis: Fixed carbon.	Volatile matter.	Ash.	Moisture.	Total.	Ultimate Analysis: Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Ash.	Moisture.	Total.	Calorific value.	Water evap. at 100° C. per lb. of coal.
Wales—Carmarthen.															
1. Stanllyd Vein (Blaina) . .	93·76	5·09	1·15	..	100·00	..	..	..	..	0·75	..	..	..	..	..
Scotland.															
2. Caprington, (Ayr) . .	83·9	11·1	3·2	1·8	100·00	..	..	..	..	..	..	..	..	..	11·5
Canada.															
3. Cascade (Alberta) . .	73·3	12·6	14·1	..	100·00	..	..	..	..	..	..	..	..	13,080	..
United States.															
4. Mammoth Seam (Penn.) . .	88·21	1·16	7·83	2·80	100·00	84·36	1·89	4·40	0·63	0·80	7·83	..	99·91	13,298	..
Africa—Zululand.															
5. Hlabisa . .	83·75	5·50	8·75	2·00	100·00	..	..	..	..	..	..	..	..	..	..
	81·47	6·37	10·16	2·00	100·00	..	..	..	..	0·39	..	..	..	..	..

from earth movements or due to the proximity of intrusive igneous rocks. But of late some doubt has been thrown on this as the only explanation of the low volatile content. One has seen, *e.g.,* in Natal and Zululand, anthracite which has resulted from the action of the heat derived from neighbouring intrusions of igneous rock, baking the coal and reducing the volatile contents. One consequential effect of this action of heat is the increase in percentage of the ash content as compared with the unindurated coal. But in the South Wales field, where we find bituminous coal seams in the east of the field in their passage westwards graduating into steam coals, dry steam coals, and finally into anthracite, not only does the ash content not increase but it actually diminishes. So it is very doubtful whether heat generated by the somewhat more intensified folding to which the seams to the west have been subjected, as compared with the same seams in the east, is the sole cause, if even a partial cause, of the disappearance of a great part of the volatile hydrocarbons from the coal. The folding was probably a slow process, continuing over years, and the heat would be dissipated without greatly affecting the coal. The more probable explanation is that the effect is the outcome of bacterial action on the vegetation which was of a somewhat different kind from that in the lower lying surface, though continuous therewith, and was longer above water than the latter, allowing of more extensive bacterial action. *(See* COAL AND COAL-MINING: *Origin and Occurrence.)*

For information relative to the available resources of anthracite in the world, by continents, the reader is referred to COAL AND COAL-MINING: *The World's Coal Reserves, Output, Consumption,* etc., from which it will be seen that in this respect Asia stands first. Seventy-five % of the anthracite of Asia is contained in thr province of Shansi, south-west of Peking, China, and there is probably in the small coal-field near Tongking in French Indo-China as much anthracite as there is in Pennsylvania. Of the European fields, that of Donetz, in South Russia, contains most anthracite. The coal-fields of the U.S.A. contain 19,684 millions of tons of anthracite, the Canadian resources amounting to only 2,185 millions of tons.

Chief Supplies.— The chief producers of anthracite in the world are Great Britain and the U.S.A. The output from the former has been steadily on the increase of late years, in 192j reaching 6,184,191 long tons, whereas the tendency of the output of this class of coal in the U.S.A. has been downwards. In the year 1917 it reached the enormous figure of 88,939,117 tons as against 83,338,401 tons for 1923; 78,506,217 tons for 1924; and for 1925 (a strike year) 55,193,883 tons.

In America the use of anthracite as a fuel for domestic use is much more in favour than in Great Britain. Some American cities enjoy a beautifully clear atmosphere owing to the smokelessness of the fuel, though of late bituminous coals have come more and more into vogue because of their cheapness. Were the people of Great Britain wishful of imitating their American cousins in this respect, many more anthracite mines than at present exist in South Wales, and, to some extent, Scotland, would have to be opened out, and the available resources, which are greatly less than those of the more bituminous coal, would be rapidly exhausted. In Great Britain an open and "flaming" fire is most popular, and anthracite stoves are used only for central heating. Besides the domestic consumption, which is the chief use to which anthracite is applied, it is largely used for malting purposes and for the drying of hops, where a steady heat is required, for which purpose the anthracite must be free from arsenic. It has been and still is used to some small extent (though not in Great Britain) for iron-smelting. There is also a growing consumption in the production of producer gas.

Of the production of anthracite in Great Britain, 60% is exported, her market being chiefly France and Scandinavia; but latterly Canada, whose import requirements are variable—between 3,000,000 and 4,000,000 tons per annum— has become a customer, though her demands are chiefly met from Pennsylvania. The higher quality, however, of the best Welsh anthracite and the water carriage from Swansea and Llanelly to Montreal are points which are beginning to tell strongly in favour of South Wales anthracite.

Anthracite is of all coals that which undergoes most classification for the purposes of marketing. To take a characteristic example from a modern Welsh anthracite mine the coal is divided by screening and working into the following brands or classes, viz.:—

	Per cent. of output.		Per cent. of output.
X B Large. . .	8·98	Washed peas . .	6.45
Special . . .	..	Small peas and grains	1·j6
Rockvein. . .	2·59	Duff. . . .	18·89
M/M/cobbles . .	12·99	Breaker duff . .	10·48
Screened . . .	0·39	Culm . . .	9·18
French nuts . .	4.68	Slurry . . .	0·10
Stove nuts. . .	10·90	Shale . . .	0·27
Washed beans . .	12·54		

In some American anthracite mines the division of the output is carried out to a still greater extent, even to 30 classes or more.

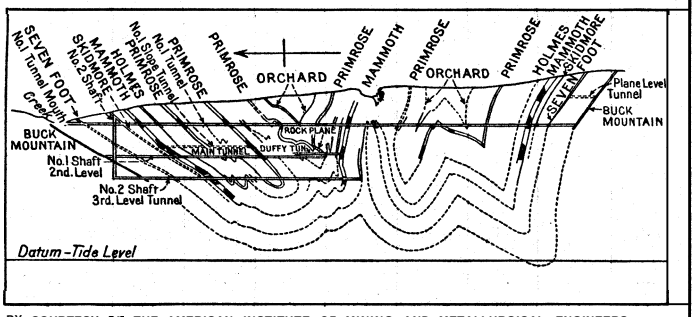
(R. R.)

UNITED STATES

According to the classification of coal adopted by the United States Geological Survey the ratio of fixed carbon to volatile matter for anthracite should equal or be above ten. It would appear that anthracite may degenerate in the process of geologic time

and absorb moisture. M. R. Campbell of the United States Geological Survey has called such coal "super-anthracite" as expressing increased metamorphosis rather than improved quality and more desirable characteristics. This super-anthracite is found in Rhode Island. It burns with the greatest of difficulty and has a low calorific value, all of which keeps it from having, at present, any extensive sale.

The definition of anthracite as coal having a fuel ratio above ten is not the same as that for class A1, which was evidently



BY COURTESY OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

FIG. 1. —CROSS SECTION OF THE NESQUEHONING TUNNEL

intended for anthracite when adopted by the twelfth international geological congress in 1913. There the lower limit was 12. Consequently it may be stated that the designation used in the United States is somewhat broader than that of class A1. That congress also designated a class A2 which was evidently intended to constitute semi-anthracite. Its fuel ratio ran between 7 and 12 whereas the United States geological survey's practice is to limit semi-anthracite by the ratios 5 and 10. In coal trade the word anthracite has had a broad meaning, those producing and selling what is known as semi-anthracite objecting to the use of any qualifying term in describing their product. Consequently coal with a fuel ratio as low as five, or even slightly less, is sometimes quoted as anthracite.

Distribution.— Disregarding the Rhode Island coal there are only four areas in the United States containing marketable quantities of anthracite. These are (1) a part of the so-called "anthracite region" of north-eastern Pennsylvania, (2) a small area at Fioresta, Gunnison county, Colo., and areas in the (3) Bering river and (4) Matanuska regions of Alaska.

The first of these three districts is by far the most important. The entire area, including both anthracite and semi-anthracite, covers 484sq.miles. The Sullivan county field around Bernice, Pa., produces semi-anthracite, as does the Lykens valley end of the southern coalfield. Some of the northern anthracite field is close to the border line of semi-anthracite. However, there are parts of the southern field which contain the most highly anthracitized beds. In general the northern coalfield is but gently folded. The principal disadvantage under which it is worked is the presence of the Wyoming "buried valley" which is filled with glacial drift. This valley imposes upon the measures below it a burden of as much in places as zooft. of unconsolidated sand and gravel. Furthermore, the bottom is scored with pot holes which were formed under the ice during the glacial period. Heavy, lacking strength and filled with water, these glacial deposits make the mining of the measures--especially where they are relatively shallow—quite hazardous. The eastern middle and southern fields are badly contorted and faulted. Because of this contortion the coal is dense and hard, and has a high fuel ratio.

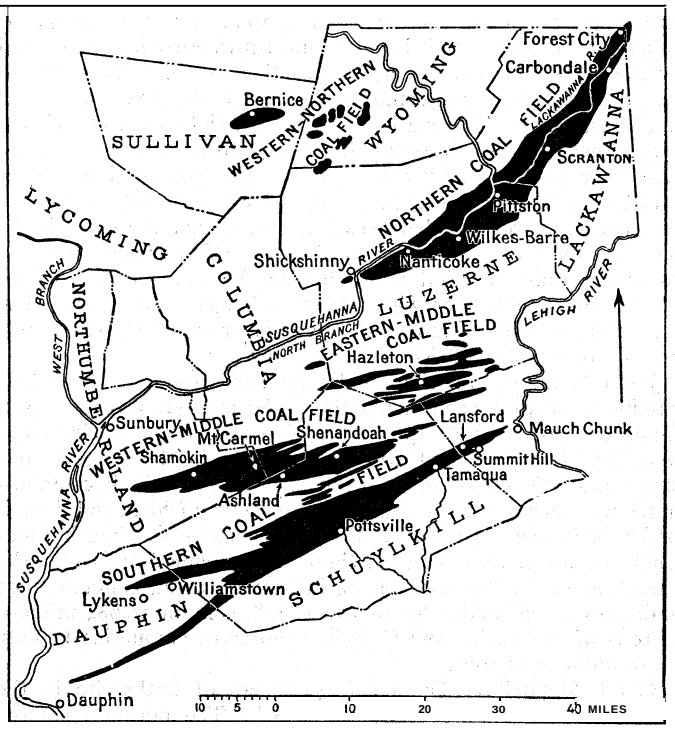
The coal of the Pennsylvania anthracite region is of the Carboniferous era though the correlation between the coals of the region and those of the bituminous fields in other parts of Pennsylvania is by no means satisfactory and the names used for the various beds are not the same.

The seams of coal are of all thicknesses from 114ft. downward. This extreme thickness was found in Nesquehoning slope No. 9 of the Lehigh Coal and Navigation Company. Some coal as thin as 18in. has been mined and much of the coal operated is under 3ft. thick. According to F. G. Tryon and M. H. Schoenfeld, U.S. Bureau of Mines, the average coal thickness of United States anthracite is 80in. and of all British coal 50in., basing the latter figure on the 1925 report of the royal commission. Most of the coal is drilled and blasted out of the solid. Undercutting machines are successfully used, where the inclination of the coal bed is not too great, but the proportion is small. Shaking conveyors are used, especially in the thin seams and in seams pitching so gently that the dislodged material cannot be chuted from face to gangway. In thin flat seams the coal is often dragged to the roadway by small scoops of a capacity of about 1,000 pounds. These scoops, which are bottomless and have one open end, are dragged by ropes through the pile formed by the coal shot from the face or pillar to a chute at the roadway, where the coal they contain is discharged into the mine cars.

Gas.—Few if any mines are more gassy than those in the Wilkes-Barre region. Fortunately, with ventilation such as is provided, the area which becomes filled with an explosive quantity of gas is rarely large. In consequence there have been no explosions involving as many victims as the larger ones in the bituminous regions where the coal dust has extended some disasters and even initiated others. Anthracite dust is not absolutely inert in an explosion but it has almost no explosive effect. However, N. H. Darton, writing as of 1912, declared that "The volume of methane issuing from three mines at Wilkes-Barre is 9,000,000cu.ft. a day, a volume equal to that of the illuminating gas from a plant supplying a city of 300,000 inhabitants."

Fires.--When anthracite beds are ignited the combustion is extinguished with great difficulty and many extensive fires have occurred. Many still burn and notable among these is a fire at Summit Hill, one in the Red Ash bed near Wilkes-Barre and one at Carbondale.

Reserves.—Marius R. Campbell has estimated that the original quantity of anthracite and semi-anthracite in the Pennsylvania



FROM "ANTHRACITE MINING AND PREPARATION"

FIG. 2.— THE ANTHRACITE COAL FIELDS OF PENNSYLVANIA

Most of the American anthracite coal comes from an area of 484 sq.m. In Pennsylvania, divided geologically and geographically into 4 separate fields known as Northern, Eastern middle, Western middle and Southern

anthracite region was 19,056,300,000 metric tons. The total production to the end of 1938 was 3,874,819,000 metric tons. Doubling this for coal irremedially wasted underground and above ground the tonnage remaining will be 11,306,662,000 metric tons. Assuming that 50,000,000 net tons will be mined yearly and that by more careful methods the loss will be cut to one-half of the production, the yearly depletion will be about 75,000,000 metric

APPROXIMATE ANALYSES AND HEATING VALUES OF ANTHRACITES AND SEMI-ANTHRACITES

Location	County	State	Fuel ratio	Moisture	Fixed carbon	Volatile matter-	Ash	Sulphur	B. T. U.
Super-Anthracite	Newport	R.I.	28·0	16·80	*64.43*	2·30	16·47	0·59	9,230
	Providence	R.I.	*23.8*	9·71	61·98	2·60	25·71	0·07	8,822
Anthracite									
Pittston buckwheat*	Luzerne	Pa.	10·4	5·93	70·35	*6.72*	16·80	0·95	11,359
Kingston grate	Luzerne	Pa.	17·1	3·34	81·08	*4'74*	10·84	0·65	12,717
Morea broken*	Schuylkill	Pa.	16·7	3·38	82·45	*4.86*	9·31	0·60	13,057
Tower City, Lykens Valley	Schuylkill	Pa.	25·7	3·33	*84.28*	3·27	9·12	0·60	13,351
Fioresta	Gunnison	Colo.	*28.8*	3·00	86·*jo*	3·00	7·50	0·69	13,500
Bering River		Alaska	12·7	7·88	*78.23*	6·1*j*	7·74	1·30	..
Matanuska River		Alaska	*12'0*	2·55	84·32	7·08	6·05	0·57	..
Semi-Anthracite									
Nanticoke, barley*	Luzerne	Pa.	8·6	5·45	72·12	8·43	14·00	0·64	12,045
Bernice, egg*	Sullivan	Pa.	8·3	2·12	*73'43*	8·80	15·65	0·58	12,575
Loyalsock	Lycoming	Pa.	7·1	1·49	78·88	11·07	7·69	0·86	..
Merrimac	hlontgomery	Va.	7·1	3·6	*67.6*	9'5	19·3	0·5	11,850
Clarksville.	Johnson	Ark.	7·6	1·7	79·5	10·5	8·3	2·5	13,870
Paris	Logan	Ark.	5·0	2·8	*73'4*	14·7	9·1	2·8	13,770
Bering River	..	Alaska	*j.2*	4·18	72·42	14·00	9·39	1·73	..

*From samples of coal as received or as fixed, extending usually over more than a year.

tons and the life of the anthracite field will be 150 years from the end of 1938, assuming that the various estimates quoted are at least approximately correct. Some of the measures have been but little explored and are none too well understood. Nor is it possible to form an adequate conception of the waste in the past or to predict the probable waste in the future. The annual tonnage may also increase or decline with the passage of years. Much of what was formerly wasted is being recovered but much has been lost beyond recovery through squeezes and fires, so the estimate of past waste has intentionally been made high.

The seams worked are becoming progressively lower and deeper, increasing the difficulty of operation. The shaft collar of the Auchincloss shaft No. 2 of the Glen Alden Coal Company, is 721·5ft. above sea-level. Its deepest working is 977ft. below the sea making a total depth of 1,698·5 feet. The West Brookside workings are probably deeper. The average depth of shafts in the shaft mines of the anthracite field is given by F. G. Tryon and M. H. Schoenfeld as 41jft. as against 1,023ft. for all mines of Great Britain. The figure for Great Britain is taken from the report of the royal commission (1925). Much coal, however, still comes in the anthracite region from shafts and drifts.

According to E. W. Parker: "The first authentic knowledge of the anthracite deposits in Pennsylvania was obtained in 1762 when it was discovered by Connecticut pioneers. The value of this discovery was made known by Obadiah Gore, a blacksmith, who set up a forge in 1770 or 1771 and used anthracite for heating iron. During the Revolutionary War some anthracite was floated down the Susquehanna river to a point near Harrisburg and thence hauled to Carlisle, where it was used for making munitions of war for the Continental army." In 1808 anthracite was first used in an open grate by Jesse Fell, of Wilkes-Barre, and in the same year Abijah Smith and Company shipped several arkloads to Columbia and other points on the Susquehanna river. Anthracite was first used in an iron furnace in Philadelphia in 1812.

Markets. — The market for American anthracite has gradually contracted in area and, of late years also, as to tonnage. Bituminous coal has displaced anthracite in the West due partly to restrictions during the World War. An effort was made to restore this market. In the East oil competition has been quite severe, owing partly to the low cost of fuel oil. As a result the output is no longer limited as before by strikes, local and general, and by physical inability to increase production. but by the variation of the market. The output in 1917 was 99,612,000 net tons; in 1927 it was 80,096,000 tons, and in 1937 was only 51,856,000 tons. There has been a great increase in the demand for small sizes. Formerly every size below chestnut was unsaleable; in 1937 48% of the sales is pea or smaller. Practically no lump is sold; in 1937 "broken" was 0.4% of the total tonnage; "egg," 5.4%; stove, 21.2%; chestnut, 25.2%; pea, 10.7%; buckwheat No. 1, 14.8%; buckwheat No. 2, or rice, 8.3%; buckwheat No. 3 or barley, 10.3%; buckwheat No. 4, 2.9%; all others, 0.8%. Care is taken in breaking down the larger and less saleable sizes such as "lump," "broken" and even "egg," not to make an unnecessary proportion of fine sizes which bring a price, at the breaker, below the cost of mining. The demand that has been stimulated for fine sizes by the development of the automatic stoker is satisfied partly by the rewashing of old piles of coal formerly rejected, which contain millions of tons of good fuel, some even larger than chestnut, and partly by dredging formerly discarded fines from the river bottoms.

Smaller anthracite occurrences are found at Cerrillos, N.M., due to the intrusion of an igneous sill 40ft. below the coal measure, also in Routt county, Colo ; Iron county, Utah; and Pierce county, Washington.

Semi-anthracite.—Other commercial bodies of coal, frequently marketed as anthracite, are found in Virginia and Arkansas. Strictly speaking these are semi-anthracite. When a coal falls into the semi-anthracite grouping that fact hardly makes it less desirable, for a little volatile matter will not make the coal smoky, but it will render it somewhat more free-burning and cause it to give a bright yellow flame, thus making it attractive as a grate fuel. Semi-anthracite also ignites more readily than anthracite. On the other hand, a furnace burning anthracite is more easily regulated than one burning the less matured fuel. The differences are small and the two types of coal are closely competitive, wherever they are so located as to enter the same markets.

The semi-anthracite of Virginia is of lower Carboniferous age and extends in a narrow band across the counties of Montgomery, Pulaski and Wythe. The principal bed runs from 4 to 20ft. in thickness. In these coals there is a large percentage of ash. The beds are quite severely contorted. The Arkansas semi-anthracite is found in Franklin, Johnson, Pope, Sebastian and Logan counties in thin beds. (R. D. H.; X.)

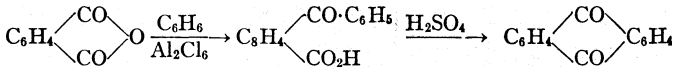
See H. S. Raushenbush, *Anthracite Question* (1924); *J. K.* Mumford, *Anthracite* (1925).

ANTHRACOTHERIUM (Gr. "coal-animal"), an extinct mammal whose jaws, bones and remains are occasionally found in lignite and coal in America, Asia and Europe. It had the typical dental formula of the artiodactyls, a group of animals whose toes are even in number and grow in pairs; a formula that is preserved in the hog. (See ARTIODACTYLA.)

ANTHRANOL: *see* ANTHRAQUINONE.

ANTHRAQUINONE, $C_{14}H_8O_2$, an important derivative of anthracene, first prepared in 1834 by A. Laurent. It is prepared commercially from anthracene by stirring a sludge of anthracene and water in horizontal cylinders with a mixture of sodium bichromate and caustic soda. This suspension is then run through a conical mill in order to remove all grit, the cones of the mill fitting so tightly that water cannot pass through unless the mill

is running; the speed of the mill when working is about 3,000 revolutions per minute. After this treatment, the mixture is run into lead-lined vats and treated with sulphuric acid, steam is blown through the mixture in order to bring it to the boil and the anthracene is rapidly oxidized to anthraquinone. When the oxidation is complete, the anthraquinone is separated in a filter press, washed and heated to 120°C. with commercial oil of vitriol, using about 2½ parts of vitriol to 1 of anthraquinone. It is then removed to lead-lined tanks and again washed with water and dried; the product obtained contains about 95% of anthraquinone which may be purified further by sublimation. The industrial synthesis of anthraquinone is gaining ground and 75% of the American production is stated to be synthetic (1927). A process, first discovered by A. Behr and W. A. v. Dorp (1874), consists in heating phthalic anhydride with benzene in the presence of aluminium chloride when orthobenzoyl-benzoic acid is produced which on treatment with sulphuric acid or other dehydrating agent yields another anthraquinone.



Phthalic anhydride — Ortho-benzoyl-benzoic acid — Anthraquinone

Dihydroxy- and tetrahydroxy-anthraquinones are obtained when metahydroxy- and dimeta-dihydroxybenzoic acids are heated with concentrated sulphuric acid in a similar way.

Anthraquinone crystallizes in yellow needles or prisms, which melt at 277° C. It sublimes easily, and is very stable towards oxidizing agents, but is readily attacked by reducing agents. With zinc dust in presence of caustic soda it yields the secondary alcohol, oxanthranol, $C_6H_4\langle^{CO}_{CH(OH)}\rangle C_6H_4$; with tin and hydrochloric acid, the phenolic compound, anthranol,

$$C_6H_4\langle^{CH}_{C'(OH)}\rangle C_6H_4;$$

and with hydriodic acid at 150° C. or on distillation with zinc dust, the hydrocarbon, anthracene, $C_{14}H_{10}$. When fused with caustic potash, it gives benzoic acid. It behaves more as a ketone than as a quinone, since with hydroxylamine it yields an oxime, and on reduction with zinc dust and caustic soda it yields a secondary alcohol, whilst it cannot be reduced by means of sulphurous acid. Various sulphonic acids of anthraquinone are known, as well as hydroxy-derivatives, for the preparation and properties of which see ALIZARIN; ANTHRACENE.

ANTHRAX (Syn.: splenic fever, malignant pustule, wool-sorters' disease). An acute, specific, infectious, virulent disease, caused by the *Bacillus anthracis,* in animals, chiefly cattle, sheep and horses, and sometimes occurring in workers in the wool or hair, as well as in those handling the hides or carcasses, of beasts, which have been affected. During the World War numbers of the British troops were infected by way of shaving brushes imported from Japan.

Animals. — Anthrax affects wild and domesticated animals over the world, and published writings on its nature, its peculiar characteristics and the injury it inflicts are innumerable. Regions notorious for its prevalence, are the marshes of Sologne, Dombes, and Bresse in France; certain parts of Germany, Hungary and Poland; in Spain the half-submerged valleys and the maritime coasts of Catalonia; the Romagna and other marshy districts of Italy; while it is epizootic, and even panzootic, in the swampy regions of Estonia, Livonia, Courland, and especially of Siberia. The records of anthrax go back to a very ancient date. Classical writers allude to anthrax as if it were the only cattle disease worthy of mention (see Virgil, Georg. iii). The oldest Anglo-Saxon manuscripts contain many fantastic recipes, charms and incantations for its prevention or cure. In the 18th and 19th centuries it sometimes spread like an epizootic over the whole of Europe, from Siberia to France. It was in anthrax that disease-producing germs (bacteria) were first discovered, in 1849, by Pollender of Wipperfiirth, and their real character afterwards verified by Davaine of Alfort in 1863; and it was in this disease that Toussaint, Pasteur and Chauveau first showed how to make the bacilli their own antidote. (See ANIMALS, EXPERIMENTS ON.)

The symptoms vary with the species of animal, the mode of infection, and the seat of the primary lesion, internal or external. Cattle, sheep and horses nearly always owe their infection to spores or bacilli ingested with their food or water, and pigs usually contract the disease by eating the flesh of animals dead of anthrax. Internal anthrax, of cattle and sheep, exhibits no premonitory symptoms that can be relied on. Generally the first indication of an outbreak is the sudden death of one or more of the herd or flock. Animals which do not die at once stagger and tremble; the breathing becomes hurried and the pulse very rapid; the internal temperature rises to 104° or 106° F.; blood oozes from the nose, mouth and anus, the visible mucous membranes are dusky or almost black. The animal becomes weak and listless, the temperature falls and death supervenes in a few hours, being immediately preceded by delirium, convulsions or coma. In some cases the animal rallies from a first attack and gradually recovers.

In the external or localized form, death may not occur for several days. Swellings may appear in any part of the body, being preceded or accompanied by fever. They are developed in the subcutaneous connective tissue where this is loose and plentiful, in the interstices of the muscles, lymphatic glands, in the mucous membranes of the mouth and tongue (cattle), pharynx and larynx (horses and pigs), and the rectum. At first they are small, circumscribed, warm, slightly painful and oedematous. In from two to eight hours they are large, cold, painless and gangrenous, and when incised a blood-stained gelatinous exudate escapes. General infection occurs and death ensues in a few hours. Anthrax of the horse usually begins as an affection of the throat or bowel. In the former there is rapid obstructive oedema of the mucous membrane of the pharynx and larynx with swelling, fever, salivation, difficulty in swallowing, noisy breathing, frothy discharge from the nose and threatening suffocation. General invasion soon ensues, and the horse may die in from four to 16 hours. The intestinal form is marked by high temperature, great prostration, small thready pulse, tumultuous action of the heart, laboured breathing and symptoms of abdominal pain with straining and diarrhoea. When moved the horse staggers and trembles. Profuse sweating, a falling temperature and cyanotic mucous membranes indicate the approach of death. The appearances after death are those of blood-poisoning and rapid putrefaction. The most notable feature, however, in the majority of cases is the enormous enlargement of the spleen, which often ruptures, while its tissue is changed into a violet or black fluid mass.

Man. — Two well-marked forms of this disease in man are recognized, "external" and "internal." In external anthrax the infecting agent is accidentally inoculated into some portion of skin, often the hand, arm or face. A minute swelling soon appears locally, and develops into a vesicle containing serum or bloody matter, seldom larger than a shilling. This vesicle speedily bursts and leaves an ulcerated or sloughing surface round which are numerous smaller vesicles which undergo similar changes, and the whole affected part becomes hard and tender, while the surrounding surface and the neighbouring lymphatic glands are also inflamed. This condition, termed "malignant pustule," is frequently accompanied by fever, delirium, sweating, great prostration and a tendency to death from septicaemia.

In internal anthrax, the spores or bacilli gain access to the system from the air, as in rooms where the contaminated wool or hair is unpacked or sorted. The symptoms usually observed are those of severe prostration, with inflammation of the lungs and pleura. Death from collapse may occur in a few hours or from blood poisoning in three or four days. Sometimes the symptoms are intestinal, and consist in severe exhausting diarrhoea, with vomiting and rapid sinking.

In all cases the course run by the disease depends upon inoculation of a susceptible animal with a bacillus capable of living and multiplying in the tissues. If the powers of resistance on the

part of the patient are sufficient to localize the disease and deal with the bacilli the patient has a chance of recovery; otherwise the bacilli invade the bloodstream directly or indirectly and death is probable as in any case of septicaemia. Treatment in animals is preventive, attenuated bacilli being inoculated as indicated by Pasteur. In man excision while the condition is local and external offers the best chance and administration of the specific antiserum may be of use. When the disease is internal or generalized no known treatment is of any avail. As preventive measures in manufactories disinfection of materials before handling and handling in a wet condition are indicated.

ANTHROPOCENTRIC PHILOSOPHY, a system of philosophy which treats man as the centre of interest. In this wide sense of the term the philosophy of Socrates (who was only interested in problems of human conduct), the philosophy of Protagoras (who regarded man as the measure of all things) and his modern disciples, the Pragmatists and Hominists (or so-called Humanists), may be described as anthropocentric. The philosophy of Kant likewise is essentially anthropocentric inasmuch as it limits all so-called knowledge to beliefs which originate in the nature and needs of man. Although Kant described his philosophy as Copernican in the sense that it reversed the dominant point of view of his predecessors in a way analogous to the Copernican reversal of the Ptolemaic astronomy, yet in another and deeper sense Kant's philosophy, in comparison, say, with that of Spinoza, is Ptolemaic rather than Copernican — for it looks at the universe from the point of view of man, whereas Spinozism looks at man from the point of view of the universe. There is an obvious kinship between geocentric astronomy and anthropocentric philosophy. One reason, perhaps the principal reason, why the earth was so long regarded as the centre of the world was because human conceit persisted so long in regarding man as the end of the universe. The pantheistic, cosmic (or non-anthropocentric) views of thinkers like Giordano Bruno, Spinoza and others were, on the other hand intimately connected with the larger conceptions of the universe introduced by the heliocentric astronomy which treated man's world, the Earth, as but one of the minor planets of the cosmos.

ANTHROPOGEOGRAPHY: see HUMAN GEOGRAPHY.

ANTHROPOID APES is the name given to the family *Simiidae,* because, of all the ape-world, they most closely resemble man. This family includes the gibbons of S E. Asia, the orangs of Borneo and Sumatra, the gorillas of W. Equatorial Africa, and the chimpanzees of W. and Central Equatorial Africa. In general structure they all resemble human beings, as in the absence of tails; in the shape of vertebral column, sternum and pelvis; in the adaptation of the arms for turning the palm uppermost at will; in the possession of a long vermiform appendix to the short caecum of the intestine; in the size of the cerebral hemispheres and the complexity of their convolutions. They differ in the proportion of the limbs, in the bony development of the eyebrow ridges, and in the opposable great toe.

Man differs from them in the absence of a hairy coat; in the development of a large lobule to the external ear; in his fully erect attitude; in his flattened foot with the non-opposable great toe; in the straight limb-bones; in the wider pelvis; in the marked sigmoid flexure of his spine; in the perfection of the muscular movements of the arm; in the delicacy of hand; in the smallness of the canine teeth and other dental peculiarities; in the development of a chin; and in the small size of his jaws compared to the relatively great size of the cranium. Together with man and the baboons, the anthropoid apes form the group known to science as Catarrhini, those, that is, possessing a narrow nasal septum, and are thus easily distinguishable from the flat-nosed monkeys or *Platyrrhini.* The anthropoid apes are arboreal and confined to the Old World. (See PRIMATES.)

See Huxley's *Man's Place in Nature;* Darwin's *Descent of Man;* Haeckel's *Anthropogeny* (Leipzig, 1874, 1903; Paris, 1877; Eng. ed., 1883); W. H. Flower and Rich. Lydekker, *Mammals Living and Extinct* (London, 1891); C. F. Sonntag, *Morphology and Evolution of the Apes and Man* (1924).

ANTHROPOLOGICAL ARTICLES. In addition to the general articles ANTHROPOLOGY; ANTHROPOLOGY, APPLIED; ANTHROPOMETRY, etc., the reader will find special articles on subdivisions of anthropological science, such as discussions of BRACHYCEPHALIC; MESATICEPHALIC; DOLICHOCEPHALIC; AVUNCULATE; MATRIARCHY; SORORATE, etc. For anthropological purposes continents, after a general introductory treatment, are divided into areas, each receiving its special ethnologic attention. In countries where a mixture of races is found a special section for anthropology is included, and the reader requiring such information in respect of any area should first look up the name of the territory. There are numerous small articles treating of Races and Tribes individually under their separate names.

It is impossible to enumerate here all the articles falling within the section ANTHROPOLOGY AND ETHNOLOGY, but as examples of the more important articles the following may be mentioned: AGE GRADES; ANIMATISM; ANIMISM; BASKET; BEAD; BLOW-GUN; BOOMERANG; CANNIBALISM; CASTE; DANCE; DEATH; DIVORCE; DUAL ORGANIZATION; ENDOGAMY; EXOGAMY; FAMILY; FIRE; GERONTOCRACY; GROUP MARRIAGE; MEAD-HUNTING; INFANTICIDE; KINSHIP; LYCANTHROPY; MAGIC; MANA; MARRIAGE and MARRIAGE CLASSES; MIGRATIONS; NAME; NOMAD; OATH; ORDEAL; POLYANDRY; POLYGYNY; RACES OF MANKIND; RELATIONSHIP SYSTEMS; SECRET LANGUAGES; SECRET SOCIETIES; SUPERSTITION; TABU, and TOTEMISM.

These articles are supplied with complete bibliographies.

ANTHROPOLOGICAL SOCIETIES: *see* ETHNOGRAPHICAL AND ANTHROPOLOGICAL SOCIETIES.

ANTHROPOLOGY, that branch of natural history which deals with the human species (from Gr. *anthropos,* man; logos, theory). It is thus part of biology, the science of living things in general. Indeed, it was the development of biological studies during the 19th century, chiefly due to the stimulus afforded by research into the origin of species, that brought anthropology into being in its modern form. Of course the Greeks, from whom the whole scientific outlook of the western world is derived, were quite prepared to assign man a place in the animal kingdom, assuming him to be subject to natural law no less than any other organism. But, although they had the right spirit of disinterested inquiry, together with an imaginative genius that gave birth to the most ingenious speculations — so that Anaximander, for instance, actually anticipated the modern theory of the evolution of life, — yet the Greeks were without the facts on which a universal science of mankind could be built. Theirs was a very narrow world, and a few years back or a few miles away brought them to the unknown.

The 19th century, on the other hand, found civilized man not only able to explore the entire face of the globe, but also eager to occupy and exploit it. Again, onwards from the earliest years of the same century, when Denmark got to work on its prehistoric shell-heaps, archaeological research had been amassing evidence of the high antiquity of man; so that by the middle of it — in fact, just before Darwin published his Origin of *Species* — clear proof had been obtained that a cave-man, the contemporary of the cave-bear, had existed untold millennia before the so-called "ancient" civilizations, such as Egypt or Babylon, had begun to flourish. Thus the time was at length ripe for a world-wide, age-long survey of the human record.

Evolutionary Method. — It remained to devise the most scientific way of handling so vast a subject. Now science may be defined as common sense controlled by method. The question, then, was how best to introduce method, that is, unity of aim and consequent thoroughness of procedure, into a study embracing a diversity of matters hitherto considered disconnectedly and therefore without much profit. At this juncture Darwin revolutionized biology, and his theory of the struggle for existence — suggested to him in the first instance by Malthus's treatment of a human problem, namely, how population is to be adjusted to food-supply — immediately served to supply the new science of man with a plan of campaign. If there is a struggle for existence not only between the human species and the other forms of life, but also within the species itself, it ought to be possible to show, by reference to the facts of history taken as a whole, what is the relative value of different kinds of behaviour.

and of the physical and mental powers involved in such behaviour, as they severally affect survival. This central interest pervading and unifying all anthropological studies may be termed "evolutionary," because life-process in general can be represented as the evolution or "unfolding" of certain powers at the expense of others that are gradually eliminated. If, however, the word is for any reason disliked, the more colourless expression "genetic" may be substituted, signifying that attention is concentrated on genesis, that is, the mode of birth, or becoming.

Factors in Survival. — Given human survival, then, as the prime object of anthropological study, its attainment through superiority in adaptation to the conditions of life can be treated as a problem involving three factors, namely, environment, race and culture. Correspondingly, anthropology has three branches, anthro-geography, physical anthropology, and cultural anthropology, which deal with these three principles singly. A fourth division considers the three in one, that is, correlates results, and is known as ethnology (q.v.). Derived from the Gr. *ethnos*, "people," it compares peoples or "ethnic types" in respect to their effectiveness as agencies of survival, Though survival is in the last resort an affair between individuals, it is only in so far as the individual conforms to some ethnic type that his chances of survival lend themselves to an anthropological estimate. Habitat, race and culture alike help to create an ethnic type, though at different stages in human history they exert influence in varying degree, culture, for instance, counting for little at the start, but later playing a prepotent part in the shaping of peoples.

Divisions of the Subject. — So much, then, for the scheme of topics that will be followed here. It would seem to be the only system that will directly subserve explanatory purposes; whereas other ways of breaking up the subject, based on practical rather than logical considerations, cut across the real connexions of the facts — in a word, do not carve at the joints. Thus nothing could be more arbitrary than to divorce from each other the prehistoric man, the modern savage and the civilized man, as if, because there were specialized methods of studying each, they were not equally subject to the same biological laws. Or, again, culture comprises languages, arts and crafts, and social institutions, with which comparative philology, comparative technology and social anthropology can deal to some extent separately; yet nothing but a superficial and one-sided treatment will result unless the nature and function of culture in general be constantly borne in mind. In short, a man is not an anthropologist merely by reason of the fact that his studies have some bearing on the history of man; for most studies have that. To be worthy of the name he must try to see human history as a whole; and its interpretation in terms of vital loss and gain must be the ultimate aim to which his work, however special, is directed.

THE STUDY OF ENVIRONMENT

Environment may be regarded as on the whole the passive condition, while race and culture are the active conditions, of survival through superior adjustment. Though the surroundings to which the human species must adapt itself include the rest of living nature, intelligence, which is the measure of genuine activity, is mostly on the side of man at present, though this was less markedly so in very early times. Forces such as climate and the formation of the earth's surface operate blindly, that is, in a purely physical way; whereas life in proportion as it is intelligent tempers necessity with a certain freedom of choice. A region, let us say, becomes colder or drier. The vegetation struggles in vain to resist the change, and shrinks. The animals hardly put up a better fight. Man, however, as he advances in civilization, can, within limits, make a successful stand by adopting fresh arts; or, if alternatively, he decides to remove to a more suitable place, he has the advantage over the plant or the beast in knowing where to go and how to get there.

Oscillations of Climate. — The farther we delve into the past, however, the signs of human intelligence decrease; so that it may be plausibly assumed that in the unknown foretime when the species was barely emergent — not less, say, than half a million years ago — the geographical control bore on man in much the same way as on the rest of the animal creation. If by this time he differed from the apes in having acquired a decided preference for a meat diet, his association with certain food-animals would be all the closer. When, therefore, the Pleistocene Ice Age began — the point of time from which it is fairly practicable to date man's story — great oscillations of climate set the biological world swaying in such concert as it could manage; and we must picture man pushed backwards and forwards, together with such other land animals as could last the pace, along whatever natural highways the geography of the moment could provide.

Land-bridges. — It is, indeed, essential to note that the distribution of land and water was changing all the while, as well as the climate; so that some paths led as it were over draw-bridges that permitted no return. America, for instance, once had a land connexion with north-eastern Asia that was then interrupted so as to leave only a precarious passage by way of the sea-ice; and so again the bridge from Africa into Europe by way of Malta broke down completely. If we could place with any certainty the cradle-land of the species — always supposing that it is one species and not an amalgamation of several that originated in as many distinct regions — we might try to calculate in terms of climatic pulsation the successive outward thrusts along the available avenues leading to more favoured spots. If, further, we could assume this cradle-land, whether because of its sheer position at the cross-roads, or because it periodically provided optimum conditions to which the species must return in order to be rejuvenated, to keep on sending out fresh editions of man, we might expect the chances of survival for an earlier, and presumably inferior, edition, to improve in direct ratio with its distance from the focus of evolutionary activity. Wiped out or at least buried deep at the centre of the human world, the relics of bygone dispensations would nevertheless occur on or near the surface anywhere round its circumference.

Theory of a Cradle-land. — On such lines Griffith Taylor, following up the work of Ellsworth Huntington and others on the climatic factor, conceives the field of human distribution on a tri-peninsular basis, with its centre somewhere near Turkistan — in fact, not far north of the legendary situation of the Garden of Eden; while Tasmania, Tierra del Fuego, and the Cape of Good Hope mark the dead ends in this three-cornered scheme. He goes on to postulate eight racial types succeeding one another — Neanderthal, Negrito, Australian, Negro, Iberian, Nordic, early Alpine, late Alpine; and tries to show that their present distribution falls into concentric zones, with the earliest races towards the fringe; while conversely, if the archaeologist digs down for their remains, the earliest will furnish the lowest stratum. Put forward as it is without dogmatism, this scheme may be cited as an instructive attempt to view human history as a whole from the angle of the anthropo-geographer. After all, it applies to man a method of zoning which the biologist has applied to the distribution of all the other forms of life with considerable success.

Culture v. Geographical Control. — The weak point in such a method as extended to man, however, is that man alone has culture; and when culture is sufficiently advanced, it becomes truer to say that man controls his environment than that his environment controls him. Race without culture must respond to a physical stimulus in a quasi-physical way; so that, for instance, so long as man was the land-animal which, so to speak, nature intended him to be, he must foot it together with the other land-animals along the existing bridges and corridors, and had virtually no choice in the matter. Given a boat, however, he became amphibious; he could to that extent make free with geography, as for example, by crossing the "zoological divide" into Australia — an impracticable water-jump for the other developed mammals, but a mere ferry for man with his attendant dog. Or, again, let the art of navigation be elaborated, and the British Isles, hitherto a geographical fastness, become the gate of the Atlantic. Cultural anthropology, therefore, since it is especially concerned with the creative efforts of the human intelligence, must largely supply the key to the ethnology of the modern world.

Areas of Relative Habitability. — On the other hand, much is to be learned from the study of environment in relation to

every phase of history. Now, the ground-plan of the principal land-masses has probably — despite picturesque theories about lost continents — not greatly altered within human times; some sagging at the south-eastern corner of Asia and to a larger extent at the north-western edge of Europe being responsible for the most noteworthy changes. Again, no striking upheavals in the way of mountain-building have occurred in the same period; though the violent disturbance of the Tertiary epoch may have done much to stimulate biological evolution and, in particular, to shape the career of our pre-human ancestor. Thus the anthropo-geographer can afford to concentrate on climate, treating flora and fauna, and even avenues of migration, as dependent subjects. Calculating temperatures, rainfall and so on for given regions as the climate varies, he can proceed to map out areas of relative habitability, suiting man more or less closely according to his degree of culture. Desert and dense forest are the extremes; between them — anywhere, in fact, between open steppe and parkland — lies the happy mean, not only for the hunters but likewise for the food-raising peoples. More especially inhospitable is the arid type of desert, more so even than the frozen type or tundra; lack of rain being the physical scourge that man has to fear most. Nay, as a cause of migration on a grand scale desiccation is perhaps more effective than any cultural influence, such as commercial enterprise or colonial expansion. It is, on the other hand, precisely in the inhospitable parts of the earth — or else in out-of-the-way places, such as islands, mountain-valleys or swamps, which may be inhospitable as well as isolated — that the broken peoples are likely to be met with, battered vessels seeking harbour where they can. Thus the study of environment teaches the anthropologist where to look alike for the strong and for the weak among the human candidates for survival. Geographical considerations will not suffice to explain the full conditions of the struggle between ethnic types; but whoever aspires to understand human history as a whole must at least acquire the map-making, map-reading faculty at the start.

THE STUDY OF RACE

Race means breed. It stands for all that we are by heredity as contrasted with experience. Thus it amounts to no more than an abstraction, because we can at best separate only in thought what a man owes to his parentage from what he owes to his acquired habits. More especially does it become difficult when habit is no longer the result mainly of individual experience, as with the other animals — when it is more likely to reflect the native bent — but is the result of culture, that is, conforms to the accumulated experience of all and sundry. Yet in a rough-and-ready way we are all accustomed to distinguish between a man's natural aptitudes and the education that he has received. Science aspires to do this in more exact fashion, but cannot be said to have discovered very trustworthy tests so far.

Mental v. Bodily Characters. — The mental characters would appear to have the greater survival value. Size and strength, for instance, count for less in the struggle for existence as waged to-day than once they did when life was more an affair of tooth and claw. It may be added that never, apart from the aid of a superior intelligence, could man have outfaced the more formidable of his animal competitors. A gorilla, indeed, is a powerful beast, but there is no reason to suppose that man's direct ancestor inclined so far as the gorilla from a line that led on the whole towards mind rather than muscle. Certainly, a Neanderthal man could no more have stood up to a gorilla bare-handed than an Australian native to the Neanderthal man whom he resembles rather in feature than in frame. On the other hand, among inheritable physical traits immunity from disease undoubtedly continues to be a race-making influence of great importance. Nevertheless, mental capacity is the birthright on which a man may reckon most.

Difficulty of Testing Intelligence. — Unfortunately, this is just the side of the subject on which the study of race is least illuminating at present. Thus physical anthropology can classify skulls with reference to their brain-capacity, and by taking an endo-cranial cast can even attempt to take shape as well as size into consideration when the brain is no longer there; or, if it be available for inspection, the arrangement of the cerebral processes can by physiological methods be studied comparatively. Yet, to discriminate the born genius from the born fool by such means has hitherto proved impossible; and it is highly doubtful whether the average intelligence could be calculated in the case of a group of similar skulls or brains known to be related by pedigree. Experimental psychology, again, has not invented very satisfactory tests of natural ability, and little has been done to apply such tests to the world's very various stocks, so as to compare them on that basis.

A Race-making Period. — In the meantime the study of the race-factor has produced more tangible results on the side concerned with the external features of the body; and, although these may be of less practical account as civilization develops, their interest from the scientific standpoint is considerable as enabling the major movements of early history to be traced. Walter Bagehot's hypothesis of a "race-making period" of human development should be borne in mind. He assumes that, so long as culture remained backward, the stress of natural selection was bound to fall mainly on the body. If the slightest physical advantage was of help in the struggle between ethnic types — a dark colour or a thick skull, let us say, as a protection against the sun — then its happy possessor would forge ahead.

Physical Race-marks. — Certain physical characters, then, we may be sure, were deeply impressed on the competing stocks of the early world, and the question is how to recognize them. Though theoretically the anthropologist should take note of all characters constituting the hereditary element, he is compelled, by the vastness of the statistical field to be covered, to work with a few, and naturally seeks among possible race-marks for the most constant and enduring. No biological trait, however, is in a strict sense invariable. The plasticity of organic life pervades all its parts. Yet some human characters undergo alternative modifications that, once acquired, are reproduced with a high degree of regularity. Head-form, hair-texture and skin-colour are instances in point, not to mention many minor features of great persistency such as eye-colour, or the shape, and especially the breadth, of the nose. None of the rest, however, can compete in utility with head-form, seeing that, apart from the high degree of invariability that it manifests — one, probably, at least as high as that displayed by any other single trait — it can be applied, unlike the tests of hair and colour, to the skeleton no less than to the living man; and is thus in particular the archaeoiogist's chief stand-by. It is therefore incumbent on physical anthropology to provide adequate standards by which differences in head-form can be compared; and all that need be said on the subject here is that the usual test of the cranial index, giving the ratio of extreme breadth to extreme length, is, although convenient, exceedingly rough. It is perhaps fairly safe to trust to it so long as the other criteria of race are in fair agreement. If, however, the head-measurements of two existing types are alike, but one is black and the other white, or one is woolly-haired and the other straight-haired, the racial connection is more open to doubt.

Head Form and Intelligence. — Not to go further into technical questions more suitable for a special article, it only remains to add that it would be especially interesting if head-form, as being by far the most carefully registered of the physical traits of man, could be correlated with intelligence. If it could be shown that a long head could not accommodate the most developed type of brain as effectively as a round one, we should be on the way to a much needed method of comparing ethnic types in terms of body and mind taken together. At present, however, all the methods in use to determine race are precarious, and their provisional findings must be accepted with the utmost caution. At most it may be said that the signs of the times point to a great development of such studies in view of the urgency of what are known to the politician as race problems.

THE STUDY OF CULTURE

The subject of culture as it bears on survival may be considered under three heads: language, material culture (arts and

crafts), and moral culture (social institutions). It is necessary to realize at the outset that, although these aspects of culture are often studied apart because of the special methods involved, they form one whole for the anthropologist, who contrasts them in their entirety with the race-factor as representing another kind of inheritance, not born with us, but acquired by tradition. Culture is indeed sometimes described as a "social heredity"; but it is fair to describe culture as an inheritance, since we speak of inheriting the acquisitions of our forbears no less than of inheriting their features. Culture is communicable intelligence. Intelligence being mind viewed in its directive and purposive capacity, the meanings that we communicate essentially relate to purposes that we wish to share. Communication is a two-sided process, taking in being just as important as giving out; so much so, indeed, that the tragedy of history may be said to consist in the fact that the nations have so often failed to interpret what their men of genius sought to express. For, strictly speaking, each man's experience is locked up in his own bosom. If the other man's mind is to be made to respond, a medium of communication, always of a physical kind, must be used; such as a gesture, a sound, or a piece of paper with marks on it. Thereupon the other party to the communication can share in the purpose suggested just in so far as he can translate the outward sign into terms of his own consciousness. Now the other animals have no culture worthy of the name, because their powers of intelligent intercourse are slight, and in particular are confined to those alive and present together. Man, however, through his culture can defy time and space. taking counsel with the dead and gathering in wisdom from the ends of the earth.

Language. — Articulate speech, is, perhaps, the very root of culture. It is a wonderful fact that there is no people now existing or known to history that is without a language such as is not only intelligible to themselves, but likewise intelligible to any other man who takes the trouble to master it. There lies humanity's chance of eventually acting together, namely, in this power of talking out its difficulties and so getting its cross-purposes straightened out. So much, indeed, is articulate speech our human prerogative that it is simplest to couple the pre-linguistic with the pre-cultural and to treat both together as the marks of the pre-human. The suggestion sometimes made, on the strength of certain differences in the make of the jaw-bone, that Neanderthal man could not articulate properly is, apart from physiological objections, very unconvincing, if only because his culture was by that time already more than rudimentary. It is almost inconceivable that he could not distinguish by names the very various implements that he chipped so carefully out of flint; or that he buried his dead according to a silent tradition and with a wordless lament. Indeed, lack of words is in language as we can actually observe it, no test of primitiveness, since, on the contrary, savages, otherwise very low in the scale of culture, often employ what to us seems a quite unnecessary number of terms to distinguish things to our view very much alike. Thus in the vocabulary of the Eskimo every shade in the taste of putrid blubber calls for a designation of its own in the bill of fare. Their language, in short, reflects a mental state in which particularization runs a long way ahead of generalization; so that it is almost as if they gave a personal name to everything that struck their senses. On the other hand, a logical arrangement of their thoughts, as revealed more especially in syntax, is far less in evidence. A corollary is that a backward people in contact with a higher culture will far more readily borrow its words than its power of using them connectedly.

Popular Origin of Language. — It should be added, however, that language, even as at present developed, remains curiously unsusceptible to the influence of logic, and retains all the marks of a popular, not to say primitive, origin. Gender, for instance, instead of conforming to biological fact, still follows the obsolete vagaries of mythological fancy. Or, again, sheer economy of effort, vocal and even mental, is responsible for phonetic and grammatical changes that blur and twist the elements of speech without regard to their function as vehicles of meaning. The most that can be said for this irresponsiveness to conscious control on the part of human language is that it implies the claim of all men to have a share in the making of it. Just because all help to create it does it seem not to be made at all, but rather to grow of itself. The most ancient and precious of the rights of man is the right to talk, a right carrying with it the corresponding duty of occasionally listening to what others say. Unfortunately, since tricks of talk are catching, from mere accent up to vocabulary and grammar, every petty group rejoices in its own dialect; wherefore the curse of Babel rests upon mankind unto this day.

Value of Common Tongue. — There is no use in language except to render intelligence more communicable. Unless a people wished to conceal its thoughts, it would be ill-advised to exchange a world-wide tongue for a local one. On the other hand, nothing counts for more in the struggle for existence between ethnic types than the advantage of common speech. Language is a poor test of race, but an excellent measure of culture in its bearing on survival. Collinguals are cousins whatever their pedigree, and, no less naturally than they talk, are inclined to share sympathies and ideas. A common language, however, implies a common education such as can maintain it, as against that tendency to sink back into a confusion of tongues which is latent in every civilization and becomes active with the first symptoms of decline. Thus the Roman empire did much to impose a uniform mode of official and polite speech on the Mediterranean world, and, had it not taken a bilingual form, the political seclusion between West and East, reflected later on in the history of the Christian Church, might have been largely averted.

MATERIAL AND MORAL CULTURE

Turning to the subject of material culture, that is, of arts and crafts as manifested in such appliances and products as are of a physical nature and, so to speak, can find a place in a museum, one may first note that natural objects embody culture just in so far as they bear the impress of human intelligence, and can communicate it to others. Thus the cathedral builder, as it were, spiritualizes the stone and thereby converts it into a medium of religious rapture. The ape that hurls a casual missile communicates a throwing impulse to his imitative companions; but a material culture has not come into being until a somewhat more intelligent animal selects his stick or his stone and keeps it by him for individual or collective use; or perhaps goes on to adapt it to his grasp by actual trimming such as involves some attempt at design. At this stage art has definitely begun, and presently makes another forward stride when the composite implement is contrived; stone and stick no longer serving severally in something like the shape that nature gave them, but being artificially combined by somehow fixing stone to stick so that they work together. Thenceforward it is but a question of selecting, shaping and combining the raw materials with ever-increasing ingenuity; and forthwith man's relation to the physical environment is so revolutionized that, instead of its slave, he becomes its master. History viewed from this angle is the history of great inventions; and, even when culture is considered as a whole, they are of outstanding importance, since with them can be closely correlated the chief stages in the economic life of mankind. Thus the mere food-collector, scattered about the waste, has little more than fire and hand-tools of wood, stone or bone to help him. Food-raising implies the domestication of animals and plants and involves the use of many devices peculiar to the pastoral or the agricultural life — conditions which alike enable men to live closely together and so cause them to need one another more. With metal-working dawns the age of conquest, navigation, commerce; and to support such vastly extended communications the art of writing is developed.

Practical and Liberal Arts. — It must not, however, be supposed that all material culture subserves the economic side of life in particular. The arts can be divided broadly into two main classes: those that help man to live, and those that help him to live well. Practical and liberal or useful and decorative, are terms sometimes used to express this distinction. Thus in the former class would be reckoned such arts as relate to food, clothing, shelter, fighting, trading and transport; in the second, those con-

cerned with fine art, science and religion, together with various lighter interests that may be summed up under the head of amusements. Indeed, it might be also said of the savage in regard to some of his habits, as, for instance, his manner of dress, that, if he can only have the luxuries he will dispense with the necessaries. The same tendency to sacrifice convenience to charm is not unknown among the civilized, and with all the less reason, seeing that the charm in their case has aesthetic significance only, whereas for the savage it may well have a magical or religious value as well, as when his necklace of teeth or shells is ornament and amulet in one. There is always a psychological as well as a sociological side to every institution, the inward meaning providing in the last resort the key to the outward form. There must be organization, and there must be a reason for it; though often the reason is implicit, and those concerned have no clear notion of what they are about. Indeed, with the savage, custom is a blind king. It is rare that any explanation of its decrees is forthcoming; or, suppose one to be given, it has all the appearance of an afterthought or excuse. After all, the principle, "Act first and justify afterwards," pervades all our actions far more than we are aware.

Imitation. — The psychological bond of society is, and always has been, imitation; but imitation is a process that becomes more intelligent as it develops. The outward sign by which mind communicates with mind must be interpreted, and man becomes a better thought-reader as a larger store of suggestions is accumulated, partly by means of language, partly through material culture as it incorporates meaning and purpose in wood and stone. At first, however, man has to rely mostly on imitating the bodily movements of his group-fellows, and such a primitive method of communication is more successful in propagating emotions than ideas. "Pull, pull together" is the burden of the primitive chorus; and, after all, that is more than half the battle of life. The moral element involved in all moral culture consists precisely in a sense of common effort directed towards a common end. Moreover, throughout human history the sentiment of community has been more important, because more widely shared, than the intellectual apprehension of the nature of the end. Every crowd must have a leader; and it is for the leader in particular to have the end in sight, whereas the rest can afford to attend chiefly to making the work go with a swing. The primitive leader of society at least knows better what he is about than his average follower; though his ideas come to him mainly as dream-like shapes that baffle his mental grasp because the means of fixing and defining them are wanting.

Inarticulate Intelligence. — Slowly does language gain the power of representing thoughts accurately; and in the meantime the primitive man of ideas has to fall back on pantomime, helped out as it is with every kind of material accompaniment, paint or feather, mask or image, bull-roarer or drum, that may assist the dramatization of his meaning.

In judging the degree of intelligence at work in early society, one must be careful to get past the letter to the spirit — in other words, to make sure that one can translate the savage symbol into the sense it is meant to bear. In their concrete-minded way, primitive folk get to understand each other very well so long as they remain in actual contact. Their difficulty is to extend the limits of effective organization beyond the range of voice and eye, that is, spatially speaking, beyond the radius of the camp or, at most, beyond that of a tribal boundary that can be reached in a few days' walk.

The Savage Pre-eminently Religious. — Primitive man is pre-eminently religious in his way of life. He puts the unseen before the seen as his object of strictly practical attention. One might, in fact, say that the hunter judges success to be more a matter of luck than skill, and therefore concentrates on getting the luck. This, however, would be to take rather a superficial view of the case. It would go nearer to the root of the matter if one expressed it rather thus: that in hunting, faith seems to count far more than skill or anything else. What precisely such faith should be in, for its efficacy to be greatest, is a problem that man is still engaged in working out. Considered anthropologically, that is, from the human end, religious faith is man's faith in himself. He believes in powers that he can somehow evoke from within himself, or else invoke from some mysterious source outside, simply by willing to take life seriously. By so doing, certain values such as the true, the beautiful and the good are, as it were, consecrated, that is, separated from the ordinary concerns of life, and lifted up into an ideal heaven whence they shine timelessly like stars. This, however, is more a description of the direction taken by advanced religion — so far, at least, as it interests itself in life, shaking off a somewhat morbid preoccupation with death — than of the outlook of primitive religion. The inferiority of the primitive religion can be summed up by saying that it is imperfectly moralized. It does not see so far as advanced religion into the moral significance of its symbols. Thus one might say, very roughly, that the lower religions conceive the divine nature as power; the middle religions as justice; and the higher religions as love. If truth, beauty and goodness meet anywhere, it is surely in love.

Comprehensiveness of Primitive Religion. — On the other hand, primitive religion, though devoid of insight into its own deeper meaning, has a certain advantage over religion as an element in modern civilization, in that, if less coherent, it is more comprehensive. All the values of life, utilitarian and humane, from food to sculpture and painting, from the study of plants and beasts to the study of the heavens, are primarily viewed by the savage as religious interests. After all, he lives in such a little world that he has in some way a better chance of seeing the various institutions of society in their entirety as a way of life than can a modern man who, to get a grip on his moral universe, must take so much more into consideration. Thus, economics and religion being alike aspects of one process of culture, that is, self-cultivation, there can be no gap between them in the good man's consciousness if he be sufficiently enlightened.

Need of Moral Education. — The vaster organizations of today are apt to reduce the individual to a cog in the social mechanism; and, the control of intelligence being correspondingly reduced, the inevitable end must be collapse, unless moral education by deepening and widening the sense of common purpose can come to the rescue. Many of the fundamental institutions of modern civilization, marriage, for instance, and religion itself, work none too well, and the reason is the difficulty of keeping them true to the central purpose of getting more and ever more out of life, not only as to be lived under supernatural conditions, but as lived under natural conditions here and now. For the anthropologist, indeed, whose business is but to observe the course of history, there is no saying why moral evolution should be desirable. He simply notes that it results from trying to survive in proportion as such trying becomes intelligent, that is, chooses its way in the light of a conscious purpose. Whole literatures deal with the various aspects of moral culture taken separately. Here, instead of running through the history of institutions chapter by chapter, it must suffice to insist that the anthropologist, seeking to view the development of human life as a whole, has somehow to bring the love of food and the love of God into one moral scheme. Indeed, everything that man has done or suffered is relevant to his subject; with this important qualification, that he studies the "how," not the "why," of an evolutionary process whereby life appears to be granted in fullest measure to those for whom it has come to have most meaning.

THE COMPETITION BETWEEN ETHNIC TYPES

The factors in the human struggle for existence having been stated, a final task must be to note briefly the manner of their joint working. Whatever the future may have in store, man has not hitherto faced his environment as a single community, united alike racially and culturally so far as interbreeding and mutual understanding can bring it about. If this were possible, such elimination of the unfit as would still be necessary might be applied directly to the individual by a stern system of eugenics or in such other ways as the wisdom of the age might devise; though whether with success it is impossible to say. Man's actual history reveals as yet no approach to such a consummation.

Relative Importance of Race in Early Times.—In the early race-making period, indeed, organization and culture in general presumably counted for less, and we may imagine that a succession of good seasons would send out swarm after swarm of semi-bestial folk hardly differing in their habits any more than so many different flocks of sheep, until inbreeding in conjunction with a fresh habitat produced a new strain in the stock. Neanderthal man, for instance, is held in the light of the latest research to have experienced two glaciations in Europe, together with a long intervening period when it may have been warmer than it is at present. Also, if we may connect with him the Talgai specimen from Australia and the Rhodesian specimen from Africa, he spread from some unknown centre—possibly indicated most nearly by the Galilee specimen—over a large part of the globe. There is no reason to suppose that culture rather than race was yet the decisive factor in the struggle for existence, so little do his cultural habits seem to vary at whatever time or place we take them. Thus he had fire, no doubt, to protect him against an oncoming glaciation; but we may guess that the natural fur on his back grew a good deal shaggier.

Value of Culture in Early Times.—Yet possibly one is apt to underrate the value of culture, even in its first known beginnings. After all, the Talgai man must have used a boat and thereby improved his chance of life, since once in Australia he was pretty safe among the blameless marsupials. Or again, the pygmy is physically not much of a man, but, as we find him now, is usually given to ingenious devices, using the bow, poisoning his arrows and so on. His present distribution in Africa and at the foundered south-eastern corner of Asia—not to speak of his possible relationship to the Grimaldi specimens from Mentone—suggests a very early origin for a racial type which from the first must have had to contend with a physical handicap, and thus may well have had to rely on its culture as soon as ever a stouter breed of human beings crossed its path. Not to multiply examples, as the primitive peoples, prehistoric or modern, rise in the scale of historic importance and of the power to last, their self-identity seems more and more to consist in a highly individualized culture, while their race, on the contrary, is ever more mixed and harder to differentiate from that of their less successful neighbours.

Decreasing Importance of Habitat.—Habitat, too, comes to count for less. The racial cradle-land or cradle-lands of man—and there may well have been several, seeing that what might be almost called a warm fauna and a cold fauna can be recognized among existing human stocks—must be thought of as some area of intenser struggle and hence of intenser activity which, as it were, set its mark once for all on the kind of man produced there, in respect to his heredity. If he went forth to conquer, the chances were that, reaching some less stimulating environment, he would degenerate. A cultural cradle-ground, on the other hand, would be a fallacious notion. True, culture is sometimes diffused from the same centre, wave after wave, because a people has developed a high and lasting individuality, out of all comparison with that of its neighbours; and the latter consequently live on its charity, nay, may be so utterly pauperized as to lose such initiative as they previously possessed. History provides abundant instances of a contrary process by which the borrower of culture trades on the capital thus acquired to outmatch in the end the fortune of the willing or unwilling lender. Culturally it is always possible for one nation to beat another at its own game. The condition of success in such a case is not so much natural talent—which represents the racial element—as taking pains to learn intelligently, that is, not by rote but by making the thing taught one's own. Modern Japan has shown how a radical change in culture can by intelligent self-adaptation be effected within a single generation. The case is all the more instructive because the ethnic type remains as individual as before, or perhaps more truly might be said to have become enriched in quality, while almost certainly increasing its survival-value.

Culture Must Be Supported by Race.—Not to labour the point further, the prepotency of the cultural factor is so well-marked a feature of the later phases of human evolution that it might even be doubted whether the modern tendency is not to exalt it unduly at the expense of the race-factor. Culture depends on education, and educability is at least partly a matter of hereditary ability. If the average individual is to survive by participating in some ethnic type of superior survival-value, he cannot afford to extend such participation to the born fool; or at least he can prevent him from being born. Such matters lie somewhat outside the province of the anthropologist, who as a man of science and a historian merely unfolds and interprets the record of the past.

Pure and Applied Anthropology.—With an applied anthropology, as it is sometimes termed, the present article is not concerned. The study of human development can, indeed, help the statesman in many ways. Nay, even if anthropology be taken in the all too narrow sense of the study of primitive man, there is much that the administrator and the missionary can learn from it that will be of practical help to them in their work. Anthropology as a pure science aims at the same goal as all the rest of the pure sciences, namely, the enlargement of the mind through knowledge. Have we the courage to seek to know ourselves as truly we have been and now are—whatever else we may aspire to become? If so, then anthropology may go forward.

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(R. R. M.)

ANTHROPOLOGY, APPLIED. In Great Britain, public recognition of the advantages to be gained by the practical application of anthropological knowledge had scarcely begun before the World War, and naturally suffered a severe setback from which it only slowly recovered. There were administrators who recognized the native point of view, and were even prepared to study

the sociology of their charges and, in a few cases, recorded the results of their observations; yet nowhere was there any general official recognition that the acquisition of such knowledge should be part of an administrative officer's duties, and adequacy in native affairs is even now not generally regarded as necessary for promotion. Nevertheless a healthy spirit is abroad even if performance at times lags behind the demands of both theory and common sense.

Applied Anthropology has two main aspects: (1) Cultural (or in the broader sense psychological). (2) Physical, embracing especially the great problems of racial characters both physical and mental, miscegenation, immunity and so forth.

CULTURAL

Practical Considerations. — While every people presents its special problem, all these are but different aspects of the greater problem of adaptation, which must be worked out afresh in many instances if the widest range of physical and cultural types are to be given their best chance of survival and development within the conditions besetting them. From the practical standpoint it must be realized that there is no possible future for the few scattered remains of the hunting peoples that still exist; nor in certain instances is the white man responsible for their disappearance, for at the time of the European colonization of the tropics superior "native" cultures were, in a number of instances, destroying these humbler groups as effectively, if more slowly, than ourselves. With regard to the agricultural peoples but recently in the Stone Age, it is yet too early to speak with confidence, for although the natives of the smaller islands of the Pacific have been blotted out or exist only as degenerate remnants it is permissible to hope that under considered efforts those of the larger islands (such as New Guinea) may not only survive but even enjoy a measure of happiness.[1]

Methods. — As to method, there is little to guide us in the past, for though culture contact is no new thing in history, the economic needs of to-day present conditions differing from those of the past, and entirely new. Moral ideas have also changed, and it is no longer possible to enslave or exterminate all peoples unable or unready to adopt or adapt to a higher civilization. Yet in spite of these apparently favourable factors there has been nothing before comparable with the persistence and energy with which the higher race is imposing itself on the backward peoples.

For practical purposes, then, we can only be guided by the knowledge gained during comparatively few years, backed by the experience of our more successful administrators, the whole tempered by a quality of prevision and a capacity to "think Black," which experience has not shown to be unduly common.

Use of Existing Knowledge. — What then are the means by which the store of knowledge we already possess may be used, and how far is a practical rather than theoretic interest in native peoples likely to introduce new methods of acquiring knowledge, or eliminate methods known to be of scientific value? Nothing suggests that the practical or applied outlook makes, or should make, any change in the method of the field worker. For if it be urged that attention to any particular theory is likely to distract the observer from a fair all-round study of facts, the reply is obvious that theory can only stimulate the field worker to fresh observations, which should neither limit his area of outlook nor discourage him from seeking the fullest knowledge of the folk he is investigating in their present and past environment. The more complete the apparatus of the observer, whether government official, missionary or professional anthropologist, the more likely is he to form a complete picture of a people in which due weight is given to the activities both mental and physical of its members, enabling the administrator to foresee their behaviour as individuals, as members of a family, or of a larger social group.

Unity and Complexity of Social Life in the Lower Cultures. — Ethnic and historical connections naturally are important, but stress must be laid from the practical point of view on the interaction of existing ideas and customs. It is impossible to understand the ideas regulating inheritance and bride price — two most important matters with which the administrator is concerned — without at the same time inquiring into the religion, sociology and economics of his people. Unforeseen and undesired ends have resulted from arbitrary interference with native custom. It cannot be too strongly urged that the native has a point of view of his own, and before sweeping away seemingly objectionable customs, the white man with knowledge of anthropology should seek to preserve the driving force which runs through native life, while changing those features which are anti-social according to civilized ideas even though they instigate much praiseworthy social activity. One of the best examples that can be cited is offered by head-hunting, a widespread habit which white civilization cannot tolerate. Yet its suppression was regarded by W. H. R. Rivers as one of the main factors in the depopulation of Melanesia.

This example demonstrates the interlocking of departmental activities, as a white man might be tempted to call them, in native life, and it furnishes the very type of practice which no white administration can permit. The *impasse* seems absolute, yet in Sarawak, where almost the same necessity for head-hunting exists, the difficulty has been overcome by sympathetic officials who have themselves taken charge of some of the old skull trophies of the people, and thereafter when the demand for the ceremonial use of a skull arose one of the old skulls was lent to the community, the whole transaction being put on a business footing by the careful recording of skulls "in" and "out." Again, in an inland district of Papua, where no man could hope to marry unless he had taken a skull, the officer in charge was able to persuade the tribe that the killing of a wild boar offered at least as good a test of pluck and skill, and so was able to substitute the taking of a boar's head for that of a man (often a woman or child).

Importance of Ceremonial. — No one doubts the close relationship between social organization, ceremony, morals, economics and even ethics among ourselves; everyone recognizes the psychological value of display, ceremonial and sport; yet in the administration of the backward races this common knowledge is too frequently ignored. What government at home would presume to stop royal processions, the Oxford and Cambridge boat-race or public football matches? Yet the corresponding expressions reproduced by natives in dances, initiation ceremonies and public feasts are frequently suppressed by the influence either of the administrator or the missionary, long before it is determined whether they are harmful or not. Active teaching is needed, now as much as ever, that the interests of people cannot be cut off with impunity, and the substitution of harmless for anti-social features in savage ritual and institutions is sound social psychotherapy.

Positive Interference. — Frequently new regulations are introduced that undermine the native social structure of which administrators have remained entirely in ignorance.

As to the difficult subject of missionary work as it affects the simpler pagan societies, it seems obvious that instruction in the social side of anthropology equal at least to that given to Colonial Civil Servants should be provided for missionaries by teachers who have themselves had field experience. Though short courses of lectures are now given at various missionary training schools in Great Britain, it does not appear that any central body has yet organized a co-ordinated scheme of instruction. Official authority, far-reaching though it may be, is simple compared to the complexity of influence exerted on native peoples by missions, for, in the intimate affairs of life some missionaries exercise such strong and constant pressure that members of their flock, and even individuals outside it, are deterred from following habits and customs which are in no sense forbidden by the civil administration. Moreover, the pressure exerted by many missions is so great that appeals to the civil authority are relatively rare, however much the native may feel aggrieved. Naturally missionary effort is largely directed to the "reform" of the sexual life of the native, *i.e.* not to any great extent against perversions or abnormalities — for these are too rare to bulk largely in the life of most primitive peoples — but especially against polygyny (polygamy), which,

[1] The outlook as it presents itself to the three generations living in a Maori village is vividly presented by G. H. Lane-Fox Pitt-Rivers in *The* Clash *of* Culture (1927), chap, xii

whether it be advantageous or disadvantageous in a biological sense, is regarded as essentially evil and attacked in every possible manner. Even though the Church feels bound to maintain this attitude it may be doubted whether it is wise or beneficial for the Government to exert its influence against polygamy among relatively untouched natives. For instance in Papua (British New Guinea) no one having more than one wife may be appointed "village policeman." Obviously this excludes the majority of headmen, individuals whose authority is most easily exerted and most readily obeyed, from holding the very office in which they could be of most use alike to the Government and to their own people. Many missionaries have recognized the incompatibility of Christian monogamy with the social structure of some well organized pagan societies. But, while it is necessary to recognize the complications and difficulties introduced by missionary effort, not all missions are equally rigid, while it would be difficult to overrate the scientific and administrative value of the work of such men as the Rev. H. A. Junod, whose *Life* of a *South African Tribe* is an outstanding example of the sympathetic and understanding attitude.

Priest-kings and Magic.—In other instances trouble has been caused by ignorance of the fact that a chief may belong to that exalted class of beings called by Frazer "Divine Kings," or if not actually of this order, be at least of semi-divine nature, and responsible for rain and generally for the prosperity of the land. Here it may be wise to recognize frankly the hierarchical superiority of the priest-king, and to appoint under him an administrative government chief; indeed, besides the priest-king there are often one or more men recognized by the tribe as executive officers in everyday affairs. Nor can the administrator ignore magic and sorcery, and it is useless for him to affirm that the British Government cannot countenance a belief in sorcery; magic may be a fiction, but the belief in it is a potent reality in all the ruder cultures, and is not extinct in higher cultures. Cases of death alleged to be caused by magic or by poison—the two often being synonymous—are continually brought before administrators, yet rarely is evidence produced against the magician which on the white man's laws of evidence can lead to conviction. In parts of Melanesia it is doubtful whether there is any authentic evidence for the use of poisons by a sorcerer; yet folk undoubtedly die as the result of his machinations; they die from no other ostensible cause, and their death is ascribed to magic. The sorcerer is not convicted, but if the people take the law into their own hands and kill him the Government steps in and punishes the slayers, who according to their peers have performed a public duty. It is small wonder then that many natives believe that the Government encourages sorcery; indeed, the relative immunity of the sorcerer from all vengeance in certain instances may actually produce this result.

Another factor which greatly adds to the difficulty of dealing reasonably and justly with sorcery and witchcraft is that generally speaking the darker races are far more suggestible than ourselves; unfortunately, space is lacking to elaborate this statement or to set out a tithe of the evidence on which it is based.

As a general system of treatment, probably an ordinance of the kind in force in Papua is useful, in which it is stated that though there is really no such thing as sorcery yet the practice is so harmful that it is treated as criminal. At any rate, the administrator is not the only person in a dilemma; witness the plaint of one Tata Ko, a well-known sorcerer, to Capt. Barton, then Governor of Papua: "If a man falls sick his family come to me and ask me to make him well. If I don't do something for him they say, 'Tata Ko, the sorcerer, desires to kill our brother,' and they are angry and will perhaps try to kill me. If I do give them something they insist on paying me well for it; should I refuse to take their presents they would not understand it and they would think I was trying to kill their friend, but when I do take what they give me, you arrest me on a charge of sorcery blackmail."

Magicians not Charlatans.—In most instances magicians are not charlatans; though they may impose upon the credulity of their clients they do believe in their own power; they have inherited the gift and perfected their craft by means of hard training. Though legislation may be useful, magic cannot be disposed of by law, for every death except perhaps of the very old is attributed to magic, and it is only when a man has some appreciation of the natural causes of death and the benefits of medicine that he relies less upon magic. Missionaries have long been aware that their best weapon is the hospital; administrators should start clinics shortly after administrative posts, as in the case of the splendidly fitted hospital ship, with its medical officer and orderlies, placed by the Sudan Government in 1922 for service on the White Nile and its tributaries. Yet, however perfect administration, magic cannot die a sudden death; and this has its advantages, for magic has its social as well as its anti-social side.

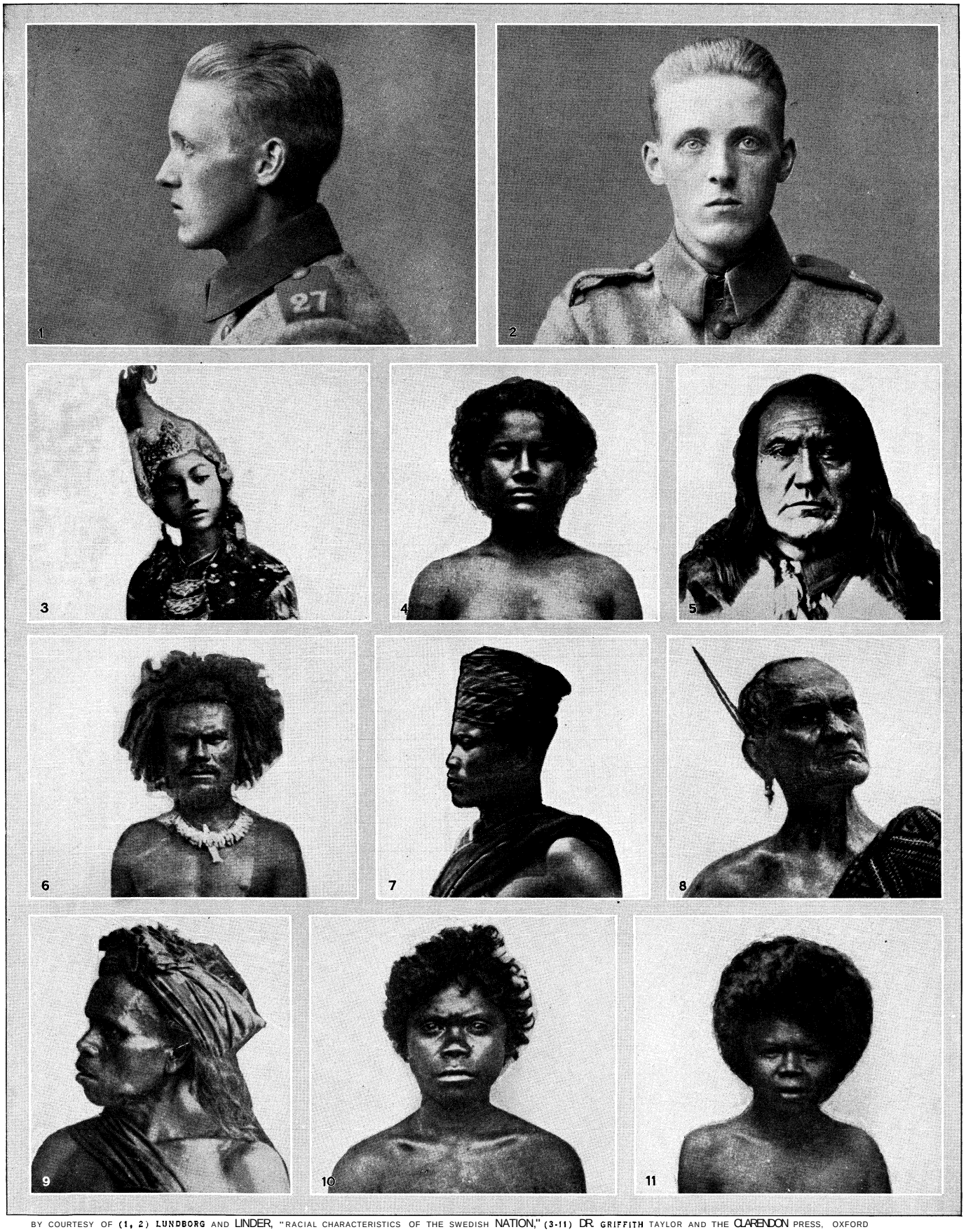
White magic will persist, and in Melanesia, for instance, its benefits are seen in connection with the Kula. In the Trobriand Islands the specialists in magic are experts in the various crafts, in gardening and canoe building, etc., and it is under their auspices that the good traditions of gardening and building are maintained. Though no canoe could sail unless the appropriate magic had been performed at each stage of its construction good magic would never be used to counteract the effects of bad material or bad workmanship. Thus, the continual magical observances guarantee a careful selection and tests of material, and are an incentive to good work. A successful trading expedition is the result of good magic, and just as magic is the most important regulator of the Kula, so is it of prime importance in garden work. The islanders, like most natives, are notoriously unthrifty, and it is doubtful if any native would cultivate sufficiently for his needs if left to individual responsibility. For man does not live by bread alone, and a garden which will make a fine display and be much talked of appeals to the mass of the population more than the knowledge of a supply against famine.

Practical Suggestions.—In order to save the backward races from extinction and enable them to adapt to new circumstances two courses seem advisable: (a) that all government servants, and others—especially missionaries—coming into direct contact with natives should take as part of their preparatory studies a course in anthropology; *(b)* that every government should appoint trained anthropologists, in order to make detailed investigations and to act, when needed, as advisers to the administration. Each of these plans has its definite sphere of usefulness, and calls for further consideration.

Training.—Apart from a degree in anthropology, which as matters stand at present it is idle to expect more than a small minority to possess, the preparatory course in anthropology may be of two kinds: a six to twelve months' course at one of the universities—usually three academic terms—in which, besides the social anthropology which is of prime importance from the administrative standpoint, a certain amount of technology and physical anthropology will also be taught. Such a course, if due stress be laid upon practical difficulties and details, is no doubt excellent in those few instances in which a man has already a strong, almost a "natural" interest in anthropology; but this plan yields disappointing results when applied as hitherto to men who have had no foreign experience.

The British Colonial Office has a syllabus for the preliminary training in native modes of thought of the men selected as African civil servants, in law, accounts, tropical products, hygiene, engineering, and sanitation, ethnology and the principles of African languages. In the past this scheme has produced good results and experience shows that a certain small number of men will be sufficiently interested to study the tribes they live among and to record their habits and customs, or at least to keep in touch with their teachers.

A further development is for the Colonial Government to pay the expenses (fees and sustenance allowance) of men with administrative experience who are keen enough to spend two to four months' leave working intensively at anthropology at one of the universities. Experience has already shown that this scheme is likely to prove of the utmost value both administratively and scientifically, one feature of special importance being that such students have a knowledge of at least some native language, and



BY COURTESY OF (1, 2) LUNDBORG AND LINDER, "RACIAL CHARACTERISTICS OF THE SWEDISH NATION," (3-11) DR. GRIFFITH TAYLOR AND THE CLARENDON PRESS, OXFORD

SPECIMENS OF CERTAIN WELL DEFINED RACIAL TYPES

1. and 2. Profile and full face of a soldier from Sodermanband. Sweden, a Nordic type. 3. A Javanese woman of Malayan stock. 4. A Tonga woman of the Polynesian race, from the Friendly Islands. 5. A man of the Salish tribe of North American Indians. 6. A man of the Polynesian race, New Hebrides. 7. A man of the Malay race. 8. A Maori, native of New Zealand. 9. A man from Sumatra, in the Malay Archipelago. 10. An aboriginal of Australia, with copper skin and wavy hair. 11. A Sakai woman, an aboriginal of the Malay Peninsula

RACIAL TYPES OF ASIA, AFRICA AND AUSTRALIA

1. A negrito of Tasmania. Pure blooded Tasmanians are totally extinct. 2. A Semang negrito, an aboriginal of the Malay peninsula. 3. A Melanesian negro of the Fiji Islands. 4. (a and b). A Japanese of the Altai type. 5. (a and b). Australian aboriginal. 6. (a and b). Polynesian man from the Gilbert (Kingsmill) Islands. 7. (a and b). Bushman boy, from the deserts of South Africa. 8. (a and b). Two views of a native of Tierra del Fuego, South America. 9. Pygmy or negrito man and woman from the Ituri river, in Central Africa. 10. A Pariyan woman (Australoid) from Mysore, India. 11. A Melanesian negro from Buku, Solomon Islands. 12. A Melanesian negro from New Ireland

so are in a position to apply the technical knowledge they have gained directly on their return to Africa.

In France, the *Institut d'Ethnologie* and the *Facultés et Établissements Publics d'Enseignement Supérieur* of the University of Paris provide instruction in the various branches of ethnography and linguistics, having special regard to the French colonies. Instruction is given in the languages of the native populations of the French possessions, Arabic, Berber, the Sudanese languages, Malagasy, as well as the more important languages of the Far East, Siamese, Annamese and Cambodian. The social, family and religious organization of Islam and the social habits and religious beliefs of the natives of the French colonies are described and compared by a band of experts of European reputation. In Holland there is a special faculty embracing ethnology, custom and law of the East Indies, Netherland law, Colonial economics, etc., in the Universities of Leyden and of Utrecht. Every candidate for the Colonial Civil Service must pass a preliminary and a doctoral (*doctorandus*) examination, after which he may become a full "Doctor" on presenting a thesis. In Austria, instruction in languages and, to a lesser degree, in ethnology, is given to missionaries at the Missionary college of St. Gabriel, near Vienna.

Professional Anthropologists. — The appointment of professional anthropologists stands on a different footing. No arguments need be employed in favour of their administrative and scientific value. The ordinary official has neither the leisure nor the training, even if he has the desire, to make intensive investigations, and as time goes on and means of communication improve, and his journeys take place increasingly by car, he will have less and less opportunity of meeting his people unofficially and studying them at first hand. A further difficulty that stands in the way of the administrative official is that the native knows that his attitude to many customs such as human sacrifice, cannibalism and black magic must be hostile, and however sympathetic he may be he is still regarded as the man in authority. The anthropologist stays at native villages remote from government headquarters, and, once he has been able to gain the confidence of the people and let them know that his only object is to learn, one of the chief obstacles to obtaining reliable information will be removed. Anthropology as a profession presents a vicious circle. There are few men ready to become government anthropologists, though the machinery for training them exists at our unirersities. Men are not trained because there are no prospects; and then, when opportunities offer, there are insufficient candidates available. Should it be possible to anticipate a regular demand the, men would soon be forthcoming.

Encouragement to anthropological research has been given by the Sudan Government; the Gold Coast and Nigeria have appointed as anthropologists officers who had qualified by taking courses in anthropology. There is a trained government anthropologist in Papua, and chairs in Anthropology have been founded in the Union of South Africa and at Sydney, where special training is provided for administrative officers in Papua. Such action shows the trend of enlightened opinion, but the advantages that anthropological knowledge offers are appreciated only in minute proportion in comparison with needs and opportunities. All governments have their experts in geology, botany, agriculture and zoology in its many branches; it is a strange paradox that so often man alone should be unstudied.

PHYSICAL

It may be useful to recall the old saying, "God made the white man, God made the black man, but the devil made the mulatto," if only to consider how far this proverb embodies a truth, and, if it does, how the facts are to be faced in practice. There arc broadly two types of racial combination. In the first, the races coming together are so far apart as to make hybridization a real breaking down of the inherent characters of each, while in the second the fewer differences present offer only a moderate variability as a basis for recombination and selection which may be desirable. This latter type, socially constituting the "melting pot," is perhaps best represented in history, and can best be appreciated anthropologically, by a study of the *Völkerwanderungen,* with the broad result that an outburst of vigour and capacity is found tc follow the mixture of peoples belonging to the same great racial groups. From the political standpoint this form of miscegenation has become of increased significance since the opening of the 20th century, but its importance from the standpoint of applied anthropology is in our present state of knowledge relatively limited.

Widely Divergent Unions. — In considering the interbreeding of widely divergent races it must be realized that the above proverb is intended to apply to moral values, and that the children of such unions are almost invariably relegated to the inferior race (in practice, the mother's) for their upbringing, and so are socially and morally at a grave disadvantage, except where a sufficient number of mixed marriages occur, when a hybrid community, with its own social habits and values, is established, allowing a fair estimate to be formed of the physical and mental qualities of its members. The only all-round study of such a community is that of Prof. Eugen Fischer of the Reheboth community of south-west Africa (*Die Reheboth Bastards und das Bastardierungsproblem beim Menschen* [Jena, 1913]). This consists of the descendants, some 150 in number, through five or more generations, of the hybrid offspring of a group of trek Boers and Hottentot women, and includes the offspring of a number of unions with members of the parent races. The genealogies are not always easy to follow, but the Reheboth Bastaards show extreme variability, and are divided into "European," "Hottentot" and "Intermediate" groups. They are a strong, healthy and fruitful people, taller than either parent race, *i.e.,* they show a common indication of hybrid vigour. Physically there is no predominance of heritage from either race, but the inheritance of facial characters and colour is described as alternate, and in spite of the three groups there is no special tendency for the inheritance of groups of characters the unit elements of which are combined in either parent race. Psychologically the most important observation is that the Hottentot mentality predominates; there is neither European energy nor steadfastness of will. Further, though several subjects show a fairly high degree of intelligence, the Bastaards live entirely in the present; they are typically *Augenblickmenschen,* while this character is not compensated by any special power of imagination or proficiency in the arts and crafts, in which they are distinctly weak.

Other Groups. — As instances of other hybrid groups, with their own adequate social organization, certain Arab tribes of the Sudan carrying much black blood, the mixed European-Chinese population of the Straits Settlements, and the negro-Amerind hybrid population of Guiana may be added. Owing to lack of precise knowledge of the building up of these groups little of importance can be said on the physical side, for terms having no precise connotation are used; *e.g.,* it is obvious that there is a vast difference genetically and socially between the tall dolichocephalic Dinka and the short mesaticephals of the Bahr-el-Ghazal, though both would be classed as "negro" by Arabs and Europeans; while with regard to the Arab stocks there can be no certainty whether any particular strain carries Armenoid blood. The members of these tribes appear to have adapted themselves admirably to their mode of life, which is predominantly Arab, socially, economically and religiously, and the majority of individuals appear to present an intermediate type with regard to two of the most easily observed characters, namely skin colour and breadth of nose, though striking individual variations occur, *e.g.,* a "black" skin may be associated with a face and nose almost typically Caucasian. Further, darkness of skin tends to be predominant, and there are certain families in which this tendency is so marked that it would perhaps be fair to speak of these as exhibiting dominance in the true Mendelian sense. Mentally and morally these tribes are Arab, not negro; thus socially and morally the inferior stock may be said to have been improved by the mixture. How far the Arab has suffered must remain an open question, and whether the improvement may not be in part due to the direct influence of Islam. The reconquests of the Sudan demonstrated the truth of an observation made years before in Arabia by Robertson Smith, namely that not the pure Arab but the mixed Arab-negro population exhibits the quaiity of religious fanaticism.

In both the other two examples quoted, whatever the physical

differences between the races concerned, they stand on equal or more nearly equal level. The mental and physical alertness of the mixed Chinese-White population of Singapore is striking, and they form a definite social class furnishing many highly efficient civil servants and clerks. Generally, Mongolian traits of feature predominate and it appears that the Mongolian eye, at least in the F.I. generation, is dominant, as it is in Malay-Melanesian matings observed in New Guinea. It may indeed be found that Mongolian-White matings give particularly interesting, and perhaps desirable, combinations. In one Japanese-White marriage the children (all female) exhibited a high degree of hybrid vigour, considerable artistic ability, and in type approximated to Polynesian; unfortunately, they passed out of observation before maturity, and it can be stated as a matter of experience that five other children, the result of two Japanese-White matings, did not reproduce this type.

With regard to the negro-Amerind mixture of Guiana, there seems no doubt that a definite type has been produced which has largely taken to a special mode of life as boatmen on the rivers. for which it is well fitted, and that this hybrid population exhibits much of the physical efficiency of the negro without his laziness and excitability. For books on the subject see the Bibliography to the article ANTHROPOLOGY and the works quoted in the text, *The* Clash of Culture (Pitt-Rivers) being specially important.

(C. G. S.)

ANTHROPOMETRY. Anthropological science aims at the establishment of man's position in nature, the discovery of the extent of human variation, the ordination of the fundamental facts concerning the growth of the individual, and the bearing on human evolution of the evidence drawn from comparisons of the existing human types with one another, or of each in turn with their prehistoric precursors. Such enterprises entail both the collection and the apportionment of evidence. And when comparisons have to be made, the advantages of numerical modes of expression over those which are purely descriptive are manifest.

NUMERICAL DATA IN SCIENTIFIC STUDIES

The measuring rod and the balance, instruments of precision, exemplify the means of collecting quantitative data, the foundations of much of the superstructure of modern science. But in the domain of biology the very texture of living matter seems opposed to exact measurement. To this obstacle there must be added that which is set up by the unceasing metabolic mutability of protoplasm. Some there are who plead for the freedom of biological research from adverse criticism should rigid numerical methods be discarded in its prosecution. Anthropometry constitutes one of the testing-grounds of those methods.

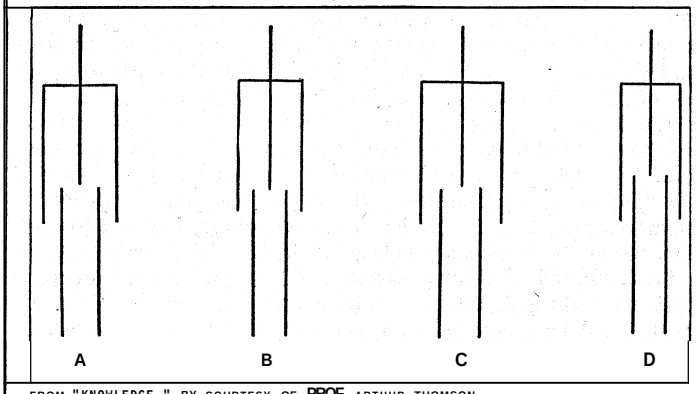
The history of anthropometry is retraceable far backwards in time. From the very dawn of graphic representation in the historic period, it has claimed the notice of artists. These, though they may not have collected data with scientific precision, or on a definitely systematic basis, can claim credit for attempts to interpret the various details they observed. But the scientific treatment of data representative of measurements based on a predetermined scheme, and collected systematically and consistently, is a matter of comparatively recent development. Anthropometry is still far from maturity. The measurements, the instruments of research, the methods of interpretation, all alike are subject to periodical revision, with a view to the correction of errors.

The numerical data of anthropometry are evidently susceptible to investigation statistically, although their range of distribution (in other words, their diversity) is notoriously great, as may be remarked in the variations of stature and weight among the individual members of an adult population.

Quetelet.—But the whole subject of anthropometrical research is influenced, if not actually governed, by the consideration that in spite of apparent irregularity the variations exhibit a distribution conforming to a rule termed the Law of Frequency of Error. This law "was excogitated for the use of astronomers and others who are concerned with extreme accuracy of measurement, and without the slightest idea, until the time of Quetelet (1833), that it might be applicable to human measures." The achievement has proved to include not merely anthropometric records but biological data of many kinds. Quetelet himself stated: —

"Should the type be absent, and should men differ not by reason of accidental causes but because there were no laws really applicable to them, one could measure them, as, for instance, in respect of stature, but without finding that the various individual measurements presented any particular characteristic, or any definite numerical relations.

"If, on the contrary, all human beings have been cast in the same mould, whence they have emerged with purely accidental



FROM "KNOWLEDGE," BY COURTESY OF PROF. ARTHUR THOMSON

FIG. 1.— AVERAGE BODILY PROPORTIONS OF ADULT MALES
From left to right: A. Labrador Eskimo; B. Anglo-Saxon; C. African Negro; D. Australian Aborigine. The reduction to the same standard height brings out contrasts in other dimensions, especially in respect to shoulder breadth

differences, then the groups will not be formed as above in disorderly fashion, but their numerical values obeying the theory of probabilities will be subject to pre-established laws so completely that the numbers representative of the several groups could be predicted in advance. For this particular instance, then, there exists a characteristic feature by means of which one realizes that the individuals are referable to the same type, and that their differences are assignable to fortuitous causes only.

"Another consequence of this theory is that the larger the number of observations the more completely do the effects of the fortuitous causes cancel each other, thus permitting of the predominance of the general type which they tended to mask previously. Thus in the human species, and having regard to individuals only, all varieties of stature are met with, at least within certain limits. Those nearest the average figure are the most numerous; those which are furthest removed from the average are the least frequent: and the several groups succeed each other in numerical sequence according to a law capable of formulation in advance. (In data found to be ordinated nearly in accord with this law, the aggregation near the median is so great that a comparatively small number of individuals will provide a sample serving to give reliable information. Beyond this number, increase in the total number does not give much greater reliability to the result.)

"Now this law holds good for mankind, not merely in regard to stature in its entirety, but in respect of its several components: the same applies to records of weight, to those of physical strength, and, in short, to any character that is measurable and reducible to numerical expression. . . .

"This discovery of the applicability of the law of accidental causes to human phenomena, no matter from what point of view humanity is regarded, is now a fact firmly established in science. I consider its correctness proved by the large number of instances available. . . ."

Quetelet illustrated regularity in gradation by reference to the distribution of stature in adult males, selecting for this purpose data provided by no fewer than 10,000 individuals. When these are ordinated according to the gradual increase of their stature, the arrangement is found to be capable of graphic representation by a curve. The curve assigned by Quetelet (and shown on p. 17 of his memoir) corresponds to that known as the curve of frequency of error (an alternative name is "normal probability curve"). It is symmetrical and unlimited in either direction.

As to the course of growth in stature from infancy to maturity Quetelet states that from the age of five years to about 15 years, the annual increments of growth are regular. This conclusion seems generally to have been accepted, and even now the sequence of records taken at intervals of a year does not serve to modify it. But the true progress of growth to maturity is not revealed unless the records are repeated more frequently. The lapse of so long as 12 months actually masks the important alternatives of periods of greater activity with others of relative relaxation. Quetelet himself was aware of variability in the rate of growth, and he agrees that in the development of a particular individual there present themselves almost invariably periods of arrest as well as those in which growth is more or less rapid. But Quetelet deprecated laying stress upon such varying rates of progress, and herein he failed to realize the full meaning of his data. The real significance of these alternations is that the regularity with which they succeed each other constitutes a characteristic feature of growth-changes. The realization of this detail will probably prove to have a very practical economic application.

Galton's Work.—The work of Francis Galton extends and expands that of his precursor. Galton was interested from the first in the problems of heredity. Both researchers soon realized the need for collecting reliable and suitable data on a large scale, and both turned their attention to the phenomena of human growth from infancy to maturity, and, discontented with physical measurements only, both brought physiological and intellectual manifestations within the domain of measurement.

Galton's outlook on the variability exhibited by the individuals of a human society is well expressed in his Herbert Spencer lecture where he likens such variability to Proteus in the old fable, in that it can be "seized, securely bound and utilized." As comment on the accuracy of the application of the law of frequency to the particular example of human stature he observed that "the statistical variations of stature are extremely regular, so much so that their general conformity with the results of calculations based on the abstract law of frequency of error is an accepted fact by anthropologists." (British Association for the Advancement of Science. Report 1885. Presidential Address Section H. p. 1209.) Nevertheless not all human measurements give such close approximation to theory as those of stature do. The theory seemed, in fact, to be limited in its range, and Galton propounded a means of bringing some of the aberrant instances within the scope of the latter. He subjected all parts of his data and methods to a keen scrutiny. His most important and more particularly personal contributions can be summed up in the words "regression" and "correlation." Regression is a feature of populations and has reference to the fact that, on the whole, the (adult) offspring must be more mediocre than their parents. Galton illustrated regression by reference to the stature of the (adult) offspring compared with that of the parents. and succeeded in measuring the amount of regression. At first he was concerned to compare the stature of a generation of parents with that of the succeeding offspring. Subsequently he extended the scope of the investigation, and published the results of studies in which the offspring were compared (inter se).

Galton discovered that the amount of regression was remarkably constant in certain instances. Taking stature as the test and comparing the "mid-filial" deviation from the average with the "mid-parental" deviation, he found that the former was on the average two-thirds of the latter. And two-thirds consequently represents the ratio of "filial regression."

Three important points emerge here. In the first place, the ratio, measuring the deviation of offspring as compared with that of parent, might be used as a test of evolution, or at least of progress. For if it were repeated in successive generations, and found to vary, the inference of progress would be quite reasonable.

In the second place, this discovery marks a stage in the construction of a theory of ancestral contributions in heredity, and the evidence of the stature was considered to indicate the similarity of the successive contributions to a series in which the terms were $\frac{1}{2}$..., $\frac{1}{4}$..., $\frac{1}{16}$.., each ancestor making a contribution however small. This is one of the aspects of anthropology in which the work of Galton stands confronted with that of Mendel, since in the light of Mendelian research certain ancestors may contribute nothing at all. (There is, in fact, on p. 13 j of Natural Inheritance, a remarkable instance of inheritance, which is possibly an example of the operation of Mendelian laws.)

The third point arises in connection with the extension of the comparisons in which evidence of regression might be manifest At first the term was used to denote the relative degree of abnormality of parent and offspring. But in the guise of correlation the term acquired a much wider significance and the extensions constitute what is perhaps the most conspicuous landmark in Galton's life-work. In the words of Karl Pearson "Galton created the subject of Correlation," and again, "Galton, starting from the organic relationship between parent and offspring . . . passed to the idea of a coefficient measuring the correlation of all pairs of organs, and thence to the organic relationship of all sorts of factors." The importance of the achievement is unquestioned, even though there be reservation of opinion as to the precise formulae to be employed. And the practical side of the study of correlation in human measures may be illustrated as follows. There is very general agreement as to the influence of such factors as (1) Heredity and (2) Environment on the final constitution of the individual. As to the relative magnitude of the parts played by these factors, no opinion is possible until shares are assigned in just, *i.e.,* in real proportion. But again, no division of responsibility can be satisfactory until expressions of number and quantity are available 'for use. And the index of correlation (even if its probable error has to be appended) sums up in itself the process of attempted measurement. Finally the progress of evolution itself may ultimately prove capable of expression in terms of a particular coefficient of correlation.

Karl Pearson.—The pages of *Biometrika* edited by Prof. Karl Pearson, constitute a massive literary memorial of Galton. In an early study (1897), before the appearance of Biometrika, Prof. Pearson investigated the variability of the two sexes in respect of their skulls, demonstrated the application of scientific methods of measuring the degree of variability manifested in different series of skulls, and brought under consideration skulls of both sexes from all parts of the world, and of prehistoric antiquity as well as of modern date. He assumed that variations constitute the raw material of the process of evolution. He found that although he was unable to point to a measure of variation really significant of progressive evolution, nevertheless the coefficient of variation employed in his research indicated little or no excess of variability in either sex over the other. His data point to a greater variability of the races of modern times, so that their structural details are still providing opportunities for further modifications should the process of evolution lay them under contribution. The contributions to Biometrika include the refinement of measures of variability and of degrees of correlation, and tests applicable to curves representing the distribution of measured characters, such as provide a means of gauging the significance of two or more peaks of frequency on a given curve. Where the curve in question represents the distribution of some particular character (such as stature) in a population, the tendency to infer the co-existence of as many distinct "elements" in the population as there are distinct peaks on the curve, is strong and reasonable, but justifiable only if confirmed by an appropriate test. The admixture of elements, whether "racial," or other is not the only possible explanation of the occurrence. The alternatives include the possibilities (a) that the total number of records available is inadequate, (b) that individuals of the two sexes are mingled in the same group, and (c) that individuals of different ages are aggregated therein. These evidently demand close scrutiny.

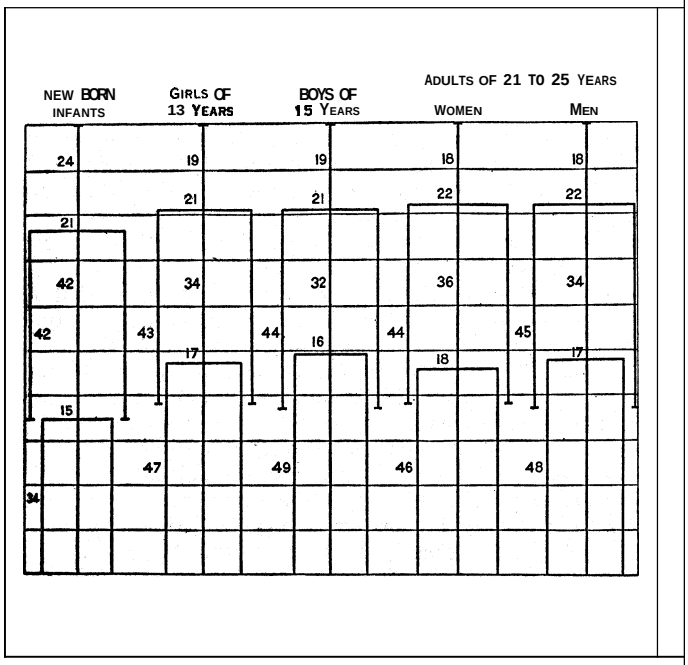
With the progress of statistical research the instruments mill be improved or even replaced, and the existing methods will be regarded as no longer adequate. Already the very premises of Prof. Pearson, regarding the extent to which statistical methods are strictly applicable to the elucidation of biological data, have been called in question.

APPLICATIONS OF ANTHROPOMETRY

One of the earliest statistical accounts of the physique of children employed in factories appeared in 1833, containing observations made at Manchester and Stockport. Records are given of the stature and weight of 1,492 boys and girls. Out of that number 1,062 were engaged in factories, although some of the children were only nine years old. The factory hands exhibit inferiority both of height and weight, but the inferiority is not marked until the 16th year in respect of height and the 14th in respect of weight.

Nearly 75 years later a similar contrast was established when "neglected" boys were compared with those of the whole community employed as "controls." The contrast is much more definite at 13 to 14 years of age than at five to six years; but it does not apply quite equally to both sexes, for though the girls exhibit the contrast in more marked degree than the boys at the earlier stage, they are not as sharply contrasted at the later age.

Child-life in Scotland. — An exhaustive investigation into the child-life of urban and rural districts, carried out under the general supervision of the Scottish committee for child-life investigation and the particular direction of Prof. Noel Paton, and published in 1926, contains a wealth of statistical data. Anthropometric observations lead to the conclusion that "up to between the first and second years the child of the agricultural labourer is on the average apparently growing more quickly than the urban child. After this, there is a striking parallelism" (p. 101). Again (p. 104), "while there is apparently some delay in the rate of growth of the average town child between birth and 18 months, after that date the growth proceeds as rapidly in the town as in the country child." Chart IX. where "urban" boys (Glasgow) are compared with "rural" boys (Forfarshire, Island of Lewis, Ayrshire), shows that the stature of the urban boys is consistently lower than that of rural boys in the period under observation (5 to 15 years).



FROM "DER MENSCH ALLER ZEITEN," BY COURTESY OF JOSEF HABBEL

FIG. 2 — THE PROPORTIONS OF PARTS IN BOTH SEXES FROM BIRTH TO MATURITY. THE STATURE IN EACH CASE BEING REPRESENTED AS 100
The figures show the increase in some parts accompanied by relative decrease in others. It is of interest to notice that the lower limbs attain their greatest relative length before the maximum stature is reached and earlier in the female (13 yrs.) than in the male (15 yrs.)

Instead of parallel lines of development it shows a divergence indicative of a temporary arrest of growth in the "urban" boys from 10 to 12 years of age. This arrest interrupts the parallelism which would otherwise exist, and though the years of incidence do not tally exactly, this interruption recalls the contrast disclosed by Greenwood's comparison of "neglected" boys of 13 to 14 years of age with the general stock at that age. In the Scottish investigations the "urban" girls exhibit the same sort of contrast with the "rural" girls as do the two groups of boys; but in the girls the divergence appears rather earlier. In respect of weight, the indication of a corresponding contrast is not altogether lacking, but is much less distinct than in regard to stature. Where the "deviation" occurs, an indication exists of a temporary arrest of growth-activity. Such a temporary arrest implies a periodic alternation of an active with a resting phase; and that such periodicity actually obtains, seems to have been fairly proved.

Munich Children. — Observations of large numbers of the school children at Munich were repeated over a series of years with somewhat fluctuating results. It appeared that the measures actually recorded (of stature and of weight respectively) manifested first (as in 1921) a reduction when compared with the data for years previous to 1914. Then, in 1924, the children who in that year attained the age of eight exceeded in stature those who reached that age a year previously by as much as 3·2mm. (2.64%) for boys, and 2.8 (2·34%) for girls. The respective weights showed a corresponding contrast. Prof. Rudolf Martin noted the improvement in physique thus revealed in the year 1924, and attributed this amelioration to improvements in the conditions of life at Munich. Anthropometry thus provided the data, and a correct interpretation is particularly important in view of the political bearing of the results announced in this investigation.

In a second research made by Prof. Martin, the children of "school age" at Munich were again the subjects of investigation, and on this occasion were compared with those of corresponding age at Chicago. For each of the ages represented by the years 6, 7, 8 . . . 13, the Bavarian children (Munich) fell short of the American children in respect of stature and of weight. Likewise, in each of the eight years in question save the first, the American children showed an extension of variation beyond the uppermost limit of the Munich children.

Physical Types and Disease. — The relation of disease to the physical conformation of the patient has been investigated by many authorities, among whom Dr. Shrubsall, in 1904, published evidence that different types make different contributions to the sum of inmates of a general hospital. The association of disease with physical type was shown to be more definite in respect of complexion (the blonde and brunette types respectively) than of a more definitely measurable character such as stature. Nevertheless, there is an association of blondness or brunette-ness with correspondingly contrasted varieties of stature, so that the relation of disease to stature is not negligible. Dr. Shrubsall laid stress on indications that the conditions of life in respect of hygiene exercise a sort of selection of particular types to the disadvantage of one and the advantage of another. He added that "to determine whether these phenomena are peculiar to London, or even true, for I have only been able to make some 50,000 observations, an anthropometric survey of the whole country is imperative, and its results would doubtless serve as a basis for any measures of public hygiene which might serve to restore the balance of power, should it be found wanting." That survey has still to be made.

Evidently the extension of such investigations would introduce anthropometric methods into the preparation of data eventually illustrating the significance of the death-rate in various regions. As regards expectation of life, the influences of profession and occupation are acknowledged already; nevertheless the reminder (p. 196) that morbidity is much greater than mortality is very apposite here.

Davenport has employed anthropometric data to distinguish various types of conformation which he terms "build." He devised an index based upon the factors of (*a*) weight and (*b*) stature conjointly, and he found that this index could be used to denote the characteristic "build" of a particular individual He proceeded to study the association of the various types of "build" with diseases, and the observations relate to juvenile as well as adult subjects. The results confirm a popular impression They exhibit prevalence of respiratory diseases in the class of individuals described as "slender" (with an index of "build" averaging 28).

Vascular troubles afflict more usually the very "fleshy" individuals, whose mean or average index of build works out at 48. The data collected by Davenport and his colleagues indicate that "fleshy" individuals prove more prolific than those of "slender" build. Moreover, the character or quality of fleshiness seems slightly to dominate that of slenderness in inheritance.

A more circumscribed type of enquiry involving the use of anthropometric data in the investigation of disease is exemplified in a report by Dr. Berry and Mr. Porteus, who investigated the dimensions of the head in mentally defective children, and in order to secure the means of comparison, carried out a most extensive survey of normal individuals, including school children, university students, and aged persons, to the number of over 6,000. The research was conducted in Australia, and as an interesting, but entirely accessory "control", about 60 aborigines were also measured. In reporting on the data, the authors admit that they can only consider the marked deviations from the normal as possessing diagnostic value, so effective are the sources of error. With this reservation (and their claims are not invalidated by the statement made by Prof. Karl Pearson in *Biometrika,* vol. v. p. 105, as to the low degree of correlation between head-measurements and intelligence), they claim that the volume of the brain, calculated from the dimensions of the head as actually measured, differs significantly in the mentally defective from what it is in the normal groups of corresponding age used for purposes of control. Not only so, but besides these mentally defective children, the deaf and dumb children subjected to investigation, as well as the reformatory inmates and the aboriginal natives, all fail to present evidence of brains of the volume shown by the controls to be appropriate to comparable individuals of normal intelligence. The data illustrate these conclusions. The volume of the brain expressed in cubic centimetres, was estimated, and average values for several groups of boys or youths provided a sequence that may be represented as follows:

	cu. cm.
Mentally defective boys at 13 years	1,292
Deaf and dumb boys at 13 years	1,307
Normal public school boys at 13 years	1,352
Reformatory youths at 20 years	1,344
Normal youths at 20 years	1,483

A detail brought out rather strikingly in the preparation of the normal data for use is the definite transient phase of arrest which appears at least twice in the progress of brain-growth to its full amount. These periods of arrest affect the brain in boys and girls alike, and in the same years, namely from 11 to 12 and again from 13 to 14. In the girl a third resting stage is indicated more definite than either of those which precede it, and distinctive of the years from 16 to 18. Subsequently the female brain completes its growth to the extent of 2% of the whole amount. The calculation of the volume of the brain involved the use of a formula which had been worked by Dr. Lee under the supervision of Prof. Karl Pearson.

Dietary **Investigations.**—A memoir was published by Dr. Corry Mann in 1926 on the acquisition of "a numerical value for a basic diet, of poor quality, but adequate physiological value, in terms of nutrition, and to assess, similarly, the value of certain items of food when these are supplied as additional rations to such a basic diet." Anthropometric data (of stature and weight) were employed, for frequent records were made of weight and height. Boys of school age, with a low rate of sickness, living in an institution near London, were the subjects of the investigation. Sixty-one boys who received only the basic diet gained an average of 3·85 lb. per boy and grew an average of 1·84in. per boy during 12 months. Forty-one boys who received in addition to the basic diet a ration of fresh cow's milk, pasteurized and homogenized, one pint, 388 calories daily. gained an average of 6.98 lb. per boy and grew an average of 2·63in. per boy during 12 months. The relative values of several diets, as measured by gains of height and weight, are exhibited graphically in figs. 3 and 4 of the reports. Besides illustrating the predominant effects of milk, these figures bring out a curious point in regard to the effects of (a) watercress and (b) casein when added to the basic diet. The effect on weight is very definite and indeed considerable when water-cress is introduced, but the effect on stature is negligible. (The actual numerical data would by themselves suggest that water-cress is deterrent to the attainment of the stature that would take place in its absence. But this conclusion should not be drawn without close scrutiny of the figures. The influence of a "random sampling" may be accountable, and the more probable conclusion is that the effect of water-cress is negligible in respect of stature.) Casein in these experiments seems to produce no significant effect on either weight or stature, despite the very marked addition it provided to the amount of protein in the diet (almost doubling it) and to the number of calories (increased from 61 to 91).

The duration of the experiment, the number of individuals under observation, the number and minuteness of the analyses confer an exceptional importance upon Dr. Corry Mann's work. It affords guidance as to the fundamental requisites for such enquiries, including the necessity for exhaustive analyses of the diets employed.

Racial Characters.— In some of the preceding instances the element of "race" or "type" may evidently need consideration as a possible factor in determining diiferences detected by anthropometry in the survey of a population. Anthropoinetric methods must therefore be applied to the study of the several divisions of mankind, and the wider aspects of the subject include the prehistoric as well as the existing members of the Hominidae. Moreover, the scrutiny must be extended from mankind to the monkeys, and to any other animals whose general anatomical structure proclaims them nearly akin to these.

In a survey of what may be termed "Racial Anthropometry" the living subject and the absolute dimensions of the body evidently claim the first place; but from the first also regard must be had to the skeleton. The bones alone are available as the vehicle of information concerning prehistoric man; and the same is true of more than one recent type of humanity, *e.g.,* the Tasmanians, the Mori-ori and the Caribs, who have become extinct within the last few centuries, or even within the memory of persons still living.

Anthropometric observations of living persons include measurements of weight and of linear dimensions. The latter may bc rectilinear, as in the case of stature, or curvilinear, and two-sub-varieties, viz., arcs and circumferences, are to be distinguished as coming within the latter description. Linear measurements of diameters or circumferences provide the means of calculating volume or capacity, and finally angular measurements constitute a separate category which has representatives in nearly every scheme and schedule.

Range of Stature and Weight
(Extreme Instances)

Stature.				
	Males.		Females.	
	mm.	in.	mm	in.
Norwegian Lapps	1,523	59·7	1,450	57·2
Nilotic Sara tribe	1,817	71·02	1,676	66.2
Weight.				
	Males.		Females.	
	kgm.	lb.	kgm.	lb.
Bush natives	40·4	89·0	36·7	81·0
Iroquois Indians	73·8	162·6	no record	no record

The highest average weight recorded in Dr. Martin's list for females is that of south Russian Jemesses, and amounts to 63.5 kgm. (140 lb.). The erratic character of such data is shown by the fact that these women provide a greater average number than do the male south Russian Jews. This paradox is probably due to the greater obesity of the females. Among all human types individual variations are considerable, amounting among the Bush natives of South Africa to a range of from 30kgm. to jgkgm. in males and 30kgm. to 4 jkgm. in females.

Such examples exhibit an extraordinary range of diversity. Their study raises a fundamental question as to its significance, and that question still lacks a final answer. As to the local diversity of human stature, no doubt exists, and it is easy to proclaim the racial distinction of the Scandinavian from the Laplander, even though their territories lie adjacent the one to the other. Yet the gap can be bridged, and the intermediate examples are so numerous and so diverse as to establish a complete gradation between the extremes.

But the question remains, is mankind a single stock with an almost infinite number of sub-varieties, or are a limited number of fundamentally distinct types now linked together? The bonds of linkage would be such factors as admixture of types (with intermediate characters in the offspring of such matings), local conditions affecting growth favourably or the reverse, and other factors as yet imperfectly known. Kollmann postulated the original coexistence of certain distinct "types." But there is no demonstrative proof on either side. Against such "original diversity" the supporters of an "original unity" of human ancestry can still proffer their arguments, reopening the old problem of polygeny versus monogeny. This is so closely connected with the mode and precise path of human evolution from the immediately pre-human stages that its temporary loss of vogue as a subject of debate is bound to be succeeded by a renewal of interest. (See MONOGENISTS.)

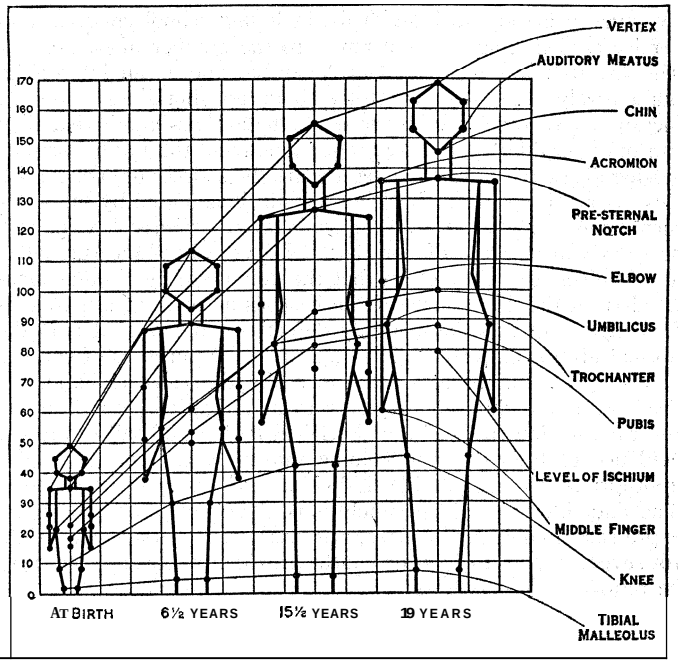
Although stature is naturally related to body-weight, the correlation of the two characters is not complete; the taller of two individuals need not necessarily be the heavier. Thus among the south Russian Jews, the women weigh on the average more than the men, though the men are notably taller (1,651mm. as against 1,536mm.). And again, the geographical distribution of those human beings who are at once among the tallest and heaviest of their kind is capricious. They preponderate in areas so widely separated as Scotland, Montenegro, Rajputana, Sumatra, the Marquesas islands and Patagonia, with African groups in the Bahr-el-Gaze1 and Zululand. The last-mentioned come, curiously enough, into close relation with a remnant of the pygmy Bush natives of South Africa. Again the tall men of Galloway are set off by the diminutive weavers of Spitalfields, the interval separating them being almost equal to that of the extremes provided by the whole range of humanity. But the range of pygmies is almost equally extensive and as certainly interrupted and discontinuous. To the pygmies of the Kalahari desert in South Africa there succeed those of the Congo State; but other representatives of pygmy size are found in Lapland, the Andaman islands, the Malay peninsula, the Philippine islands and New Guinea. Latitude and longitude alike seem devoid of relation to such apparently fortuitous dispersals. (See PYGMY, and the appropriate sections in the articles on the places named.)

	Average stature	Average weight
Zulus (men)	172 (approx.)	?
Bush natives (men) . . .	155 (approx.)	89 lb.
Galloway (men)	179 (appro.;.)	173 lb.
Spitalfields (men)	155 (approx.)	100 lb.

But even if it be admitted that the measure of stature is not a sure indicator of body-weight, yet the taller individuals seem on an average to possess heavier brains.

Prehistoric Man.—In the present connection, the stature and bulk of the prehistoric representatives of humanity claim attention. The evidence comes necessarily from the skeleton, and consequently estimates of body-weight are very liable to error in determination. Kor are estimates of stature derived from the bones by any means free from this drawback. Where skeletons have been found intact and extended "at length," direct measurements have been sometimes practicable as the specimen lay exposed to observation, and before it was disturbed in any other way. Such a measurement will differ notably from the stature of the individual in life; yet it will evidently furnish a useful control of estimates based upon the measurements of separate bones and the employment of formulae devised for the purpose of reconstructing stature from such measurements.

Calculation is the only method available when the remains are fragmentary. Imperfections in the limb-bones will necessarily be detrimental to an estimate of stature based on their dimensions, and certain corrections have to be made, *e.g.*, according to the sex of the skeleton. Should the estimate have to be made from the femoral length, it seems an easy proceeding, in view of the statement at one time current that the femoral length is 25% of the stature; but this rule needs amendment if the length of the femur is markedly above, or below the average. Correction will be needed if the bone is part of the skeleton of a negro and not of European



BY COURTESY OF THE CAMBRIDGE PHILOSOPHICAL SOCIETY

FIG. 3.— DIAGRAMMATIC REPRESENTATION OF INCREASE IN STATURE, IN CENTIMETRES. FROM BIRTH TO MANHOOD. 19 YEARS

The rate of growth is greatest in the first 6½ years, when the stature is approximately doubled

origin; and until evidence is adduced to the contrary, the need for correction must be assumed if the skeleton is of prehistoric antiquity and not modern. In the case of prehistoric Europeans, the amount of the addition or subtraction may, however, be assumed to be very moderate. Thus by the employment of suitable formulae, a fairly close estimate of stature can be made upon data provided by single bones.

To judge by such skeletons as have been recorded so far, the stature of prehistoric man was by no means uniform, and in general it presents little difference from that of the modern inhabitants of the same areas. Examples of the extremes of variation present themselves in the skeleton from Cro-Magnon, for despite the advanced age assigned to this individual, he is supposed to have measured 1,820mm. in height (Boule), while at the other end of the scale the skeleton from Chancelade of comparable antiquity denotes a stature of 1,550mm. only (Boule). Comparison with the range of averages quoted above for modern men is not justifiable, and yet the diversity of stature in prehistoric times is rendered sufficiently evident. Both these examples (Cro-Magnon and Chancelade) represent mankind in the so-called Palaeolithic period, and from the same period there are forthcoming other individuals so characterized as to fall between the two just mentioned in respect of stature. These data can be tabulated as follows:—

1. Les Eyzies. Old man of Cro-Magnon
   (Upper Palaeolithic)
   Boule's estimate of stature, 1,820mm.
   Manouvrier's estimate of the same, 1,736mm.
2. Man of the Neanderthal
   (Middle Palaeolithic)
   Pearson's estimate of stature, 1,629mm.

3. Man of Chancelade
(Contemporary with Cro-Magnon)
Rahon's estimate of stature, 1,592mm.
Testut's estimate of stature, 1,550mm.

In dimensions, at least, the man of the Palaeolithic period does not support the view that in prehistoric times primitive brutality was associated with gigantic bulk. Even beyond the confines of Europe, the prehistoric Rhodesian man with a stature of 1,830mm., tall though he may have been, does not notably exceed individuals among the existing inhabitants of the region. In China, again, the precursors of the modern inhabitants of Fengtien and Honan in the Aeneolithic period show no very outstanding difference in point of stature from the existing inhabitants.

Body Ratios. — The stature of mankind is related to the body-weight sufficiently closely to serve as a means of estimating the latter; and in view of the possibility of forming an estimate of the brain-weight from the dimensions of the skull, it appears that if there be available from a skeleton the skull and one of the thigh-bones these remnants suffice for making these two estimates. (The thigh-bone can be used in estimating first the stature, and subsequently the body-weight of the individual.) The ratio of brain-weight to body-weight has been termed the index of cephnlization. Its value. is approximate to $\frac{1}{50}$ in normal healthy adult men. This may be taken as a distinctive human character with which to compare the ratio exhibited by an adult male gorilla, viz., $\frac{1}{200}$. Estimates based on the dimensions of the appropriate parts of prehistoric human skeletons present no startling contrasts with such as modern humanity provides. An exceptionally interesting index is that derived from the skull-cap and the femur of the Javanese fossil *Pithecanthropus erectus,* for the value assigned to the index is in this instance $\frac{1}{70}$, and it assigns to the fossil form a place intermediate between mankind and the higher apes. Thus the values of the ratio of brain-weight to body-weight are: — (I) Normal adult man, $\frac{1}{50}$; (2) *Pithecanthropus erectus* (Java), $\frac{1}{70}$; *(3)* Hylobates, small anthropoid ape, $\frac{1}{90}$; (4) Gorilla, large anthropoid ape, $\frac{1}{200}$.

The numerical value of the human ratio testifies to the abundant provisioa of brain-material in mankind as compared even with closely allied mammals. But the ratio or index presents such a wide range of value in various animals as to require comment. Thus, for instance, the human figure $\frac{1}{50}$, though well in advance of that for the gorilla, does not actually head the Iist. In this respect man falls behind many birds. At the other end of the scale come gigantic animals such as the hippopotamus, the whale and certain fishes. Some correction is thus seen to be necessary, and among the more obvious factors that of absolute size is evidently important. The birds most favourably placed (index about $\frac{1}{35}$) are small, *e.g.,* small finches. For a whale there has been calculated an index represented by $\frac{1}{14,000}$ (Wilder). The same influence is manifestly active during the lifetime of the human individual, for as an infant he owns at birth the "superhuman" ratio of $\frac{1}{6}$. Allowance for absolute dimensions must needs be made before any inference regarding cerebral endowment can be drawn from the figures; and in the above instances the human being, the Javanese Pithecanthropus and the gorilla are in this respect comparable, while the small anthropoid ape represents the general standard for such apes handicapped as generously as possible, by reason of the relatively diminutive size of this particular species. Even so, it fails to attain the human standard.

The "Canon" Error. — A fundamental error underlies many "systems of proportion," namely the assumption that a particular part of the body bears precise numerical relations to all the rest. Such an assumption is almost universal in artistic schemes, and is, in fact, implicit in the selection of many units or moduli, such as the finger, the foot, the cubit, the head or the vertebral column. That this matter should be disposed of once and for all is the more important since a definite "canon" is still commended as the basis of the comparison of one human type with another, an application wholly to be condemned. According to Duval, the works of the ancient sculptors present precisely the same variations as are met with in nature. In fact the rule was by no means obeyed by all or in every detail, and freedom from slavery to an artificial system resulted in the production of contrasted forms. Some of these are still in existence, so that contrasts can be drawn between such examples as the Running Fighter (Louvre) and the Antinous.

The anthropometric method of investigation recognizes no authority in the shape of a modulus or canon. The latter is the outcome of an assumption that remains unproved. In this respect, it invites comparison with the theoretical "archetype," a concept in morphological anatomy which enjoyed a transient vogue in the 18th and part of the 19th centuries.

Standards Required. — But while recognition of a pre-determined form of representation is refused, this does not imply rejection of all forms of representation. Anthropology willingly recognizes a standard of proportion which is the outcome of actual observations, and represents the mean of measurements made on many individuals with unvarying precision. Such a standard is indispensable when human beings are being compared with each other, or even when the human form is brought into account with those of the higher apes; and in certain instances the standard may usefully take the rigid form of what mechanics colloquially term a "jig." Thus Dr. Percy Stocks (Annual Report of the Chief Medical Officer of the Board of Education, 1936, p. 105), reporting on "Goitre in the English School-child," recommends the employment of a "standard gauge" for thyroid-breadth. By its use, the number and proportionate frequency may be learned of those children possessed of a thyroid gland exceeding the standard breadth of 42mm.

Schematic Representation. — In the accompanying figures (1 and 2) there will be observed indications of the respective lengths and widths of particular parts of the body. The stature of all is reduced to a common measure so that contrasts in the relative proportion of parts may be facilitated. For the construction of such diagrams, particular measurements, of which a list is appended, were made on a number of individuals. And from the collected data, certain averages or mean values have been derived.

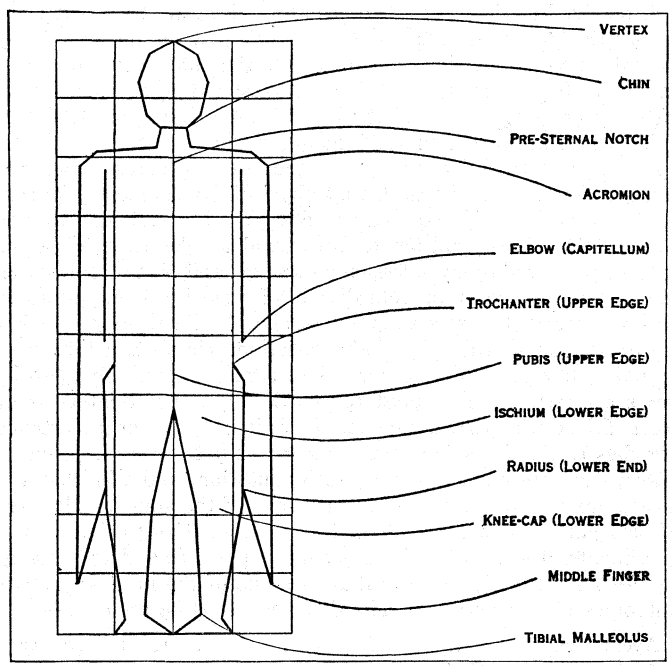


FIG. 4. — SCHEMATIC OUTLINE OF ANTHROPOID APE (GORILLA)
The stature being taken as 100, the other parts are represented proportionately and show contrasts with the corresponding parts of the human figure outlined in preceding illustrations

Comparisons and contrasts need consideration in respect of the male and female (fig. 2); next in turn the immature stages call for consideration (fig. 3); and finally there are added schematic outlines of an anthropoid ape (fig. 4) depicted in the same way as the foregoing figures. The contrast between the newly born infant and the adult in respect of the proportionate weight of the

brain has been the subject of comment in an earlier paragraph. Here the contrast affects the proportionate length of the limbs. The difference in respect of the relative lengths of the upper and the lower limb is a matter of common knowledge and is in the present instance capable of expression in a numerical manner. Observations on a large anthropoid ape (gorilla) have been used in the preparation of the schematic figure with which to compare the adult human form. But in this matter, again, contrasts are much more impressive than similarities. These contrasts include (a) the relation of the length of the torso to the stature as a whole, (b) that of the span of the outstretched arms to the stature, *(c)* that of the upper limb to the lower limb, and (d) that of the forearm to the upper arm. The differences are very strongly marked, and the other anthropoid apes would serve to illustrate them almost as well as the gorilla; in certain particulars they would provide an even more decided contrast. Thus the apes present a very considerable diversity and are themselves the subjects of a gradation in characters, the line of which in some details is directed towards and continuous with that of human types.

Growth.—Anthropometry is also the mainstay of many important investigations involving the study of the growing individual, particularly the details of the normal process, since these provide the "control" necessarily employed and indispensable in researches upon the factors influencing development such as those mentioned above. Among the various paths of research there must be recognized that followed by artists such as Dürer, whose work on the proportions of the human figure includes reference to infants and adolescents. Records have been kept by certain parents of the dimensions (whether of stature or weight) of their own children, *e.g.*, the data collected in the 17th and 18th centuries by M. Guéneau de Montbeillard, and the illustrious Comte de Buffon, who inaugurated the method which, after a long interval, received a wider recognition and application. Quetelet, combining the measurements quoted by Buffon with those made by himself, points out the sudden acceleration of growth manifest at the 15th year in boys, and the corresponding acceleration in girls a year or two below that age. Without attempting to detect evidence of any other marked change during the period covered by the record, Quetelet repeats that the rate of progress is, in fact, subject to variation. He adds that physical development, like that of the moral side of human nature, advances in a series of bounds. But despite his recognition of occasional acceleration, he seems to have preferred to lay stress on a more general phenomenon, viz., the apparently constant retardation of velocity from an early period onwards. It was reserved for Dr. Godin to make further discoveries of the rule of periodic variation. He observed during a period of five years a large number of adolescents (from 13 to 18 years of age). He measured 100 of these youths at intervals of six months during that period, and he claims that great importance attaches to the facts (a) that the same subjects were kept under observation throughout the years in question, and (*b*) that the measurements were repeated frequently. Of the abundant harvest of data gathered by Dr. Godin, the figures relating to the average increments of stature of his subjects at 14, 15, 16 and 17 years of age respectively will serve to illustrate one of the most important outcomes of the research. The data may thus be set out:—

Average age	*14*	*15*	*16*	*17*
Average stature: Godin	46	57	46	35
,, ,, Quetelet	48	46	44	41
,, ,, Carlier.	51	62	**51**	12

The sudden augmentation of the increment at the 15th year is the point on which stress is laid. Quetelet's figures fail to exhibit this local increase, perhaps owing to the selection deliberately made by Quetelet of his subjects. However, in respect of rhythmic variation in the rate of growth, Dr. Godin's figures, supported by those of Carlier and others, represent the actual sequence of events more faithfully than do Quetelet's, and the details are wonderfully illuminating. In the six months between 1 j and 15½ years, the lower limb contributes to the augmented growth in a characteristic and distinctive fashion. Thus out of a total increment of 56, the lower limb provides 19 in the following proportion:— the thigh, 12; the leg, 6; and the foot (instep), 1. To realize the peculiar and distinctive nature of such a combination, the increments for the other half-years must be considered, and the whole series as set out in the memoir may be given as follows.—

Age.	*13½–14.*	*14–14½.*	*14½–15.*	*15–15½.*
Meas. thigh	9	4	8	12
Leg.	2	9	0	6
Foot (instep)	**3**	0	**3**	1
Minm. circum. of leg	6	2	6	2

Age.	*15½–16.*	*16–16½.*	*16½–17.*	*17–17½.*
Meas. thigh		3	3	0
Leg.	4	10	*3*	1
Foot (instep)	2	0		0
Minm. circum. of leg	**5**	**2**	**3**	**0**

Proportional Growth.— The essential feature (viz., the alteration of the activity in thigh and leg respectively) is sufficiently evident. But at one epoch, viz., that from 1 j to 15½ years, the two segments for once combine forces and though the leg contributes relatively little, still a certain combination does exist, and the result is the very marked augmentation of stature just noted.

But the tabulation reveals more than this. The contribution of the arch of the foot is at this critical epoch at a very low level, though in other periods it is of appreciable amount. Thus in the lower limb alone contributions are made by at least three distinct "elements" and usually in a sequence involving alternate phases of activity and restfulness. Moreover, the alternatives are themselves alternate with those of the neighbouring segment of the limb.

Another point is that while a given segment, for instance the leg, is making a small or even negligible increase in length, such inactivity does not affect the growth of this part in its entirety. Evidently the limb may be increasing in some other direction at this period. Reference to the tabulated data relating to the growth of the circumference of the leg will leave no doubt on this point, for the active periods of growth in length alternate with comparable phases of activity in respect of the thickness of the limb. There is a suggestion of a similar relation in the records of length and circumference measured on the forearm. And the conclusion thus formed regarding the limb as a whole applies not improbably to the bones which form its framework.

A final result of the observation is the indication that at the age of 15½ years (in the type of youths measured) the thigh has nearly completed its growth in length. Here the observation of Carus (1854), confirmed by Humphry in 1858, relating to the proportionate length of the lower limb as a whole at the 15th year, is recalled appropriately to mind.

The changing rate of growth, and the alternate activity in adjacent parts of the body detected by Dr. Godin, constitute a periodicity requiring comment from another point of view. The sum total of such phenomena has been compared to those presented by certain chemical reactions, and having regard to the admitted variation in the rate of progress of some reactions, and to the chemical analogies, if not the identity, of the metabolic processes at the base of animal growth, the comparison does not seem inappropriate. In one particular comparison there are brought together (1) The rate of growth of the individual, and (2) The rate of change in a chemical reaction of the kind in which that velocity attains its maximum when just halfway towards its completion. To bring the progress of zoological development into line with this, the rate of change should be shown to be most active when the animal under consideration has just attained one half of the bulk it will eventually assume. Dr. Robertson has published observations on such a comparison since 1911. In 1924 attention was redirected to his work by Dr. Cruickshank and Mr. Miller in their report to the Medical Research Council (Special Report Series No. 86) on the estimation of foetal age. The investigations are relevant to the last-mentioned subject, since if the periodicity of growth were fully known, estimates of foetal age based upon the data of weight and body-length could be made more closely approximate to the real value by the employment of more suitable corrections than are at present available. Consequently the subject has practical bearings in addition to its theoretical interest. Dr. Robertson

found some evidence in support of the view identifying the phenomena of growth with those of the particular kind of chemical action referred to above; yet the agreement does not appear to amount to identity, for reference is made to several phases of activity in the progress of human development, alternations which do not necessarily appear in the chemical reaction. The whole of this side of the subject requires fuller investigation.

Roberts' Work.—Roberts drew attention to the stress laid by Quetelet upon the distinction of the "average" man from the "mean," *i.e.*, the most frequent observation or event of the series. But he dissented from Quetelet's deliberate opinion that so small a number as 30 individuals suffice for the establishment of an anthropological type, for he disputed the premise of that conclusion, namely the belief that the human type is so uniform that a small sample will represent the whole mass of humanity. Roberts proclaimed the necessity for renewing enquiry into variations, and for studying their frequency, their several degrees, and their possible causes. He pointed out the fact overlooked by Quetelet and first observed by Bowditch (in 1877) that at the ages of 13 and 14 years, the young girls in Great Britain and in the United States exceed in both their height and weight the boys of the corresponding ages; and he remarked upon the contrast between urban and rural populations recorded by Quetelet for Belgium, inasmuch as the greater stature assigned by Quetelet to the town-dwellers is the exact opposite of the conditions obtaining in Great Britain. He insisted upon the importance of collecting large numbers of observations for the establishment on a wide basis of the relative height and weight of individuals for each year of age. He called attention to the remarkable range of variety in respect of such a dimension as height when a large number of observations are available for comparison.

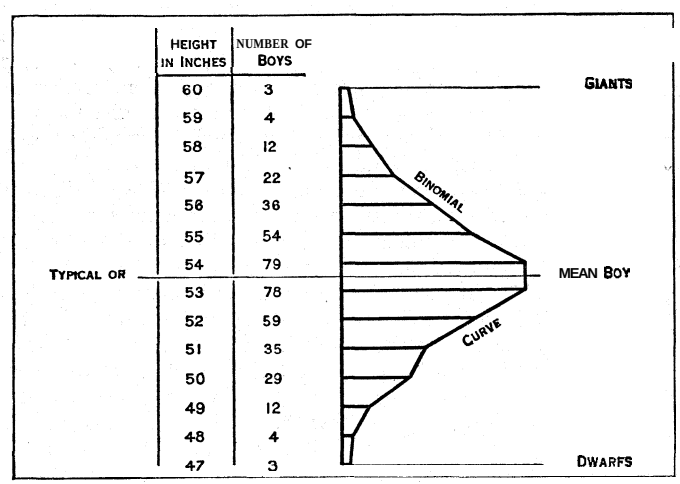
More recent researches distinguish two particular periods of growth-activity in respect of stature, namely from 5 to 7 years, and from 13 to 16 years respectively. With these two periods alternate others when circumferential growth is predominant. Hammond has published figures which indicate a comparable alternation in the parts of other animals. The comparison of the growth-curves of Japanese and New Britain children and adolescents with those of European children shows the earlier age at which the female (in the non-European races) first surpasses the male in stature, the corresponding recovery by the male being made at the 13th year by Japanese, while in New Britain that event is actually delayed to the commencement of the 17th year, *i.e.*, beyond its arrival in Europeans.

Heredity and Head Form.—Another group of investigations relates to facts of heredity, including illustrations provided by the proportions of the head. The well-known contrast between heads of rounded form (brachy-cephalic) and long heads (dolicho-cephalic) is usually expressed numerically by the percentage proportion of the width in terms of the length. This "cephalic index" gives a convenient means of comparing heads of contrasted proportions, and in regard to its indications, its values in excess of 80 denote heads of definitely rounded form, while the long heads own values below 7j. The rule or order of inheritance in respect of the parental characters has not been very extensively investigated as yet. It has been suggested that suitable posing of the infant in a cot may be a potent factor in determining the final proportions (round head if the child lies habitually on its back, and long head if it lies on the side). Without accepting this pronouncement, the possibility that such influences are by no means entirely negligible should be kept in mind. Direct evidence as to the comparison of parent with offspring in respect of head proportions distinguishes the researches of Puccioni, who shows that the contrast between the two parents is repeated, though with slightly diminished emphasis, in the children, the evidence of blending being very slight. Puccioni's family yields numerical values of the index as follows:

Parents:	father	78·1
	mother	86.7
Children:	elder	82.3 (10 years)
	younger	76·6 ($7\frac{1}{2}$ years)

These figures are of interest from several points of view. For instance, both children are boys and the mother would seem to have transmitted characteristic head proportions to one but not to the other. The latter does not merely differ from his mother herein, but has accentuated the distinguishing head form of his father. In this connection, notice should be taken of the youth ($7\frac{1}{2}$ years) of this individual and of the consequent possibility that maturity may effect changes, among which further accentuation of long-headedness is very probable. Again, it appears that although in regard to the maternal index the offspring provide some evidence of regression, nevertheless even such evidence appears only when the mean value of the children's indices is recorded without reference to the increased long-headedness of the younger child, which constitutes the most striking feature of the record. Nor does any support emerge for the "melting-pot" theory of F. Boas (1911), in which environmental factors hold a prominent place, since in the present instance the environment was unchanged. As to the Mendelian aspect of the inheritance of the form of the head, discussed by Frets (192j), on the basis of an investigation of over 3.000 persons, it was found that the cephalic index (expressive of the form of the head) is hereditary, though modifying factors affect this general tendency. Frets lays stress on the difference between large and small heads in respect of this tendency. For instance, where heads are large, that of brachy-cephalic proportions is dominant over that of dolicho-cephalic proportions; but among small heads that of dolicho-cephalic proportions is the dominant. In submitting two alternative schemes to account for the actual sequences disclosed by the records collected by him, Frets remarks that the dominance of brachy-cephaly is stronger in the female parent, whereas that of dolicho-cephaly is stronger in the male.

Work in the British Isles.—Very remarkable extensions of Roberts' work have been made by the committees appointed by the British Association for the Advancement of Science (1875–83), by the London School Board (1904), and by the London County Council (1909). These extensions comprise the collection of measurements representing the height and weight of school children. Roberts' tables record measurements representative of the physique of individuals at each year of age from the 5th to the 23rd in succession, and thereafter discontinuous data carry them



FROM ROBERTS, "MANUAL OF ANTHROPOMETRY"

FIG. 5.—COMPARATIVE HEIGHTS OF BOYS OF 11–12 YEARS OF AGE
This distribution *of* heights is based on the stature of 430 boys. The curve binding the ends of **the horizontal lines together resembles the binomial curve, but the two halves are not quite symmetrical**

on to the 50th year. The collection of information relating to the years subsequent to the "school age" necessitates recourse from schools to universities, the public services and institutions, or to factories. First among the university sources, Cambridge commenced contributions in 1833, when the average stature of 80 students is recorded as 1,768mm., and the corresponding weight as about 10 stone (after making necessary corrections). About half a century later, the collection of data was revived at the instance of Galton, and on the basis of about 2,000 observations, it appeared that the average stature was approximately 1,750mm.

The collection of statistical data made at Cambridge during the middle period mentioned above, was undertaken by a committee

of the Philosophical Society of that university at a time when an anthropometric laboratory was opened at South Kensington under the supervision of Galton himself. The information collected at Cambridge included observations of a physiological kind such as those relating to eyesight and muscular and respiratory energy. Among the measurements were comprised those of the three principal dimensions of the head, and in 1888 the late Dr. Venn drew upon these in the preparation of a very striking comparison. Combining the measurements in question so as to furnish a single numeral expressive of the size of the head, he enquired into the size thus presented by various groups of students distinguished not only by differences of age but by their proficiency in examinations. Over 1,000 individuals were available for the purposes of the enquiry, and the striking feature of the comparison may be stated as follows. The scholars, grouped with men distinguished in examination tests, revealed at the commencement of their residence heads with dimensions distinctly greater than those of their associates. The latter nevertheless acquired during residence a remarkable compensation for this initial handicap; for while the heads of all increased in size during the period in question, the smaller heads grew so much more vigorously than those of the first group that the original margin of superiority was reduced by at least one half.

Valuable work of a corresponding nature is being carried on by Dr. A. H. Mumford, Medical Officer of Manchester Grammar school.

Work in America. — In the University of Pennsylvania, the director of the department of physical education sets an example of systematic thoroughness. In the preparation of records, the needs of the individual are kept in mind, in view of the contingency that he may seek or need advice regarding the state of his health, or the selection of a particular form of athletic recreation. But while the student may receive benefits, he also incurs liability under that system; and the status accorded to it by the authorities is summed up in the director's remark that "It is quite possible for a student to have his degree withheld because he has not fulfilled his requirements in physical education."

Measurements of Recruits and Prisoners of War. — In the combatant services of States, recruiting necessarily involves the practice of anthropometry, if only for the purpose of securing uniformity, or of determining graduation or rejection. Conscription makes available a large amount of material in the form of youths called up for service year by year. Such material has been studied in various countries, but the World War naturally led to a vast extension of recruiting and conscription. In Great Britain it caused the anthropometric study of an enormous number of individuals; and by reason of the prolongation of the war, the scrutiny affected an ever-increasing range of years. The Report to the Ministry of National Service, vol. i. (1920) surveys the results up to 1919. The "Grades" into which the subjects were divided are well known, as is also the revelation of a large proportion of individuals of poor physique in certain districts. The actual observations include measurements of height, weight and chest-circumferenie; and while the results show the need for remedial action, it does not appear that the state of affairs indicates a recent or rapid deterioration (Shrubsall, 1924). Considerations based on the anthropometry of Cambridge undergraduates played an important part in determining the principles actually employed in graduating the individuals according to their physique.

A remarkable side-issue of the war was the anthropometric examination of prisoners. An example had been set already by Japan, where Prof. Koganei published in 1903 the results of his anthropometric study of Chinese soldiers, taken prisoner in the war against that country. In Great Britain Prof. Parsons reported on some of the captured Germans, while in Austria a large and systematic investigation was made of Russian prisoners, who represented a considerable number of ethnic types. Since the cessation of hostilities in 1918, the extensive anthropometry of which they were the occasion has likewise come to an end in some countries. On the Continent conscription persists, and in Switzerland the survey of recruits has proceeded without interruption. Judging by recent reports, the survey is becoming less mechanical. Interest increases progressively in the actual history of the recruit during his engagement. The employment of particular measures or combinations of measures expressive of the general condition of each individual is intimated by the most frequent references to "indices" of fitness, such as Pignet's. And even though it be necessary to admit the shortcomings of some of the coefficients proposed, the very fact that they owe their origin to an attempt to increase the significance of the recorded data should be taken into account and set against those weaknesses. But not all coefficients are open to such adverse criticism, and alternative methods of employing the data may yield valuable results. Thus the methods devised by Prof. Dreyer for assessing physical fitness seem to be proving their value, and receive confirmation of their reliability as the area of their employment extends.

Gaol Population. — The inmates of prisons provide another source of information regarding physical development, and from this Quetelet drew some of the statistics used by him in 1835. At a later date, Bertillon advised and used anthropometric methods for the identification of habitual cffendersand, indeed, of any person under arrest. Such methods together with the descriptive records of the complexion, hair colour and eye colour are accessory to the practice of dactyloscopy or study of fingerprints.

PRACTICE AND SCHEDULES

The instruments of anthropometry include measuring-rods of different sizes. Of these the smaller are commonly fitted with arms, and are called calipers. A flexible measure (for circumferential measurements) and a weighing-machine complete the outfit for the greater number of the records usually made. But special instruments are required for certain measurements of the head, as also for the estimation of muscular power, and again for the measurement of "lung-capacity." Descriptions of the various instruments, with illustrations and directions as to their use, appear in various manuals among which may be cited the Report of the British Association Committee for 1908, or again, Martin's *Anthropometrie* (1925) or *Richtlinien für Körpermessungen* by the same author (1924).

The list of measurements of admitted utility has increased considerably since the schedule included the primary measures of stature and weight. The latter still retain their value and, in fact, constitute the sole basis of many schemes still in progress, but the additions are numerous. The British Association Committee of 1875 dealt with four measurements properly so-called, viz., height, weight, girth of chest and span of arms; but to these data observations on the colour of hair and eyes, visual acuity, heating capacity and strength of arm were added. In 1888 Dr. Venn reported observations on Cambridge students, with data from a list comprising stature and weight, together with three head-measurements, and others relating to visual acuity, breathing capacity and strength of arm. In 1902 a committee appointed by the British Association (in succession to that of 1875) to advise on anthropometric investigation in the British Isles, opened enquiries which led in 1908 to the publication of a report approving of 80 specified measurements. This report includes sections on physiological and psychological measurements as well as the methods of recording photographic data. A recent critic (1924) describes the report as crude, and in certain respects it is evidently capable of improvement. During the period of its preparation, efforts were made to secure some degree of international consistency in regard to these matters, and two reports, published in succession, the first in 1906 and the second in 1912, exhibit the extent to which agreement had then progressed. These reports are not in entire agreement with the British Association's report of 1908, though the amount of divergence is not great. The international agreement itself might be again revised with advantage to all concerned.

The last few years have seen the birth and growth of an entirely novel extension of anthropometry, viz., to a matter previously physiological in nature, termed comparative serology. As the name suggests, the object of comparative study is the blood-serum. Moreover, the practical application involves the pitting of one serum against another, and the outcome of the encounter confers distinct "grades" on the competitors. Tests carried on in large

numbers in various localities (mostly in Central Europe) point to variations in frequency of the possessors of different grades of blood-serum, and the confirmation of these results will be very welcome.

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ANTHROPOMORPHISM, the attribution of human form, or the character or qualities of humanity, to objects believed to be above humanity in the scale of being, and in particular to God or the gods. The word is also used in a wider sense to signify the attribution of human qualities to anything impersonal or nonrational or below humanity in the scale of being, as when reference is made to the "vision" of molluscs, or the "reasoning powers" of lower animals, or, generally, when the actions of animals are interpreted after the analogies of human nature. Anthropomorphism may be a form of poetic metaphor, as in many passages in the Hebrew Scriptures; thus, Pusey, commenting on the saying "Thou didst walk through the sea with Thine horses" (Habb. iii. 15), observes that "such anthropomorphisms have a truth which men's favourite abstractions have not" (Minor Prophets, 433).

We are here concerned with the development of anthropomorphism as a factor in the interpretation of religion, and with special reference to the doctrine of Deity. We may distinguish three stages: (i) Physical anthropomorphism: the belief that Deity has human form. This is found in all levels of religious development, from that of the Fuegians to that of the ancient Greeks.[1] (ii) Mental and moral anthropomorphism: here the belief in a Deity of limited bodily form, or any kind of material nature, is abandoned, and stress is laid on qualities of thought, feeling, and will, in monotheistic religion believed to be possessed by Deity without their human limitations: "the Wrath of God," "the Wisdom of God," "the Love of God." (iii) Spiritual anthropomorphism: the belief that our experience of the highest developments of human nature and their ideal possibilities, adequately interpreted, provides an insight into the nature of Deity: "God is the Truth in all that is true, the Beauty in all that is beautiful, the Goodness in all that is good."

It thus appears that to abandon every kind of anthropomorphism is to abandon theism for agnosticism. This was seen clearly and stated by Herbert Spencer:

"It seems strange that men should suppose that the highest worship lies in assimilating the object of their worship to themselves. . . . It is true that from the time when the rudest savages imagined the causes of all things to be creatures of flesh and blood like themselves, down to our own time, the degree of assumed likeness has been diminishing. But though a bodily form and substance, similar to that of man, has long ceased among cultivated races to be a literally conceived attribute of the Ultimate Cause,—though the grosser human desires have also been rejected as unfit elements of the conception,—though there is some hesitation in ascribing even the higher human feelings, save in greatly idealized shapes,—yet it is still thought not only proper, but imperative, to ascribe the most abstract qualities of our nature. To think of the Creative Power as in all respects anthropomorphous is now considered impious by men who yet hold themselves bound to think of the Creative power as in some respects anthropomorphous; and who do not see that the one proceeding is but an evanescent form of the other" (First Principles, pt. i.).

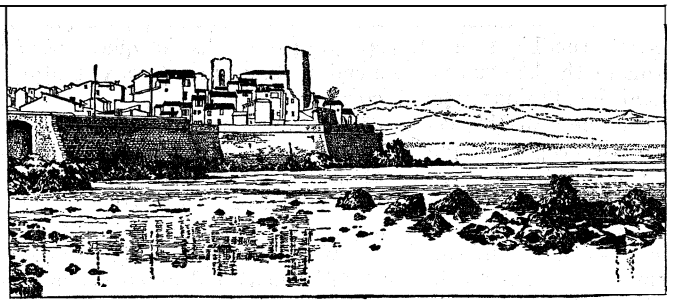
Theistic philosophy has dealt with this argument by contending that when we regard our ideals of truth, beauty, goodness, as affording interpretative insight into the nature of the Creative Power, this is not an evanescent form of the anthropomorphism of savages, but an anthropomorphism which is capable of growing in depth and critical power with the growth of human nature. In religion, it is maintained, our intelligence is confronted by an Object which is immeasurably above it in its own line, and therefore not inconceivable and unthinkable but the realization of our highest ideal of spiritual excellence.

Anthropomorphism may be studied as a factor in the history of religions; and again as leading to the fundamental problem of the philosophy of theism. The student can only be referred to works on these subjects; but the following will serve as introductions to the subject on its philosophical side: Mellone. The Price of Progress (1924), especially ch. vii., on "Symbolism"; Pringle-Pattison, *Man's* Place *in* the Cosmos (2nd ed. 1902), pp. 61, 206, 287 ff.; and The Idea *of* God (1920), ch. viii.; Streeter, Reality (1926), ch. iv., v.; Martineau, Essays *and* Addresses, vol. iv., "Science, Nescience, and Faith"; and on the negative side; Spencer, First Principles, later editions, pt. i.; Bertrand Russell, Philosophical Essays, ch. ii., "The Free Man's Worship" (cf. same writer, "The Essence of Religion," Hibbert Journal (1912–13), vol. xi., p. 46, and A. S. Pringle-Pattison, "The Free Man's Worship," ibid. (1913–14), vol. xii., p. 47. (S. H. M.)

ANTI or **CAMPA,** a tribe of Arawakan stock, inhabiting the forests of the upper Ucayali basin, on the east of the Andes, south Peru. They gave their name to the eastern province of Antisuyu, and were ferocious cannibals. They are of fine physique and wear a robe with holes for the head and arms. Their long hair hangs down over the shoulders, and round their necks a toucan beak or a bunch of feathers is worn as an ornament.

ANTI-AIRCRAFT, the term applied to the several means of, and personnel for, action against aircraft in war, commonly abbreviated to A-A. Thus *A–A.* Gun, *1st A–A.* Brigade, Royal *Artillery.* See ARTILLERY: Anti-aircraft Artillery.

ANTIBES, resort city of southern France, department of the Alpes-Maritimes (formerly in that of Var, but transferred after Alpes-Maritimes was formed in 1860 out of the county of Nice). Pop. (1936) 15,857. Antipolis, named from its position "facing the city" (of Nice), is said to have been founded about 340 B.C.



FROM "LA CÔTE D'AZUR," BY COURTESY OF THE P. L. M. RY.

THE RAMPARTS OF ANCIENT **ANTIBES** WHERE **FESTIVALS** WERE HELD IN ROMAN DAYS. THE TOWN IS NOW A CENTRE FOR SPORT OF ALL KINDS AND CAP D'ANTIBES IS A WINTER AND SUMMER RESORT

by colonists from Marseille and remained important in Roman times. It was the seat of a bishopric from the 5th century to 1244, when the see was transferred to Grasse. It is on the east side of the Garoupe peninsula on the Gulf of Nice. The town was formerly fortified, but all the ramparts (save the Ft. Carré) have been demolished, and a new town has arisen on their site. There is a large lighthouse on the cape. Dried fruits, salt fish and oil are exported. There is air service to Ajaccio.

ANTICATHODE, the target inserted in an X-ray tube on which the high-speed electrons, or cathode rays (*q.v.*), are directed. In tubes with a separate anode the anticathode is

[1] In the Christian Church, simple minds have believed in the corporeal nature of God. Gibbon and other writers quote from John Cassian the tale of the poor monk who, being convinced of his error, exclaimed "You have taken away my God! I have none left now whom I can worship!"

generally connected electrically, and outside the tube, to the anode (*q.v.*). In a Coolidge tube the anticathode acts also as the anode. On the impact of a sufficiently swift electron (*q.v.*), it gives forth an X-radiation characteristic of the material of which it is composed. (See RÖNTGEN RAYS: Applications; and ATOMIC NUMBER.)

ANTICHRIST. The earliest mention of the name Antichrist, which was probably first coined in Christian eschatological literature is in the Epistles of St. John (I. ii., 18, 22, iv. 3; II. 7), and it has since come into universal use. The conception, paraphrased in this word, of a mighty ruler who mill appear at the end of time, and whose essence will be enmity to God (Dan. xi. 36; cf. II. Thess. ii. 4; ὁ ἀντικείμενος), is older, and traceable to Jewish eschatology. Its origin is to be sought in the first place in the prophecy of Daniel, written at the beginning of the Maccabean period. The historical figure who served as a model for the "Antichrist" was Antiochus IV. Epiphanes, the persecutor of the Jews, and he has impressed indelible traits upon the conception. Since then ever-recurring characteristics of this figure (cf. especially Dan. xi. 40, etc.) are, that he would appear 'as a mighty ruler at the head of gigantic armies, that he would destroy three rulers (the three horns, Dan. VII. 8, 24), persecute the saints (vii., 25), rule for three and a half years (vii. 25, etc) and subject the temple of God to a horrible devastation βδέλυγμα τῆς ἐρημώσεως). When the end of the world foretold by Daniel did not take place, but the book of Daniel retained its validity as a sacred scripture which foretold future things, the personality of the tyrant who was God's enemy disengaged itself from that of Antiochus IV., and became merely a figure of prophecy, which was applied now to one and now to another historical phenomenon. Thus for the author of the Psalms of *Solomon* (c. 60 B.C.), Pompey, who destroyed the independent rule of the Maccabees and stormed Jerusalem, was the Adversary of God (cf. ii. 26, etc.); so too, the tyrant whom the Ascension of *Moses* (c. A.D. 30) expects at the end of all things, possesses besides the traits of Antiochus IV., those of Herod the Great. A further influence on the development of the eschatological imagination of the Jews was exercised by such a figure as that of the emperor Caligula (A.D. 37–41) who is known to have given the order, never carried out, to erect his statue in the temple of Jerusalem. In the little Jewish Apocalypse, the existence of which is assumed by many scholars, which in Mark xiii. and Matt. xxiv. is combined with the words of Christ to form the great eschatological discourse, the prophecy of the "abomination of desolation" (Mk. xiii. 14ff) may have originated in this episode of Jewish history. Later Jewish and Christian writers of apocalypses saw in Iiero the tyrant of the end of time. The author of the Syriac Apocalypse of Baruch (or his source), cap. 36–40, speaks in quite general terms of the last ruler of the end of time. In 4 Ezra v. 6 also is found the allusion: *regnabit* quem non sperant.

The roots of this eschatological iancy are to be sought perhaps still deeper in a purely mythological and speculative expectation of a battle at the end of days between God and the devil, which has no reference whatever to historical occurrences. This idea has its original source in the apocalypses of Iran, for these are based upon the conflict between Ahura-Mazda (Auramazda, Ormazd) and Añgrō-Mainyush (Ahriman) and its consummation at the end of the world. This Iranian dualism is proved to have penetrated into the late Jewish eschatology from the beginning of the 1st century before Christ, and did so probably still earlier. Thus the opposition between God and the devil already plays a part in the Jewish groundwork of the Testaments of the Patriarchs, which was perhaps composed at the end of the period of the Maccabees. In this the name of the devil appears besides the usual form (σατανᾶς, διάβολος) especially as Belial (Beliar, probably, from Ps. xviii. 4, where the rivers of Belial are spoken of, originally a god of the underworld), a name which also plays a part in the Antichrist tradition. In the Ascension of Moses, we already hear, at the beginning of the description of the latter time (x., i.); "And then will God's rule be made manifest over all his creatures, then will the devil have an end" (cf. Mt. xii. 28; Lk. xi. 20; Joh. xii. 31, xiv. 30, xvi. 11). This conception of the strife of God with the devil was further interwoven, before its introduction into the Antichrist myth, with another idea of different origin, namely, the myth derived from the Babylonian religion, of the battle of the supreme God (Marduk) with the dragon of chaos (Tiamāt), originally a myth of the origin of things, which, later perhaps, was changed into an eschatological one, again under Iranian influence. Thus it comes that the devil, the opponent of God, appears in the end often also in the form of a terrible dragon-monster; this appears most clearly in Rev. xii. Now it is possible that the whole conception of Antichrist has its final roots in this already complicated myth, that the form of the mighty adversary of God is but the equivalent in human form of the devil or of the dragon of chaos. In any case, however, this myth has exercised a formative influence on the conception of Antichrist. For only thus can we explain how his figure acquires numerous superhuman and ghostly traits, which cannot be explained by any particular historical phenomenon on which it may have been based. Thus the figure of Antiochus IV. has already become superhuman, when in Dan. viii. 10, it is said that the little horn "waxed great, even to the host of heaven; and cast down some of the host and of the stars to the ground." Similarly Pompey, in the second psalm of Solomon, is obviously represented as the dragon of chaos, and his figure exalted into myth. Without this assumption of a continual infusion of mythological conceptions, we cannot understand the figure of Antichrist. Finally, it must be mentioned that Antichrist receives, as least in the later sources, the name originally proper to the devil himself.

From the Jews, Christianity took over the idea. It is present quite unaltered in certain passages, specifically traceable to Judaism, *e.g.* (Rev. xi.). "The Beast that ascendeth out of the bottomless pit" and surrounded by a mighty host of nations slays the "two witnesses" in Jerusalem, is the entirely superhuman Jewish conception of Antichrist. Even if the beast (ch. xiii.) which rises from the sea at the summons of the devil, be interpreted as the Roman empire, and, especially, as any particular Roman ruler, yet the original form of the malevolent tyrant of the latter time is completely preserved.

A fundamental change of the whole idea from the specifically Christian point of view, then, is signified by the conclusion of ch. ii. of the Second Epistle to the Thessalonians. There can, of course, be no doubt as to the identity of the "man of sin, the son of perdition" here described with the dominating figure of Jewish eschatology (cf. ii. 3, etc., b ἄνθρωπος τῆς ἀνομίας *i.e.*, Beliar [?] ὁ ἀντικείμενος—the allusion that follows to Dan. xi. 36). But Antichrist here appears as a tempter who works by signs and wonders (ii. g) and seeks to obtain divine honours; it is further signified that this "man of sin" will obtain credence, more especially among the Jews, because they have not accepted the truth. The conception, moreover, has become almost more superhuman than ever (cf. ii. 4, "showing himself that he is God"). The destruction of the Adversary is drawn from Isaiah xi. 4, where it is said of the Messiah: "with the breath of His lips shall He slay the wicked." The idea that Antichrist was to establish himself in the temple of Jerusalem (ii. 4) is very enigmatical, and has not yet been explained. The "abomination of desolation" has naturally had its influence upon it; possibly also the experience of the time of Caligula (see above). Remarkable also is the allusion to a power which still retards the revelation of Antichrist (II. Thess. ii. 6, etc., τὸ κατέχον, b κατέχων), an allusion which, in the tradition of the Fathers of the Church, came to be universally, and probably correctly, referred to the Roman empire. In this then consists the significant turn given by St. Paul in the Second Epistle to the Thessalonians to the whole conception, namely, in the substitution for the tyrant of the latter time who should persecute the Jewish people of a pseudo-Messianic figure, who, establishing himself in the temple of God, should find credence and a following precisely among the Jews. And while the originally Jewish idea led straight to the conception, set forth in Revelation, of the Roman empire or its ruler as Antichrist, here on the contrary, it is probably the Roman empire that is the power which still retards the reign of Antichrist.

With this, the expectation of such an event at last separates itself from any connection with historical fact, and becomes purely ideal In this process of transformation of the idea, which has become of importance for the history of the world, is revealed probably the genius of Paul, or at any rate, that of the young Christianity which was breaking its ties with Judaism and establishing itself in the world of the Roman empire.

This version of the figure of Antichrist, who may now really for the first time be described by this name, appears to have been at once widely accepted in Christendom. The idea that the Jews would believe in Antichrist, as punishment for not having believed in the true Christ, seems to be expressed by the author of the fourth gospel (v. 43). The conception of Antichrist as a perverter of men, leads naturally to his connection with false doctrine (I. John ii. 18, 22; iv. 3; II. John 7). The Teaching of the Apostles (xvi. 4) describes his form in the same way as II. Thessalonians (*καὶ τότε φαινήσεται ὁ κοσμοπλανὴς ὡς υἱὸς θεοῦ καὶ ποιεῖ σημεῖα καὶ τέρατα*). In the late Christian Sibylline fragment (iii. 63, etc.) also, "Beliar" appears above all as a worker of wonders, this figure having possibly been influenced by that of Simon Magus. Finally the author of the Apocalypse of St. John also has made use of the new conception of Antichrist as a wonder-worker and seducer, and has set his figure beside that of the "first" Beast which was for him the actual embodiment of Antichrist (xiii. 11, etc.). Since this second Beast could not appear along with the first as a power demanding worship and directly playing the part of Antichrist, he made out of him the false prophet (xvi. 13, xix. 20, xx. 10) who seduces the inhabitants of the earth to worship the first Beast, and probably interpreted this figure as applying to the Roman provincial priesthood. (See APOCALYPSE.)

In proportion as the figure of Nero again ceased to dominate the imagination of the faithful, the wholly unhistorical, unpolitical and anti-Jewish conception of Antichrist, which based itself more especially on II. Thess. ii., gained the upper hand, having usually become associated with the description of the universal conflagration of the world which had also originated in the Iranian eschatology. On the strength of exegetical combinations, and with the assistance of various traditions, it was developed even in its details, which it thenceforth maintained practically unchanged. In this form it is in great part present in the eschatological portions of the Adv. Haereses of Irenaeus, and in the de *Antichristo* and commentary on Daniel of Hippolytus. In times of political excitement, during the following centuries, men appealed again and again to the prophecy of Antichrist. Then the foreground scenery of the prophecies was shifted; special prophecies, having reference to contemporary events, are pushed to the front, but in the background remains standing, with scarcely a change, the prophecy of Antichrist that is bound up with no particular time. Thus at the beginning of the *Testamentum Domini,* edited by Rahmani, there is an apocalypse, possibly of the time of Decius, though it has been worked over (Harnack, ibid. ii., 514 etc.). In the 3rd century, the period of Aurelianus and Gallienus with its wild warfare of Romans and Persians, and of Roman pretenders one with another, seems especially to have aroused the spirit of prophecy. To this period belongs the Jewish apocalypse of Elijah (ed. Buttenwieser) of which the Antichrist is possibly Odaenathus of Palmyra, while *Sibyll.* xiii., a Christian writing of this period, glorifies this very prince. It is possible that at this time also the Sibylline fragment (iii. 63 etc.) and the Christian recension of the two first Sibylline books were written. To this time possibly belongs also a recension of the Coptic apocalypse of Elijah, edited by Steindorff (*Texte und Untersuchungen* N.F. ii. 3). To the 4th century belongs, according to Kamper (Die deutsche Kaiseridee, 1896, p. 18) and Sackur (Texte *und* Forschungen, 1898, p. 114 etc), the first nucleus of the "Tiburtine" Sibyl, very celebrated in the middle ages, with its prophecy of the return of Constans, and its dream, which later on exercised so much influence, that after ruling over the whole world he would go to Jerusalem and lay down his crown upon Golgotha. To the 4th century also perhaps belongs a series of apocalyptic pieces and homilies which have been handed down under the name of Ephraem. At the beginning of the Mohammedan period, then, we meet with the most influential and the most curious of these prophetic books, the *Pseudo-Methodius,* which prophesied of the emperor who would awake from his sleep and conquer Islam. From the *Pseudo-Methodius* are derived innumerable Byzantine prophecies (*cf.* especially Vassiliev Anecdota *Graeco-Byzantina*) which follow the fortunes of the Byzantine emperors and their governments. A prophecy in verse, adorned with pictures, which is ascribed to Leo VI. the Philosopher (Migne, Patr. *Graeca,* cvii. p. 1,121, etc.) tells of the downfall of the house of the Comneni, and sings of the emperor of the future who would one day awake from death and go forth from the cave in which he had lain. Thus the prophecy of the sleeping emperor of the future is very closely connected with the Antichrist tradition. There is extant a Daniel prophecy which, in the time of the Latin empire, foretells the restoration of the Greek rule. In the East, too, Antichrist prophecies were extraordinarily flourishing during the period of the rise of Islam and of the Crusaders. To these belong the apocalypses in Arabic, Ethiopian and perhaps also in Syrian, preserved in the so-called Liber *Clementis discipuli* S. Petri (Petri *apostoli apocalypsis* per *Clementem*), the late Syrian apocalypse of Ezra (Bousset, *Antichrist,* 45, etc.) the Coptic (14th) vision of Daniel (in the appendix to Woide's edition of the Codex *Alexandrinus;* Oxford 1799) the Ethiopian *Wisdom* of the Sibyl, which is closely related to the Tiburtine Sibyl (see Basset, Apocryphes *éthiopiennes,* x.); in the last mentioned of these sources long series of Islamic rulers are foretold before the final time of Antichrist. Jewish apocalypse also awakes to fresh developments in the Mohammedan period, and shows a close relationship with the Christian Antichrist literature. One of the most interesting apocalypses is the Jewish History of Daniel, handed down in Persian.

This whole type of prophecy reached the West above all through the *Pseudo-Methodius,* which was soon translated into Latin. Especially influential, too, in this respect, was the letter which the monk Adso in 954 wrote to Queen Gerberga, De *ortu* et *tempore Antichristi.* The old Tiburtine *Sibylla* went through edition after edition, in each case being altered so as to apply to the government of the monarch who happened to be ruling at the time. Then in the West the period arrived in which eschatology and above all the expectation of the coming of Antichrist, exercised a great influence on the world's history. This period, as is well known, was inaugurated, at the end of the 12th century by the apocalyptic writings of the abbot Joachim of Floris. Soon the word Antichrist re-echoed from all sides in the embittered controversies of the West. The pope bestowed this title upon the emperor, the emperor upon the pope, the Guelphs on the Ghibellines and the Ghibellines on the Guelphs. In the contests between the rival powers and courts of the period, the prophecy of Antichrist played a political part. It gave motives to art, to lyrical, epic and dramatic poetry. Among the visionary Franciscans, enthusiastic adherents of Joachim's prophecies, arose above all the conviction that the pope mas Antichrist, or at least his precursor. From the Franciscans, influenced by Abbot Joachim, the lines of connection are clearly traceable with Milič of Kremsier (Libellus *de Antichristo*) and Matthias of Janow. For Wycliffe and his adherent John Purvey (probably the author of the *Commentarius* in *Apocalypsin* ante *centum annos editus,* edited in 1528 by Luther), as on the other hand for Hus, the conviction that the papacy is essentially Antichrist is absolute. Finally, if Luther advanced in his contest with the papacy with greater and greater energy, he did so because he was borne on by the conviction that the pope in Rome was Antichrist. And if in the Augustana the expression of this conviction was suppressed for political reasons, in the Articles of Schmalkaiden, drawn up by him, Luther propounded it in the most uncompromising fashion. This sentence was for him an *articulus stantis et cadentis ecclesiae.* To write the history of the idea of Antichrist in the latter middle ages, would be almost to write that of the middle ages. (W. B.)

See Bousset, *Antichrist,* etc., 1895 (Eng. trans. A. H. Keane 1896); Bousset, *Die Religion des Judentums,* etc. (3 Auf. herausg. H. Gressmann 1926), p. 254 ff; H. Preuss, *Die Vorstellungen vom Antichrist im* spat. *Mittelalter,* etc. (1906); Hastings Encyc. *Rel. Eth. s.v.; Encyc. Biblica s.v.* Commentaries to 1 & 2 John, 2 Thess., etc.

ANTICLIMAX (*i.e.*, the opposite to "climax"), in rhetoric, an abrupt declension (either deliberate or unintended) on the part of a speaker or writer from the dignity of idea which he appeared to be aiming at; as in the following well-known distich:—

The great Dalhousie, he, the god of war,
Lieutenant-colonel to the earl of *Mar*.

An anticlimax can be intentionally employed only for a jocular or satiric purpose. It frequently partakes of the nature of antithesis, as:—

Die and endow a college or a cat.

It is often difficult to distinguish between "anticlimax" and "bathos"; but the former is more decidedly a relative term. A whole speech may never rise above the level of bathos; but a climax of greater or less elevation is the necessary antecedent of an anticlimax.

ANTI-CORN-LAW LEAGUE, a body formed at Manchester in 1838 to oppose the Corn Laws. It was led by Cobden, Bright and Villiers, formed branches throughout the country, and became a very powerful political force. It was dissolved upon the attainment of its object in the repeals of 1846–49. (*See* CORN LAWS.)

ANTICOSTI, island province of Quebec, Canada, in the Gulf of St. Lawrence, 49° to 50° N., 61° 40′ to 64° 30′ W., length 13½ mi., breadth 30 mi. Pop. (1941) 424, chiefly lighthouse-keepers. The coast is dangerous, and the harbours, Ellis bay and Fox bay, are poor. Its main wealth is timber. Anticosti was sighted by Jacques Cartier in 1534, and named Assomption. In 1763 it was ceded by France to Britain, and in 1774 became part of Canada. Wild animals, especially bears, are numerous, but fish and game had been almost exterminated when, in 1896, Anticosti and the shore fisheries were leased to M. Menier, the French chocolate manufacturer, who converted the island into a game preserve. In 1926 the Anticosti Corporation of pulp and paper manufacturers bought the island from Senator Menier, who has retained his residence and sporting rights.

See Logan, Geological Survey of Canada, Report of Progress from its Commencement to *1863* (Montreal, 1863–65); E. Billings, Geological Survey of Canada: *Catalogue* of the Silurian Fossils of *Anti*costi (Montreal, 1866); J. Schmitt, Anticosti (Paris, 1904).

ANTICYCLONE, a name first proposed by F. Galton for an atmospheric system opposite to a cyclone (*q.v.*). In an anticyclone the barometric pressure is high, seldom less than 1,01½ m.bars, or 30 inches, and there is a steady decrease from the centre; in a well-marked anticyclone the isobars are usually circular or oval curves. Certain parts of the earth, notably large parts of the latitude belts about 30° N. and 30° S., also continental areas in winter in mid latitudes, are characterized by high pressures and are termed anticyclonic regions. At the surface the air tends to flow outwards in all directions from the central area and is deflected on account of the earth's rotation (see FERREL'S LAW) so as to give a spiral movement, in the direction of the hands of a watch-face, upwards in the northern hemisphere and in the opposite direction in the southern hemisphere. Anticyclones are usually regions of calms or light winds with little or no rainfall; these conditions are best seen in the desert regions of the globe; in temperate zones there is more variety of weather, *e.g.*, in Britain they are usually accompanied by dull, cheerless, foggy weather in winter and by bright, hot weather in summer.

ANTICYRA, the ancient name of three cities of Greece. (1) (Mod. *Aspraspitia*), in Phocis, on the bay of Anticyra, in the Corinthian gulf; some remains are still visible. It was a town of considerable importance, famous for its black hellebore, a herb regarded as a cure for insanity. (2) In Thessaly, on the right bank of the river Spercheios, near its mouth. (3) In Locris, on the north side of the entrance to the Corinthian gulf, near Naupactus.

ANTIDOTES, remedies for counteracting poisons. The following antidotes for special poisons are sometimes given in case of emergency usually following and followed by an emetic, and whenever possible under the supervision of a physician. In general, antidotes for acid poisons are: ammonia (a teaspoonful to half a pint of water) or lime-water, plaster, magnesia or chalk. For alkali poisons, antidotes are vinegar, dilute acetic acid or lemon juice. For an unidentified poison, the general rule is to give eggs, salad oil (except in phosphorus poisoning), flour and water or lime-water (except for alkaline poisons), preceded by large draughts of water or milk, and to induce vomiting by placing the finger in the throat or by an emetic. Kitchen soap and water may be used several times repeated. The antidote is only one part of the treatment which may include first an emetic and is often followed by stimulants such as strong black coffee.

ANTIDOTES FOR SPECIAL POISONINGS

Lead: Epsom salts in large doses, 2 tablespoonfuls to a glass of water, bland liquors, castor-oil, milk or eggs.

Phosphorus: magnesia in water, potassium permanganate 1 to 1,000 solution in water, copper sulphate (bluestone in water), repeated V. gr. doses to cause vomiting, turpentine, a half teaspoonful in a glass of milk or water. Do not give oils or fats.

Prussic acid: peroxide of hydrogen internally, lime-water, kitchen soap or soda.

Plant Poisoning: Plant poisons in general do not require an antidote, being treated by induced vomiting, stimulants and brisk purge, like castor-oil.

Hydrochloric (*muriatic*), nitric (aqua fortis), oxalic, acetic, *sulphuric* (vitriol) acids: weak alkaline drinks at once, ammonia (8 teaspoonfuls in half a pint of water), baking soda, magnesia, chalk, lime, whitewash from walls, plaster, given in water, soap and water or tooth-powder. (No emetic.)

Carbolic acid (creosote, guaiacol, creosol): soluble sulphates, such as magnesium sulphate, sodium sulphate (Epsom and Glauber's salts), dilute alcohol, raw eggs, flour and water, milk, castor- or sweet oil. (No emetic.)

Alkalis: dilute acids, vinegar one glass to quart of water, dilute acetic acid, 2–3 per cent, lemon juice, soothing fluid, oils, melted fat, milk, cream. (No emetic.)

Silver preparations (*silver* nitrate, lunar caustic): large drinks of salt water, soap, draughts of milk, baking soda.

Mercury (corrosive sublimate or bichloride of mercury, blue ointment, oxide of mercury, black wash, yellow wash, cinnabar vermilion): raw eggs or milk repeated after meals, soap, castor-oil, flour and water. Emesis absolutely necessary after antidote has been down for 5–10 minutes. Mercury becomes free in intestines.

Arsenic (Fowler's *solution, Paris* green, *Scheele's* green, *Schweinfurt* green, arsenical dyes in papers and candies): precipitate form from magnesium (three tablespoons in a glass of water), iron sulphate (two fluid ounces in a glass of water), then mix, or ferric chloride precipitated by sodium bicarbonate; the rust scraped from iron stirred up in water and given, magnesia, follow with castor-oil.

Copper (blue vitriol or bluestone, verdigris): milk, eggs, soap, flour and water.

Antimony (Tartar emetic, *wine* of antimony): same as for mercury. Strong coffee or tea, teaspoonful of tannic acid in half glass of water followed by eggs or milk.

Iodine: starch and water.

Formaldehyde: bland drinks, milk and oils.

Opium: no antidote (emetics and stimulants used). Artificial respiration if breathing stops. Keep victim moving; repeated doses of caffeine.

Chloral (chloralamide, *chloralose,* chloral camphor): no antidotes (treatment similar to opium treatment).

Veronal, trional, *sulphonal,* ammonal: no antidote (stimulants).

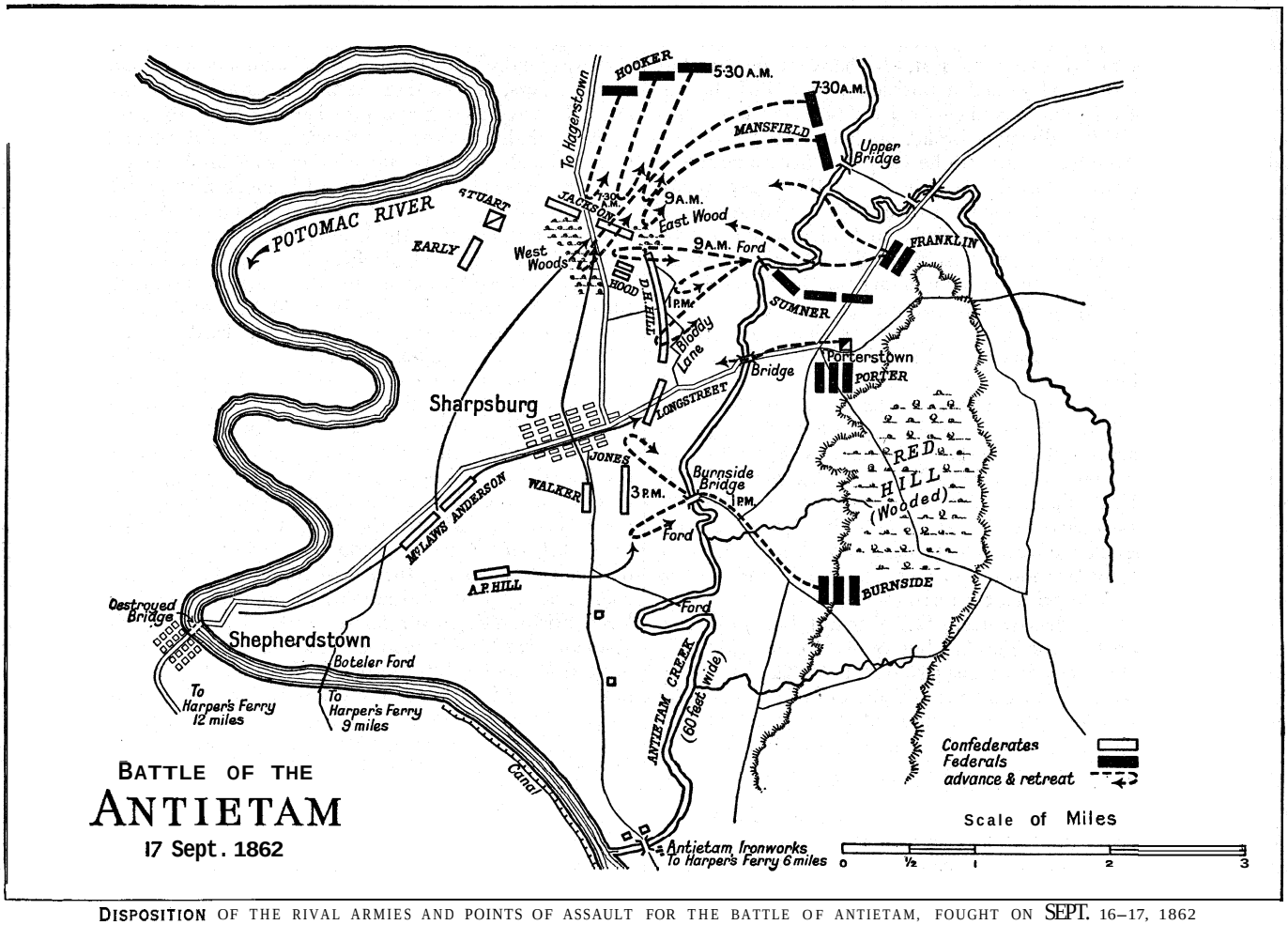
Ptomaine (poison from decayed meats, fish, vegetables, contaminated canned foods): (after emetic) castor-oil, Epsom salts or other rapidly acting cathartic, enema of warm soap-suds with a teaspoon of turpentine to the pint or two teaspoons of glycerine.

Aconite: no antidote (induced vomiting and stimulant).

Belladonna: no antidote (induced vomiting and stimulant).

Strychnia (nux vomicu): no antidote (emetic and quiet). In extreme poisoning inject solution magnesium sulphate into spinal canal. Person in semi-sitting position during and after injection.

(W. R. R.)



DISPOSITION OF THE RIVAL ARMIES AND POINTS OF ASSAULT FOR THE BATTLE OF ANTIETAM, FOUGHT ON SEPT. 16–17, 1862
This battle was one of the most severe in the American Civil War, the Federals losing 12,000 killed and wounded, the Confederates slightly less. The Federal forces were greatly superior, but McClellan's refusal to throw in his reserves destroyed his chances of victory. Lee, on the other hand, bringing every man and gun into action, was able to withstand the piecemeal attacks launched against him at five different points at five different hours. On the morning following the battle Lee prepared to renew the struggle but McClellan allowed him to recross the Potomac unmolested

ANTIENT CONCERTS, the name of a famous series of London concerts, started in 1776 and continued without a break till 1848. The founders of the concerts were a body of aristocratic amateurs, who were supported by all the best musicians and cultivated music-lovers of the period. The programmes were devoted to the finest music, orchestral and vocal, of the day, or more strictly speaking of the past, for it was one of the rules that no music less than 20 years old was admissible. From the keen interest taken in them by George III. the concerts acquired the secondary title of "the king's concerts" and this tradition of court patronage was maintained when the Prince Consort "directed" one of them in 1847 at which Mendelssohn was the soloist.

ANTIETAM, THE BATTLE OF THE. The Antietam flowing south into the Potomac above Harper's Ferry gives its name to the battle fought (Sept. 17, 1862) between the Federals under McClellan and the Confederates under R. E. Lee. After his incursion into Maryland Lee with three divisions had retreated from South Mountain behind the Antietam (Sept. 15), where he awaited the arrival of six divisions under Jackson from Harper's Ferry, which had capitulated at 8 A.M. that day. Jackson rejoined with three next morning. That afternoon McClellan, who following slowly in pursuit had only reached the Antietam late on the 15th, sent the I. Corps (Hooker) across by the bridge highest up the stream. About dusk Hooker came into collision with Hood's two brigades on the Confederate left. The XII Corps (Mansfield) crossed at 11:30 P.M., and encamped a mile in Hooker's rear. McClellan's plan was to make his main attack upon the Confederate left with the I, XII. and II (Sumner) Corps, supported if necessary by the VI. Corps (Franklin), whilst Burnside with the IX. Corps was "at least to create a diversion with the hope of something more by assailing the enemy's right." When one or both of these movements were "fully successful," he intended to launch his reserve—V. Corps (Porter)—against Lee's centre.

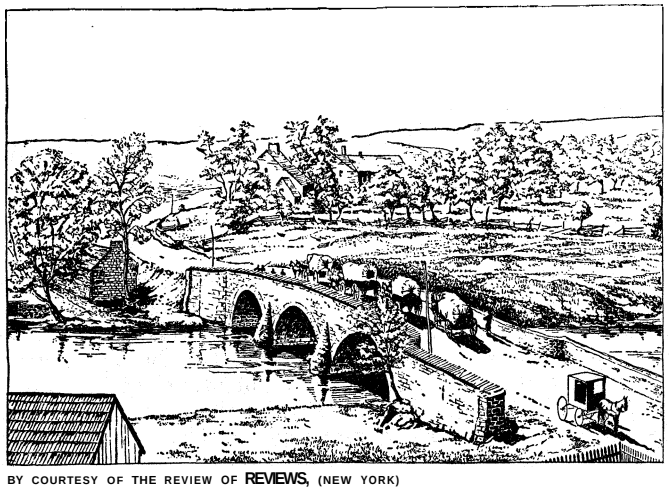
Lee's position was fairly strong, extending over three miles from "the Burnside bridge" over the Antietam to a bend in the Potomac. In the West Woods outcropping ledges of limestone provided excellent cover. But the line of retreat to the Boteler Ford below Shepherdstown, where alone the Potomac could be crossed, ran parallel to the right flank, itself somewhat "in the air." On the extreme left *Stuart's* cavalry occupied a ridge overlooking the Potomac; Jackson with two divisions held the turnpike and the woods on either side, with Hood's brigades in reserve; *D. H.* Hill's division continued the line southwards, and Longstreet's seven brigades stretched from Sharpsburg to "the Burnside bridge." Two cavalry regiments guarded the bridge below. Jackson's third division (Walker) was at first held in reserve behind the right flank.

Hooker's attack began at 5:30 A.M. on the 17th and was over two hours later. His corps was already retiring, when Mansfield's Corps advanced. Its attack ended about 9 A.M. One division had established itself in the West Woods; Walker's division had reinforced Jackson. A little later Sumner with Sedgwick's division charged through the West Woods, but was taken in flank by *McLaws's* division, which with Anderson's had only that morning arrived from Harper's Ferry, and by Walker's, and was driven back with a loss of over 2,000 men. By 10:30 A.M. the fighting on Jackson's front was over and the Confederates had regained possession of the West Woods.

Further south French and Richardson of Sumner's Corps attacked D. H. Hill, who was reinforced by *Anderson.* Here the fighting lasted from 10 A.M. to 1 P.M. Richardson on the left drove back *Anderson* and gained a position from which he enfiladed "the Bloody Lane," a sunken road which Hill was holding against French. Hill's division broke, and if McClellan had allowed Franklin to advance across the turnpike, Lee's line might have been cut in two. Burnside only received the order to advance some hours after Hooker's battle began. After a prolonged struggle the IX. Corps carried the bridge about 1 P.M. Two hours later it advanced against Sharpsburg, which was defended by one division only. It was rolling up the Confederate line and had reached the outskirts of Sharpsburg, when about 4 P.M. *A.* P. Hill's division, after a forced march from Harper's Ferry, came up from the Potomac and striking its left flank drove it back to the bridge.

With the defeat of the IX. Corps the battle of the Antietam ended. McClellan had fully 70,000 men on the field, but he kept one-third of his army out of the battle. The V. Corps remained in reserve all day; only one of Franklin's brigades was seriously engaged. Federal casualties numbered over 12,000. *Lee* lost between a fifth and a quarter of his army, less than 40,000 strong. Despite his losses Lee offered battle next day, but McClellan, though reinforced by two more divisions, allowed *Lee* to recross the Potomac that night without interruption.

The historian Ropes has written, "Of General Lee's management of the battle there is nothing but praise to be said." He might have added, it has been suggested "of McClellan's management there is nothing but censure." The Northern commander made no adequate reconnaissance to find out the Confederate position or where the creek could be forded. The attack, instead of being simultaneous along the whole front, was made piecemeal; there were, in fact. five separate attacks at different hours. This is the more remarkable as one of the maps preserved in the official records shows that McClellan was in signal communication with his corps commanders' headquarters. Had the Federal



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THE BRIDGE AT THE ANTIETAM CREEK, MEMORABLE IN THE HISTORY OF THE CIVIL WAR. FROM A PHOTOGRAPH TAKEN SOON AFTER THE BATTLE In the conflict of Sept. 16–17, 1862, Gen. McClellan's artillery controlled the bridge and so enabled the disordered Union lines to recover in time to check the assaults of the Confederates

reserves been led across Antietam creek by the bridge and fords near its mouth, *Lee's* sole line of retreat via Boteler ford might have been cut and his Army intercepted. (W. B. Wo.)

See F. W. Palfrey, *The Antietam and Fredericksburg* (1882); *E.* P. Alexander, *The American Civil War* (1908); *G.* F. R. Henderson, *Stonewall Jackson* vol. ii. (1902); J. C. Ropes, *Story of the Civil War,* vol. ii. (1894–1913).

ANTIFEBRIN, a name commonly employed for acetanilide (*q.v.*), an organic compound present in various headache powders.

ANTI-FEDERALISTS, the name given in the political history of the United States to those who, after the formation of the Federal Constitution of 1787, opposed its ratification by the people of the several States. The "party" (though it was never regularly organized as such) was composed of "statesrights," particularist, individualist and radical democratic elements; that is, of those persons who thought that a stronger government threatened the sovereignty and prestige of the States, or the special interests, individual or commercial, of localities, or the liberties of individuals, or who fancied they saw in the government proposed a new centralized, disguised "monarchic" power that would only replace the cast-off despotism of Great Britain. In every State the opposition to the Constitution was strong, and in two—North Carolina and Rhode Island—it prevented ratification until the definite establishment of the new government practically forced their adhesion. The individualist was the strongest element of opposition; the necessity, or at least the desirability, of a bill of rights was almost universally felt. Instead of accepting the Constitution upon the condition of amendments—in which way they might very likely have secured large concessions—the Anti-Federalists stood for unconditional rejection, and public opinion, which went against them, proved that for all its shortcomings the Constitution was regarded as preferable to the articles of confederation. After the inauguration of the new government, the composition of the Anti-Federalist Party changed. The Federalist (*q* v.) Party gradually showed "broad-construction," nationalist tendencies; the Anti-Federalist Party became a "strict-construction" party and advocated popular rights against the alleged aristocratic, centralizing tendencies of its opponent, and gradually was transformed into the Democratic-Republican party, mustered and led by Thomas Jefferson, who, however, had approved the ratification of the Constitution and was not, therefore, an Anti-Federalist in the original sense of that term.

See O. *G.* Libby, *Geographical Distribution of the Vote . . . on the Federal Constitution, 1787–1788* (University of Wisconsin Bulletin, 1894); S. B. Harding, *Contest over the Ratification of the Federal Constitution in . . . Massachusetts* (Harvard University Studies, 1896); and authorities on political and constitutional history in the article UNITED STATES.

ANTI-FREEZE, a substance which is added to the water used in cooling systems of automobiles or similar machines to lower its freezing point For use in automobile radiators. the anti-freeze material should not contain anything which is an electrolyte, since this would corrode the metal. The material used should be of low molecular weight so that a given weight will have a greater effect on the freezing point. It should not be volatile at normal operating temperatures nor should it increase the viscosity of the liquid too much.

A great many organic compounds have been used as anti-freeze substances Glucose, honey, molasses and sugar have found some use. Glycerine and alcohol have found the most general application. Ethylene glycol has become available in commercial quantities and is being widely adopted.

ANTI-FRICTION METALS. In a theoretically perfect bearing the load should be carried on a film of oil between the axle and bearing, and the nature of the bearing metal should therefore be immaterial. In actual practice, however, such perfection is not attained and it becomes necessary to select a metal which will minimize as far as possible the inevitable mechanical errors of adjustment and alignment. The properties which a good bearing metal should possess are, first, a low coefficient of friction and, secondly, sufficient plasticity to allow the axle to bed down combined with sufficient compressive strength to carry the total load. In early days lead was commonly used as a bearing metal, but it was too soft, and it was soon discovered that the alloys of lead and tin with additions of other metals were far superior.

One of the earliest of these was introduced by Isaac Babbitt and contained approximately 83% of tin, 11% of antimony and 6% of copper. So successful was this alloy that it soon became the standard for all bearing metals and was named, after its inventor, "Babbitt metal." Numerous imitations were then introduced under the same name so that it became necessary to distinguish genuine Babbitt metal from other compositions and at the present time the expression is so loosely used that in the United States it comprises practically all the white bearing metals of any composition. In fact the expression "Babbitt metal" is synonymous

with the British expression "anti-friction metal," and the American Standard Specifications are drawn up for "White Bearing Metal Alloys, known commercially as Babbitt Metal."

Although anti-friction metals had been successfully employed for many years, it was not until Charpy published the results of his classical research in 1898 that the real nature of the alloys was properly understood. Charpy demonstrated that they possessed one essential feature, namely, a conglomerate structure consisting of particles of hard material embedded in a soft matrix. Such structures can be obtained by the addition of other metals which combine to produce hard compounds with the softer metal to which they are added.

Five Groups of Bearing Metals.—The bearing metals commonly in use may be divided into five groups, viz.:—

(1.) Tin base alloys consisting essentially of tin and contain; ing compounds of tin and antimony and tin and copper.

(2.) Lead base alloys consisting of lead and containing a compound of tin and antimony.

(3.) Copper base alloys or bronzes containing compounds of copper and tin, and sometimes of copper and phosphorus.

(4.) Copper base alloys similar to the foregoing but containing considerable quantities of lead.

(5.) Zinc base and miscellaneous alloys.

In the alloys of Group (1), of which a typical composition may be taken as 87% tin, 7½% antimony and 3% copper, the antimony combines with a part of the tin to form hard, well defined cubes corresponding to the formula Sn Sb, while the copper combines with a further portion of the tin to form the compound Sn Cu_3 which separates in characteristic needle-shaped crystals.

The alloys of Group (2) are, of course, cheaper than those of Group (1) and, although they have not the same compressive strength, they are quite suitable for many purposes, especially where loads are not great and speeds high. In these alloys the hard constituent is the compound Sn Sb, which is embedded in lead. For the best results the antimony should be between 10 and 18% and the tin not less than 10%, except for very light service.

The alloys of Group (3), although possessing the same characteristic structure as those already described, differ in some respects. In this case the hard compound is formed between copper and tin and corresponds to the formula Sn Cu_6, while in the case of phosphor bronze there is an additional hard compound, phosphide of copper, Cu_3P, which separates with the Sn Cu_6. But these compounds are embedded, not in copper, but in a solid solution of tin in copper which is harder than copper and very much harder and stronger than the soft metals, tin and lead, of the two previous groups. Owing to the great strength of these alloys they are adapted for all purposes where very heavy loads at comparatively slow speeds have to be dealt with. The percentage of tin should not be less than 9 and for ordinary purposes not more than 15, while, if phosphorus is added, this should be from ½ to 1 per cent.

The alloys of Group (4) are similar to those of Group (3), except that they contain an amount of lead up to 30 per cent. This lead does not alloy with the copper but remains free in the form of globules scattered throughout the metal. This free lead does not greatly reduce the compressive strength of the alloy, but appears to act as a lubricant and improves the antifrictional properties.

In Group (5) may be included all the miscellaneous alloys which have been employed for special purposes. Perhaps the most important of these are the zinc base alloys which are used for hard work and occasionally under water. It is impossible to deal with all the alloys which have been suggested as bearing metals, but mention must be made of a recent development in the use of lead alloys containing barium either alone or with calcium. These alloys were introduced during the World War, when economy in the use of tin was essential, and they are said to possess properties very similar to those of the tin base alloys although sufficient experience has hardly been gained yet to enable a decided view to be expressed. They contain from 2 to 4% of barium and the remainder lead, or if calcium is added, 1% of calcium replaces 2% of barium. (See BALL BEARINGS.)

(E. F. L.)

ANTIGO, a city of Wisconsin, U.S.A., about 160 m. N.W. of Milwaukee, the county seat of Langlade county. It is served by the Chicago and North Western railway. The population was 9,495 in 1940. Antigo is a supply-base for the summer resort-of north-eastern Wisconsin, and a shipping-point for large quantities of goldenseal and ginseng, seed grains, potatoes and dairy products. It has a large cheese factory, machine shops and wood-working plants. There are 103 lakes in the county, and over 700 m of trout streams.

Antigo was settled in 1880, and was chartered as a city in 1885. Its name is said to be part of an Indian word, neequee-nntigosebi, meaning "evergreen."

ANTIGONE: see OEDIPUS.

ANTIGONUS CYCLOPS or **MONOPMTMALMOS** (382–301 B.C.) so called from his having lost an eye—Macedonian king, son of Philip, was one of the generals of Alexander the Great. He was made governor of Greater Phrygia in 333, and in the division of the provinces after Alexander's death (323) Pamphylia and Lycia were added to his command. He incurred the enmity of Perdiccas, the regent, by refusing to assist Eumenes (*q.v.*) to obtain possession of the provinces allotted to him. In danger of his life he escaped to Greece where he obtained the favour of Antipater (*q.v.*), regent of Macedonia (321); and when, soon after, on the death of Perdiccas a new division took place, he was entrusted with the command of the war against Eumenes, who had joined Perdiccas against the coalition of Antipater, Antigonus, and the other generals. Eumenes was completely defeated, and a new army that was marching to his relief was routed by Antigonus. Polyperchon succeeding Antipater (d. 319) in the regency, to the exclusion of Cassander, his son, Antigonus resolved to set himself up as lord of all Asia, and, in conjunction with Cassander and Ptolemy of Egypt, refused to recognize Polyperchon. He entered into negotiations with Eumenes, but Eumenes remained faithful to the royal house and formed a coalition with the satraps of the eastern provinces. He was at last, through treachery, delivered up to Antigonus in Persia and put to death (316). Antigonus again claimed authority over the whole of Asia, seized the treasures at Susa, and entered Babylonia, of which Seleucus was governor. Seleucus fled to Ptolemy and entered into a league with him (315), together with Lysimachus and Cassander. Aiter the war had been carried on with varying success from 315 to 311, peace was concluded, by which the government of Asia Minor and Syria was provisionally secured to Antigonus. This agreement was soon violated on the pretext that garrisons had been placed in some of the free Greek cities by Antigonus, and Ptolemy and Cassander renewed hostilities against him. Demetrius Poliorcetes, the son of Antigonus, wrested part of Greece from Cassander in 306 and defeated Ptolemy in a naval engagement off Salamis, in Cyprus. On this victory Antigonus assumed the title of king and bestowed a similar title on his son, a declaration that he claimed to be the heir of Alexander. Antigonus now prepared a large army and a formidable fleet, the command of which he gave to Demetrius, and hastened to attack Ptolemy in his own dominions. His invasion of Egypt, however, proved a failure and he had to retire. Demetrius then attempted the reduction of Rhodes, which had refused to assist Antigonus against Egypt; but, meeting with obstinate resistance, he had to make a treaty upon the best terms that he could (304). In 302, although Demetrius was again winning success after success in Greece, Antigonus was obliged to recall him to meet the confederacy that had been formed between Cassander, Seleucus, and Lysimachus. A decisive battle was fought at Ipsus, in which Antigonus fell. in the 81st year of his age.

Diodorus Siculus xviii., xx. 46–86; Plutarch, *Demetrius,* Eumenes; Kepos, *Eumenes;* Justin xv. 1–4. *See* MACEDONIAN *EMPIRE;* and Köhler, "Das Reich des Antigonos," in the *Sitzungsberichte* d. *Berl. Akad.* **1898, p.** 835; *Cambridge Ancient History,* vol. vi. ch. xv., and the bibliography there given.

ANTIGONUS GONATAS (*c.* 319–239 B.C.), Macedonian king, was the son of Demetrius Poliorcetes, and grandson of Antigonus Cyclops (*q.v.*). On the death of his father (283), he

assumed the title of king of Macedonia, but did not obtain possession of the throne till 276, after it had been successively in the hands of Pyrrhus, Lysimachus, Seleucus, and Ptolemy Ceraunus. Antigonus repelled the invasion of the Gauls, and continued in undisputed possession of Macedonia till 274, when Pyrrhus returned from Italy, and (in 273) made himself master of nearly all the country. On the advance of Pyrrhus into Peloponnesus, he recovered his dominions.

He was again (between 263 and 255) driven out of his kingdom by Alexander, the son of Pyrrhus, and again recovered it. The latter part of his reign was comparatively peaceful, and he gained the affection of his subjects by his honesty and his cultivation of the arts.

BIBLIOGRAPHY.—Plutarch, *Demetrius, Pyrrhus, Aratus;* Justin **xxiv.,** 1; xxv. 1–3; Polybius ii. 43–45, ix., 29, 34. *See* Thirlwall, *History* of *Greece,* vol. viii. (1847); Holm, *Griech. Gesch.* vol. **iv.** (1894); Niese, *Gesch. d. griech. u. maked. Staaten,* vol. i. and ii. (1893, 1899); Beloch, *Griech. Gesch.* vol. iii. (1904); W. W. Tarn, *Antigonos Gonatas* (1913); *R.* Schubert, *Quellen zur Geschichte der Diadochenzeit* (Leipzig, 1914); E. Pozzi, *Le Battaglie di Cos e di Andro* (Reale Accademia delle Scienze, Turin, 1913). *See* also the *Cambridge Ancient History* (with bibliography).

ANTIGONUS OF CARYSTUS (in Euboea), Greek writer, flourished in the 3rd century B.C. at the court of Attalus I. (241–197) of Pergamum. His chief work was the *Lives of Philosophers,* drawn from his personal knowledge, of which considerable fragments are found in Athenaeus and Diogenes Laertius. His *Collection of Wonderful Tales,* chiefly extracted from the Θαυμάσια Ἀκούσματα attributed to Aristotle and the Θαυμάσια of Callimachus is still preserved.

Text in Keller, *Rerum Naturalium Scriptores Graeci Minores,* i. (1877); *see* Kopke, *De Antigono Carystio (1862);* Wilamowitz-Mollendorff, "A. von Karystos," **in** *Philologische Untersuchungen,* **iv.** (1881).

ANTIGUA, an island in the British West Indies, forming, with Barbuda and Redonda, one of the five presidencies in the colony of the Leeward Islands. It lies 50m. E. of St. Kitts, in 17° 6′ N. and 61° 45′ W., and is 54m. in circumference, with an area of 108 square miles. There is no central range of mountains as in most other West Indian islands, but among the hills in the south-west an elevation of 1,328ft. is attained. Absence of rivers, paucity of springs, and almost complete deforestation make Antigua subject to frequent droughts, and although the average rainfall is 45·6in., the variations from year to year are great. The high rocky coast is much indented with excellent harbours, that of St. John being safe and commodious, but inferior to English Harbour, formerly a naval depot. The soil, especially in the interior, is very fertile. Sugar and molasses are the only important exports. Sweet potatoes, yams, maize and guinea corn are grown for local consumption. Antigua is the residence of the governor of the Leeward Islands, and the meeting place of the general legislative council. The Presidency has a local legislative council of 16 nominated members, half official and half unofficial. Until 1898, when the Crown Colony system was adopted, the council was partly elected, partly nominated. Elementary education is compulsory. Some agricultural training is provided by the Government, and the Cambridge local examinations and those of the University of London are held annually. Antigua is the see of a bishop of the Church of England, the members of which predominate, but Moravians and Wesleyans are numerous. There is a small volunteer defence force.

The island has direct steam communication with Great Britain, the United States and Canada, and is served by the submarine cable. St. John (population about 10,000), the capital, situated in the north-west, is built on an eminence overlooking one of the most beautiful harbours in the West Indies. The trade (imports £253,291, exports £266,368) is, since the institution of Imperial Preference, principally with England and Canada. The dependent islands of Barbuda and Redonda (*qq.v.*) have an area of 63 square miles. Population of Antigua (1939) 34,527.

Antigua was discovered in 1493 by Columbus, who is said to have named it after a church in Seville, Santa Maria la Antigua. It remained uninhabited until 1632, when a body of English settlers took possession, and in 1663 a further settlement was made under the direction of Lord Willoughby, to whom the island was granted by Charles II. It was raided by the French in 1666, but was soon after reconquered by the British and formally restored to them by the Treaty of Breda.

ANTIGUA, the ancient capital of Guatemala, Central America, and now the centre of the growing of the finest grades of coffee of that country. Antigua was partially destroyed by an earthquake in 1773, and the capital was thereafter removed to the present site of Guatemala city, 27 mi. E.N.E. Antigua has about 12,300 inhabitants and is far from a ruin, although what were some of the most imposing churches and monasteries of America stand in imposing ruins there. The ancient palace of the captain general is still intact, and many substantial houses have been built from the lower story of palaces wrecked in the earthquake. Antigua is reached by automobile from Guatemala city over a broad highway usually in good condition. Antigua is situated in a flat, confined valley (elevation 5,000 ft.) at the foot of the Volcan del Agua ("Volcano of Water"), and is one of the most beautiful sites in Central America.

ANTPLEGBMENA (ἀντιλεγόμενα, contradicted, disputed), an epithet used by the early Christian writers to denote those books of the New Testament which, although sometimes publicly read in the churches, were not for a considerable time admitted to be genuine, or received into the canon of Scripture; and applied later to those New Testament books having but a doubtful place in the Canon *(see* BIBLE: *New Testament,* 1. *Canon).*

ANTILIA or **ANTILLA** or Island of the Seven Cities (Portuguese *Isla das Sete Cidades),* a legendary island in the Atlantic ocean. The oldest etymology (145j) connects it with Plato's Atlantis (*q.v.*), others with Latin *anterior* (*i.e.,* the island that is reached "before" Cipango), or with the *Jezirat al Tennyn,* "Dragon's Isle," of Arab geographers. Antilia is marked in an anonymous map, dated 1424, in the grand-ducal library at Weimar; in the maps of the Genoese B. Beccario (1435), and of the Venetian Andrea Bianco (1436), and again in 1455 and 1476. In most of these it is accompanied by smaller *insulae de novo repertae,* "newly discovered islands," Royllo, St. Atanagio and Tanmar. The Florentine Paul Toscanelli, in letters to Columbus and the Portuguese court (1474), takes Antilia as the principal landmark for measuring the distance between Lisbon and the Island of Cipango or Zipangu (Japan). On the globe made at Nuremberg in 1492 *(see* MAP: *History)* the geographer Martin Behaim relates that in 734—probably a misprint for 714—after the Moors had conquered Spain and Portugal, the island of Antilia or "Septe Cidade" was colonized by Christian refugees under the archbishop of Oporto and six bishops, and that a Spanish vessel sighted the island in 1414. In older Portuguese tradition each leader founded and ruled a city, free from the disorders of less Utopian states. Later Portuguese tradition localized Antilia in the largest of the Azores, St. Michael's. This legend may commemorate some imperfectly recorded discovery or may embody the idea of a western elysium like the Isles of the Blest, or Fortunate Islands.

ANTILLES, a term of obscure origin, now employed, especially by foreign writers, as synonymous with "West India Islands." It dates traditionally from a period anterior to the discovery of the New World by European navigators, being the name assigned to semi-mythical lands indicated in mediaeval charts sometimes as an archipelago, sometimes as a continent of varying size, uncertainly located in mid-ocean between the Canaries and India. It came to be identified with the lands discovered by Columbus. When these were found to consist of a vast archipelago, *Antilia* assumed its present plural form *Antilles,* which was applied to this whole group.

A distinction is made between the Greater Antilles (Cuba, Jamaica, Haiti-San Domingo and Porto Rico) and the Lesser Antilles, comprising the rest of the islands.

ANTILOCHUS, in Greek legend, son of Nestor, king of Pylos. One of the suitors of Helen, he accompanied his father to the Trojan War, and distinguished himself as acting commander of the Pylians. He was an intimate friend of Achilles, to whom he was commissioned to announce the death of Patroclus. When his

father was attacked by Memnon, he saved his life at the sacrifice of his own (Pindar, *Pyth.*, vi. 28), thus fulfilling the oracle which had bidden him "beware of an Ethiopian." According to other accounts, he was slain by Hector (Hyginus, *Fab.*, 113), or by Paris in the temple of the Thymbraean Apollo together with Achilles (Dares Phrygius 34).

ANTIMACASSAR, a protective covering thrown over the back of a chair or the head or cushions of a sofa, named from *Macassar*, a hair-oil in general use in the 19th century. The original antimacassars were made of stiff, white crochet-work, but later soft coloured materials. embroidered in wools or silks, were used. In the 20th century the use of antimacassars which, in better class homes, at least, had died out, was revived in the form of strips of elaborately patterned lace.

ANTIMACHUS, of Colophon or Claros, Greek poet and grammarian, flourished about 400 B.C. His chief works were: a lengthy epic *Thebais*, an account of the expedition of the Seven against Thebes and the war of the Epigoni; and an elegiac poem Lydd, so called from the poet's mistress. These poems, though not popular, were praised by Plato. (Cic., *Brut.*, 191; Plutarch, *Consol. ad Apoll.* 9; Athenaeus xiii. 597.) He was the founder of "learned" epic poetry, and the forerunner of the Alexandrian school, whose canon allotted him the next place to Homer. He also prepared a critical recension of the Homeric poems (mentioned 12 times in the Venetian Scholia).

See Fragments, ed. Stoll (1845); Bergk, *Poetae Lyrici Graeci (1882)*; Kinkel, *Fragmenta epicorum Graecorum* (1877).

ANTI-MASONIC PARTY, an American political organization which had its rise after the mysterious disappearance, in 1826, of William Morgan (c. 1776–*c.* 1826), a freemason of Batavia (N.Y.) who had become dissatisfied with his Order and had planned to publish its secrets. When his purpose became known to the freemasons, Morgan was subjected to frequent annoyances, and finally in Sept. 1826, he was seized and surreptitiously conveyed to Ft. Niagara, whence he disappeared. Though his ultimate fate was never known, it was generally believed at the time that he had been murdered. The event created great excitement, and led many to believe that freemasonry and good citizenship were incompatible. Opposition to freemasonry was taken up by the churches as a sort of religious crusade, and it also became a local political issue in western New York, where early in 1827 the citizens in many mass meetings resolved to support no freemason for public office. In New York at this time the National Republicans, or "Adams men," were a very feeble organization, and shrewd political leaders at once determined to utilize the strong anti-masonic feeling in creating a new and vigorous party to oppose the rising Jacksonian Democracy. In this effort they were aided by the fact that Jackson was a high freemason and frequently spoke in praise of the Order. In the elections of 1828 the new anti-masonic party proved unexpectedly strong, and after this year it practically superseded the National Republican Party in New York. In 1829 the hand of its leaders was shown, when, in addition to its antagonism to the freemasons it became a champion of internal improvements and of the protective tariff. From New York the movement spread into other middle States and into New England. A national organization was planned as early as 1827, and in 1831 the party at a national convention in Baltimore nominated as its candidate for the Presidency William Wirt of Maryland. In the election of the following year it secured the seven electoral votes of the State of Vermont. This was the high tide of its prosperity, for by 1836 most of its members had united with the Whigs.

The growth of the anti-masonic movement was due to the political and social conditions of the time rather than to the Morgan episode, which was merely the torch that ignited the train. Under the name of "anti-masons" able leaders united those who were discontented with existing political conditions. The fact that William Wirt, their choice for the Presidency in 1831, was not only a freemason, but even defended the Order in a speech before the convention that nominated him, indicates that simple opposition to freemasonry soon became a minor factor in holding together the various elements of which the party was composed.

See J. D. Hammond, *History of Political Parties in the State of New York* (Albany, 1842); the *Autobiography of Thurlow Weed* (Boston, 1884); A. G. Mackey and W. R. Singleton, *The History of Freemasonry*, vol. vi. (1898); and Charles McCarthy, *The Anti-masonic Party: A Study of Political Anti-Masonry in the United States, 1827–1840*, in the Report of the *American Historical Association for 1902* (1903).

ANTIMONY, a bluish-white, exceedingly brittle metal. In its naturally occurring sulphide (stibnite) it has been known from very early times, more especially in Eastern countries, reference to it being made in the Old Testament. Basil Valentine alludes to stibnite in his *Triumphal* Car of *Antimony* (*c.* 1600), and at a later date describes the preparation of the metal.

Native mineral antimony occurs occasionally, and as such was first recognized in 1748. It is usually found in lamellar or granular masses, with a tin-white colour and metallic lustre, in limestone or in mineral veins often in association with ores of silver. Distinct crystals are rarely met with; these are rhombohedral and isomorphous with arsenic and bismuth. Hardness 3–3½, specific gravity 6·65–7·72. Sala in Sweden, Allemont in Dauphiné, and Sarawak in Borneo may be mentioned as some of the localities for this mineral. Antimony, however, occurs chiefly as the sulphide, stibnite; to a much smaller extent it occurs in combination with other metallic sulphides in the minerals wolfsbergite, boulangerite, bournonite, pyrargyrite, etc. For the preparation of metallic antimony the crude stibnite being readily fusible (m.p. 540°C) is first liquated, to free it from earthy and siliceous matter, and is then roasted in order to convert it into oxide. After oxidation, the product is reduced by heating with coal, care being taken to prevent any loss through volatilization by covering the mass with a layer of some protective substance such as potash, soda or glauber salt, which also aids in refining. For rich ores the method of roasting the sulphide with scrap-iron is sometimes employed; carbon, salt and sodium sulphate being used to slag the iron. The crude antimony is fused with stibnite to remove iron and then with a flux of potash and antimony sulphide (potassium thioantimonite) to remove sulphur in the form of thioantimoniate. By these operations pure antimony is obtained. Antimony has an atomic weight of 121·77 (Symbol Sb, atomic number 51, isotopes 121–123) and is included in the same natural family of elements as nitrogen, phosphorus, arsenic and bismuth.

Antimony combines readily with many other metals to form alloys, some of which find extensive application in the arts. Type-metal (*q.v.*) is an alloy of lead with antimony and tin, to which occnsionally a small quantity of copper or zinc is added. An alloy of tin and antimony forms the basis of Britannia-metal (*q.v.*), small quantities of copper, lead, zinc or bismuth being added. For the linings of brasses, various white metals are used, these being alloys of copper, antimony and tin, and occasionally lead.

Antimony is a silvery white, crystalline, brittle metal, and has a high lustre. Its specific gravity varies from 6.7 to 6.86; it melts at 630·5°C (Heycock and Neville), and boils at about 1,500°C. Its specific heat is 0·0523 (H. Kopp). The vapour density of antimony at 1,j72°C is 10·74, and at 1,640°C 9.78 (V. Meyer), so that the antimony molecule is less complex than the molecules of the elements phosphorus and arsenic. An amorphous modification of antimony can be prepared by heating the metal in a stream of nitrogen, when it condenses in the cool part of the apparatus as a grey powder of specific gravity 6.22, melting at 614°C and containing 98–99% of anlimony (F. Hérard, 1888). Another form of the metal, known as explosive antimony, was discovered by G. Gore (1858), on electrolysing a solution of antimony trichloride in hydrochloric acid, using a positive pole of antimony and a negative pole of copper or platinum wire. It has a specific gravity of 5.78 and always contains some unaltered antimony trichloride (from 6 to 20%, G. Gore). It is very unstable, a scratch causing it instantaneously to pass into the stable form with explosive violence and the development of much heat (*see* ALLOTROPY).

Pure antimony is quite permanent in air at ordinary temperatures, but when heated in air or oxygen it burns, forming the trioxide. It decomposes steam at a red heat, and burns in chlorine. Dilute hydrochloric acid is without action on it, but on warming

with the concentrated acid, antimony trichloride is formed; it dissolves in warm concentrated sulphuric acid, the normal sulphate $Sb_2(SO_4)_3$ being formed. Nitric acid oxidizes antimony, the oxide obtained depending on the temperature and concentration of the acid. It combines directly with sulphur and phosphorus, and is readily oxidized when heated with metallic oxides (such as litharge, mercuric oxide, manganese dioxide, etc.).

Detection and Estimation. — Antimony and its salts may be readily detected by the orange precipitate of antimony sulphide which is produced when sulphuretted hydrogen is passed through their acid solutions, and also by the Marsh test (see ARSENIC), in which the black stain of antimony produced is not soluble in bleaching powder solution. Antimony compounds when heated on charcoal with sodium carbonate in the reducing flame give brittle beads of metallic antimony, and a white incrustation of the oxide. The antimonious compounds are decomposed on addition of water, with formation of insoluble basic salts, soluble in solutions of tartaric acid. Antimony may be estimated quantitatively by conversion into the sulphide; the precipitate obtained is dried at 100° C and heated in a current of carbon dioxide, or it may be converted into the tetroxide by nitric acid. It may also be determined volumetrically by titrating an antimonious salt, in the presence of an excess of sodium bicarbonate as a buffer, with a standard solution of iodine.

Inorganic **Compounds.**—Antimoniuretted hydrogen or stibine, SbH_3, may be prepared by the action of hydrochloric acid on an alloy of antimony and zinc, by the action of nascent hydrogen on antimony compounds or by dropping water on to aluminium antimonide. As prepared by the first two methods it contains a relatively large amount of hydrogen, from which it can be freed by passing through a tube immersed in liquid air, when it condenses to a white solid. It is a poisonous colourless gas, with a characteristic offensive smell. In its general behaviour it resembles arsine, burning with a violet flame and being decomposed by heat into its constituent elements. With silver nitrate solution it gives a black precipitate of silver antimonide, $SbAg_3$; it is decomposed by the halogen elements and also by sulphuretted hydrogen.

Oxides and Acids. — There are three known oxides of antimony, the trioxide Sb_4O_6 which is capable of combining with both acids and bases to form salts, the tetroxide Sb_2O_4 and the acidic pentoxide Sb_2O_5. Antimony trioxide occurs as the minerals valentinite and senarmontite, and can be artificially prepared by burning antimony in air, by decomposing antimony trichloride with an aqueous solution of sodium carbonate, or by the action of dilute nitric acid on the metal. It is a white powder, almost insoluble in water, and when volatilized condenses in two crystalline forms, either octahedral or prismatic. It is insoluble in sulphuric and nitric acids, but is readily soluble in hydrochloric and tartaric acids and in solutions of the caustic alkalis. Antimony tetroxide, formed by strongly heating in air either the trioxide or pentoxide or by oxidizing the metal with nitric acid and afterwards igniting to redness, is a non-volatile white powder, insoluble in water and almost so in acids — concentrated hydrochloric acid dissolving a small quantity. It is decomposed by a hot solution of potassium bitartrate. Antimony pentoxide, a pale yellow powder, is obtained by repeatedly evaporating antimony with nitric acid and heating the resulting antimonic acid to a temperature not above 275° C. On being heated strongly it gives up oxygen and forms the tetroxide. It is insoluble in water, but dissolves slowly in hydrochloric acid. It possesses a feebly acidic character, giving metantimoniates when heated with alkaline carbonates.

Orthoantimonic acid, H_3SbO_4, obtained by the decomposition of its potassium salt with nitric acid (A. Geuther), or by the addition of water to the pentachloride, is a white powder almost insoluble in water and nitric acid, and when heated is first converted into metantimonic acid, $HSbO_3$, and then into the pentoxide Sb_2O_5. Pyroantimonic acid, $H_4Sb_2O_7$ (the metantimonic acid of E. Frémy), is obtained by decomposing antimony pentachloride with hot water, and drying the precipitate so obtained at 100° C. It is a white powder which is more soluble in water and acids than orthoantimonic acid. It forms two series of salts, of the types $M_2H_2Sb_2O_7$ and $M_4Sb_2O_7$. Metantimonic acid, $HSbO_3$, obtained by heating orthoantimonic acid to 175° C, is a white powder almost insoluble in water, but slowly hydrated into the ortho-acid.

Halogen Compounds. — Compounds of antimony with all the halogen elements are known, one atom of the metal combining with three or five atoms of the halogen, except in the case of bromine, where only the tribromide is known. The majority of these halide compounds are decomposed by water, with the formation of basic salts. Antimony trichloride ("Butter of Antimony"), $SbCl_3$, is obtained by burning the metal in chlorine, by distilling antimony with excess of mercuric chloride, or by fractional distillation of antimony tetroxide or trisulphide in hydrochloric acid. It is a colourless deliquescent solid of specific gravity 3·06; it melts at 73·2° C to a colourless oil; and boils at 223°. It is soluble in alcohol, and also in a small quantity of water; but with an excess of water it gives a precipitate of various oxychlorides, known as powder of algaroth (*q.v.*). The trichloride is used in the preparation of tartar emetic, as a bronzing solution for gun barrels and as a caustic in medicine. Antimony pentachloride, $SbCl_5$, prepared by heating the trichloride in a current of chlorine, is a nearly colourless fuming liquid of unpleasant smell, which can be solidified to a mass of crystals melting at −6° C. It dissociates into the trichloride and chlorine when heated. Antimony trifluoride, SbF_3, is obtained by dissolving the trioxide in aqueous hydrofluoric acid or by distilling antimony with mercuric fluoride. The double compound $SbF_3,(NH_4)_2SO_4$ known as "antimony salts" is used in dyeing. The pentafluoride SbF_5 results when metantimonic acid is dissolved in hydrofluoric acid and it forms an amorphous gummy mass, which is decomposed by heat. Tartar emetic, potassium antimonyl tartrate, $C_4H_4O_6(SbO)K\frac{1}{2}H_2O$, made from the trioxide and cream of tartar, is used medicinally and as a mordant in dyeing although for the latter purpose it is partly superseded by the double oxalate or lactate. On precipitating antimony trichloride or tartar emetic in acid solution with sulphuretted hydrogen, an orange-red precipitate of the hydrated trisulphide is obtained, which turns black on being heated to 200° C. The trisulphide heated in a current of hydrogen is reduced to the metallic state; it burns in air forming the tetroxide, and is soluble in concentrated hydrochloric acid, in solutions of the caustic alkalis, and in alkaline sulphides. By the union of antimony trisulphide with basic sulphides, livers of antimony are obtained. These thioantimonites are usually prepared by fusing their components together, and are dark powders which are less soluble in water the more antimony they contain. They are used in the vulcanizing of rubber and in the preparation of matches. The so-called golden sulphide consists mainly of Sb_2S_4 obtained together with sulphur by acidifying solutions of alkali thioantimonates. It is doubtful whether antimony pentasulphide, Sb_2S_5, prepared by precipitating a solution of the pentachloride with sulphuretted hydrogen, by decomposing "Schlippe's salt" (*q.v.*) with an acid, or by passing sulphuretted hydrogen into water containing antimonic acid, is a chemical entity or merely a mixture of tri- and tetra-sulphide with sulphur. It forms a fine dark orange powder insoluble in water, but readily soluble in aqueous solutions of the caustic alkalis and alkaline carbonates. This so-called pentasulphide is employed in the vulcanization of rubber.

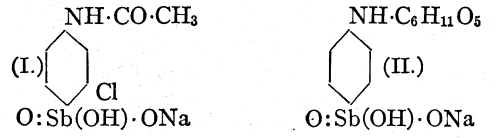
Organic Compounds. — Many organic compounds containing antimony are known. By distilling an alloy of antimony and sodium with methyl iodide, mixed with sand, trimethylstibine, $Sb(CH_3)_3$, is obtained; this combines with excess of methyl iodide to form tetramethylstibonium iodide, $Sb(CH_3)_4I$, which on treatment with moist silver oxide gives the corresponding tetramethylstibonium hydroxide, $Sb(CH_3)_4OH$, a strong base obtained in deliquescent crystals, of alkaline reaction, and absorbing carbon dioxide readily. The Grignard (*q.v.*) reaction has facilitated the production of organo-antimonials (H. Hibbert, 1906). Methyl magnesium iodide and antimony trichloride yield trimethylstibine which combines with bromine, forming trimethylstibine dibromide. On heating, this dibromide loses methyl bromide and gives rise to dimethylstibine bromide $(CH_3)_2SbBr$. This product absorbs bromine forming a tribromide

which undergoes demethylation on gentle heating so that it yields methylstibine dibromide. By this progressive demethylation derivatives of primary and secondary stibines have been obtained (G. T. Morgan and G. R. Davies, 1926). Corresponding antimony compounds containing the ethyl group are known, as is also a triphenylstibine, $Sb(C_6H_5)_3$, which is prepared from antimony trichloride, sodium and monochlorbenzene. See G. T. Morgan, Organic Compounds of Arsenic and Antimony (1918).

ANTIMONY IN MEDICINE

So far back as Basil Valentine and Paracelsus, antimonial preparations were in great vogue as medicinal agents, and came to be so much abused that a prohibition was placed upon their employment by the Paris parliament in 1566. Metallic antimony was utilized to make goblets in which wine was allowed to stand so as to acquire emetic properties, and "everlasting" pills of the metal, supposed to act by contact merely, or by slight solution, were administered and recovered for future use after they had fulfilled their purpose. Antimony compounds act as irritants both externally and internally. Tartar emetic acts directly on the wall of the stomach, producing vomiting, and continues this effect by its action on the medulla. It is a powerful cardiac depressant, diminishing both the force and frequency of the heart's beat. It depresses respiration, and in large doses lowers temperature. It depresses the nervous system, especially the spinal cord. It is excreted by all the secretions and excretions of the body. Thus as it passes out by the bronchial mucous membrane it increases the amount of secretion and so acts as an expectorant. On the skin its action is that of a diaphoretic, and being also excreted by the bile it acts slightly as a cholagogue. The medicinal uses of the older forms of antimony compounds may be summed up in the words diaphoretic, febrifuge, parasiticidal and emetic. Antimony trioxide or potassium antimonyl tartrate are employed for the first two purposes, whereas the synonym, tartar emetic, for the latter salt indicates that antimony compounds are of value in certain cases of poisoning.

It has long been known that antimony has medicinal properties similar to those of arsenic, and modern scientific developments in therapeutic chemistry have tended to produce antimonial substitutes of the phenylarsonic acid and arsenobenzol types in order to obtain remedies of greater utility. The antimony analogue of arsenobenzol has been made, but clinical experience has proved it to be of little value. Compounds of the nature of urea-stibamine (urea and *p*-aminophenylstibinic acid) have been used in kala-azar. Other analogous aromatic stibinates also employed intravenously are sodium metachloro-para-acetylaminophenyl-stibinate (I.), a drug of low toxicity and high parasitotropic value, and stibamine glucoside (II.) which, under the name of neostam, is a very efficacious remedy used extensively against kala-azar, especially in Assam.



Interesting results have attended the modern use of tartar emetic and the allied sodium antimony1 tartrate in bilharziasis, and the affection of a similar type known as schistosomiasis. The compound is given on the recommendation of J. B. Christopherson (1919) intravenously in these affections. The important point is that these drugs kill the ova in addition to the worm. These two compounds have been used successfully in various forms of Leishmania infection, such as kala-azar, oriental sore and American Leishmaniasis, together with many other tropical affections. These diseases have also been treated with promising results by injections of a glycerin solution of antimony trioxide.

Toxicology. — In acute poisoning by antimony the symptoms are almost identical with those of arsenical poisoning, which is much commoner (see ARSENIC). The post-mortem appearances are also very similar, but the gastro-intestinal irritation is much less marked and inflammation of the lungs is more commonly seen. If the patient is not already vomiting freely the treatment is to use the stomach-pump, or give sulphate of zinc (gr. 10–30) by the mouth or apomorphine (gr. $\frac{1}{20}$–$\frac{1}{10}$) subcutaneously. Frequent doses of a teaspoonful of tannin dissolved in water should be administered, together with strong tea and coffee and mucilaginous fluids. Stimulants may be given subcutaneously, and the patient should be placed in bed between warm blankets with hot-water bottles. Chronic poisoning by antimony is very rare, but resembles in essentials chronic poisoning by arsenic. For medicinal uses of antimony see W. H. Martindale and W. W. Westcott, The Extra Pharmacopoeia, 19th ed. vol. i. 1928.

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PRODUCTION AND EXPLOITATION OF ANTIMONY

In 1929 China contributed 71% of the world's output of antimony, which was about 35,000 short tons. In 1929 North and South America contributed less than 20% of the world's output. In 1937 China supplied 43% and North and South America about 45%, chiefly from Mexico; which produced three times as much antimony in 1937 as in 1929. Prior to the World War the principal producers of antimony were Austria-Hungary, Asia Minor, Borneo, France, and since 1900, China. During the war belligerent governments bought large quantities of antimony for the manufacture of shrapnel, shells, and bullets, which require about 12% antimony in the antimonial lead. Antimony also serves as a retarding agent in priming caps. In peace time the chief uses of antimony include antimonial lead for storage batteries, and covering for telephone cables, and uses in alloys (v. supra). Antimony oxide finds extensive use in enamels and pigments; the sulphide is employed in rubber manufacture.

Principal Producers of *Antimony* and World Output*
(in *metric* tons)

Country	1933	1935	1937
China (†)	13,800	17,700	14,702
Mexico	1,794	4,113	9,788
Bolivia	1,744	1,898	3,934
Czechoslovakia	1,090	1,637	829(‡)
United States	490	466	1,056
France	312	...	...
Turkey	271	103	602
World output	20,200	27,800	34,500

(*) "Minerals Yearbook 1938," U.S. Bureau of Mines. (†) Antimony content of regulus, crude antimony and oxide exported. ($) 1936.

ANTINOMIANISM, an interpretation of the antithesis between law and gospel, recurrent from the earliest times (Gr. ἀντί against νόμος, law). Christians being released, in important particulars, from conformity to the Old Testament polity as a whole, a real difficulty attended the settlement of the limits and the immediate authority of the remainder, known vaguely as the moral law. Indications are not wanting that St. Paul's doctrine of justification by faith was, in his own day, mistaken or perverted in the interests of immoral licence. Gnostic sects approached the question in two ways. Marcionites, named by Clement of Alexandria *Antitactae* (revolters against the Demiurge) held the Old Testament economy to be tainted throughout by its source; but they are not accused of licentiousness. Manichaeans, again, holding their spiritual being to be unaffected by the action of matter, regarded carnal sins as being, at worst, forms of bodily disease. Kindred to this latter view was the position of sundry sects of fanatics during the Reformation period, who denied that regenerate persons sinned, even when committing acts in themselves gross and evil (see ANABAPTISTS).

During the Commonwealth period Antinomianism was found in England among the high Calvinists who maintained that an elect person, being predestined to salvation, is absolved from the moral law and is not called upon to repent. In less extreme forms, Antinomianism is a feature of those forms of Christianity which lay stress on justification by faith (see Fletcher's *Checks* to *Antinomianism*, 1771).

ANTINOMY, literaliy the mutual incompatibility, real or apparent, of two laws. The term acquired a special significance in the philosophy of Kant, who used it to describe the contradictory results of applying to the universe of pure thought the categories or criteria proper to the universe of sensible perception (phenomena). These antinomies are four — two mathematical, two dynamical — connected with (1) the limitation of the universe in respect of space and time, (2) the theory that the whole consists of indivisible atoms (whereas, in fact, none such exist), (3) the problem of freedom in relation to universal causality, (4) the existence of a universal being — about each of which pure reason contradicts the empirical, as thesis and antithesis. Kant claimed to solve these contradictions by saying that in no case is the contradiction real, however seriously it has been intended by the opposing partisans, or must appear to the mind without critical enlightenment. It is wrong, therefore, to impute to Kant, as is often done, the view that human reason is, on ultimate subjects, at war with itself, in the sense of being impelled by equally strong arguments towards alternatives contradictory of each other. The difficulty arises from a confusion between the spheres of phenomena and noumena. In fact no rational cosmology is possible.

BIBLIOGRAPHY.—W. Windelband, *History of Philosophy* (Eng. trans. 1893); John Watson, *Selections from Kant* (trans. 1897) pp. 155 fol.; F. Paulsen, I. *Kant* (Eng. trans. 1902); pp. 216 fol.; H. Sidgwick, *Philos. of Rant,* lectures x. and xi. (1905).

ANTINOÜS, a beautiful youth of Claudiopolis in Bithynia was the favourite of the emperor Hadrian, whom he accompanied on his journeys. He committed suicide by drowning himself in the Nile (A.D. 130). After his death Hadrian caused the most extravagant respect to be paid to his memory. He was raised to the rank of the gods; temples were built for his worship in Bithynia, Mantinea in Arcadia and Athens; festivals celebrated in his honour, and oracles delivered in his name. The city of Antinoopolis was founded on the ruins of Besa, where he died (Dio Cassius lix. 11; Spartianus, Hadrian). A number of statues, busts, gems, and coins represented Antinoiis as the ideal type of youthful beauty, often with the attributes of some special god. A colossal bust is in the Vatican; a bust in the Louvre, a bas relief from the Villa Albani, a statue in the Capitoline museum, another in Berlin, another in the Lateran, and many more exist.

See Levezow, *Über den Antinous* (1808); Ebers, *Der Kaiser* (1881); *Antinous, A Romance of Ancient Rome,* from the German of A. Hausrath, by M. Safford (1882); Dietrich, *Antinoos* (1884); Laban, *Der Gemzitsausdruck des Antinoos* (1891); F. Gregorovius, The *Emperor Hadrian* (trans. *M. E.* Robinson, 1898), Bk. II. chap. xvi.; B. W. Henderson, *Life and Principate of Hadrian* (1923), *VIII.* § 3.

ANTIOCH (Mod. *Antākiyah*), the name of many ancient cities, the most famous of which was Ἀντιόχεια ἡ ἐπὶ Δάφνῃ (Pliny, Antiochia Epidaphnes) situated on the left bank of the Orontes about 20m. from the sea in a fertile plain which separates the Lebanon ranges from the spurs of the Taurus. The physical disposition of the surrounding country which forced the main streams of north- and south-bound traffic into one channel in the Orontes valley, thereby determined that a city hereabouts would be in a favourable position to sift the trade of Asia Minor and the Upper Euphrates, of Egypt and Palestine.

History. — Antigonus was the first to recognize the strategic importance of the neighbourhood. He began to build a city, Antigonia, a few miles farther north on the Kara-su (307 B.C.). On his defeat and death at Ipsus at the hands of his rival Seleucus Nicator (301), the latter after selecting a site with military advantages under Mons Silpius founded Antioch and made use of Antigonia as quarry for his building. To the original city laid out in imitation of the plan of Alexandria with two great colonnaded streets intersecting in the centre, other walled quarters were added on the east side by Antiochus I., on the north on an island by Seleucus II. and Antiochus III. Finally Antiochus IV. (Epiphanes) added a fourth quarter, thus giving rise to the name Tetrapolis. Happy in its situation Antioch flourished exceedingly, developed into a mighty centre of trade and by the 4th century A.D. had a population of nearly a quarter of a million. To the west about 4m. off was Daphne (mod. *Beit* el-Mi'), a delightful pleasure resort of shady groves and running waters in the midst of which rose a great temple to the Pythian Apollo founded by Seleucus I. The precincts of Daphne were endowed with the right of asylum and it became the haunt of society's outcasts (Tacitus, *Ann.* 360). Its beauty and lax morals (*Daphnici* Mores) passed into a proverb in the western world and Antioch shared the fame and the infamy.

Under Antiochus I. (280–261 B.C.) Antioch became the capital of the western section of the Seleucid empire and soon after the residence also of the Seleucid emperors. It enjoyed a great reputation for letters and the arts (Cicero, pro Arch. 3) but there seems to have been little real intellectual life. The Antiochenes were turbulent, fickle and notoriously dissolute. They rose against Alexander Balas in 147 B.C. and Demetrius II. in 129. In 83 B.C. they turned against the weak Seleucids and opened the gates to Tigranes of Armenia. They tried to depose Antiochus XIII. (65 B.C.) and petitioned Rome successfully against his restoration. With Syria it passed to Rome (64 B.C.) but remained a civitas *libera.* Antioch was magnificent as its epithet "Golden" implies, but earthquakes to which the district has been peculiarly liable played havoc with its magnificence from time to time. The first recorded occurred in 148 B.C., doing immense damage, and as recently as 1872 a violent shock destroyed a large part of the old walls.

Although the Romans expressed freely their contempt for the Antiochenes, their emperors favoured the city as a worthy capital for their eastern empire. Caesar visited it in 47 B.C. and confirmed its freedom. Octavian, Tiberius, Trajan, Antoninus Pius and Hadrian adorned and equipped it with temple, theatre, colonnade, circus, bath, aqueduct, all the architectural features and embellishments of a Roman metropolis. Diocletian built a vast palace on the island and Constantine a fine church. At Antioch Germanicus died (A.D. 19) and his body was buried in the forum. Titus set up the Cherubim taken from the Jerusalem Temple, over one of its gates. Cornmodus had Olympic games celebrated here. In A.D. 266 the town was suddenly raided by the Persians who slew many in the theatre. In 387 it lost its metropolitan status owing to the revolt against a new tax levied by Theodosius. Zeno restored many of its public buildings and renamed it *Theopolis* only to see it ruined by an earthquake soon afterwards (526). And Chosroes completed the destruction (538).

Rise **sf Christianity.**—Antioch was an early home of Christianity and its Church became in a special sense the mother of the Gentile churches. After the fall of Jerusalem it became the real metropolis of Christianity. It was the scene of the early evangelizing work of Paul and Barnabas and the home church whence they set forth on their missionary journeys and to which they returned to report results. Peter visited Antioch (Gal. ii. 11) and, basing its claim on a tradition that he remained there for a time as head of its Church, Antioch was accorded by the Council of Nicaea the place of honour after Alexandria and Rome. It was at Antioch that the term "Christian" was first given to converts to the new faith (Acts xi. 26), as some maintain, in derision. So well was Christianity received there that by the end of the 4th century, its adherents were reckoned by Chrysostom at about 100,000. In 50 years (A.D. 252–300) as many as ten assemblies of the Church were held in Antioch. The favour shown by Julian to Jewish and pagan rites provoked the populace and the closing of its great church of Constantine led to the burning down of the temple of Apollo at Daphne. Antiochene lampoons against Julian were countered by him in his satiric apologia, still extant, called *Misopogon* (c. A.D. 362). The church was reopened by his successor, Valens, but shared the fate of the city when the Sassanid Chosroes I. destroyed it (538) and carried off part of the inhabitants to New Antioch in Assyria. The hermit Simeon Stylites lived on his pillar in the district (40m. E.) at the beginning of the 5th century and his body was brought to Antioch for burial. The Arabs took the city in 638 when they overran Syria, but Damascus made a greater appeal to them as a capital city, and as Damascus advanced Antioch declined. It passed into the possession of the Crusaders in 1098 after a bitter siege of nine months the end of which was hastened by an earthquake and betrayal. Assigned to Bohemund, prince of Tarentum, it remained the capital of a

Latin principality for nearly two centuries. In 1517 it passed into Turkish hands. It fell before the onslaught of the troops of Mohammed 'Ali of Egypt on their march towards Constantinople (1840), but was restored to Turkish possession soon after. In October 1918 it was occupied by the Egyptian Expeditionary Force, in 1920 by France under the League mandate. In 1939, with the Hatay, it was ceded to Turkey.

Dogma.—Several heresies had their origin in Antioch. One of its bishops, Paul (of Samosata) advocated (*c.* 260) a form of Rlonarchianism maintaining that Christ was a mere man but so endowed as to rise gradually to divine dignity. Arius was here a pupil of Lucian the presbyter, text-critic and martyr (d. 311) and Nestorius was a monk of Antioch. Antioch in time gave its name to a school of Christian thought the chief representatives of which were the bishops Diodorus (Tarsus, d. 394), John Chrysostom (Constantinople, d. 407), Theodore (Mopsuestia, d. 429) and Theodore (Cyrrhus, d. 457). It was anti-mystic in trend. It stressed the human element, making it rather than the divine the starting point of its enquiry, focussed attention on the historical Christ, and advocated direct and immediate interpretation of Scripture. It saw in the Incarnation the accomplishment of man's destiny rather than a means to deliver him from the consequences of sin.

Synods.—More than 30 synods were held at Antioch in ancient times, the first three of which (264–269) discussed the errors of Paul of Samosata and condemned him, but only with the eclipse of his patroness Zenobia of Palmyra (272) could the decree of expulsion be made effective. The most celebrated synod was that of 341 at which about roo bishops were present. It passed 25 canons and promulgated three creeds in an endeavour to displace the Nicene. Power was vested mainly in the metropolitan (archbishop) and in synods to be held twice a year (5th Canon of Nicaea). The relations between dioceses were regulated; bishops were enjoined to exercise strict guardianship over Church property and were forbidden to name their successors. These canons, formed an elementary ecclesiastical law for both east and west, and likewise formed part of the *Codex Canonum* used by the Council of Chalcedon (451). They were twenty-five in number and their authenticity, previously much disputed, was substantially proved by Hefele. One of the most interesting of their provisions was that which in increasing the powers of the metropolitan deprived the country bishops (*chorefiscopi*) of direct recourse to the emperor. The synod is commonly called *in encaeniis* (Cv *ἐγκαινίοις*) or in *dedicatione,* its occasion being the dedication of the Basilica.

Modern.—Pop. (1935) 28,000 (4,000 Christians) with language mainly Turkish; from 1919 to 1939 in Syria, the town was ceded in 1939 with Alexandretta to Turkey. The position it once occupied as the chief city of north Syria has passed to Aleppo.

The valley of the Orontes is growing in wealth and productiveness with the draining of the central lake. The cultures include tobacco, maize and cotton. There is a large olive grove and the mulberry tree is cultivated for the silk industry. There are several soap factories where the oils of the *ghār* (bay) and the olive are mixed to produce a perfumed and highly esteemed soap. Other manufactures are shoes and knives, and exports include hides and liquorice.

The Americans have a mission school and there is a British vice-consul.

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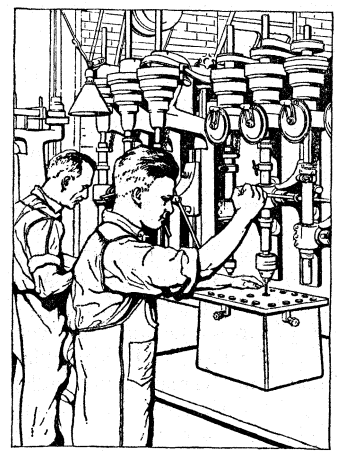
ANTIOCH COLLEGE, an institution of higher education at Yellow Springs (O.). The college is governed by a board of 20 trustees, the president of the college being *ex officio* president of the board, and was opened in 1853, Horace Mann being its first president. As reorganized in 1921, by Arthur E. Morgan then president, Antioch entered upon a distinctive career that has attracted widespread attention both on the part of the general public and of educators. The enrolment is limited to about joo The course for undergraduates commonly requires five or six years, and leads to the B S. or B.A. degree.

In choosing students, consideration is given to reports on required physical examinations. secondary school records, intelligence tests, life sketches by the applicants, and reports of references The traditional dominant purpose of the American college is the '[stimulation and development of those gifts of intellect with which nature has endowed the student." Antioch has endeavoured to restate the proper purpose of the college. According to its philosophy, that purpose is nothing less than the integration of life and its symmetrical development.



BY COURTESY OF ANTIOCH COLLEGE

STUDENTS AT ANTIOCH COLLEGE SECURING PRACTICAL EXPERIENCE IN A LOCAL MACHINE SHOP

In America the college and university, including the technical school, are becoming recognized as providing the chief and almost the only ordered means for preparing intelligent young people for life. Students should be concerned, not with scholarship or technical skill alone, but with learning what life means and how to make the most of it. Antioch holds that there is no single faculty, not even intelligence, which is the chief element of human excellence, or which chiefly needs systematic development.

The work of the college falls under four main heads; required physical education, a required liberal curriculum, technical or professional training, and part-time practical economic work. The required courses include two years of English and literature; four years of history, economics, and government; one year each of mathematics, chemistry, physics, biology, earth science (a combination of physiography, geology, and astronomy); psychology; and a study of scientific method. A year of philosophy is required; and a year of "applied aesthetics."

In the autumn of 1928, Antioch adopted a system of "autonomous study," for all students above the sophomore year. Under the new plan upperclass students are not required to attend classes. The work for an entire term is outlined and the student then is left to master the subject in his own way, coming to the instructor only for necessary help, for discussion, and for inspiration.

To develop traits not easily reached by class-room work, such as initiative, self-reliance, responsibility, courage, and adaptability, and to help practical adjustment to life, both men and women students spend half their time at college and half in practical economic occupations, in alternate five-week shifts. Each working position is continuously filled, one student working while his or her alternate studies. These "co-operative" students work over a radius of 1,000m., with zoo employers, in a wide variety of callings; the positions being chosen because of their educational value to the particular students. Self-support is incidental, but the students, to a large degree, themselves meet college expenses.

(A. E. M.)

ANTIOCH IN PISIDIA, an ancient city, the remains of which lie close to the modern Yalovach, in the vilayet of Hamidabad in Turkey. It was situated on the lower southern slopes of the Sultan Dagh, on the right bank of a stream, the ancient

Anthius, which flows into the Hoiran Geul. It was founded on the territory of a Phrygian sanctuary, by Seleucus Nicator, before 280 B.C. and was made a free city by the Romans in 189 B.C. It was a thoroughly Hellenized, Greek-speaking city, in the midst of a Phrygian people, with a mixed population that included many Jews. Before 11 B.C. Augustus made it a colony, with the title Caesarea, and it became the centre of civil and military administration in south Galatia, the romanization of which was progressing rapidly in the time of Claudius, A.D. 41–54, when Paul visited it (Acts xiii. 14, xiv. 21, xvi. 6, xviii. 23). In 1097 the Crusaders found rest and shelter within its walls. The ruins are interesting, and show that Antioch was a strongly fortified city of Hellenic and Roman type. There are many inscriptions in Greek and Latin, including fragments of a Latin copy of the Res Gestae of Augustus.

ANTIOCHUS, the name of 13 kings of the Seleucid dynasty in nearer Asia. ANTIOCHUS I. SOTER (281–262 B.C.) was the son of Seleucus, a general of Alexander the Great and founder of the dynasty Upon his father's assassination (281 B.C.) he succeeded to the difficult task of holding the Seleucid empire together He turned back an invasion of Gauls from the north, fought the Ptolemies of Egypt over the possession of Palestine. and endeavoured to check the growing power of Pergamum. His son, ANTIOCHUS II. THEOS (262–247 B.C.), made peace with Egypt by his marriage with the daughter of Ptolemy Philadelphus, but was tyrannical and unpopular with his people. Antiochus III., surnamed The Great (223–187 B.C.), and most famous of the line, was a nephew of Antiochus Theos. By wars in the East, in Asia Minor, and against Egypt he extended the Seleucid empire almost to its original bounds. In an invasion of Greece he was, however, disastrously defeated by the Romans at the Pass of Thermopylae and forced to retire into Asia Minor. The Roman army under command of the brothers Scipio crossed the Hellespont and again defeated him at Magnesia, destroying his army. The defeat stripped Antiochus of all his former conquests in Asia Minor. ANTIOCHUS IV, EPIPHANES (176–164 B.C.), defeated Egypt's attempt to reconquer Palestine and invaded and occupied Egypt until later driven out by the Romans. He is also known for his attempt to suppress Judaism by force, his persecutions resulting in the Maccabaean rebellion. Antiochus VII. Sidetes (138–129 B.C.) was the last strong ruler of the dynasty. He conquered Jerusalem and died fighting the Parthians.

The name was also borne by the kings of Commagene (69 B.C.–A.D. 72), whose house was affiliated to the Seleucid ANTIOCHUS I. of Commagene, who without sufficient reason has been identified with the Seleucid Antiochus XIII. Asiaticus, made peace on advantageous terms with Pompey in 64 B.C. Subsequently he fought on Pompey's side in the Civil War, and later still repelled an attack on Samosata by Marcus Antonius (Mark Antony). He died before 31 B.C. and was succeeded by one Mithridates I. This Mithridates was succeeded by an ANTIOCHUS II., who was executed by Augustus in 29 B.C. After anotlier Mithridates we know of an ANTIOCHUS III., on whose death in A.D. 17 Commagene became a Roman province. In 38 his son ANTIOCHUS IV. EPIPHANES was made king by Caligula, who deposed him almost immediately. Restored by Claudius in 41, he reigned until 72 as an ally of Rome against Parthia. In that year he was deposed on suspicion of treason and retired to Rome. Several of his coins are extant.

On all the above *see* "Antiochos" in Pauly-Wissowa's *Realencyklopadie der classischen Altertumswissenschaft,* i. part ii. **(1894).**

ANTIOCHUS OF ASCALON (1st century, B.C.), Greek philosopher who attempted to reconcile the doctrines of his teachers Philo of Larissa and Mnesarchus the Stoic. Against the scepticism of Philo, he held that the intellect has in itself a sufficient test of truth; against Mnesarchus, that happiness, though its main factor is virtue, depends also on outward circumstances. This electicism is known as the Fifth Academy (see ACADEMY, GREEK). His writings are lost, and we owe our information to Cicero (Acad *Pr.,* ii. 43), and Sextus Empiricus (Pyrrh. *hyp.,* i. 235). Antiochus lectured also in Rome and Alexandria.

See R. Hoyer, *De Antiocho Ascalonita* (Bonn, **1883).**

ANTIOCHUS OF SYRACUSE, Greek historian, flourished about 420 B.C. He wrote a History of Sicily from the earliest times to 424, which was used by Thucydides, and the Colonizing of Italy, frequently referred to by Strabo and Dionysius of Halicarnassus.

See Miiller, *Fragmenta Historicorum Graecorum,* i.; Wolfflin, *Antiochos von Syrakus* **(1872).**

ANTIOPE. (1) In Greek legend, the mother by Zeus of Amphion and Zethus. Her beauty attracted Zeus, who, assuming the form of a satyr, took her by force. She ran away from her father and married Epopeus, king of Sicyon. Thereupon her father killed himself, first bidding his brother Lycus punish her. Lycus (who in some accounts was her former husband) killed Epopeus, brought Antiope back, and imprisoned and tormented her (or his wife Dirce did so, out of jealousy). On the way back, or after escaping from prison, she bore twins, Amphion and Zethus, who were brought up by herdsmen. Long after, she escaped and joined her sons; they recognized her, killed Lycus, and bound Dirce to the horns of a wild bull. For this, Dionysus, to whose worship Dirce had been devoted, visited Antiope with madness, which caused her to wander restlessly all over Greece till she was cured and married by Phocus of Tithorea, on Mt. Parnassus, where both were buried in one grave (Ovid *Metam.* VI, III.; Apollodorus III., 42–44; Hyginus, Fab.; 7, 8; Pausanias, IX. 17, 6).

(2) Daughter of Ares, sister of Hippolyte, queen of the Amazons, the wife of Theseus (*q.v.*).

ANTIOQUIA, an interior department of the republic of Colombia, lying south of Bolivar, west of the Magdalena river, and east of Cauca. Area. 25,409 sq mi.; pop. (census 1896) 648,190, (census 1938) 1,188,587. The greater part of its territory lies between the Magdalena and Cauca rivers and includes the northern end of the central Cordillera. The country is covered with valuable forests, and its mineral wealth renders it one of the most important mining regions of the republic. The capital, Medellin—with population (census 1902) 53,000, (1938) 143,952—is a thriving mining, commercial and manufacturing centre, 4.822 ft. above sea level, and 125 mi. from Puerto Berrio on the Magdalena. Other important towns are Antioquia, the old capital, on the Cauca; and Puerto Berrio on the Magdalena, connected by a railway with the capital.

ANTIPAROS (anc Oliaros), a Greek island in the modern eparchy of Naxos, separated by a narrow strait from the west coast of Paros; 7 mi. long by 3 mi. broad. Pop. 612, mostly in Kastro, on the north coast, employed in agriculture and fishing. Formerly piracy was common. The only remarkable feature in the island is a stalactite cavern on the south coast, reached by a dangerous descent with the aid of rope-ladders; the grotto is about 150 ft. by 100, and 50 ft. high.

See J. P. de Tournefort, *Relation d'un voyage* au *Levant* (1717); Engl. ed., **1718,** vol. i. **p. 146.**

ANTIPAS: see ANTIPATCR.

ANTIPATER (398?–319 B.C.), Macedonian general, and regent of Macedonia during Alexander's Eastern expedition (334–323). He had previously (346) been sent by Philip as ambassador to Athens and negotiated peace after the battle of Chaeroneia (338). About 332, while he was dealing with a rebellion in Thrace, the Spartan king Agis (*q.v.*) rose against Macedonia. Having settled affairs in Thrace as well as he could, Antipater hastened south and, near Megalopolis (331), gained a complete victory over the insurgents (Diodorus xvii. 62). His regency was troubled by the ambition of Olympias, mother of Alexander, and he was nominally superseded by Craterus. But on the death of Alexander, in 323, he was, by the first partition of the empire, left in command of Macedonia, and in the Lamian War at the battle of Crannon (322) crushed the Greeks, who had attempted to re-assert their independence. Later in the same year, hearing that Perdiccas contemplated making himself sole master of the empire, Antipater and Craterus prepared for war against him and allied themselves with Ptolemy, the governor of Egypt. Antipater crossed to Asia in 321, and while still in Syria he heard that Perdiccas had been

murdered by his own soldiers. Craterus fell in battle against Eumenes (Diodorus xviii. 25–39). Antipater, then sole regent, having quelled a mutiny of his troops and commissioned Antigonus to continue the war against Eumenes, returned to Macedonia, where he arrived in 320 (Justin xiii. 6). In 319 he fell ill and, passing over his son Cassander, appointed the aged Polyperchon regent, a measure which gave rise to much confusion and ill-feeling (Diodorus xvii., xviii.).

See *Cambridge Ancient History* vol. vi., chaps. xiv. and xv., with bibliographies there given.

ANTIPATHY is a permanent emotional attitude of dislike and aversion felt toward both people and things, an attitude usually originating in some sort of conflict, real or imagined, between the person feeling the antipathy and the object toward which the antipathy is felt. If one person has been compelled to comply with another, against his will, he is apt to feel a lasting antipathy toward his victorious antagonist. In many cases people forget the names or titles of persons toward whom they feel antipathy, not realizing that such lapses of memory are merely expressions of their secret aversions. Some people experience very unpleasant antipathies upon sight of mice, spiders, snakes or insects such as cockroaches; or when the tips of the fingers are rubbed over cotton, or when cloth is placed in the mouth. These antipathies may possibly originate in childhood. (W. M. M.)

ANTIPHANES (*c.* 408–334 B.C.), the most important writer of the Middle Attic Comedy with the exception of Alexis. He was apparently a foreigner who settled in Athens, where he began to write about 387. More than 200 of the 365 (or 260) comedies attributed to him are known to us from the titles and considerable fragments preserved in Athenaeus.

BIBLIOGRAPHY.—Fragments in Koch, *Comicorum Atticorum Fragmenta* (1884) ii.; *see* also Clinton, *Phzlological Museum* (1832) i.; Meineke, *Historia Critica Comicorum Graecorum* (1839).

ANTIPHILUS, a Greek painter, of the age of Alexander. He worked for Philip of Macedon and Ptolemy I. of Egypt. The descriptions of his works extant show that he excelled in light and shade, in *genre* representations and in caricature.

See Brunn, *Geschichte der grieclzischen Kunstler,* ii. p. 249.

ANTIPHON, of Rhamnus in Attica, the earliest of the "ten" Attic orators, was born in 480 B.C. He was largely responsible for the establishment of the Four Hundred in 411 *(see* THERAMENES); on the restoration of the, democracy he was accused of treason and condemned to death (Thuc. viii. 68). He was a professional speech-writer for other litigants, and never addressed the people himself except when he defended his policy at his trial. Fifteen of his speeches are extant: twelve are school exercises, divided into tetralogies, each consisting of two speeches for prosecution and two for defence; three refer to actual legal processes. All deal with cases of homicide (φονικαὶ δίκαι). Antiphon is also said to have composed a Τέχνη or art of Rhetoric.

See edition, with commentary, by Maetzner (1838); text by Blass (1881); Jebb, *Attzc Orators;* Plutarch, *Vitae X. Oratorum;* Philostratus, *Vit. Sophistarum,* i. 15; van Cleef, *Index Antiphonteus,* Ithaca, N.Y. (1895); P. Hamberger in *Die nednerische Disposition in der alten* Τέχνη ῥητορική (Paderborn, 1914)—deals with Antiphon's style. *See* also RHETORIC.

ANTIPHONY, a species of psalmody in which the choir or congregation, being divided into two parts, sing alternately in a manner suggested by the derivation of the word (Gr. ἀντὶ, and φωνή, a voice). The peculiar structure of the Hebrew psalms renders it probable that the antiphonal method originated in the service of the ancient Jewish Church. According to the historian Socrates, its introduction into Christian worship was due to Ignatius (d. A.D. 11j) who in a vision had seen the angels singing in alternate choirs. In the Latin Church it was not practised until more than two centuries later, when it was introduced by Ambrose, bishop of Milan. The antiphonary still in use in the Roman Catholic Church was compiled by Gregory the Great (A.D. 590).

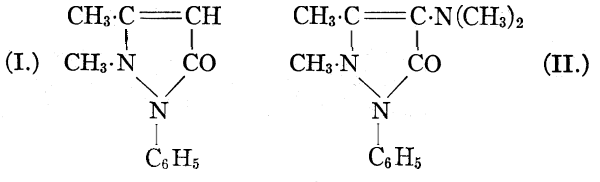
ANTIPODES, a term applied strictly to any two people or places on opposite sides of the earth, so situated that a line drawn from the one to the other passes throuqh the centre of the globe and forms a globe diameter. (Gr ἀντὶ, opposed to, and πόδες, feet.) Any two places having this relation—as London and, approximately, Antipodes Island, near New Zealand—must be distant from each other by 180° of longitude, and the one must be as many degrees to the north of the equator as the other is to the south, in other words, the latitudes are numerically equal, but one is north and the other south. At the antipodes the seasons and day and night are rexerscd but in calculation of days and nights, midnight on the one side may be regarded as corresponding to noon either of the previous or the following day.

ANTIPOLO, a municipality in the highlands of the province of Rizal, in Luzon, in the Philippine Islands, about 20 mi. from Manila. Pop. (1939), 6,135, of whom 3,113 were males; there were 3 whites. It is in the midst of a rich agricultural district which supplies various medicinal waters. In the Roman Catholic church is housed the image of the celebrated "Virgin of Antipolo" whose annual fiesta attracts large crowds. A small meteorological station is also there. There were 3,542 parcels of land declared for taxation in 1938, with 2,123 owners; the assessed valuation of agricultural lands was 465,100 pesos. There were also 6,366 hectares of nonagricultural lands, of which 2,255 were pasture lands and 4045 forest and uncultivated. (C. S. L.)

ANTIPYRETICS are agents used to reduce the temperature in fever. They may be classified under two headings, namely, chemical and physical. Cntil about 1885 the chief chemical antipyretic was quinine, which was used most successfully in malaria. Soon after that numerous other drugs were introduced and it is mainly to them that the name of antipyretics is applied. Of them antipyrin, acetanilid and phenacetin have survived longest and even they are now looked upon with some suspicion because their use is so often accompanied by ill effects. Their action seems to be a specific effect on the heat regulating centre, situated somewhere in the brain. Through it they are thought to decrease the production of heat in the body and thereby lower temperature. Salicylates, such as aspirin, have a much more favourable and comparatively safe antipyretic action in fever. They cause dilatation of the peripheral blood vessels and sweating, and consequently a more rapid loss of heat from the body. The physical means of controlling unduly elevated temperature would seem the more satisfactory. They are cold baths, ice packs, alcohol sponges, and similar measures The danger is slight and the results, although often only temporary, are sometimes quite striking.

ANTIPYRINE, a colourless and slightly bitter alkaloidal substance derived from coal tar, used in medicine as an antipyretic and analgesic, called also phenazonum and analgesine. It melts at 113° C. is soluble in 1·3 parts of water and dissolves even more readily in alcohol. It reduces the temperature of fevers and pyrexia of pneumonia, pleurisy and phthisis It relieves locomotor ataxy, facial neuralgia and rheumatism. Administered hypodermically it is beneficial in lumbago, sciatica and angina pectoris. A skin rash has been observed after its use, poisonous effects have been noticed with injudicious usage, and it has even been employed homicidally. The safe dose is ·03 grams (5 grains). In aqueous solution it has a mild anaesthetic action when painted on the mucous membrane.

Antipyrine was first prepared (1884) by L. Knorr. In studying the condensation of aceto-acetic ester (*q.v.*) with phenylhydrazine, this investigator obtained phenylmethylpyrazolone, a substance which has since proved useful as an intermediate for certain azo-dyes *(see* DYES, SYNTHETIC). Methylation of this pyrazolone derivative led to phenyld methyl*iso*pyrazolone (I. antipyrine).



The success attending the use of antipyrine in therapeutics led to many researches in the pyrazolone series, and out of these the most important drug obtained was *Pyramidon* or *Dimethylaminoantipyrine* (formula II.) which had similar uses to antipyrine but was efficacious in smaller doses and of special effect in sciatica. In its preparation, antipyrine was converted into the green nitroso-

antipyrine by the action of nitrous acid. Reduction with zinc dust and acetic acid led to aminoantipyrine (yellow needles, m.p. 109° C) which was methylated with methyl iodide in methyl-alcoholic potash. Pyramidon is a white powder melting at 108°, soluble in nine parts of water. Both antipyrine and pyramidon are used in combination with other drugs. Salipyrine (antipyrine salicylicum) is antipyrine salicylate, employed in acute rheumatic fever, sciatica and chronic rheumatism. Acetopyrine (antipyrine acetosalicylate), an analgesic and antipyretic, is used in sciatica, influenza, etc. Amidopyrine acetosalicylate and veramon (amido-antipyrine diethylbarbiturate) are salts of pyramidon with aspirin and veronal respectively, used in headache and neuralgia.

(*G.* T. M.)

ANTIQUARY, a person who devotes himself to the study of ancient learning and "antiques"; *i.e.,* ancient objects of art or science. In 1572 a society was founded by Bishop Matthew Parker, Sir Robert Cotton, William Camden, and others for the preservation of national antiquities, and existed till 1604, when it was abolished by James I. on account of its alleged political character. Papers read at its meetings are preserved in the Cottonian library and were printed by Thomas Hearne in 1720 under the title *A Collection of Curious Discourses, a* second edition appearing in 1771. In 1707 a number of English antiquaries began to hold regular meetings for the discussion of their hobby and in 1717 the Society of Antiquaries was formally reconstituted, finally receiving a charter from George II. in 1751. Its headquarters are now at Burlington House, Piccadilly.

The Society of Antiquaries of Scotland was founded in 1780. and manages a large national antiquarian museum in Edinburgh. In Ireland a society was founded in 1849 called the Kilkenny Archaeological Society, holding its meetings at Kilkenny. In 1869 its name was changed to the Royal Historical and Archaeological Association of Ireland, and in 1890 to the Royal Society of Antiquaries of Ireland, its office being transferred to Dublin. In France *La Société Nationale des Antiquaires de France* was formed in 1814 by the reconstruction of the *Académie Celtique,* which had existed since 1805. The American Antiquarian Society mas founded in 1812, with its headquarters at Worcester, Massachusetts. It has a library of upwards of 100,000 volumes and its transactions have been published half-yearly since 1849. In Germany the *Gesamtverein der Deutschen Geschichts- und Altertumsvereine* was founded in 1852. La *Société Royale des Antiquaires du Nord* at Copenhagen is widely known.

ANTIQUE, belonging to former times, venerable. The term is applied to the remains of ancient art, such as sculptures, gems, etc., principally to those of Greek or Roman origin; to furniture of an early period, and to anything out of date or old-fashioned.

ANTIRRHINUM: *see* SNAPDRAGON.

ANTI-SALOON LEAGUE, an American temperance organization founded on May 24, 1893, at Oberlin, O. The forerunner of the Anti-Saloon League was the Oberlin Temperance Alliance founded at Oberlin on March 20, 1874. The Metcalf law of 1882, granting local option to all Ohio college towns, and the Beatty Township Local-option law of 1888, gave impetus to the meeting held in the Spear library, Oberlin, on May 24, 1893, which resulted in the formation of the Ohio Anti-Saloon League. The next important step in the temperance movement was the founding of the Anti-Saloon League of the District of Columbia, on June 22, 1893, followed on December 18, 1895, by the National Anti-Saloon League—later called the Anti-Saloon League of America—in the Sunday school section of Calvary Baptist Church, U'ashington. Its basic organization was the same as that of the Ohio Anti-Saloon League. Subsequently all the states were organized into leagues, on the same plan as, but subordinate to, the National League.

The Anti-Saloon League of America is non-partisan and interdenominational in character. The League is pledged to maintain an attitude of strict neutrality on all questions of public policy not directly and immediately concerned with the traffic in strong drink "The object of this League is the extermination of the beverage liquor traffic, for the accomplishing of which the alliance of all who are in harmony with this object is invited." The program of the Anti-Saloon League has always been "agitation (including education), legislation and law enforcement." The departments of the League are executive or administrative, legal legislative, publicity, together with a new department of education, publicity and research established January 1, 1928. These departments are located at Westerville, 0 , and Washington, D.C. In legislation its policy has been to secure progressive legislation against the liquor traffic backed by a sound public sentiment. Shortly after its organization a vigorous campaign was launched for municipal local option, and this was paralleled by a continuous drive for complete national prohibition. The latter goal was nominally attained by the adoption of the 18th Amendment to the United States Constitution. During the Prohibition Era the society sought to make the restrictive laws more effective, and through its legal department defended them against attack in all tribunals including the Federal Supreme Court. But the repeal of the Amendment in 1933 threw the League, as it were, on the defensive, obliging it to put all its strength into an endeavour to check the extension of legalized liquor traffic where it was still forbidden, and to secure the inclusion of the local option clause at least in laws which might be passed for regulating the sale of intoxicants.

ANTI-SEMITISM, a religious, political, and social agitation against the Jews, which played a conspicuous part in the political struggles of the concluding quarter of the 19th century and which' manifested itself again in Germany after the advent of Hitler in 1933. The Jews contend that anti-semitism is a mere atavistic revival of the Jew-hatred of the middle ages. The extreme section of the anti-semites declare that it is a racial struggle, and that the anti-semites are engaged in an effort to prevent what is called the Aryan race from being subjugated by a Semitic immigration. There is no essential foundation for either of these contentions. Religious prejudices reaching back to the dawn of history have been reawakened by the allti-semitic agitation, but they did not originate it, and they have not entirely controlled it. The alleged racial divergence is, too, only a linguistic hypothesis on the physical evidence of which anthropologists are not agreed (Topinard, *Anthropologie,* p. 444; Taylor, *Origins* of *Aryans,* cap. i.). Moreover, the Jews have been Europeans for over 1,000 years, during which their character has been in some respects transformed.

The movement took its rise in Germany and Austria, very largely as a consequence of the widespread ruin brought about by the financial crisis of 1873. In that year an obscure Hamburg journalist, Wilhelm Marr, published a sensational pamphlet entitled *Der Sieg des Judenthums über das Germanenthum* ("The Victory of Judaism over Germanism"). The book fell upon fruitful soil. It applied to the ancient prejudices a theory of nationality which, under the great sponsorship of Hegel, had seized on the minds of the German youth, and to which the stirring events of 1870 had already given a deep practical significance. It also supplied the sufferers from the *Krach* with a welcome scapegoat. It was, however, in the passions of party politics that the new crusade found its chief sources of vitality. The enemies of the *bourgeoisie* at once saw that the movement was calculated to discredit and weaken the school of Manchester Liberalism, then in the ascendant. Agrarian capitalism seized the opportunity of paying off old scores. The clericals, smarting under the *Kulturkampf,* which was supported by the whole body of Jewish liberalism, joined eagerly in the new cry. The agitation gradually swelled, its growth being helped by the sensitiveness of the Jews themselves, who contributed much to newspaper publicity.

Towards the end of 1879 it spread with sudden fury over the whole of Germany. The secret springs of the new agitation were more or less directly supplied by Prince Bismarck, who, after his desertion by the national liberals under the leadership of the Jew, Lasker, began to recognize in anti-semitism a means of "dishing" the liberals. Marr's pamphlet was reprinted, and within a few months ran through nine further editions. The historian Treitschke gave the sanction of his great name to the movement. The conservative and ultramontane press rang with the sins of the Jews, and in October an anti-semitic league was founded in Berlin and Dresden.

The leadership of the agitation was now definitely assumed by a man who combined with social influence, oratorical power, and inexhaustible energy a definite scheme of social regeneration and an organization for carrying it out. This man was Adolf Stocker, one of the court preachers. He had embraced the doctrines of Christian socialism, and he had formed a society called "The Christian Social Working-man's Union." He was also a conspicuous member of the Prussian diet, where he sat and voted with the conservatives. Under his auspices the years 1880–81 became a period of bitter and scandalous conflict with the Jews. The conservatives supported him, partly to satisfy their old grudges against the liberal *bourgeoisie* and partly because Christian socialism, with its anti-semitic appeal to ignorant prejudice, was likely to weaken the hold of the social democrats on the lower classes. The Lutheran clergy followed suit, in order to prevent the Roman Catholics from obtaining a monopoly of Christian socialism, while the ultramontanes readily adopted anti-semitism, partly to maintain their monopoly, and partly to avenge themselves on the Jewish and liberal supporters of the *Kulturkampf*. In this way a formidable body of public opinion was recruited. Violent debates took place in the Prussian diet. A petition to exclude the Jews from the national schools and universities and to disable them from holding public appointments was presented to Prince Bismarck. Jews were boycotted and insulted. Duels between Jews and anti-semites, many of them fatal, became of daily occurrence. Even unruly demonstrations and street riots were reported. Pamphlets attacking every aspect of Jewish life streamed by the hundred from the printing-press. On their side the Jews did not want for friends, and it was owing to the strong attitude adopted by the liberals that the agitation failed to secure legislative fruition. The crown prince (afterwards Emperor Frederick) and crown princess boldly set themselves at the head of the party of protest. The crown prince publicly declared that the agitation was "a shame and a disgrace to Germany." A manifesto denouncing the movement as a blot on German culture, a danger to German unity and a flagrant injustice to the Jews themselves was signed by a long list of illustrious men, including Herr von Forckenbeck, Professors Mommsen, Gneist, Droysen, Virchow, and Dr. Werner Siemens (*Times*, Nov. 18, 1880).

The first severe blow suffered by the German anti-semites was in 1881, when, to the indignation of the whole civilized world, the barbarous riots against the Jews in Russia and the revival of the mediaeval Blood Accusation in Hungary (see *infra*) illustrated the liability of unreasoning mobs to carry into violent practice the incendiary doctrines of the new Jew-haters. From this blow anti-semitism might have recovered had it not been for the divisions and scandals in its own ranks. Some of the extremists among the racial anti-semites began to extend their campaign against Judaism to its offspring, Christianity. In 1879 Prof. Sepp, arguing that Jesus was of no human race, had proposed that Christianity should reject the Hebrew Scriptures and seek a fresh historical basis in the cuneiform inscriptions. Later Dr. Eugen Duhring, in several brochures, notably *Die Judenfrage als Frage des Rassencharakters* (1881, 5th ed., Berlin, 1901), had attacked Christianity as a manifestation of the Semitic spirit which was not compatible with the theological and ethical conceptions of the Scandinavian peoples. The philosopher, Friedrich Nietzsche, had also adopted the same view. With these tendencies the Christian socialists could have no sympathy, and the consequence was that when in March 1581 a political organization of anti-semitism was dttempted, two rival bodies were created, "Der Deutsche Volksverein." under the conservative auspices of Herr Liebermann von Sonnenberg and Herr Förster, and "Der Soziale Reichsverein," led by the racial and radical anti-semites, Ernst Henrici and Otto Böckel. In 1886, at an anti-semitic congress held at Cassel, a reunion was effected under the name of "Der Deutsche anti-semitische Verein," but this lasted only three years. In June 1889 the anti-semitic Christian socialists under Stocker again seceded.

During the subsequent ten years the movement became more and more discredited. The financial scandals connected with Forster's attempt to found a Christian socialist colony in Paraguay, the conviction of Baron von Hammerstein, the anti-semitic conservative leader, for forgery and swindling (1895–96), and several minor scandals of the same unsavoury character, covered the party with the very obloquy which it had attempted to attach to the Jews. At the same time, the Christian socialists who had remained with the conservative party also suffered. After the elections of 1893, Stocker was dismissed from his post of court preacher. The following year the emperor publicly condemned Christian socialism and the "political pastors," and Stocker was expelled from the conservative party for refusing to modify the socialistic propaganda of his organ, *Das Volk*. Another blow to anti-semitism came from the Roman Catholics. They had become alarmed by the unbridled violence of the demagogues, and in 1894 the ultramontane *Germania* publicly washed its hands of the Jew-baiters (July 1, 1894). Thus gradually German anti-semitism became stripped of every adventitious alliance; and at the general election of 1903 it managed to return only nine members to the *Reiclzstag*.

More serious were the effects of the German teachings on the political and social life of Russia. Here mediaeval anti-semitism was still an integral part of the polity of the empire. The Jews were cooped up in one huge ghetto in the western provinces, "marked out to all their fellow-countrymen as aliens, and a pariah caste set apart for special and degrading treatment" (*Persecution of the Jews in Russia*, 1891, p. 5). Their activity or ('exploitation," as it was called, was exaggerated and resented by the landowners who had been ruined by the emancipation of the serfs. Besides this, a nationalist and reactionary agitation, originating like its German analogue in the Hegelianism of a section of the lettered public, had manifested itself in Moscow. After some early vicissitudes, it had been organized into the Slavophil party, which, under Ignatiev and Pobêdonostsev, became paramount in the government, with a policy based on absolutism, orthodoxy and the racial unity of the Russian people. This was the situation on the eve of Easter 1831. The hardening nationalism above, the increasing discontent below, the economic activity of the Hebrew heretics, and the echoes of anti-semitism from over the western border were combining for an explosion.

A scuffle in a tavern at Elisabethgrad in Kherson sufficed to ignite this combustible material. The scuffle grew into a riot, the tavern was sacked, and the drunken mob, hounded on by agitators who declared that the Jews were using Christian blood for the manufacture of their Easter bread, attacked and looted the Jewish quarter. The outbreak spread rapidly. Within a few weeks the whole of western Russia, from the Black Sea to the Baltic, was smoking with the ruins of Jewish homes. Scores of Jewish women were dishonoured, hundreds of men, women and children were slaughtered, and tens of thousands were reduced to beggary and left without a shelter. Murderous riots or incendiary outrages took place in no fewer than 167 towns and villages, including Warsaw, Odessa and Kiev. Europe had witnessed no such scenes of mob savagery since the Black Death massacres in the 14th century. As the facts gradually filtered through to the western capitals they caused a thrill of horror everywhere. An indignation meeting held at the Mansion House in London, under the presidency of the lord mayor, was the aignal for a long series of popular demonstrations condemning the persecutions, held in most of the chief cities of England and the Continent. The tsar's ministers, ardent Slavophils, were not slow to recognize in the outbreak an endorsement of the nationalist teaching of which they were the apostles, and, while reprobating the acts of violence, came to the conclusion that the most reasonable solution was to aggravate the legal disabilities of the persecuted heretics. To this view the tsar was won over, partly by the clamorous indignation of western Europe, which had wounded his national *amour propre* and partly by the strongly partisan report of a commission appointed to enquire into the "exploitation" alleged against the Jews, the reasons why "the former laws limiting the rights of the Jews" had been mitigated, and how these laws could be altered so as "to stop the pernicious conduct of the Jews" (Rescript of Sept. 3, 1881). The result of this report was the drafting of a "Temporary Order concerning the Jews" by the minister of the interior, which received the assent of the tsar

on May 3, 1882. This order had the effect of creating a number of fresh ghettos within the pale of Jewish settlement. The Jews were driven into the towns and their rural interests arbitrarily confiscated, with the result that their activities were completely paralysed, and they became a prey to unparalleled misery. As the gruesome effect of this legislation became known, a fresh outburst of horror and indignation swelled up from western Europe. It proved powerless.

The Russian May laws were the most conspicuous legislative monument achieved by modern anti-semitism. They were an experimental application of the political principles extracted by Marr and his German disciples from the metaphysics of Hegel, and as such they afford a valuable means of testing the practical operation of modern anti-semitism. Their immediate result was a ruinous commercial depression which was felt all over the empire and which profoundly affected the national credit. The Russian minister of finance was soon at his wits' ends for money. Negotiations for a large loan were entered upon with the house of Rothschild, and a preliminary contract was signed, when, at the instance of the London firm, M. Wyshnigradski, the finance minister, was informed that unless the persecutions of the Jews were stopped the great banking-house would be compelled to withdraw from the operation. Deeply mortified by this attempt to deal with him de *puissance à puissance*, the tsar peremptorily broke off the negotiations and ordered that overtures should be made to a non-Jewish French syndicate. In this way anti-semitism, which had already so profoundly influenced the domestic politics of Europe, set its mark on the international relations of the Powers, for it was the urgent need of the Russian treasury quite as much as the termination of Prince Bismarck's secret treaty of mutual neutrality which brought about the Franco-Russian alliance (Daudet, *Hist. Dipl.* de *l'Alliance Franco-Russe,* pp. 259 *et. seq.).*

A new era of conflict dawned with the great constitutional struggle towards the end of the century. The conditions, however, were very different from those which prevailed in the '80s. The May laws had avenged themselves with singular fitness. By confining the Jews to the towns at the very moment when Count Witte's policy of protection was creating an enormous industrial proletariat they placed at the disposal of the disaffected masses an ally powerful in numbers and intelligence, and especially in its bitter sense of wrong, its reckless despair, and its cosmopolitan outlook and connections. As early as 1885 the Jewish workmen, assisted by Jewish university students, led the way in the formation of trade unions. They also became the *colporteurs* of western European socialism, and they played an important part in the organization of the Russian Social Democratic Federation which their "Arbeiter Bund" joined in 1898 with no fewer than 30,000 members. The Jewish element in the new democratic movement excited the resentment of the government, and under the minister of the interior, M. Sipiaguine, the persecuting laws were once more rigorously enforced. They were not abolished until the revolution of 1917.

The only other country in Europe in which there has been legalized anti-semitism is Rumania. In the old days of Turkish domination the lot of the Rumanian Jews was not conspicuously unhappy. It was only when the nation began to be emancipated and the struggle in the East assumed the form of a crusade against Islam that the Jews were persecuted. Rumanian politicians preached a nationalism limited exclusively to indigenous Christians. Thus, although the Jews had been settled in the land for many centuries, they were by law declared aliens. This was done in defiance of the Treaty of Paris of 1856 and the convention of 1858, which declared all Rumanians to be equal before the law, and also in violation of the Treaty of Berlin under which Rumania agreed to abolish religious disabilities. It was not until 1919 that they were finally swept away.

In Austria-Hungary the anti-semitic impulses came almost simultaneously from the North and East. Already in the '70s the doctrinaire anti-semitism of Berlin had found an echo in Budapest. Two members of the diet, Victor Istoczy and Geza Onody, together with a publicist named Georg Marczianyi, busied themselves in making known the doctrine of Marr in Hungary. In 1880 Istoczy tried to establish a "Kichtjuden Bund" in Hungary, with statutes literally translated from those of the German anti-semitic league. The movement, however, made no progress. The news of the uprising in Russia and the appearance of Jewish refugees on the frontier had the effect of giving a certain prominence to the agitation of Istoczy and Onody and of exciting the rural communities, but it did not succeed in impressing the public with the pseudo-scientific doctrines of the new anti-semitism. It was not until the agitators resorted to the Blood Accusation — that never-failing decoy of obscurantism and superstition — that Hungary took a definite place in the anti-semitic movement. The outbreak was short and fortunately bloodless, but while it lasted its scandals shocked the whole of Europe. In April 1882 a Christian girl named Esther Sobymossi was missed from the Hungarian village of Tisza Eszlar, where a small community of Jews was settled. The rumour got abroad that she had been kidnapped and murdered by the Jews, but it remained the burden of idle gossip and gave rise to neither judicial complaint nor public disorder. At this moment the question of the Bosnian Pacification credits was before the diet. The unpopularity of the task assumed by Austria-Hungary, under the Treaty of Berlin, which was calculated to strengthen the disaffected Croat element in the empire, had reduced the government majority to very small proportions, and all the reactionary factions in the country were accordingly in arms. The government was violently and unscrupulously attacked on all sides. On May 23 there was a debate in the diet when M. Onody, in an incendiary harangue, told the story of the missing girl at Tisza Eszlar and accused ministers of criminal indulgence to races alien to the national spirit. In the then excited state of the public mind on the Croat question, the manoeuvre was adroitly conceived. All the anti-liberal elements in the country became banded together in this effort to discredit the liberal government, and the Hungarian anti-semites found themselves at the head of a powerful party. Fifteen Jews were arrested and thrown into prison. No pains were spared in preparing the case for trial. Perjury and even forgery were freely resorted to. The son of one of the accused, a boy of 14, was taken into custody by the police and by threats and cajoleries prevailed upon to give evidence for the prosecution. He was elaborately coached for the terrible *rôle* he was to play. The trial opened at Nyiregyhaza on June 19, and lasted till Aug. 3. It was one of the most dramatic *causes célèbres* of the century. Under the brilliant cross-examination of the advocates for the defence the whole of the shocking conspiracy was gradually exposed. The public prosecutor thereupon withdrew from the case, and the four judges — the chief of whom held strong anti-semitic opinions — unanimously acquitted all the prisoners.

Meanwhile, a more formidable and complicated outburst was preparing in Austria itself. Here the lines of the German agitation were closely followed, but with far more dramatic results. It was exclusively political — that is to say, it appealed to anti-Jewish prejudices for party purposes while it sought to rehabilitate them on a pseudo-scientific basis, racial and economic. At first it was confined to sporadic pamphleteers. By their side there gradually grew up a school of Christian socialists, recruited from the ultra-clericals. For some years the two movements remained distinct, but signs of approximation were early visible. In 1891 the German Radical Nationalists under Schönerer, who had joined hands with the anti-semitic leagues, formed an alliance with the feudal Christian socialists. During the elections of that year Prince Liechtenstein came forward as an anti-semitic candidate and the acknowledged leader of the united party. The elections resulted in the return of 15 anti-semites to the *Reichsrat,* chiefly from Vienna.

Although Prince Liechtenstein and the bulk of the Christian socialists had joined the anti-semites with the support of the clerical organ, the *Vaterland,* the clerical party as a whole still held aloof from the Jew-baiters. The events of 1892–95 put an end to their hesitation. The Hungarian government, in compliance with long-standing pledges to the liberal party, introduced into the diet a series of ecclesiastical reform bills providing for civil marriage, freedom of worship, and the legal recognition of Judaism on an equality with other denominations. These proposals gave a great

impulse to anti-semitism and served to drive into its ranks a large number of clericals. In Oct. 1894 the magnates adopted two of the ecclesiastical bills with amendments, but threw out the Jewish bill by a majority of six. The Crown sided with the magnates and the ministry resigned. An effort was made to form a clerical cabinet, but it failed. Baron Banffy was then entrusted with the construction of a fresh liberal ministry. The announcement that he would persist with the ecclesiastical bills lashed the clericals and anti-semites into a fury, and the agitation broke out afresh. The pope addressed a letter to Count Zichy encouraging the magnates to resist, and once more two of the bills were amended and the third rejected. The papal nuncio, hfgr. Agliardi, thought proper to pay a visit to Budapest, where he allowed himself to be interviewed on the crisis. This interference in the domestic concerns of Hungary was deeply resented, and Baron Banffy requested Count Kalnoky, the imperial minister of foreign affairs, to protest against it at the Vatican. Count Kalnoky refused and tendered his resignation to the emperor. Clerical sympathies were predominant in Vienna, and the emperor was induced for a moment to decline the count's resignation, but he soon retraced his steps. Count Kalnoky's resignation was accepted, the papal nuncio was recalled, a batch of new magnates were created, and the Hungarian ecclesiastical bills passed.

Simultaneously with this crisis another startling phase of the anti-semitic drama was being enacted in Vienna itself. Encouraged by the support of the clericals, the anti-semites resolved to make an effort to carry the Vienna municipal elections. So far the alliance of the clericals with the anti-semites had been unofficial, but on the eve of the elections (Jan. 1895) the pope, influenced partly by the Hungarian crisis and partly by an idea of Cardinal Rampolla that the best antidote to democratic socialism would be a clerically controlled fusion of the Christian socialists and anti-semites, sent his blessing to Prince Liechtenstein and his followers. The elections resulted in a great triumph for the Jew haters. The new municipal council was, however, immediately dissolved by the government, and new elections were ordered. These only strengthened the position of the anti-semites, who carried 92 seats out of a total of 138. A cabinet crisis followed, and the premiership was entrusted to the Statthalter of Galicia, Count Badeni, who assumed office with a pledge of war to the knife against anti-semitism. In October the new municipal council elected as burgomaster of Vienna Dr. Karl Lueger, a vehement anti-semite, who had displaced Prince Liechtenstein as leader of the party. The emperor declined to sanction the election, but the council repeated it in face of the imperial displeasure. Once more a dissolution was ordered, and for three months the city was governed by imperial commissioners. In Feb. 1896 elections were again held, and the anti-semites were returned with an increased majority. The emperor then capitulated. The growing anarchy in parliament at this moment served still further to strengthen the anti-semites, and their conquest of Vienna was speedily followed by a not less striking conquest of the *Landtag* of Lower Austria (Nov. 1896). After that a reaction of sanity slowly but surely asserted itself. In 1908 the anti-semites had governed Vienna 12 years, and, although they had accomplished much mischief, the millennium of which they were supposed to be the heralds had not dawned. On the contrary, the commercial interests of the city had suffered and the rates had been enormously increased (*Neue Freie Presse*, March 29, 1901), while the predatory hopes which secured them office had only been realized on a small and select scale. The spectacle of a clerico-anti-semitic tammany in Vienna had strengthened the resistance of the better elements in the country, and anti-semitism soon ceased to be a political force.

The last country in Europe to make use of the teachings of German anti-semitism in its party politics was France. The anti-clericalism of the *bourgeois* republic and its unexampled series of financial scandals, culminating in the Panama "Krach," afforded obvious opportunities for anti-semitism.

Nevertheless, it was not until 1882 that the movement was seriously heard of. Paul Bontoux, who had formerly been in the employ of the Rothschilds, but had been obliged to leave the firm in consequence of his disastrous speculations, had joined the legitimist party, and had started the Union Générale with funds obtained from his new allies. Bontoux promised to break up the alleged financial monopoly of the Jews and Protestants and to found a new plutocracy in its stead, which should be mainly Roman Catholic and aristocratic. The bait was eagerly swallowed. For five years the Union Générale, with the blessing of the pope, pursued an apparently prosperous career, but in Jan. 1882 it failed, with liabilities amounting to 212,000,000 francs. The cry was at once raised that the collapse was due to the manoeuvres of the Jews, and a strong anti-semitic feeling manifested itself in clerical and aristocratic circles. In 1886 violent expression was given to this feeling in a book since become famous, La *France juive*, by Edouard Drumont. The author illustrated the theories of German anti-semitism with a *chronique scandaleuse* full of piquant personalities, in which the corruption of French national life under Jewish influences was painted in alarming colours. The book was read with avidity by the public, who welcomed its explanations of the growing debauchery. The Wilson scandals and the suspension of the Panama Company in the following year, while not bearing out Drumont's anti-semitism, fully justified his view of the prevailing corruption. Out of this condition of things rose the Boulangist movement, which rallied all the disaffected elements in the country, including Drumont's following of anti-semites. It was not, however, until the flight of General Boulanger and the ruin of his party that anti-semitism came forward as a political movement.

The chief author of the rout of Boulangism was a Jewish politician and journalist, Joseph Reinach, formerly private secretary to Gambetta and one of the ablest men in France. He was a Frenchman by birth and education, but his father and uncles were Germans, who had founded an important banking establishment in Paris. Hence he was held to personify the alien Jewish domination in France, and the ex-Boulangists turned against him and his co-religionists with fury. The Boulangist agitation had for a second time involved the legitimists in heavy pecuniary losses, and under the leadership of the marquis de Morès they now threw all their influence on the side of Drumont. An anti-semitic league was established, and with royalist assistance branches were organized all over the country. In 1892 Drumont founded a daily anti-semitic newspaper, *La Libre Parole*. With the organization of this journal a regular campaign for the discovery of scandals was instituted. At the same time, a body of aristocratic swashbucklers, with the marquis de Morès and the comte de Lamase at their head, set themselves to terrorize the Jews and provoke them to duels. Anti-semitism was most powerful in the army, which was the only branch of the public service in which the reactionary classes were fully represented. The republican law compelling the seminarists to serve their term in the army had strengthened its clerical and royalist elements, and the result was a movement against the Jewish officers, of whom 500 held commissions. In 1894, a prominent Jewish staff officer, Capt. Alfred Dreyfus was arrested on a charge of treason. From the beginning the hand of the anti-semite was flagrant in the new sensation. Anti-semitic feeling was now thoroughly aroused. Panama had prepared the people to believe anything; and when it was announced that a court-martial, sitting in secret, had convicted Dreyfus, there was a howl of execration against the Jews from one end of the country to the other. Dreyfus was degraded and transported for life amid unparalleled scenes of public excitement. The Dreyfus case registers the climax not only of French, but of European anti-semitism. It was the most ambitious and most unscrupulous attempt yet made to prove the nationalist hypothesis of the anti-semites, and in its failure it afforded the most striking illustration of the dangers of the whole movement by bringing France to the verge of revolution. By a series of amazing accidents it was soon discovered that the whole case against Dreyfus rested on a tissue of forgeries and even worse crimes. Nevertheless, the authorities, supported by parliament, declined to reopen the Dreyfus case. It now became clear that nothing short of an appeal to public opinion and a full exposure of all the iniquities that had been perpetrated would secure justice at the hands of the military chiefs. On behalf of Dreyfus, Émile Zola, the eminent novelist, formulated the case against the general staff of the army in an open letter to the president of the republic,

which by its dramatic accusations startled the whole world. The letter was denounced as wild and fantastic even by those who were in favour of revision. Zola was prosecuted for libel and convicted, and had to flee the country; but the agitation he had started was taken in hand by others, notably M. Clemenceau, M. Reinach and M. Yves Guyot. In Aug. 1898 their efforts found their first reward. A re-examination of the documents in the case by M. Cavaignac, then minister of war, showed that one at least was undoubtedly forged. (Esterhazy and Col. Henry, of the war office intelligence department — who cut his throat when under arrest — were the real culprits.)

In spite of this damaging discovery the war office still persisted in believing Dreyfus guilty and opposed a fresh enquiry. It was supported by three successive ministers of war and apparently an overwhelming body of public opinion. By this time the question of the guilt or innocence of Dreyfus had become an altogether subsidiary issue. As in Germany and Austria, the anti-semitic crusade had passed into the hands of the political parties. On the one hand the radicals and socialists, recognizing the anti-republican aims of the agitators and alarmed by the clerical predominance in the army, had thrown in their lot with the Dreyfusards; on the other, the reactionaries, anxious to secure the support of the army, took the opposite view, denounced their opponents as *sans patrie,* and declared that they were conspiring to weaken and degrade the Army in the face of the national enemy. The controversy was, consequently, no longer for or against Dreyfus, but for or against the Army, and behind it was a life-or-death struggle between the republic and its enemies. The situation became alarming. Rumours of military plots filled the air. Powerful leagues for working up public feeling were formed and organized; attempts to discredit the republic and intimidate the government were made. The president was insulted; there were tumults in the streets, and an attempt was made by M. Déroulède to induce the military to march on the Elysée and upset the republic.

The government now resolved to strike at the root of the mischief by limiting the power of religious orders, and with this view a drastic Associations bill was introduced into the chambers. This anti-clerical move provoked the wildest passions of the reactionaries, but it found an overwhelming support in the elections of 1902 and the bill became law. The war thus definitely reopened soon led to a revival of the Dreyfus controversy. The nationalists flooded the country with incendiary defamations of "the government of national treason," and Dreyfus on his part loudly demanded a fresh trial. It was clear that conciliation and compromise were useless. Early in 1905 M. Jaurès urged upon the chamber that the demand of the Jewish officer should be granted if only to tranquillize the country. The necessary *faits nouveaux* were speedily found by the minister of war, General André, and having been examined by a special commission of revision were ordered to be transmitted to the court of cassation for final ajudication. On July 12, 1906, the court, all chambers united, gave its judgment. After a lengthy review of the case it declared unanimously that the whole accusation against Dreyfus had been disproved, and it quashed the judgment of the court-martial *sans renvoi.* Nothing was left undone to repair the terrible series of wrongs which had grown out of the Dreyfus case. Nevertheless, its destructive work could not be wholly healed. For over ten years it had been a nightmare to France, and it now modified the whole course of French history. In the ruin of the French Church, which owed its disestablishment very largely to the Dreyfus conspiracy, may be read the most eloquent warning against the demoralizing madness of anti-semitisrn.

During the World War of 1914–18, which gave rise to a widespread revival of national consciousness, anti-semitism of the Marr type made a fresh appeal to German and Russian public opinion, largely under the influence of a Germanized Englishman, Houston Stewart Chamberlain, the son-in-law of Richard Wagner. The Bolshevist revolution in Russia, which was erroneously pictured as the work of the Jews, helped this new phase of the movement. and for a time a strange theory of a Jewish conspiracy founded on a secret Jewish teaching and aiming at the overthrow of Christian civilization obtained a certain vogue. In 1919 an effort was made in Germany to bolster up this superstition by re-publication of a book, *Protocols of the Elders* of *Zion* (Eng. edit. 1920), alleged to be the minutes of a secret Zionist congress at which this teaching was set forth. The book at first commanded a great deal of undeserved attention, but in 1921 it was discovered by the *Times* to be an impudent forgery, the work of a former member of the *Ochrana* or Russian secret police. This was a crowning discomfiture of anti-semitism in Western Europe. (L. W.)

For the fanatical recrudescence of anti-semitism in National-Socialist Germany, see GERMANY.

The publication of a manifesto on July 14, 1938, by a group of Italian professors who urged prohibition of Aryan-Jewish marriages was the signal for a new anti-semitic program by the Italian Government, less violent, however, than that of Germany. In Sept. 1938, official decrees ordered the emigration of foreign Jews who had entered Italy since 1919 and the expulsion of Jewish teachers and students from all schools. After the partition of Czechoslovakia, anti-semitism in Europe gained a fresh momentum which culminated in the violent German riots of Nov. 1938. (X.)

BIBLIOGRAPHY.—The most comprehensive works on anti-semitism are *Israel among the Nations,* by A. Leroy-Beaulieu (1895) and *L'Anti-sémitisme, son histoire et ses causes,* by Bernard Lazare (1894). A good list of books relating to Jewish ethnology will be found at the end of M. Isidor Loeb's valuable article, "Juifs," in the *Dictionnaire universe1 de gtographie* (1884). To these should be added, Adolf Jellinek, *Der Jüdische Stamm* (1869); Chwolson, *Die semitischen Völker* (1872); Nossig, *Materialien zur Statistik* (1887); Jacobs, *Jewish Statistics* (1891); and Andree, *Zur Volkskunde der Juden* (1881). A bibliography of the Jewish question from 1875 to 1884 has been published by Mr. Joseph Jacobs (1885). During the period since 1885 the anti-semitic movement has produced an immense pamphlet literature. Some of these productions have already been referred to; others will be found in current bibliographies. The most valuable collection of facts relating to the Russian persecutions of 1881–82 are to be found in the *Feuilles Jaunes* (52 nos.), compiled and circulated for the information of the European press by the Alliance Israelite of Paris. Complete collections are very scarce. For the subsequent struggle *see* the publications of the *Bund* (Geneva; Imprimerie Israelite); Semenoff, *The Russian Government and tlze Massacres,* and *Quarterly Review,* Oct. 1906. On the Rumanian question, *see* Bluntschli, *Roumania and the Legal Status of the Jews* (London, 1879); Sincerus, *Juifs en Rounzanie* (London, 1901); Dehn, *Diplonzatze u. Hochfinanz in der rumanischen Judenfrage* (1901); on Hungary and the Tisza Eszlar Case, *see* (besides the references in Jacobs) Nathan, *Der Prozess von Tisza Eszlar* (Berlin, 1892). On this case and the Blood Accusation generally, *see* Wright, "The Jews and the Malicious Charge of Human Sacrifice," *Nineteenth Century,* 1883; Strack, *The Jew and Human Sacrifice* (1909). The origins of the Austrian agitation are dealt with by Nitti, *Catholic Socialism* (1895), but the most valuable source of information is the *Österreichische Wochenschrift,* ed. Dr. Bloch. The case of the French anti-semites is stated by E. Drumont in his *France juive* and other works; the other side by Isidor Loeb, Bernard Lazare, Leonce Reynaud, etc. Of the Dreyfus case there is an enormous literature; *see* especially the reports of the Zola and Picquart trials, the revision case before the Court of Cassation, the proceedings of the Rennes court-martial, and the final judgment of the Court of Cassation printed in full in the *Figaro,* July 15, 1906; also Reinach, *Histoire de l'affaire Dreyfus* (1908). On the history of the anti-semitic movement generally, *see* Wolf, *Notes on the Diplomatic History of the Jewish Question* (1919); *The Peace Conference, Paris 1919, Report of the Delegates of the Jews of the British Empire* (1920); Wolf, *The Myth of the Jewish Menace in World Affairs* (1921). (L. W.)

ANTISEPTICS and **ASEPSIS.** Antiseptics are substances used for the prevention of bacterial development in animal or vegetable matter. Some are true germicides, capable of destroying the bacteria, whilst others merely inhibit their growth. The antiseptic method of treating wounds *(see* SURGERY) was introduced by the late Lord Lister, and was an outcome of Pasteur's germ theory of putrefaction. The standardization of antiseptics has been effected in many instances, and a water solution of carbolic acid of a certain fixed strength is now taken as the standard with which other antiseptics are compared. The more important of those in use to-day are carbolic acid, the perchloride and biniodide of mercury, iodoform, formalin, salicylic acid, etc. Among the more recently introduced antiseptics, chinosol, a yellow substance freely soluble in water, and lysol, another coal-tar derivative, are much used. But every antiseptic, however good, is more or less toxic and irritating to a wounded surface. Hence antiseptics are nowadays used mainly for the dis-

infection of instruments, apparatus, the field of operation on the patient's skin and the surgeon's hands, and in cases which are already septic (see SEPSIS). Where an incision is to be made into healthy skin or tissues antisepsis has been replaced by asepsis, which relies on keeping free from the invasion of bacteria rather than destroying them when present.

During recent years the study of antiseptics has gone mainly along two lines—to produce more efficient antiseptics for use in the ordinary way by external application, and to elaborate chemical substances which can be injected into the circulation and destroy the infecting microbes. At the same time many studies have been made on the natural antiseptics by which the body rids itself of infection.

Natural Antiseptics.— These exist in greater or less degree in almost every cell of the human body, as well as in most of the secretions. Mechnikov showed that some cells (phagocytes), and especially the white corpuscles of the blood, could ingest and digest microbes, and Wright discovered that this ingestion or phagocytosis only took place after the microbes had been acted on by the blood fluids. The blood fluids also have a considerable power of destroying or restraining the growth of many pathogenic bacteria (see IMMUNITY). Fleming showed in 1922 that the cells and secretions of the human body have a remarkable antiseptic power toward certain microbes by virtue of their containing a ferment which has been called "Lysozyme." Of all the secretions the tears are the richest in this ferment, and it has been shown that human tears, even when diluted six million times, have a markedly destructive action on some of the microbes found in the air—obviously a natural means of protection against infection.

Chemical Antiseptics.— Research has been directed to the action of these on the natural defences of the body, and the body cells are, in general, found to be much more susceptible to the action of these chemicals than are bacteria. If an ordinary chemical antiseptic, *e.g.*, carbolic acid, is added to blood infected with staphylococci or streptococci (the ordinary microbes of suppuration) the following instructive series of events may be observed. The normal blood itself has such a power of killing these microbes that with a moderate implantation some 95 to 99% are destroyed; but when the concentration of carbolic acid in the blood reaches 1 in 600 the whole of the natural antiseptic power of the blood is lost and every microbe implanted survives and multiplies. Of course, more concentrated solution of the chemical will, in addition to killing the blood cells, inhibit or destroy the bacteria and so exert an antiseptic action, but this is only manifest after the natural defences against infection have been destroyed.

Chemotherapy.— The ideal method of using an antiseptic for the treatment of a bacterial infection is to introduce it into the circulation so that it reaches every portion of the infected focus and destroys the microbes. For ordinary bacterial infections this ideal has not yet been attained, but remarkable advances have been made in this direction in certain infections. In 1910 Ehrlich prepared an organic arsenical product which, when injected into the body, rapidly destroyed the microbe of syphilis, and this product, salvarsan, together with the more recently introduced substances of similar constitution, has revolutionized the treatment of this disease (see VENEREAL DISEASES). Following Ehrlich, Morgenroth prepared a quinine derivative (Optochin) which had a remarkable affinity for the pneumococcus (the microbe which causes pneumonia), while it had little action on other microbes; but unfortunately this substance had certain toxic qualities which rendered it unsuitable in practice. In some other infections, also, drugs have been found which can destroy the infecting agent without exercising any serious toxic action on the human body; notable among these are Emetine in amoebic dysentery (see DYSENTERY), and "Bayer 205" in sleeping sickness. The fact that drugs can be prepared which have a very specific action on one microbe offers some hope that in the near future there will be produced chemicals which will destroy the ordinary disease-producing bacteria without damaging the tissues.

Chemical Antiseptics and Wounds.—Prior to the World War the use of antiseptics in surgery had been largely discarded in favour of aseptic methods which aimed at preventing the access of microbes to the wound. During the war, however, it was found that all the wounds were infected with septic microbes, and many antiseptic methods were employed in the hope of destroying these microbes. Briefly, the results obtained were these: none of the antiseptics was able rapidly to sterilize a wound; most of them were without any evident effect on the bacterial infection; those which have appeared to have some influence on the course of the infection had, in addition to their "antiseptic" action on the bacteria, a stimulant effect on the infected tissues, and this probably contributed largely to their success. The popular pre-war antiseptics, such as carbolic acid, iodine and the salts of mercury, were found to be without effect on the progress of an infection, although outside the body these are powerful bactericidal agents.

Chlorine derivatives obtained great popularity in the form of eusol (hypochlorous acid), sodium hypochlorite (Dakin's fluid) or chloramine-T, a more complicated organic derivative, and this type of antiseptic is still in common use under various trade names. Some of the aniline dyes also are used as antiseptics, and outside the body these are probably the most powerful of all the chemical bactericidal agents. Gentian violet, brilliant green and acriflavine have been largely used, but in all these cases the action on the bacteria is slow and the dyes are rapidly absorbed by the tissues and dressings of the wound. Acriflavine differs from almost all other antiseptics in that it has a more powerful action in blood serum than it has in water, and it was hoped from this that it would prove very effective in killing bacteria embedded in the tissues; this hope, however, has not been fulfilled, although the dye still obtains some popularity in the treatment of certain infections.

Another method of using an antiseptic is to fill the wound with an almost insoluble substance which slowly gives off an antiseptic substance. A good example of this is iodoform, and although this in itself has no power of killing microbes it slowly breaks down in contact with the body fluids and liberates small quantities of iodine, to which the antiseptic action of the iodoform is attributed. This substance, iodoform, used to be very popular in the treatment of septic infections, but it possesses a very penetrating odour and has been largely given up on this account. In addition to its direct antiseptic action, it possesses, in common with some of the chlorine antiseptics, the power of inducing a large flow of lymph from the wound and so aiding the natural defensive mechanism of the body.

Sterilization.— While antiseptics have not been very successful in killing bacteria in infected tissues in the body, they are invaluable in sterilizing apparatus, instruments and infected matter of many kinds outside the body. An infected water supply can be efficiently and economically sterilized by the use of a small quantity of chlorine (see WATER PURIFICATION); the infective excreta from cases of typhoid fever and similar diseases can be rendered harmless by treating them with carbolic acid or other similar antiseptic; catgut for use in surgical operations can only be sterilized by the use of chemical antiseptics, and there are innumerable other ways in which these chemicals fulfil their function of destroying bacteria. (4. FL.; W. S. L.-B.)

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ANTI-SLAVERY SOCIETY. The Anti-Slavery and Aborigines Protection Society is a fusion of two societies, founded in 1837 and 1839 respectively. The Aborigines Protection Society was formed mainly through the efforts of Thomas Hodgkin and Thomas Fowell Buxton, as the outcome of a select parliamentary committee appointed to consider measures for securing justice for the natives in British possessions. The British and Foreign Anti-Slavery Society, which succeeded other similar organizations established during the long struggle, aimed expressly at the universal extinction of slavery and the slave trade, Thomas Clarkson being its first president. As time went on, it was found that some

degree of overlapping in the work of the two societies was unavoidable, owing particularly to the growth of labour systems hardly distinguishable from slavery, and they were united in 1909.

Slavery in Recent Times.—The objects of the society's work in the second half of the last century were many and various. They included the abuses of coolie indentured labour and the Kanaka and similar labour systems in the South Seas, slavery and the slave-trade in Egypt and the Sudan (upon which the Anti-Slavery Society was in close touch with Gen. Gordon); slave-dealing in Morocco and the southern Sahara, native labour in South Africa, domestic slavery in many parts of Africa, labour conditions in the New Hebrides, and the scandalous "contract labour" system from the interior of Portuguese Angola to the cocoa islands of S. Thomé and Principe.

The Brussels Conference of 1889–90, and the General Act which followed, opened the way to fighting African slavery more effectively. Towards the end of the century the question of slavery in Zanzibar was predominant, and the society sent out its own commissioner to East Africa more than once to investigate conditions.

While slavery and the slave trade are now universally reprobated by civilized States, they still persist in outlying regions. The Slavery Commission of the League of Nations in 1925 reported that the slave trade and "similar acts" prevail in 19 political areas, including Abyssinia, China and Liberia. The more subtle forms of modern slavery, however, are those connected with the increasing demand for tropical and semi-tropical produce; *e.g.*, rubber, cotton, sugar, palm oil, etc.; which cannot be gathered by white workers. This means a tendency to exploit unwilling labour.

Other forms of modern slavery are debt slavery, or peonage, as illustrated by the horrors disclosed, largely owing to the society's efforts in 1911–12, in the remote Putumayo region of the Upper Amazon. The society laboured successfully for the abolition of the *Mui Tsai* system in Hongkong, another form of slavery disguised under the name of "adoption" of children. The society keeps in frequent communication with the League of Nations.

ANTISTHENES (*c.* 444–*c.* 365 B.C.), the founder of the Cynic school of philosophy, was born at Athens of a Thracian mother. In his youth he studied rhetoric under Gorgias, perhaps also under Hippias and Prodicus. He came under the influence of Socrates, and became a devoted pupil. So eager was he to hear the words of Socrates that he used to walk daily from Peiraeus to Athens, and persuaded his friends to accompany him. He founded a school of his own in the Cynosarges. Thither he attracted the poorer classes by the simplicity of his life and teaching. He wore a cloak, and carried a staff and a wallet, and this costume became the uniform of his followers. Diogenes Laertius says that his works filled ten volumes, but of these fragments only remain. Aristotle speaks of him as uneducated and simple-minded, and Plato describes him as struggling in vain with the difficulties of dialectic. His work represents one great aspect of Socratic philosophy, and should be compared with the Cyrenaic and Megarian doctrines. (See CYNICS.)

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ANTISTREPTOCOCCUS SERUM is the serum obtained from an animal (usually a horse) which has been repeatedly injected with streptococcus. Such serum is prepared for use in the prevention and treatment of streptococcus infections in man, and is valuable on account of the antibodies contained in it which have been produced by the animal against the streptococcus and its poisons. This micro-organism is a very common one and is responsible for a great variety of diseases in man. However, antistreptococcus serum has been found to be beneficial in only two of these, namely, scarlet fever and erysipelas. Its value in the former disease has been definitely established by clinical experience, and in the case of the latter most reports indicate that it is often of benefit if given early in the disease. The results of its use in puerperal fever and septicaemia have, on the other hand, been disappointing. The streptococcus of scarlet fever and that of erysipelas belong to different strains, as is shown by failure of erysipelas anti-serum to be of any value in scarlet fever and vice versa.

ANTISTROPHE, the portion of an ode which is sung by the chorus in its returning movement from west to east, in response to the strophe, which was sung from east to west. It is of the nature of a reply, and balances the effect of the strophe. Thus, in Gray's ode called "The Progress of Poesy," the strophe, which dwelt in triumphant accents on the beauty, power and ecstasy of verse, is answered by the antistrophe, in a depressed and melancholy key:

> Man's feeble race what ills await,
> Labour, and Penury, the racks of Pain,
> Disease and Sorrow's weeping Train,
> And Death, sad refuge from the storms of Fate. . . .

When the sections of the chorus have ended their responses, they unite and close in the epode, thus exemplifying the triple form in which the ancient sacred hymns of Greece were composed, from the days of Stesichorus onwards.

ANTITHESIS (the Greek for "setting opposite"), in rhetoric, the bringing out of a contrast in the meaning by an obvious contrast in the expression, as in the following:—"When there is need of silence, you speak, and when there is need of speech, you are dumb; when present, you wish to be absent, and when absent, you desire to be present; in peace you are for war, and in war you long for peace; in council you descant on bravery, and in the battle you tremble." The force of the antithesis is increased if the words on which the beat of the contrast falls are alliterative, or otherwise similar in sound, as—"The fairest but the falsest of her sex." Among English writers who have made the most abundant use of antithesis are Pope, Young, Johnson, and Gibbon.

ANTITOXIN, a principle in the blood serum which combats the bacteria causing a disease. When the blood of the patient is deficient in antitoxins, serum containing the appropriate antitoxin is injected. (See DIPHTHERIA; SCARLET FEVER; and MEDICAL RESEARCH.)

ANTITYPE, the correlative of "type," to which it corresponds either as the stamp to the die or as the die to the stamp (Gr. ἀντίτυπος). It is used in the New Testament in Heb. ix. 24, I. Peter iii. 21, translated "figure" (A.V) and "pattern" or "likeness" (R.V.). So, theologically, it denotes the reality behind the symbol or copy; *e.g.*, Christ the antitype, of which the Jewish ritual is the type. In the Greek Fathers (*e.g.*, Irenaeus, Gregory Nazianzen) the bread and wine in the Eucharist are called antitypes.

ANTIUM (mod. Anzio), ancient Volscian city, on the coast of Latium, about 33m. S. of Rome. The legends are fanciful. Antium, Ardrea, and Circeii Lavinium appear as under Roman protection in the treaty with Carthage in 348 B.C. In 341 it lost its independence after rising with Latium against Rome, and the beaks (*rostra*) of six captured Antiatine ships decorated and gave their name to the orators' tribunal in the Roman forum. From late Republican times wealthy Romans including the Julian and Claudian emperors frequently visited it; both Caligula and Nero were born there. The latter founded a colony of veterans and built a new harbour, the projecting moles of which are still extant. In the middle ages it was deserted in favour of Nettuno. The harbour was restored at the end of the 17th century, but is frequently silted up. Remains of Roman villas occur along the shore, both east and north-west of the town, and many of them have tanks for pisciculture. That of Nero is generally placed at the so-called Arco Muto. Many works of art have been found, also the only known example of a Roman calendar previous to the Julian era, painted on a wall. Of the famous temple of Fortune mentioned by Horace no remains are known. The sea is encroaching slightly at Anzio, but some miles farther north-west the old Roman coast-line now lies slightly inland (see TIBER). The Volscian city stood on higher ground and was defended by a deep ditch, which can still be traced, and by walls. The modern place is a summer resort and between it and Nettuno, 2 m. to the east, are numerous villas.

ANTIVARI (Montenegrin BAR), so called by the Venetians from its position opposite Bari, in Italy, a seaport of Montenegro, Turkish until 1878. Pop. (1931) 5,544. The old town is built inland, hidden among dense olive groves, and overshadowed by the peak of Rumija (5,226 ft.). It is a ruinous walled village with the shell of an old Venetian fortress, surrounded by mosques and bazaars, and containing the residence of the Roman Catholic archbishop. The fine bay of Antivari, with Prstan, its port, is about 3 mi. distant through barren country shut in by mountains. It is commanded by the fortress of Spizza (Austrian till 1918) on the northern horn of the bay. In the centre of the shore is a royal villa. The harbour works (begun in 1906) afford accommodation for 200 large vessels, and include dockyards, warehouses, a customs house, dispensary, electric lighting, telephone, and wireless installation. The only railway runs from Virpazar to Antivari, but there is a good coast road, and a service of steamers coastwise and to Bari. Fishing, olive oil refining, and tobacco growing are the main industries, but there are iron and phosphate deposits in the neighbourhood, and probably valuable bauxite ones at Spizza. The civil population successfully resisted Italian occupation in 1919, but in 1941 the town was occupied by Italy, after the rapid German conquest of the Balkans.

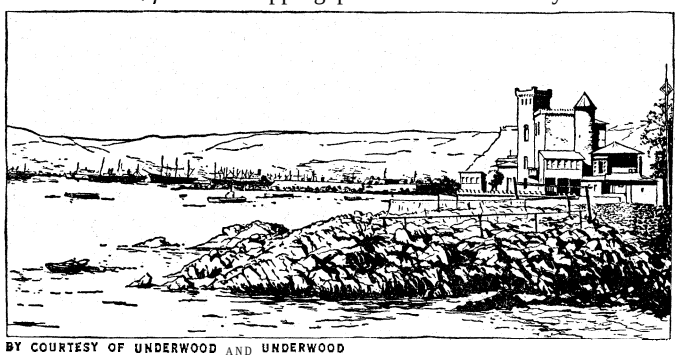
ANTLERS, the name given to the bony outgrowths on the heads of deer, which are shed and renewed each year. For details see DEER.

ANT-LION, the name given to neuropterous insects of the family Myrmeleonidae, with relatively short and apically clubbed antennae and four narrow densely reticulated wings which are usually marked with brown or black. The perfect insects are mostly nocturnal and are believed to be carnivorous. The best-known species, Myrmeleon formicarius, which may be found adult in the late summer, occurs in many European countries, though like the rest of this group it does not occur in England. Strictly speaking, however, the term ant-lion applies to the larval form on account of its peculiar and forbidding appearance and its skilful and unique manner of entrapping prey by means of a pitfall. The sandy-grey abdomen is oval and beset with warts and bristles; the prothorax forms a mobile neck for the large squsre head, which carries a pair of long and powerful toothed mandibles.

In dry and sandy soil the ant-lion lays its trap. Having marked out the chosen site by a circular groove, it starts to crawl backwards, using its abdomen as a plough to shovel up the soil. By the aid of one front leg it places consecutive heaps of loosened particles upon its head, then with a smart jerk throws each little pile clear of the scene of operations. Proceeding thus it gradually works its way from the circumference towards the centre. When this is reached and the pit completed, the larva settles down at the bottom, buried in the soil with only the jaws projecting above the surface. Since the sides of the pit consist of loose sand they afford an insecure foothold to any small insect that ventures over the edge. Slipping to the bottom the prey is immediately seized by the lurking ant-lion; or if it attempts to scramble again up the treacherous walls of the pit, is speedily checked in its efforts and brought down by showers of loose sand which are jerked at it from below by the larva. By means of similar head jerks the skins of insects sucked dry of their contents are thrown out of the pit. A full-grown larva digs a pit about 2 in. deep and 3 in. wide at the edge.

The larva makes a globular case of sand stuck together with fine silk spun, it is said, from a slender spinneret at the posterior end of the body. In this it remains until the completion of the transformation into the sexually mature insect, which then emerges from the case, leaving the pupal integument behind. In certain species of *Myrmeleonidae,* such as *Dendroleon pantheormis,* the larva, although resembling that of *Myrmeleon* structurally, makes no pitfall, but seizes passing prey from any nook or crevice in which it shelters. In the United States, 58 species are recognized, and the ant-lion is locally known as doodlebug.

ANTOFAGASTA, a town and port of northern Chile, and capital of the Chilean province of the same name, situated about 768m. N. of Valparaiso in lat. 23° 38' 39" S. and long. 70° 24' 39" W. of Greenwich. Population (estimated 1902) 16,084; (1942) 60,000. Antofagasta is the seaport for a railway running to Oruro, Bolivia, and is the only available outlet for the trade of the south-western departments of that republic. The smelting works for the neighbouring silver mines are here, and a thriving trade with the inland mining towns is carried on. The town was founded in 1870 as a shipping port for the recently discovered



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THE HARBOUR AT ANTOFAGASTA, THE PRINCIPAL PORT OF CHILE

silver mines of that vicinity, and belonged to Bolivia until 1879, when it was occupied by a Chilean military force.

The province of ANTOFAGASTA has an area of 47,511 sq.mi. lying within the desert of Atacama and between the provinces of Tarapacá and Atacama. Its population in 1940 was 145,147. It is rich in saline and other mineral deposits, the important Caracoles silver mines being about 90m. north-east of the port of Antofagasta. Like the other provinces of this region, Antofagasta produces for export copper, silver, silver ores, lead, nitrate of soda, borax and salt. Iron and manganese ores are also found. Besides Antofagasta the principal towns are Taltal, Mejillones, Cobija (the old capital) and Tocopilla. Up to 1879 the province belonged to Bolivia, and was known as the department of Atacama, or the Litoral. It fell into the possession of Chile in the war of 1879–82, and was definitely ceded to that republic in 1885.

ANTOINE, ANDRÉ (1851–), French actor-manager, was born at Limoges, and in his early years was in business. But he was an enthusiastic amateur actor, and in 1887 he founded in Paris the Théâtre Libre, in order to realize his ideas as to the proper development of dramatic art. In this undertaking he had the support of Zola, who championed Antoine's efforts for the replacement on the Parisian stage of the "well-made play" for something nearer the actualities of life. Many other writers backed the campaign, and Antoine began to produce the great series of plays by Brieux, Curel and Porto-Riche, which made his theatre famous. Mr. A. B. Walkley, in introducing M. Antoine to an English audience in 1922 justly said of him: "The great thing about the Théâtre Libre was the spirit, courage and indomitable energy of its founder." Great as was its importance in Paris and in France, it was perhaps still greater in other countries. The Freie Bühne of Berlin, the Independent Theatre in London and other institutions of the kind, descended from it. For an account of his work, which had enormous influence on the French stage, see DRAMA: England. In 1894 he gave up the direction of this theatre, and became connected with the Gymnase, and later (1896) with the Odéon. His resignation from the Odéon in 1914 was universally regretted.

See S. M. Waxman, Antoine and the *Théâtre Libre* (1926).

ANTONELLI, GIACOMO (1806–1876), Italian cardinal, was born at Sonnino April 2, 1806. Created cardinal (June 11, 1847), he was chosen by Pius IX to preside over the council of state entrusted with the drafting of the constitution. On March 10, 1848, Antonelli became premier of the first constitutional ministry of Pius IX. Upon the fall of his cabinet Antonelli created for himself the governorship of the sacred palaces in order to retain constant access to and influence over the pope. After the assassination of Pellegrino Rossi (Nov. 15, 1848), he arranged the flight of Pius IX to Gaeta, where he was appointed secretary of State. Notwithstanding promises to the powers, he restored

absolute government upon returning to Rome (April 12 1850) and violated the conditions of the surrender by wholesale imprisonment of Liberals. In 18 jj he narrowly escaped assassination. As ally of the Bourbons of Naples, from whom he had received an annual subsidy, he attempted, after 1860, to facilitate their restoration by fomenting brigandage on the Neapolitan frontier. To the overtures of Ricasoli (*q.v.*) in 1861, Pius IX., at Antonelli's suggestion, replied with the famous *"Non possumus,"* but subsequently (1867) accepted, too late, Ricasoli's proposal concerning ecclesiastical property. After the September Convention (1864) Antonelli organized the legion of Antibes to replace French troops in Rome, and in 1867 secured French aid against Garibaidi's invasion of papal territory. Upon the reoccupation of Rome by the French after Mentana (1867), Antonelli again ruled supreme, but upon the entry of the Italians in 1870 was obliged to restrict his activity to the management of foreign relations. Me wrote, with papal approval, the letter requesting the Italians to occupy the Leonine city; *i.e.,* the district of Rome in which the Vatican is situated, and obtained from the Italians payment of the Peter's pence (5,000,000 lire) remaining in the papal exchequer, as well as 50,000 *scudi*—the first and only instalment of the Italian allowance (subsequently fixed by the Law of Guarantees, March 21 1871) ever accepted by the Holy See. At Antonelli's death (Nov. 6 1876) the Vatican finances were found to be in disorder, with a deficit of 45,000,000 lire. His activity was devoted almost exclusively to the struggle between the papacy and the Italian *Risorgimento,* the history of which is comprehensible only when his unscrupulous influence is fully taken into account.

ANTONEELO DA MESSBNA (c. 1430–1479), Italian painter, was probably born at Messina about the beginning of the 15th century. He spent some time in the Netherlands studying the methods of the disciples of Jan Van Eyck; returned with his secret to Messina about 1465; probably visited Milan; removed to Venice in 1472, where he painted for the Council of Ten; and died there in the middle of Feb. 1479 (see Venturi's article in Thieme-Becker, Kzinstlerlexikon, 1907).

His style is remarkable for its union—not always successful—of Italian simplicity with Flemish love of detail. There are extant —besides a number more or less dubious—zo authentic productions, consisting of renderings of "Ecce Homo," Madonnas, saints, and half-length portraits, many of them painted on wood. The finest of all is said to be the nameless picture of a man in the Berlin museum. The National Gallery, London, has three works by him, including the "St. Jerome in his Study." Antonello exercised an important influence on Italian painting by the transmission of Flemish tendencies.

ANTONINI ITINERARIUM, a valuable register, still extant, of the stations and distances along the various roads of the Roman empire. The original edition probably dated from the beginning of the 3rd century while the extant portion is assigned to the time of Diocletian. If it is to be ascribed to the initiative of one of the emperors, Antoninus Caracalla would be the most likely name. Editions were published by Wesseling in 1735, Parthey and Pindar in 1848. The portion relating to Britain was published as *Iter Britanniarum* by T. Reynolds in 1799.

ANTONINUS, ST. (ANTONIO PIEROZZI, also called DE FORCIGLIONI) (1389–1459), archbishop of Florence, was born in that city March 1 1389. He entered the Dominican order in his 16th year, and was consecrated archbishop of Florence in 1446, and won the esteem and love of his people, especially by his energy and resource in combating the effects of the plague and earthquake in 1448 and 1453. He died on May 2 1459, and was canonized by Pope Adrian VI. in 1523. Antoninus sat as papal theologian at the council of Florence (1439).

See Bolland, *Acta Sanctorum,* i., and U. Chevalier, *Rép.* des s. *hist.* (1905), pp. 285–286.

ANTONINUS LIBERALIS, Greek grammarian, probably flourished about A.D. 150. He wrote a collection of 41 tales of mythical metamorphoses (Μεταμορφώσεων Συναγωγή), chiefly valuable as a source of mythological knowledge.

BIBLIOGRAPHY.—See Westermann, *Mythographi* Graeci (1843); Oder, De *Antonino* Liberali (1886).

ANTONINUS PIUS (Titus Aurelius Fulvus Boionus Arrius Antoninus) (A.D. 86–161), Roman emperor 138–161, the son of Aurelius Fulvus, a Roman consul whose family had originally belonged to Nemausus (Nimes). He was brought up by his grandfather, Arrius Antoninus, a friend of the younger Pliny. He was consul in 120, was next chosen as one of the four consulars for Italy, and won distinction as proconsul of Asia. On Feb. 25 138, he was adopted by the Emperor Hadrian as his successor, on condition that he himself adopt Marcus Annius Verus, nephew of his wife Faustina, and Lucius, son of Aelius Verus (afterwards the Emperors Marcus Aurelius and Lucius Aelius Verus). A few months afterwards, on Hadrian's death, he became emperor. Antoninus was experienced and intelligent, and sincerely desired the welfare of his subjects. One of his first acts was to beg the senate in person to decree divine honours to Hadrian (this gained him his name of Pius), and this foreshadowed his policy, for throughout his reign he sought to increase the dignity of the senate, consulting it in person on matters of State, and giving back Italy to its management. He discouraged informers (delatores), and when conspiracies occurred showed great clemency. With the help of his council of skilled jurists, he made legal reforms tending to greater simplicity and humanity. In Italy he promoted art and science, built baths and aqueducts, and expanded the system of provision for orphans. Under his personal care the provinces prospered; their burdens (*e.g.* the imperial post) were lightened, and liberal relief was granted to distressed cities. The peace of his reign was broken only by insurrections of the Moors (152), Egyptians (153), Jews and Brigantes, and these were easily put down. The one military result of interest to us now is the building in Britain of the wall of Antoninus from the Forth to the Clyde. Antoninus died of fever at Lorium in Etruria, probably March 7 161. His one surviving child married the Emperor Marcus Aurelius.

The only account of his life handed down to us is that of Julius Capitolinus, one of the Scriptores *Historiae* Augustae. See Bossart-Muller, *Zur* Geschichte des Kaisers A. (1868); Lacour-Gayett, *A.* le Pieux et son Temps (1888); Bryant, The *Reign* of *Antonine* (Camb. Hist. Essays, 1895); P. B. Watson, *Marcus* Aurelius *Antoninus* (1884), chap. ii.; for a general account of social conditions, Rostovtzev, Economic History of the Roman *Empire under* the Flavians and *Antonines* (1926).

ANTONIO (1531–95), claimant of the throne of Portugal, known as the Prior of Crato, was a grandson of King Emanuel the Great and son of Luis, duke of Beja, by a Jewess, Yolande Gomez. On the death of King John III. (1557) he claimed the Portuguese throne, to which Philip II. of Spain was also a claimant. He obtained some support from France and England for political reasons, but the small force which he raised in Portugal was easily routed by the duke of Alva at Alcantara (Aug. 25 1580).

Antonio fled to France, where Catherine de' Medici, who regarded him as a useful instrument against Philip II., connived at the fitting out of a fleet manned by Portuguese exiles and English and French adventurers. This fleet was defeated by the Spanish admiral Santa Cruz (July 27 1582). Driven from France by the attention of Philip II.'s agents, Antonio found refuge in England. In 1589, the year after the Armada, an English expedition under Drake and Norris, financed partly by Elizabeth and partly by private persons, set out to invade Portugal and establish Antonio as king. The expedition was a disastrous failure, costing thousands of lives. Antonio spent the rest of his life in exile, dying in Paris Aug. 26 1595. He was the author of a cento of the Psalms, *Psalmi* Confessionales (Paris, 1592), which was translated into English under the title of *The* Royal Penitent by Francis Chamberleyn (London, 1659), and into Germbn as *Heilige Betrachtungen* (Marburg, 1677).

BIBLIOGRAPHY.—Antonio is frequently mentioned in the French, English and Spanish State papers of the time. A life of him, attributed to Gomes Vasconcellos de Figueredo, was published in a French translation by Mme. de Sainctonge at Amsterdam (1696). A modern account of him, *Un prétendant* portugais au *XVIe siècle,* by E. Fournier (Paris, 1852), is based on authentic sources. See also Dom Antonio Prior de *Crato—notas* de *bibliographia,* by J. de Aranjo (Lisbon, 1897).

ANTONIO, NICOLAS (1617–1684), Spanish bibliographer, was born at Seville on July 31, 1617, and died at Madrid in the spring of 1684. His Bibliotheca Hispana nova, dealing with the works of Spanish authors who flourished after 1500, appeared in Rome in 1672; the Bibliotheca Hispana *vetus,* a literary history of Spain from the time of Augustus to the end of the 11th century, was revised by Manuel Martí and published by Antonio's friend, Cardinal José Saenz de Aguirre in Rome in 1696. A fine edition of both parts, with additional matter found in Antonio's manuscripts, and with supplementary notes by Francisco Perez Bayer was issued in Madrid in 1787–88. This great work, incomparably superior to any previous bibliography, is still unsuperseded and indispensable.

Of Antonio's miscellaneous writings the most important is the posthumous *Censura de historias fabulosas* (Valencia, 1742), in which erudition is combined with critical insight. His *Bibliotheca Hispana rabinica* has not been printed; the manuscript is in the national library at Madrid.

ANTONIO DE LEBRIJA (ANTONIUS NEBRISSENSIS) (1444–1522), Spanish scholar, born at Lebrija in the province of Andalusia, studied at Salamanca and at Bologna. After holding the professorship of poetry and grammar at Salamanca, he was transferred to the university of Alcalá de Henares, where he lectured until his death in 1522. His services to the cause of classical literature in Spain have been compared with those rendered by Valla, Erasmus and Budaeus to Italy, Holland and France.

BIBLIOGRAPHY.—MacCrie, *The Reformation in Spain in the Sixteenth Century* (1829); Antonio, *Bibliotheca Hispana Nova,* i. 132 (1888); Prescott, *History of Ferdinand and Isabella,* i. 410 (note).

ANTONIUS, the name of a large number of well-known citizens of ancient Rome, of the gens Antonia. The following are important:—

(1) MARCUS ANTONIUS (143–87 B.C.), one of the most distinguished Roman orators of his time, was quaestor in 113, and praetor in 102 with proconsular powers, the province of Cilicia being assigned to him. He was consul in 99, censor 97, and held a command in the Marsic War in 90. An adherent of Sulla, he was put to death by Marius and Cinna in 87. His reputation for eloquence rests on the authority of Cicero, none of his orations being extant. He is one of the chief speakers in Cicero's De *Oratore.*

See Velleius Paterculus ii. 22; Appian, *Bell. Civ,* i. 72; Dio Cassius xlv. 47; Plutarch, *Marius,* 44; Cicero, *Orator,* 5, *Brutus,* 37; Quintilian, *Instit.* iii. 1, 19; O. Enderlein, *De* M. *Antonio oratore* (1882).

(2) MARCUS ANTOXIUS, nicknamed CRETICUS in derision, elder son of the above, and father of the triumvir. He was praetor in 74 B.C., and received an extraordinary command to clear the sea of pirates. He failed in the task and made himself unpopular by plundering the provinces (Sallust, *Hist.,* iii., fragments ed. B. Maurenbrecher, p. 108; Velleius Paterculus ii., 31; Cicero, In *Verrem,* iii., 91). He attacked the Cretans, who had made an alliance with the pirates, but was totally defeated. Diodorus Siculus (xl. 1) states that he only saved himself by a disgraceful treaty. He died (72–71) in Crete. All authorities are agreed as to his avarice and incompetence.

(3) GAIUS ANTONIUS, nicknamed HYBRIDA from his half-savage disposition (Pliny, *Nat. Hist.* viii. 213), second son of Marcus (1) and uncle of the triumvir. Despite a bad reputation, he held the consulship in 63, with Cicero, and was subsequently appointed to Macedonia. There he made himself so detested that he left the province, and was accused in Rome (59) both of having taken part in the Catilinarian conspiracy and of extortion in his province. In spite of Cicero's eloquent defence, Antonius was condemned and went into exile at Cephallenia. He seems to have been recalled by Caesar, since he was present at a meeting of the senate in 44, and was censor in 42.

See Cicero, *In Cat.* iii. 6, *pro Flacco,* 38; Plutarch, *Cicero,* 12; Dio Cassius xxxvii. 39, 40; xxxviii. 10. On his trial *see* article Pauly-Wissowa's *Realencyklopädie.*

(4) MARCUS ANTONIUS, commonly called MARK ANTONY, the Triumvir, grandson of (1) and son of (2), related on his mother's side to Julius Caesar, was born about 83 B.C. In 54 he was with Caesar in Gaul. Raised by Caesar's influence to the offices of quaestor, augur, and tribune of the plebs, he supported the cause of his patron, and was expelled from the senate-house when the civil war broke out. He was deputy-governor of Italy during Caesar's absence in Spain (49), second in command in the decisive battle of Pharsalus (48), and again deputy-governor of Italy while Caesar was in Africa (47). In 46 he seems to have taken offence because Caesar insisted on payment for the property of Pompey which Antony had appropriated. But the breach was soon healed, for we find Antony meeting the dictator at Narbo the following year, and refusing when Trebonius suggested that he should join in the conspiracy. In 44 he was consul with Caesar. After the murder of Caesar on March 15 Antony determined to make himself sole ruler. At first he seemed disposed to treat the conspirators leniently, but at the same time he so roused the people against them by the publication of Caesar's will and by his eloquent funeral oration that they were obliged to leave the city. He forced the senate to transfer to him the province of Cisalpine Gaul, which was then held by Decimus Junius Brutus, one of the conspirators. Brutus refused to surrender the province and Antony set out to attack him in Oct. 44.

But at this time Octavian, whom Caesar had adopted, arrived in Italy and claimed the inheritance of his "father." Octavian obtained the support of the senate and of Cicero; and the veteran troops of the dictator flocked to his standard. Antony was denounced as a public enemy and Octavian was entrusted with the command of the war against him. Antony was defeated at Mutina (43), where he was besieging Brutus. The senate became suspicious of Octavian, who, irritated by its treatment of him, entered Rome at the head of his troops and forced the senate to grant him the consulship (Aug. 19). Meanwhile, Antony escaped to Cisalpine Gaul, effected a junction with Lepidus, and marched towards Rome with a large force. Octavian came to terms with Antony and Lepidus. The three leaders met at Bononia and adopted the title *Triumviri reipublicae constituendae* as joint rulers. Gaul was to belong to Antony, Spain to Lepidus, and Africa, Sardinia, and Sicily to Octavian. The arrangement was to last for five years. A reign of terror followed; proscriptions, confiscations, and executions became general, and Cicero, among others, fell a victim to Antony's revenge. In the following year (42) Antony and Octavian proceeded against the conspirators, and by the two battles of Philippi annihilated the senatorial and republican parties. Antony proceeded to Greece and thence to Asia Minor. On his passage through Cilicia in 41 he fell a victim to the charms of Cleopatra, in whose company he spent the winter at Alexandria. At length he was aroused by the Parthian invasion of Syria and the news that his wife Fulvia and his brother were at war with Octavian. On arriving in Italy he found that Octavian was already victorious; on the death of Fulvia, a reconciliation was effected between the triumvirs and cemented by the marriage of Antony with Octavian's sister. In the new division of the Roman world made at Brundusium Antony received the east. Returning to his province, he made several attempts to subdue the Parthians, without any decided success. In 39 he visited Athens, where he behaved in a most extravagant manner, assuming the attributes of the god Dionysus. In 37, after meeting Octavian in Italy and renewing the triumvirate for five years, he returned to Syria and Cleopatra. The way in which he disposed of kingdoms and provinces in her favour alienated his supporters, and in 32 the senate deprived him of his powers and declared war against Cleopatra. After two years spent in preparations, Antony was defeated at the battle of Actium (Sept. 2, 31). He followed Cleopatra, who had escaped with 60 ships, to Egypt and there, pursued by his enemies and deserted by his troops, committed suicide in the mistaken belief that Cleopatra had already done so (30 B.C.). Antony had been married in succession to Fadia, Antonia, Fulvia, and Octavia, and left a number of children.

See ROME, *History,* ii. "The Republic" (ad *fin.*); Caesar, *De Bello Gallico, De Bello Civili;* Plutarch, Lives of *Antony, Brutus, Cicero, Caesar;* Cicero, *Letters* (ed. Tyrrell and Purser) and *Philippics;* Appian, *Bell. Civ.* i.–v.; Dio Cassius xli–liii. In addition to the standard histories, *see* V. Gardthausen, *Augustus und seine Zeit* (1891–1904); W. Drumann, *Geschichte Roms* (2nd ed. P. Groebe), i. pp. 46–384 (1899); article by Groebe in Pauly-Wissowa's *Realencyklopädie;* and a short but vivid sketch by de Quincey in his *Essay on the Caesars.*

(5) LUCIUS ANTONIUS, youngest son of (2), and brother of the triumvir. In 44, as tribune of the people, he brought forward a law authorizing Caesar to nominate the chief magistrates during his absence from Rome. After the murder of Caesar, he supported his brother Marcus. He proposed an agrarian law in favour of the people and Caesar's veterans and took part in the operations at Mutina (43). In 41 he was consul, and had a dispute with Octavian, which led to the so-called Perusian War, in which he was supported by Fulvia (Mark Antony's wife). He was compelled to surrender to Octavian at Perusia. His life was spared, and he was sent by Octavian to Spain as governor. Nothing is known of his death.

See Appian, *Bellum Civile,* v. 14 **ff.;** Dio Cassius xlviii. 5–14.

(6) GAIUS ANTONIUS, second son of (2) and brother of the triumvir. He supported Caesar against Pompey, and in 44 was urban praetor. On his way to his province of Macedonia he fell into the hands of M. Junius Brutus, who at first kept him as hostage but ultimately put him to death (42).

See Plutarch, *Brutus,* 28; Dio Cassius xlvii. 21–24. On the whole family, *see* the articles in Pauly-Wissowa's *Realencyklopadie* i. pt. 2 (1894).

ANTONOMASIA, in rhetoric, the Greek term for a substitution of any epithet or phrase for a proper name; as "the author of *Paradise Lost*" for Milton.

ANTRAIGUES, EMMANUEL HENRI LOUIS ALEXANDRE DE LAUNAY, COMTE D' (1755?–1812), French publicist and political adventurer, was a nephew of François Emmanuel de Saint-Priest (1735–1821), one of the last ministers of Louis XVI. During the emigration he was the secret agent of the Comte de Provence (Louis XVIII.) at different courts of Europe, and at the same time received money from the courts he visited. At Venice, where he was attaché to the Russian legation, he was arrested in 1797, but escaped to Russia. Sent as Russian attaché to Dresden, he published a violent pamphlet against Napoleon I., and was expelled by the Saxon Government. He then went to London, and it was universally believed that he betrayed the secret articles of the Treaty of Tilsit to the British Cabinet, but his biographer, Pingaud, contests this. In 1812, he and his wife Madame Saint-Huberty, an operatic singer, were assassinated by a servant whom they had dismissed.

See H. Vaschalde, *Notice bibliographique sur Louis Alexandre de Launay, comte d'Antraigues, sa vie et ses oeuvres;* Léonce Pingaud, *Un Agent secret sous la révolution et l'empire, le comte d'Antraigues* (Paris, 1893); Edouard de Goncourt, *La Saint-Huberty et l'opéra au XVIIIe siècle.*

ANTRIM, RANDAL MACDONNELL, 1ST MARQUESS OF (1609–1683), son of the 1st Earl of Antrim, was born in 1609 and educated as a Roman Catholic. He married the widow of the 1st Duke of Buckingham. On the outbreak of the Scottish war, in 1639, he made a scheme to attack Argyll in Scotland, which came to nothing. From that time onwards he was engaged in various schemes for the assistance of Charles I. against the parliament—all of them abortive. He was at various times arrested as a suspect. The papers found on him at his capture in 1643 informed the parliamentary leaders of a plan for a rising by Montrose in Scotland to be supported from Ireland. On Jan. 26, 1644, Antrim was created a marquess. He was employed on various missions in Ireland and on the Continent until 1647, when he ceased to support the king's cause. In 1649 he entered into communications with Cromwell, for whom he performed various services, though there appears no authority to support Carte's story that Antrim was the author of a forged agreement for the betrayal of the king's army by Lord Inchiquin. Subsequently he joined Ireton and was present at the siege of Carlow. He returned to England in Dec. 1650, and in lieu of his confiscated estate received a pension of £500 and later of £800, together with lands in Mayo. At the Restoration, Antrim was excluded from the Act of Oblivion on account of his religion and, on presenting himself at court, was imprisoned in the Tower, subsequently being called before the lords justices in Ireland. In 1663 through the influence of the queen mother he obtained a pardon, his estates being restored to him by the Irish Act of Explanation in 1665. Antrim died on Feb. 3, 1683. He is described by Clarendon as of handsome appearance but "of excessive pride and vanity and of a marvellous weak and narrow understanding."

See *Hibernia Anglicana,* by *R.* Cox (1689–90) esp. app. xlix. vol. ii. 206; *History of the Irish Confederation, by J. T.* Gilbert (1882–91); *Aphorismical Discovery* (Irish Archaeological Society, 1879–80); *Thomason Tracts* (Brit. Mus.), *E* 59 (18), 149 (12), 138 (7), 153 (19), 61 (23); *Murder will out, or the King's Letter justifying the Marquess of Antrim* (1689); *Hist. mss. Comm. Series mss. of Marq. of Ormonde.*

ANTRIM, a county in Ulster, Northern Ireland. It is bounded north and east by the narrow seas separating Ireland from Scotland, the Atlantic ocean and Irish sea, south by Belfast lough and the Lagan river dividing it from Down, west by Lough Neagh, dividing it from Armagh and Tyrone, and by the River Bann dividing it from Londonderry. Land area, 1,098 sq.mi. Pop. (excluding Belfast) 197.266. The hilly district to the east shows north to south trend lines. There are some outstanding peaks, such as Knocklayd (1,695ft.), Slieveanorra (1,676ft.), Trostan (1,817ft.), Slemish (1,457ft.), and Divis (1,567ft.); but the basalt which covers the greater part of the area has been largely weathered into a low plateau often covered by peat. The basalt reaches the sea along the north coast in steep cliffs; *e.g.,* the perpendicular columnar basalt of Giant's Causeway. Fair Head is another rocky eminence of dolerite, backed by gneiss and schistose grits. A narrow zone of Jurassic, Triassic, and Cretaceous rocks separates the basalt from the consequently milder east coast, which has low headlands and wide bays backed by the higher interior. Triassic and Cretaceous rocks also bound the basalt on the south-east and Trias is important near the lower Lagan. Lough Neagh occupies an irregularity in the surface of the basaltic plateau due probably to faulting in Pliocene times. It is bounded by basalt rocks on the north and by Pliocene deposits on the south. The plateau of the east slopes down gradually to the valley of the Bann, beyond which the basalt is found again in the hills of east county Londonderry.

Early History.—The evidences of palaeolithic life in Ireland are scanty and have led to diversity of opinion. There is considerably more data for the neolithic period. In Antrim there are traces of the beach 25ft. above the present sea-level which was probably formed in the period of the Littorina sea in north Europe, and in which are found the earliest certain human relics. The coast of Antrim was doubly important in neolithic times. Its proximity to Scotland makes it possible that it received some of the earliest immigrants into Ireland. Further, its chalk deposits, protected from excessive erosion by a capping of basalt, were rich in flint which was in great demand for the manufacture of weapons. It is rich in rude stone monuments. Amber beads suggest that Antrim remained in contact with north Europe via Scotland during the bronze age, and spiraliform designs may have reached bronze age Ireland from north or from south Europe.

The Romans did not land in Ireland. The civilizing influence of the Continent was felt, however, even in remote Antrim. St. Patrick is said to have been brought back among the prisoners after an Irish raid on the coasts of Britain. He became a swineherd on the western slopes of Slemish. Later he studied on the Continent and returned as a bishop, founding many churches in north-east Ireland.

During the period of Scandinavian influence, Norwegians, followed by Danes, penetrated along the lower Bann and also Belfast lough, and from these made raids into the surrounding country. To this period have been attributed the earlier round towers found in Ireland, examples of which may be seen at Antrim and Armoy and on Ram island in Lough Neagh.

Antrim's position in the far north delayed its conquest by the Normans. Henry II., however, authorized John de Courcy to go into Ulster. He marched north, defeated MacDonlevy and took his kingdom, consisting of modern Antrim and Down. Ruins of castles may be seen perched on basalt crags fringing the coast from Carrickfergus to Dunluce and Dunseverick. The first-named has a commanding position of strategic importance and was occupied by Edward Bruce during his expedition to Ireland in 1315. During Tudor times there was a considerable infiltration of Scots into Antrim which, therefore, has a mixed population, althcugb

it was not included in the territory partitioned during the plantation of Ulster. It was a recognized division before the general establishment of shires.

Economic Survey. — The chief centres of population in later times are in the lowlands and along the coastal fringe. With the exception of Belfast (*q.v.*) and possibly of Larne, there is no large port around the coasts of Antrim. The numerous bays, however, afford shelter for small fishing villages and holiday resorts. Larne has passenger communication with the Scottish ports of Stranraer and Ayr. The fisheries of the Bann and of Lough Neagh are not only attractive to sportsmen but are also of commercial value, the chief centre being Toome.

The plateaux of east Antrim consist of heathery moorland with a few scattered peat deposits. They provide pasturage for sheep but are sparsely populated, most of the villages being in the valleys. The more recent deposits of the valleys of the Bann and the Lagan, and also of the lowlands around Lough Neagh, form the richest agricultural areas. Oats, potatoes and flax are the principal crops. The production of flax increased considerably during the World War but has been on the decrease since. The peasants of Antrim and of Ulster in general depend largely on the potato crop and have suffered so much in bad seasons that attempts are being made to encourage home industries and to organize resources scientifically. The cultivation of fruits is being encouraged and extended. The valley of the Lagan provides rich pasturages which are famous as cattle-fattening centres.

The great linen and ship building industries of Antrim centre on Belfast (*q.v.*) which is the metropolis of the area. Other centres of the linen industry are Lisburn on the Lagan, and Ballymena on the Braid. The former probably owes its importance to skilled Huguenot weavers who settled there after the revocation of the Edict of Nantes. Industry in Antrim has been handicapped by absence of local supplies of coal and iron, but it has grown in Belfast to which such supplies can easily be brought by water, chiefly from Scotland. Some coal for local needs is mined at Ballycastle. There are a few minor activities which should be noted. Whisky distilling is carried on at a few centres. Bushmills in the north has several paper mills. Rock salt some 80ft. thick is mined near Carrickfergus. The Keuper clays yield material for bricks. Bauxite, which is believed to be derived from the decay of lavas, is found between Glenarm and Broughshane, in association with iron-ores, both these materials being worked commercially. Bauxite occurs also near Ballintoy.

With the exception of the Great Northern railway line from Belfast to the south and west, with a branch from Lisburn to Antrim, the principal lines of communication are those of the L.M.S.R. The railway network depends largely on the physical features of the county. From Belfast there is a line up the fertile Lagan valley with connections to Antrim and Ballymena and thus along the west of the main mountain area to Coleraine. Another line from Belfast skirts the important north shore of Belfast lough, through Carrickfergus to Larne. Valley routes have been utilized to give this packet station inland connections with Ballymena and also with a line connecting Antrim and Belfast lough. Two other routes across the mountains of the east may be mentioned. From Ballymena a line runs some distance beyond Parkmore; from Ballymoney there is a branch to Ballycastle. Along the east coast the absence of important towns and the narrowness of the coastal plain have hindered development of communication, the chief centres being linked, as already stated, with inland towns rather than directly with one another along the coast.

The county is divided into nine urban districts and nine rural districts and into seven poor law unions. It returns seven members to the parliament of Northern Ireland and two members to the parliament of Great Britain and Northern Ireland.

ANTRPM, a town, County Xntrim, Northern Ireland, in a valley half a mile from Lough Neagh. Pop. **(1926)** 1,979. Near the town is one of the most perfect of the round towers of Ireland, 93ft. high and 50ft. in circumference at the base, which may perhaps have been a protection against the Scandinavians who made Lough Neagh one of their bases. Antrim Castle also testifies to the strategic advantages of the site, which in more peaceful times led to the rise of a small market town, with manufactures of paper, linen and woollen cloth, commanding important routes. The town now has railway communications with Belfast, Larne, Coleraine and other important centres.

ANTRUM, a chamber or recess. When applied to the human body, the unqualified term usually refers to the antrum of Highmore or maxillary sinus. This is an air space situated in the cheek bone on either side of the nasal orifice. It is the largest of the bony sinuses which communicate with the nasal cavity. It is lined with mucous membrane, and opens into the nasal cavity by a small hole at the highest point on its inner wall. During the course of a cold its lining membrane is usually inflamed like that of the rest of the nose, and if its opening becomes closed by a plug of mucus or by swelling of the mucous membrane, pus may accumulate in the cavity and give rise to fever and pain. On account of the position of its opening, natural drainage is poor, and sometimes it is necessary to make an artificial opening at a lower level, to facilitate irrigation and drainage. Other antra are: the pyloric antrum, the lower third of the stomach between the large fundus and the narrow pyloric canal; the duodenal antrum or duodenal bulb, a dilatation in that part of the duodenum continuous with the stomach; the tympanic or mastoid antrum, a small air space in the mastoid bone leading from the middle ear to other air spaces in the mastoid.

ANTRUSTION, the name of the members of the military household of the Merovingian kings. Any one desiring to enter the body of antrustions had to present himself armed at the royal palace, and there, with his hands in those of the king, take a special oath in addition to the oath of fidelity sworn by every subject at the king's accession. In return for the services to which he was bound the antrustion became specially entitled to the royal assistance and protection, and his *wergeld* was three times that of an ordinary Frank. The antrustion was always of Frankish descent, and only in certain exceptional cases were Gallo-Romans admitted into the king's bodyguard. The antrustions, belonging as they did to one body, had strictly defined duties towards one another; thus one antrustion was forbidden to bear witness against another under penalty of 15 *solidi.*

The antrustions seem to have played an important part at the time of Clovis. Afterwards, their rôle became less important. For each of their expeditions, the kings raised an army of citizens in which the Gallo-Romans mingled more and more with the Franks; they only kept one small permanent body which acted as their bodyguard, some members of which were from time to time told off for other tasks, such as that of forming garrisons in the frontier towns. The institution seems to have disappeared during the anarchy with which the 8th century opened.

See M. Deloche, *La Trustis et l'antrustion royal sous les deux premières races* (1873); *H.* Brunner, *Deutsche Rechtsgeschichte,* vol. ii., pp. 97 *et seq.,* in *Handbuch systematisches der deutschen Rechtswissenschaft* **(1893);** *G.* Waitz, *Deutsche Verfassungsgeschichte,* 3rd ed. vol. ii. pp. 33; *et seq. (1896);* *P.* Guilhermoz, *Essai sur les origines de la noblesse au moyen âge* (1902). (C. PF.)

ANT-THRUSH: *see* **PITTA.**

ANTUNG, a treaty port in eastern south Manchuria on the Korean frontier (39° 59' N. 124° 30' E.). It lies at the mouth of the Yalu river and is the natural outlet of its basin, which drains the tangled forested mountain country of east Manchuria and west Korea. Its importance as a timber market, especially significant by reason of the generally treeless character of north China, is a result of this position. Antung has had long-standing trading relations with Chefoo in the silk trade in which Antung has long been tributary to Chefoo but which she now threatens to supplant. The modern importance of Antung, however, is bound up essentially with its position as a frontier station through which the railway from Korea, whose communications are closely linked with those of Japan, passes into south Manchuria, across a long bridge over the Yalu. This railway connection is particularly significant in view of the Japanese direction of the development of south Manchuria. Japan in fact monopolizes the foreign import trade of Antung and takes one-half of its exports of raw silk and bean products. At the beginning of the present century

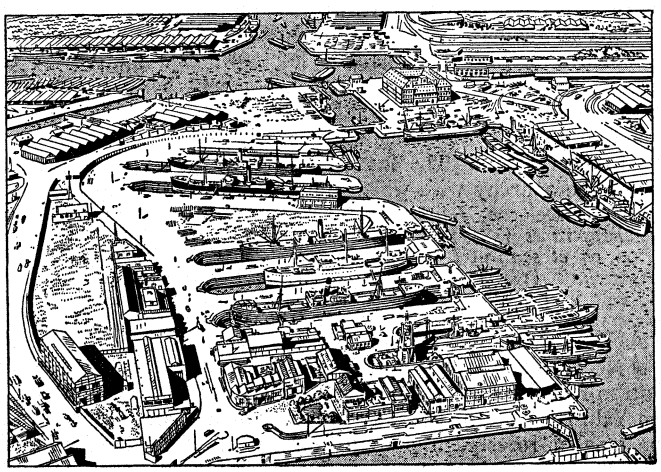
timber was the most important export of Antung, but it has since given place to silk and to bean products. The volume of trade has risen steadily since 1907, when the port was opened to foreign trade. In 1938 total exports amounted to $12,890,621; imports totalled $24,334,841. Population (1938), 315,242.

ANTWERP, the most northern of the nine provinces of Belgium, conterminous with the Dutch frontier on the north. Malines, Lierre and Turnhout are among its towns, but the chief one is the commercial metropolis of Belgium. It is divided into districts (*arrondissements*), viz., Antwerp, Malines, Lierre, Turnhout and Boom. These are subdivided into 23 cantons and 154 communes. Area 1,104 sq.mi. Pop. (est. 1938) 1,254,242 or 1,136.1 per sq.mi.

ANTWERP (ANTWERPEN, French Anvers), a fortified city in Belgium on the right bank of the Schelde. It is the capital of the province of the same name and Belgium's commercial centre.

In the 4th century Antwerp was mentioned as one of the places in the second Germany, and in the 11th century Godfrey of Bouillon was for some years best known as marquis of Antwerp Antwerp was the headquarters of Edward III during his early negotiations with van Artevelde, and his son Lionel, earl of Cambridge, was born there in 1338. At the end of the 15th century, with the closing of the Zwyn, the foreign trading gilds or houses were transferred from Bruges to Antwerp, and the building assigned to the English is mentioned in 1510. In 1560, the highest point of its prosperity, six nations, viz., Spaniards, Danes and Hansa together, Italians, English, Portuguese and Germans, mere named and over 1,000 foreign merchants were resident. Guicciardini, the Florentine merchant, described the activity of the port, into which 500 ships sometimes passed in a day, and as evidence of the extent of its land trade he mentioned that 2.000 carts entered the city each week. Venice had fallen from its first place in European commerce, but still it was active and prosperous. Guicciardini, in explaining the importance of Antwerp, stated that there was as much business done there in a fortnight as in Venice in a year.

The religious troubles that marked the second half of the 16th century broke out in Antwerp as in every other part of Belgium excepting Liége. In 1576 the Spanish soldiery plundered the town during what was called "the Spanish Fury," and 6,000 citizens were



PIX PROM PUBLIX

THE PORT OF ANTWERP IS THE TERMINUS OF THE BELGIAN RIVER AND CANAL SYSTEM AND SERVES BOTH INLAND AND OCEAN NAVIGATION

massacred. Eight hundred houses were burned down, and over two millions sterling of damage was wrought in the town on that occasion.

In 1585 a severe blow was struck at the prosperity of Antwerp when Parma captured it after a long siege and sent all its Protestant citizens into exile. The recognition of the independence of the United Provinces by the Treaty of Miinster in 1648 carried with it a severe blow to Antwerp for it stipulated that the Schelde should be closed to navigation. This impediment remained in force until 1863, although the provisions were relaxed during French rule from 1795 to 1814, and also during the time Belgium formed part of the kingdom of the Netherlands (1815 to 1830). Antwerp had reached the lowest point of its fortunes in 1800, and its population had sunk under 40,000, when Napoleon, realizing its strategical importance, assigned two millions for the construction of two docks and a mole.

In 1830 the city was captured by the Belgian insurgents, but the citadel continued to be held by a Dutch garrison under Gen.

ANTWERP IS NOT ONLY ONE OF THE WORLD'S BUSIEST PORTS BUT HAS A PROFOUND HISTORIC AND ARTISTIC INTEREST. THE CATHEDRAL, THE BEST EXAMPLE OF GOTHIC CHURCH ARCHITECTURE IN BELGIUM. WAS BEGUN IN 1352. IT HAS A BEAUTIFUL TOWER 400 FT. HIGH AND CONTAINS MANY PAINTINGS BY FLEMISH MASTERS AND A HEAD OF CHRIST ATTRIBUTED TO LEONARDO DA VINCI

ChassC. For a time this officer subjected the town to a periodical bombardment which inflicted much damage, and at the end of 1832 the citadel itself was besieged by a French army. During this attack the town was further injured. In Dec. 1832, after a gallant defense, Chassé made an honourable surrender.

Between 1878 and 1914 it was converted from a fortress to a fortified position by construction of an outer line of forts 5 to 11 mi. from the city, but none of these had been completed when war was declared in Aug. 1914. The Belgian government left Brussels for Antwerp on Aug. 17, 1914; and three days later the Belgian army took up a position behind the fortified lines. The bombardment began on Sept. 28 and on Oct. 9 the city surrendered.

On May 18, 1940, during World War II, the Germans again occupied Antwerp in their drive toward the channel ports. The fall of the city endangered the whole Belgian army, which surrendered at the command of King Leopold III ten days later.

Antwerp is finely laid out with broad avenues along the first enceinte. Long streets and terraces of fine houses belonging to merchants and manufacturers testify to its prosperity, and recall the 16th century distich that Antwerp was noted for its moneyed men ("Antwerpia nummis"). Despite war and disturbances it still preserves many memorials of its early grandeur, notably its

fine cathedral, begun in the 14th century, but not finished till 1518. Its tower of over 400 ft. is seen from afar over the flat country. A second tower was planned but never erected. The proportions of the interior are noble, and in the church are hung three of the masterpieces of Rubens, viz , "The Descent from the Cross," "The Elevation of the Cross" and "The Assumption." St. James is far more ornate than the cathedral, and contains the tomb of Rubens, who devoted himself to its embellishment.

The old Bourse or Exchange (1531) was destroyed by fire in 1858 and was replaced by a new one in 1872. Fire has also destroyed several other old buildings in the city, notably in 1891 the house of the Hansa League on the northern quays. The Maison Plantin, the house of the great 15th century printer C. Plantin (*q.v.*) and his successor Moretus, stands exactly as it did in the time of the latter. The new picture gallery close to the southern quays is a fine building divided into ancient and modern sections. The collection of old masters is very fine, containing many splendid examples of Rubens, Van Dyck, Metsys and the chief Dutch masters.

Antwerp, famous in the middle ages and in the 20th century for its commercial enterprise, enjoyed in the 17th century a celebrity not less distinct or glorious in art for its school of painting, which included Rubens, Van Dyck, Jordaens, Bruegel, the two Teniers and many others.

Commerce+ — In1863 Dutch rights to levy toll were redeemed by purchase and Antwerp thereafter grew rapidly in shipping tonnage. World War I made a complete break, but after the war trade rapidly surpassed prewar achievements, with a tonnage of 15,050,182 in 1922, rising steadily to more than 20,000,000 in the 1930s. Docks were built progressively before 1914, and included (1) the little or Bonaparte dock, (2) the Willem dock, also of Napoleon's time, (3) the Junction dock, (4) the Kattendijk, built 1860, enlarged 1881, (5) the Wood dock, (6) the Kempische dock, (7) the Asia dock linked by canal with the Meuse, as well as the Schelde, (8) the Lefebvre dock, (9) the America dock, opened 1905. Extensions after 1918 included construction of a canal dock over three miles long which stretches from the old wet dock No. 3 to the bend of the Schelde at Kruisschans, where it ends in a maritime lock approximately 886 ft. long and 115 ft. wide, with a depth ranging from 33 to 48 ft.

The dock itself is maintained at a depth of about 39 ft., and is connected with the other docks in the harbour by a channel about 440yd. long and 110yd. wide. Further schemes of extension included the construction of wet docks adjoining the canal dock and in 1925 the building of two wet and three dry docks was undertaken. The complete plan was designed to give the port a total dock water area of 1,334ac. and a quayage length of 28 miles. The necessary railway extensions bring the length of the port railway system up to 500 miles. The improvements at Antwerp are not confined to the construction of new docks. The quays flanking the Schelde, 3½m. in length, are of granite, with hydraulic cranes, warehouses, etc. The construction of river boats for export to Africa was resumed after 1918, and this industry rapidly approached its former importance. Shipbuilding proper showed but little prosperity; ship-repairing is done. In 1927 the port obtained the right to export Alsatian potash to the amount of 150,000 tons per annum and storage buildings for this are being built.

Limits and Population. — At the time of the declaration of Belgian independence Antwerp's defence was its citadel and an enceinte of about 2½ miles. In 1859, in a general reorganization of Belgian defence, the old enceinte and the citadel with the exception of the Steen, now a historical museum, were removed. A new enceinte of 8m. was devised which is now being demolished to allow of further extensions. In May 1927 the area controlled by the municipality was increased by growth north ards to the extent of 3,500 hectares, with absorption of five villages. Napoleon thought the left bank of the Schelde was the most natural line of expansion of Antwerp and there have been projects of a tunnel under the river but nothing has yet been done.

In 1800 the population did not exceed 40,000 In 1846 it was 88,487; in 1851, 95,501; in 1880, 169,100; in 1900, 272.830; in 1904, 291,949 or, with two incorporated suburbs, 361.723; in 1930, 284,373; in 1938 (est.), 273,317.

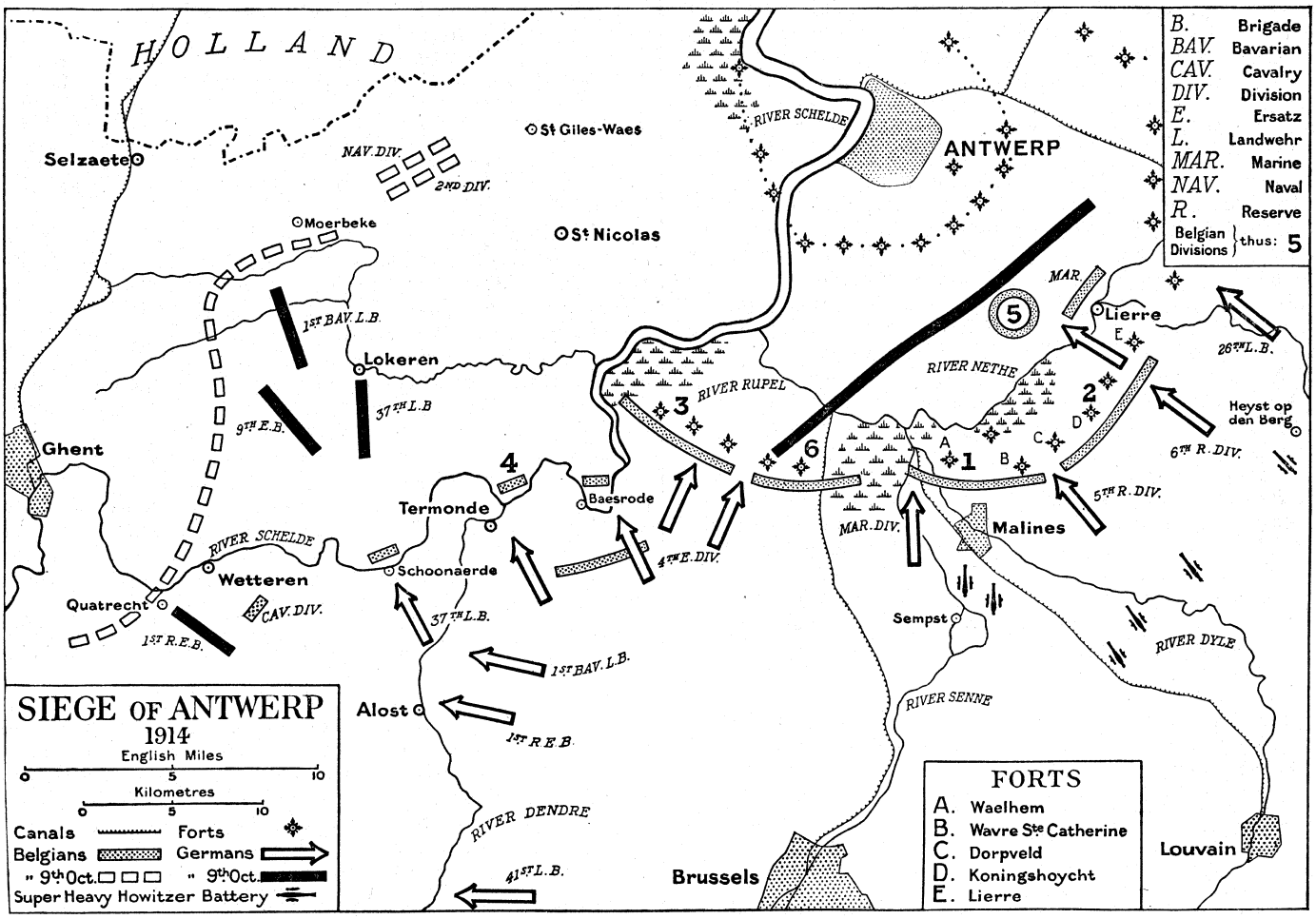
See C. Scribanii, *Origines Antwerpiensium* and *Antwerpia* (1610); J. L. Motley, *Rise of the Dutch Republic* (1859); E. Gens, *Histoive de la ville d'Anvers (1861)*; P. Génard, *Anvers à travevs les âges* (2 vols., 1888–92); W. C. Robinson, *Antwerp* (1904); J. Wegg, *Antwerp, 1477–1559* (1916), *Decline* of *Antwerp under Philip of Spain* (1924); J. A. Goris, *Étude sur les colonies marchandes à Anvers* (1925). *See* also *Annuaire statistique de la Belgique,* and bibliographies of World War I.

ANTWERP, SIEGE OF, Sept.–Oct. 1914. This was the preliminary move of the Germans' second bid for victory in the World War, after their opening sweep through Belgium and Northern France had been foiled in the Battle of the Marne. In rear of the Meuse the natural line of defence for the Belgian Army against an adversary from the east is the Schelde and the entrenched camp of Antwerp. As a commercial metropolis Antwerp was an obvious centre for arsenals, hospitals and stores of munitions and provisions, and it became the army's base of operations. By reason of its situation the fortress was also a refuge, if only a temporary one; and it was an excellent fiank position for use against the lines of communication of the German Armies operating in the north of France. Through Ostend and Zeebrugge, Antwerp had easy means of communication with England. Under the shelter of Antwerp and the Schelde, British troops could safely land in Flanders, operate in liaison with the Belgian Army, protect the Pas-de-Calais coast with its sea traffic, vital to England, and prevent the Allied left wing from being turned and enveloped.

The Defences Described. — The entrenched camp of Antwerp, as it was in 1914, was the result of two distinct undertakings, the first carried out between 1859 and 1870 under the direction of Brialmont, and comprising a line of detached forts placed about two to three miles from the agglomeration of buildings, and a polygonal enceinte on the outskirts of the city; the second, aiter 1906, which provided a principal line of defence, at a distance of 5 to 11m. from the city proper, composed of 17 forts about 3m. apart, with permanent redoubts in the intervals. Forts and redoubts were constructed entirely of ordinary concrete, with vaults 2·50 metres thick at the crown and surrounded by wet ditches, 33ft. wide. The old fort line mas about to be transformed into an *enceinte de sûreté,* the forts being organized for small weapons and connected by concrete redoubts and a grille.

These extensive works had necessarily to be spread over several years and on the outbreak of hostilities in 1914, not one of the forts planned in 1906 was completed. No equipment for fire observation and no observation posts existed and the necessary survey work for firing by the map was incomplete. The substructures and the armouring, constructed to resist the 21-cm. mortar, were not calculated to face 30·5- or 42-cm. projectiles. The total perimeter was 60m. of which 6m. were protected by inundations. The defence force numbered only 40,000 men, most of whom had seen no military service for ten years. The staff was entirely inadequate for the duties.

Operations Begin — The retreat of the Belgian Army behind the Nethe on Aug. 20 (*see* BELGIUM, INVASION OF [1914]), was temporary. When the German I. Army wheeled through and past Brussels on its way to France, it dropped the III. Res. Corps under von Beseler, and three Landwehr brigades, to face northward as a flankguard against the Belgian Field Army in Antwerp. Von Beseler took up his position on the line Grimberghen-over-de-Vaert-Aerschot. On Aug. 25 and again on Sept. 9 the Belgians, in co-operation with the Allied attacks on the frontiers and the Marne, made sorties from Antwerp and attacked his lines. On the second of these occasions his situation was at one time critical. A third sortie was being prepared toward Sept. 20, when reports began to come in of important German movements and of a quantity of very heavy artillery on the roads in the region north of Brussels. Falkenhayn, acting as chief of the general staff, had given the order to carry the fortress and the powerful *matériel,* which had laid in ruins the forts of Liége, Namur and Maubeuge, was being established in position between the Senne and the Grande Nethe, from Sempst to Heyst. The total artil-



MAP SHOWING STAGES IN THE ATTACK OF THE GERMAN ARMY ON THE FORTIFICATIONS OF ANTWERP IN 1914

Antwerp, with its double ring of forts from which sorties could be made, became a menace to the right flank of the German army during its advance toward Paris in 1914. The Germans, therefore, decided to carry the fortress by means of the heavy artillery, which had already laid in ruins the forts of Liége, Namur and Maubeuge. The bombardment by 186 pieces of field artillery, among which were 13 super-heavy howitzers of 30.5 and 42 cm., began on Sept. 28, and continued for 4 days with clocklike regularity. The outer ring of forts was destroyed, and the Belgians compelled to evacuate them on Oct. 4. To save Antwerp itself from a destruction which would have been without military advantage, the civil authorities capitulated on Oct. 10. The plan marks the various stages of the attack which, as will be seen, followed Napoleon's principle of striking always at the weakest spots with superior foroe

lery strength of the Germans before Antwerp was 186 pieces of field artillery, 48 long guns of 10, 13, and 15 cm., 120 howitzers of 15 and 21 cm. and 13 super-heavy howitzers of 30·5 and 42 cm.

Von Beseler's army group comprised at that time the 37th Landwehr Bde. between Alost and Termonde, where it had served in flank guard since Sept. 14; the 4th Res. Div. between Termonde and the Willebroeck Canal; the Marine Div. between this canal and the Dyle about Malines; the III. Res. Corps from the Dyle to the Antwerp-Aerschot railway and the 26th Landwehr Bde. north of Aerschot, with a group furnished by the III. Res. Corps further to the right front of Westerloo.

On Sept. 27 the Belgian Field Army was distributed as follows: The 1st and and Divs. between the Senne and the Nethe, from Willebroeck to Lierre, with the 5th Div. in reserve north of the Nethe; the 6th and 3rd Divs. between the Senne and the Schelde; the 4th Div. at Termonde and the Cavalry Div. about Alost-Wetteren to cover the communications between Antwerp and the sea.

The German Bombardment.--On the morning of the 28th the German bombardment was let loose along the whole front between Termonde and Lierre. It at once became clear that the attack was being concentrated on the south front of the fortress. Von Beseler had not the necessary forces to prosecute a siege on another side while still covering the communications through Brussels against a sortie. Trusting in the proved powers of his weapons of attack which, installed beyond the range of the Belgian gun, could fire as deliberately as on an experimental range, he decided to spare his infantry, to destroy the forts and throw into confusion the lines of defence by gunfire, controlled by aircraft. These results attained, he proposed cautiously to advance his infantry and gain a footing in the shattered forts and pulverized lines of defence.

The bombardment was continued for four days with clocklike regularity. It was directed against four forts (Waelhem, Wavre Ste. Catherine, Koningshoycht and Lierre) and the spaces between them. The concrete was inferior in quality to that of Liége and Namur, and galleries were pierced, men's quarters destroyed, cupolas razed, jammed or made inaccessible; powder magazines blew up, fires broke out and the air in the shelters became unbreathable. Forts and trenches had been reduced to rubbish heaps by the time that the enemy, on Oct. 1 at 5 P.M., delivered his assault. Resistance was offered everywhere except at Wavre Ste. Catherine, where the garrison had been driven away by the flames.

The bombardment recommenced on Oct. 2, increasing in precision, and the inevitable happened. The Dorpveld redoubt and Fort Waelhem, which had been reduced to the last extremity, now surrendered. The Tallaert redoubt blew up; the Koningshoycht and Lierre forts, which had been ruined, were evacuated. On the night of Oct. 2–3, and on Oct. 4, all the defence troops were transferred to the north of the Nethe from Waelhem to Lierre. The Belgian troops now began seriously to be disheartened. For a fortnight past the race to the sea had been in progress in France, the battle front had reached Arras and Béthune and fresh German masses were traversing Belgium in a westerly direction. The question was, would the Allies win the

race in time to join hands with the Belgians on the Schelde? This junction was essential, even if it entailed the abandonment of the fortress. The king was strongly in favour of holding the fortress until the last extremity, in order to keep occupied the German troops and material now concentrated before it, and also to gain time for the formation of a Franco-British-Belgian front on the Dendre or on the Schelde, leaning on the Dutch frontier.

Assistance from Britain. — Mr. Winston Churchill, at that time First Lord of the Admiralty, fully realized the rôle of the fortress as the bulwark of the Pas-de-Calais. When he heard that the Belgian Government was to leave the city he came to take stock of the situation. The king informed him personally of the task he proposed for the Belgian Army on the extreme left of the Allies. Entirely in agreement, Mr. Churchill returned to London to push forward the dispatch of English and French reinforcements to Antwerp and, above all, to Ghent.

The immediate result of Mr. Churchill's intervention was the arrival at Antwerp on the evening of Oct. 3 of a brigade of 2,000 nien of the British Royal Naval Division. The appearance of these, the first Allies the Belgian soldiers had set eyes on during the two months of the War, roused enthusiasm, but unfortunately this assistance could be no more than a moral stimulus. Meantime, von Beseler was bringing up his heavy batteries to crush Fort Kessel, while his infantry was making its way slowly into Lierre, being held up on the northern boundary of that town by the fire of the marine brigade on the 5th. To the south of the town four German battalions crossed the Nethe under cover of the bombardment and on the night of Oct. 5–6 the 5th Belgian Division made what, in the circumstances, was a gallant attempt to push them back into the river.

This counter-attack, with bayonets fixed and unloaded rifles, reached the Nethe at one point and caused the enemy serious alarm for a moment, but the fatigue of the attacking troops and the superiority of the German artillery rendered any permanent success impossible. It was essential to save the Belgian Army from being surrounded, and the king decided that the field troops should cross the Schelde on the night of Oct. 6–7 and march to join the British 7th and 3rd Cavalry Divs. then landing at Zeebrugge and Ostend, which were to move to Ghent in conjunction with a brigade of French marines. The decision came just in time, for on Oct. 7 the Germans forced the Schelde at Schoonaerde and pushed on toward Lokeren.

The **City** Abandoned. — The continuation of the defence was entrusted to Gen. Deguise with the garrison troops, the 2nd Division and the British Naval Division, which had been brought up to 10,000 men. The general placed these two divisions on the line of forts 1 to 8, where throughout the days of the 7th and 8th they stoically endured the usual bombardment. An attempt to intimidate the governor by the bombardment of the city had no effect. The departure of the field army, on the other hand, did affect the morale of the population and the fortress troops. The British Admiralty did not want the Naval Division to be surrounded and telephoned for it to be withdrawn, whereupon Deguise decided to withdraw the 2nd Division also, to abandon the city and to continue the defence on the left bank. But the fortress troops had now reached the limit of their endurance and the general, knowing the Germans to be near Lokeren, authorized officers and units to leave the fortress and rejoin the field army. Meanwhile the civil authorities, seeing the city empty of troops and threatened with destruction by the fires which had been started by the bombardment, sent a deputation to von Beseler to save the city from a disaster which could have no military advantage. The fortress was empty, the works out of action; on Oct. 10 the governor signed the capitulation. (See BELGIUM, INVASION OF.)

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ANU, a Babylonian deity, who, as the first figure in the triad Anu, Enlil and Ea, came to be regarded as the father and king of the gods. Anu is prominently associated with the city of Erech in southern Babylonia, but the cult was transferred to this place in prehistoric times from Der east of the Tigris. At Erech he was closely associated with the worship of his daughter, the heaven goddess Innini-Ishtar. The name signifies the "high one" and he was probably a god of the atmospheric region above the earth—perhaps a storm god like Adad (*q.v.*). In the old Babylonian period; *i.e.,* before Hammurabi, Anu was regarded as the god of the heavens and his name became in fact synonymous with the heavens, so that in some cases it is doubtful whether, under the term, the god or the heavens is meant. To Anu was assigned the control of the heavens, to Enlil the earth, and to Ea the waters. The summing up of divine powers manifested in the universe in a threefold division represents an outcome of speculation in the schools attached to the temples of Babylonia, but the selection of Anu, Enlil and Ea for the three representatives of the three spheres recognized, shows that each of the three must have been regarded in his centre as the most important member in a larger or smaller group, so that their union in a triad marks also the combination of the three pantheons into a harmonious whole.

In the astral theology of Babylonia and Assyria, Anu, Enlil and Ea became the three zones of the ecliptic, the northern, middle and southern zone respectively. The purely theoretical character of Anu is thus still further emphasized, and in the annals and votive inscriptions as well as in the incantations and hymns, he is rarely introduced as an active force to whom a personal appeal can be made. His name becomes little more than a synonym for the heavens in general and even his title as king or father of the gods has little of the personal element in it. A consort Antum (or as some scholars prefer to read, Anatum) is assigned to him, on the theory that every deity must have a female associate, but Antum is a purely artificial product and is really a title of Ishtar as queen of heaven. Anatum became the special name of Ishtar as "lady of battle." She was identified with the Western Asiatic *Ashratum. Anu* and *A-an-turn* occur in the Hittite treaties of the 16th-14th centuries, but it is not certain that the Syrian-Canaanite war goddess *'Anat* was borrowed from Babylonian Antum or Anatum. Egyptian war goddess *'Anat* is an Asiatic importation.

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ANUAK: *see* NILOTES.

ANUBIS: *see* EGYPT: *Religion.*

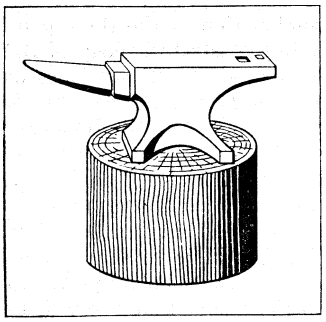
ANURA, the name for that division of the Amphibia (*q.v.*) which includes the frogs and toads (*qq.v.*); it is characterized by the absence of a tail and the elongation of the hind legs.

ANURADHAPURA, the second and most famous capital of the ancient Sinhalese kings. It is the administrative capital of the North Central province of Ceylon, and is the resort of many Buddhist pilgrims. It was established in the jth century B.C., and was the seat of government at the time of the conversion of its king and his people to Buddhism by Mahinda, a son of Asoka. It suffered much during the earlier Tamil invasions, and was evacuated by the Sinhalese in A.D. 760 in favour of Polonnaruwa. It Is situated in the close neighbourhood of the tno huge artificial reservoirs of Tissa Wewa and Nunara Wewa. Of its archaeological remains the most remarkable are its huge pyramidal *dagobas,* constructed of small sun-dried bricks; its *pokunas,* or bathing-pools; and the foundations of monastic buildings and palaces. The city contains the famous Bo-tree, believed to be originally a branch of the very tree under the shade of which Gautama attained to Buddhahood, miraculously transported from India in 245 B.C. It is the oldest tree in existence of which we have any historical record. The city was completely abandoned to the jungle until it was rediscovered and opened up by the British government in the middle of the 19th century. It is on the main line of railway from Polghawela to Mannar, Jaffna and Trincomalee. Population (census 1931), town, 8,975; province, 97,365.

ANUS, the terminal aperture of the intestinal tract. This is not to be confused with the rectum, of which it is the final portion. In the embryo the anus is closed by a membrane which normally ruptures shortly before birth. Encircling the anal canal are the muscle fibres which control the evacuation of faeces, When contracted they throw the skin and mucous membrane into folds, giving a wrinkled appearance. The common disorder called haemorrhoids or piles is due to dilated veins which project from the anus and often bleed. Cancer of the rectum or anus may also cause bleeding.

ANVARI (Auhad ad-din Anvari), Persian poet, born in Khorasan early in the 12th century, enjoyed the especial favour of the sultan Sinjar, whom he attended in all his warlike expeditions. Anvari died at Balkh towards the end of the 12th century. The *Diwan,* or collection of his poems, consists of a series of long poems, and a number of simpler lyrics. His longest piece, The Tears of Khorassan, was translated into English verse by Captain Kirkpatrick.

ANVIL, a mass of iron on which material is supported while being shaped under the hammer. The blacksmith's common anvil is made of wrought iron, often in America of cast iron, with a smooth working face of hardened steel. It has at one end a projecting conical beak or bick for use in hammering curved pieces of metal; occasionally the other end is also provided with a bick, which is then partly rectangular in section., There is also a square hole in the face, into which tools, such as the anvil-cutter or chisel, can be dropped, cutting edge uppermost. For power hammers the anvil proper is supported on an anvil block of great massiveness, sometimes weighing over 200 tons for a 12-ton hammer, and this again rests on a strong foundation of timber and masonry or concrete. (See FORGING.)



THE ANVIL. AN IMPLEMENT DATING FROM THE EARLIEST ATTEMPTS OF MAN TO WORK IN METAL

ANVILLE, JEAN BAPTISTE BOURGUIGNON D' (1697–1782), perhaps the greatest geographical author of the 18th century, was born at Paris on July 11 1697. One of D'Anville's main objects was to reform geography by putting an end to the blind copying of older maps, by testing the commonly accepted positions of places through a rigorous examination of all the descriptive authority, and by excluding from cartography every name inadequately supported. Vast spaces, which had before been covered with countries and cities, were thus suddenly reduced almost to a blank.

D'Anville's historical method was useful in his 1743 map of Italy, which first indicated numerous errors in the mapping of that country, and was accompanied by a valuable memoir (a novelty in such work) showing in full the sources of the design. A trigonometrical survey which Benedict XIV. soon after had made in the papal States strikingly confirmed the French geographer's results. In his later years D'Anville did service to ancient and mediaeval geography; he mapped afresh all the chief of the pre-Christian civilizations (especially Egypt), and wrote *Mémoire* et *abrégé* de *géographie ancienne et générale* and Etats *formés* en Europe *après la* chute *de l'empire* romain en *occident* (1771). His last employment consisted in arranging his collection of maps, plans and geographical materials. It was the most extensive in Europe, and had been purchased by the king, who, however, left him the use of it until his death, which occurred in Jan. 1782, after he had been for two years in a state of mental and bodily decay.

D'Anville's published memoirs and dissertations amounted to 78, and his maps to 211. A complete edition of his works was announced in 1806 by de Manne in 6 vols. quarto, only two of which had appeared when the editor died in 1832. *See* Dacier's *Éloge de d'Anville* (1802). Besides the separate works noticed above, d'Anville's maps executed for Rollin's *Histoire ancienne* and *Histoire romaine,* and his *Traité des mesures anciennes et modernes* (1769), deserve special notice.

ANWEILER or **ANNWEILER,** a town in the Bavarian palatinate, Germany, on the river Queich, 8m. W. of Landau. Pop. (1933) 4,267. A well-known red sandstone is quarried in the picturesque neighbouring hills of the Haardt, here called the Palatinate Switzerland. On the Sonnenberg (1,600ft.) is the ruined castle of Trifels, where Richard Coeur de Lion was imprisoned (1193). Industries include cloth-weaving, tanning, dyeing and saw-milling, and trade is in wine.

ANXUR: see TERRACISA.

ANZENGRUBER, LUDWIG (1839–89), Austrian dramatist and novelist, was born at Vienna, Nov. 29 1839, and died there on Dec. 10 1889. He earned a precarious livelihood by journalism, then became a clerk in the police department until 1870, when he made a hit with his anti-clerical play, "Der Pfarrer von Kirchfeld." Anzengruber made his greatest successes with plays of Austrian peasant life. Der *Meineidbauer* (1871) is a gloomy picture, but Die *Kreuzelschreiber* (1872), Der *G'wissenswurm* (1874) and *Doppelselbstmord* (1875) are gay and witty comedies. Das vierte Gebot (1877) is a problem play, and has affinities with Ibsen's *A* Doll's House. Anzengruber also wrote a novel, Der *Schandfleck* (1876; remodelled 1884); and various short tales of village life collected under the title Wolken *und Sonn'schein* (1888).

Anzengruber's collected works, with a biography, were published in 10 vols. in 1890 (3rd ed., 1897); his correspondence has been edited by A. Bettelheim (1902). *See* A. Bettelheim, *L. Anzengruber* (1890); *L.* Rosner, *Erinnerungen an* L. *Anzengruber* (1890); *H.* Sittenberger, *Studien zur Dramaturgie der Gegenwart* (1899); S. Friedmann, *L. Anzengruber* (1902).

ANZIN, a suburb of Valenciennes, north France, department of Nord, on the Scheldt. Pop. (1936) 14,804. It is the centre of the French "house-coal" region, mining going back to 1717. Metallurgical industries include iron and copper founding and the manufacture of steam engines, machinery, chain-cables and a great variety of heavy iron goods. There are also glass-works and breweries. The region was much damaged during World War I.

ANZOÁTEGUI, a northeastern state of Venezuela, between the Caribbean sea and the Orinoco river, bounded east by the states of Sucre and Monagas and west by the states of Guarico and Miranda. Pop. (1941) 157,030. The state includes some of the oldest settlements in Venezuela. Its principal productions are coffee, sugar and cacao, and—less important—cotton, tobacco, coco-nuts, timber, indigo and dye-woods. Its most important town is the capital, Barcelona.

AONIA, a district of ancient Boeotia containing the mountains Helicon and Cithaeron, and thus sacred to the Muses.

AORIST, the name given in Greek grammar to certain past tenses of verbs (first aorist, second aorist). (Gr. ἀόριστος, indefinite.) Corresponding tenses in Sanskrit are also called aorist.

AORNOS, SIEGE OF (326 B.C.). Two natural fortresses bearing the name of Aornos are mentioned in the campaigns of Alexander the Great. One has been identified as Tashkurghan, and the other as Pir-sar north of the Buner river. The name is a corruption of the Sanskrit *avarana* which means "enclosure," or "fortress"; the Greeks interpreting this word by sound as meaning "the place to which no bird can rise." The Aornos at Pir-sar was a natural stronghold with a flat summit consisting of arable ground and containing a supply of water. Alexander attempted to take it by occupying a ridge overlooking it and separated from it by a ravine. Failing, he constructed a mound from the mountain side to a small hill on a level with Aornos. The tribesmen took alarm and suggested a truce over the terms of which they argued, as their plan was to gain sufficient time to evacuate the rock secretly. Alexander discovering their intention allowed them to begin their retirement, then he fell upon them, slaughtered a large number and captured the stronghold. (J. F. C. F.)

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AORTA, the main systemic artery arising from the heart. It receives the blood, which has been aerated in the lungs, from the

left ventricle of the heart, and starts it on its way to all parts of the body. From the left ventricle the aorta arches first upward, then to the left and backward, and finally descends on the left of the spinal column through the thorax and abdomen to the fourth lumbar vertebra where it divides into two main branches, the common iliac arteries. From the aorta also arise the great arteries which supply the head and arms, and smaller arteries to the thoracic and abdominal organs. The diseases most commonly affecting it are arteriosclerosis and syphilis. By weakening its wall these diseases may cause an out-pouching of the aorta, called an aneurism, which sometimes ruptures, causing fatal haemorrhage.

AORTIC VALVE, a valve separating the left ventricle of the heart and the aorta. It consists of three semicircular, pocket-like folds, whose free edges are directed away from the heart. Blood flows into the aorta with each beat of the heart, but between beats the blood is prevented from flowing backward by the valve leaflets. The pockets fill with an eddying current of blood and their free edges meet exactly. When this valve is affected by certain diseases, notably, rheumatic fever and syphilis, the delicate leaflets become shrunken and thick and no longer perform their function. The valve leaks, thus imposing an extra burden on the heart which sometimes leads to symptoms of heart failure. The aortic valve is second only to the mitral in the frequency with which it becomes diseased.

AOSTA, EMANUELE FILIBERTO, DUKE OF (1869–1931), Italian general. was born Jan. 13 1869, the eldest son of Prince Amedeo of Savoy, duke of Aosta, and thus a cousin of Victor Emmanuel III. He adopted a military career, but this was interrupted by a serious illness, and when World War I began he was on the retired list. Later, however, he was appointed to the command of the 3rd Army. After the war the City of Naples gave him the Palace of Capodimonte, which had been ceded to it by the King, and it was there that he fixed his residence. He was for some years president of the Opera Nazionale Dopolavoro, an institution for providing recreation and instruction to the working classes after the day's work was over. In June 1926 he was created marshal.

AOSTA (anc. *Augusta Praetoria Salassorum*), town and episcopal see, Piedmont, Italy, province of Aosta, 80 mi. N N.W. by rail from the town of Turin, and 48 mi. direct; 1,910 ft above sea-level at the confluence of the Buthier and Dora Baltea. and at the junction of the Great and Little St. Bernard routes. Pop. (1936) 13,466 (town); 23,641 (commune). The cathedral, reconstructed in the 11th century, was much altered in the 15th and 17th; it has a rich treasury including an ivory diptych of 406 with a representation of Honorius. The church of St. Orso, founded 425 and rebuilt in the 12th century, has good cloisters (1133), and there is a picturesque 15th-century priory.

The valley of Aosta fell to the Burgundian kings; and, after many changes, came under Count Humbert I. of Savoy (Biancamano) in 1032. The privilege of holding the assembly of the states-general was granted in 1189. An executive council was nominated from it in 1536, and continued until 1802. After restoration of the rule of Savoy this was reconstituted by Charles Albert, king of Sardinia, at the birth of his grandson Prince Amedeo, who was created duke of Aosta. Aosta was the birthplace of Anselm. For ancient remains *see* AUGUSTA PRAETORIA SALASSORUM.

See P. Toesca, *Aosta* (1911).

APACHE, an aggregation of tribes or bands, forming with the Navaho the southernmost offshoot of the great Athabascan family of North American Indians, and noted for a ferocity, wiliness and raiding disposition which have made their name a by-word. In general physical type they resemble the other south-western Indians on the basis of anthropometric observations, but display a distinctive physiognomy which is perhaps to be interpreted as the reflection of their habits of mind and life. They never possessed national unity and were scarcely even organized into definite tribes, but since known have consisted of bands which variously separated, merged or shifted their location. Two main divisions are distinguishable: a group east of the Rio Grande, mostly in the mountains at the edge of the Great Plains, known to the Spaniards as *vaqueros* (buffalo hunters) and *llaneros* (plainsmen) and comprising the modern Jicarilla, Mescalero and Lipan; and a group about the headwaters of the Gila in southern New Mexico and Arizona, which included the Chiricahua, Coyotero, Pinaleño, Arivaipa and others, The former took on certain customs of the Plains tribes; both groups have also absorbed religious and other cultural traits from the Pueblo, although remaining essentially non-agricultural, unsettled and predatory. The eastern group was found in its historic range by the Spaniards in 1540; the western may not yet have arrived in Arizona by that date. It is probable that Apache and Navaho were an undifferentiated people not many centuries ago, but that the latter, on occupying the San Juan drainage between the several branches of the Pueblo, absorbed more culture from closer contact with these relatively advanced peoples, and gradually came to prosper and increase. The Apache were not so much brave as extremely skilled in raiding and guerrilla fighting. They terrorized the south-west, the western Plains and Texas and northern Mexico. The Chiricahua were not finally subdued until 1886 after many years of intermittent and often dramatic warfare under Cochise, Victorio and Geronimo against American and Mexican troops. The total population in 1903 was 6,000—probably as great as at any time in their history.

In Paris, the name Apache is given to a class of criminals to describe whom in America the name thug was borrowed from India.

APALACHEE, a tribe of North American Indians of Muskhogean stock. They have been known since the 16th century, and formerly ranged the country around Apalachee Bay, Florida. The name is apparently Choctaw, meaning "people on the other side." About 1600 the Spanish Franciscans founded a successful mission among them, but early in the 18th century the tribe suffered defeat at the hands of the British, the mission churches were burnt, the priests killed, and the tribe practically annihilated, more than one thousand of them being sold as slaves.

See *Handbook of American Indians,* ed. *F. W.* Hodge (Washington, 1907).

APALACHICOLA, a city of Florida, U.S.A.; a port of entry and the county seat of Franklin county; on the Gulf of Mexico, about 1 jom. S.E. of Pensacola, at the mouth of the Apalachicola river and on a bay of the same name. It is served by river and coasting steamers, and by the Apalachicola Northern railroad, which connects at Port St. Joe with Gulf and trans-Atlantic steamers, and at River Junction with the Atlantic Coast Line, the Seaboard Air Line, and the Louisville and Nashville railways. In 1930 the population was 3,150 by federal census; in 1940 it was 3,268. The bay is well protected by several islands, and before the development of railways in the Gulf states Apalachicola was one of the principal centres of trade, ranking third among the Gulf ports in 1835.

Oysters and shrimps, fish, resin and turpentine are the principal commodities handled.

APAMEA (APAMEIA), the name of several towns in western Asia.

1. A treasure city and stud-depot of the Seleucid kings in the valley of the Orontes, so named by Seleucus Nicator, after Apama, his wife. Destroyed by Chosroes II in the 7th century A.D., it was partially rebuilt and known as *Famia* by the Arabs; and overthrown by an earthquake in 1152.

See R. F. Burton and T. Drake, *Unexplored Syria;* E. **Sachau,** *Reise in Syrien* (1883).

2. A city in Phrygia, founded by Antiochus Soter and named after his mother; near, but on lower ground than, Celaenae. Here the Marsyas leaves the hills to join the Maeander, and it became a seat of Seleucid power, and a centre of Graeco-Roman and Graeco-Hebrew commerce. There Antiochus the Great collected the army with which he met the Romans at Magnesia, and there two years later the treaty between Rome and the Seleucid realm was signed. After Antiochus' departure for the East, Apamea lapsed to the Pergamenian kingdom and thence to Rome in 133, but it was resold to Mithridates V., who held it till 120. After the Mithridatic wars it became a great centre for trade carried on by Italians and by Jews. In 84 Sulla made it the seat of a

conventus of the Asian province, and it long claimed primacy among Phrygian cities. Disorganization in the 3rd century A.D. led to decline, and though the city was the seat of a bishop it did not revive because trade routes were diverted to Constantinople. The Turks took it first in 1070, and from the 13th century onwards it was always in Muslim hands. An earthquake completed its ruin. The site is now partly occupied by Dineir (*q.v.*), also called Geikler, which is connected with Smyrna by railway; there are considerable remains, including a great number of important Graeco-Roman inscriptions.

See W. M. Ramsay, *Cities and Bishoprics of Phrygia,* vol. ii.; G. Weber, *Dineir-Celènes* (1892); D. G. Hogarth in *Journ.* Hell. *Studies* (1888); O. Hirschfeld in *Trans. Berlin Academy* (1875).

3. A town on the left bank of the Euphrates, at the end of a bridge of boats (*zeugma*); the Til-Barsip of the Assyrian inscriptions, now Birijik (*q.v.*).

4. The earlier Myrlea of Bithynia, now Mudania (*q.v.*), the port of Brusa. The name was given it by Prusias I., who rebuilt it.

5. A city mentioned by Stephanus and Pliny as situated near the Tigris, the identification of which is still uncertain.

6. A Greek city in Parthia, near Rhagae.

APARRI, a municipality of the province of Cagaybn, Luzon, Philippine Islands, on the Cagayán river near its mouth, about 55 mi. N. of the capital, Tuguegarao. Population (1939), 26,409, of whom 13,149 were males; there were 36 whites. It was visited in 1572 by Gov. Guido de Lavezares and somewhat later by Luis Pérez Dasmariiias. In 1898 Filipino insurgents under Col. Daniel Tirona landed at the port; but in 1901 civil government under the United States was established. It has an administrative centre and 10 barrios (wards), a meteorological station and is a port of entry, the only free port in northern Luzon. It is the northernmost in location of the larger municipalities and is the inlet and outlet of the Cagayán valley which, with its short dry season, is one of the largest tobacco producing regions in the Philippines. Other agricultural products are palay (rice), corn, sugar and coco-nuts. Fishing and cattle raising are also leading industries. The Christian inhabitants are mainly Ilocanos and Ibanags. Literacy, based on ages from 10 years up, was 52.3% in 1939. The number of parcels of land declared for taxation in the municipality in 1938 was 3,445. (C. S. L.)

APARTMENT **HOUSE.** In Great Britain, the term "apartment house" would be understood to mean a house let off in tenements or "lodgings." A British domestic dwelling erected for the specific purpose of providing separate dwellings, each with its separate entrance, is termed a block of "flats" and each of its separate dwelling places is called a "flat." In the United States, on the other hand, a building specially built to form a group of separate dwellings is known as an apartment house. This is one of many striking illustrations of the different uses of the same English word in Great Britain and America, for whereas in New York an "apartment" means a separate dwelling, and sometimes a very highly rented one, in London it means a poor type of accommodation without a separate entrance in a lodging house, or tenement house in a poor quarter.

Apartment Houses in American Cities.—Formerly apartment houses were features exclusively of large cities such as New York and Chicago. The few in other cities were exceptions standing in sharp contrast to the general character of residences. These were largely houses in which a single family lived, or in neighbourhoods of some cities two-family houses. In recent years, however, there has been a widespread definite trend from this long-prevailing condition to apartment-house life. As officially defined, an apartment house is any building arranged for three or more families living independently of one another and doing their own cooking on the premises. Actually, the great number of apartment houses contain a multitude of families the number of which may range from a dozen to 66 and to more in some of the extremely large buildings.

An outgrowth of the tenement house, the apartment house is only a higher-class application of the same plan of domiciling many families in a single building. Until recent times, this massing was considered wholly as the special lot of the poor in the congested districts of certain large cities. That families should live in such a state, tier above tier, was looked upon as an odious existence and as a sure proof of their low standing. Possession of a private house gave a distinct prestige, and even after the apartment house evolved from the tenement the general sentiment favouring the idea of a house for a family was long dominant. But either by choice or necessity the attitude of a considerable part of the American people toward apartment-house life has undergone a great change. Apartment-house life is now accepted as normal by all classes up to the multi-millionaire.

Apartment houses differ from tenements in the character of building and equipment. The tenement barrack is the cheapest and ugliest form in which families are grouped. Lower types of apartments retain some of the defects of the tenement as, for instance, the need of walking up many flights of stairs. On the other hand, they are better designed, have generally more light and air, are furnished with better conveniences and present a more inviting appearance. In the varying upper grades of apartment houses elevator and other service is supplied. The final stage of apartment houses is reached in the costly places occupied by the very rich, with their elaborate suites of spacious rooms having every facility to minister to luxurious desires and gratify social ambitions.

Spread of the Apartment Movement.—The greatest and most impressive change in the residential composition of American cities was shown by the results of a questionnaire on housing sent early in 1927 by the U.S. Bureau of Labor Statistics. In the list were more than three hundred American cities having a population of 25,000 or more. Full reports received from 294 cities showed that of the total expenditures for building construction of all kinds in the year 1926 a little over a fourth—a j 9%—was spent for one-family dwellings. But the next highest expenditure was for apartment houses; the proportion—21.9%—almost approached that for one-family houses. In 1921 the construction of apartment houses was nearly two and a half times less than that of one-family dwellings—54,814 to 130,873. But year after year apartment-house building gained until in 1926, with a record of 209,742, it much exceeded the 188,074 one-family dwellings built. The year 1926 marked the turning point. It was the first year in which, in 257 American cities, apartment-house construction predominated over that of one-family houses. In that year apartment-house construction accounted for almost one-half of all the money spent for family habitations in those cities considered as a whole.

The widespread transition to apartment houses was further shown by the total percentages of families provided for by housing construction in the 257 cities during the six-year period. The percentage for one-family houses decreased from 58.3 in 1921 to 40·7 in 1926 and that for two-family houses from 17·3 to 13·9. The percentage for apartment houses almost doubled, rising from 24·4 to 45.4. During the six years nearly 848,000 apartment houses were built.

Commenting upon these significant figures the report declared that they tended to show that Americans were becoming a race of cliff dwellers. In the period from 1921 to 1926 there had been an increase of 105·8% in the number of families provided for by the building of all classes of dwellings. The number of families accommodated in apartment houses had increased 282.6%. Shrinking percentages revealed the lessening number of families seeking homes in one and two-family houses. The increase in the case of one-family houses was a fraction more than 43%, and in that of two-family houses a shade over 65%.

Effects in Various Cities.—The movement to apartments differedgreatly in particular cities. There are in the United States fourteen cities of more than 500,000 population each. New York city has always been regarded as the leader in constant apartment-house building. But the returns showed that Boston, in 1921, provided for more families by apartment-house construction than any other city in the United States. In that year 54% of all the families accommodated in up-to-date dwellings in Boston took rooms in apartments. San Francisco and Chicago each erected, in 1921, a relatively larger number of apartment units than did New York city. In 1925, however, New York regained the lead in the building of apartment houses; nearly

61% of all families provided for were accommodated in new dwellings of the apartment type, and this proportion increased in 1926 to more than 71%.

The wide differences in apartment building were exemplified in the cases of Los Angeles and San Francisco. In the former city fully half of the total families provided for in the years 1921, 1925 and 1926 by new housing construction went into single-family dwellings. San Francisco, on the other hand, showed a larger proportion of families provided for in apartment houses than in one-family dwellings.

The proportion of families provided for by new apartment-house construction in various cities was as follows: New York led with 71 6%, Chicago closely following with 69 3%. Then came St. Louis with 58 4; Washington 56 3; San Francisco 53 3; Boston 42 6; Los Angeles 39 8; Detroit 35; Cleveland 28·9; Pittsburgh 24 3; Buffalo and Milwaukee 19 3% each.

Philadelphia and Baltimore have retained their traditional character as cities of private homes. Although Philadelphia has grown greatly in the last decade, it still has few apartments as compared with other cities. In 1926 about 80% of Philadelphia families lived in private houses. In Baltimore, where but a small number of apartments have been built, the proportion was considerably larger. Less than 20% of Chicago's population live in private houses; in Boston about 26%, and in the borough of Manhattan, New York City, less than 4%.

Tendency to Fewer Rooms.—According to the Tenement House Department of New York City the movement of both rich and poor is to apartment life. The servant problem has been forcing even the rich and well-to-do to abandon city private homes. Many of the rich also have seaside or country mansions to which they can go at will. Paying $20,000 to $30,000 yearly rentals for sumptuous apartments they find in them a superior service; and although they have personal servants the number is many less than that required for a large private house.

The highly expensive apartments on Park avenue and on Fifth avenue, New York City, usually contain from nine to 16 sound-proof rooms, frequently arranged in duplex or triplex style. The larger apartments include a number of chambers and dressing rooms, ample cupboards, a commodious living room, a dining room, a library and a foyer, a kitchen, several rooms for maids and a number of baths.

Apart from the rich, the overwhelming general tendency has been toward living in fewer rooms. The records of the New York City Tenement House Department show that since 1902 the average number of rooms in apartments for the whole city has decreased from 4 69 to 3·56. The three-room apartment is now the established unit in demand. To an extent, this has become increasingly true of other cities.

One reason is increased rents due to high building and living costs and to mounting taxation. Other influential factors are the opportunities afforded by the automobile and by other means for out-of-door enjoyment. So much time is spent out of the apartment that only rooms for actual living needs are considered essential.

This process has been hastened by the spread of apartment hotels with their average two-room apartments and by the prevalent practice of many members of servantless households eating their meals in restaurants or in other public hostelries. Even among high-class apartment renters there has been a pronounced tendency to smaller apartments. Not long ago seven to nine-room apartments on Riverside drive, New York City, were in fashionable demand. In recent years renting them has become so difficult that the owners converted many of the buildings into smaller apartments.

Co-operative Apartments.— These are houses in which the tenant owns his own apartment by buying outright or by instalment purchase. Beginning about the year 1920 this movement made considerable progress, appealing both to the very rich and to persons of moderate means. By 1927 the majority of apartments in at least 150 co-operative apartment-buildings in New York City had been sold. Sums paid varied from $750 to $20,000 a room, the price depending upon the building's position and character, and the apartment's space, style and arrangement. In Chicago, Washington, D.C., and Los Angeles the co-operative apartment movement has been conspicuously successful. In various other cities the movement is passing through its initial stages. *See* FLAT.

See R. W. Sexton, *American Apartment Houses of To-day, Illustrating Plans, Details, Exteriors and Interiors of Modern City and Suburban Apartment Houses Throughout the United States* (1926); Teunis J. Von der Bent, *The Planning of Apartment Houses, Tenements and Country Houses* (1917); Frederic Culver, "Successful Co-operative Apartment Buildings" (in the *Architectural Forum*, Nov. 1920 p. 187–189); F. C. Brown, "Tendencies in Apartment House Design" (in the *Architectural Record*, 1921–22, v. 49, p. 489–502; v. 50 p. 44–63, 102–117, 199–213, 370–387, 489-503; v. 51, p. 62–76, 152–169, 249–268); J. T. Boyd, "Garden Apartments in Cities" (in the *Architectural Record*, 1920, *v.* 48, p. 53–75, 121–135).

APATHY. In the history of moral philosophy the term apathy indicates the negative side of an ideal of life that is characterized positively by peace of mind and the rational guidance of conduct, and negatively by the absence of passions and emotional excitement. Such an ideal is characteristic of eastern philosophy generally, also of ancient Stoicism, and even of certain forms of ancient Epicureanism. Of modern philosophies Spinozism is frequently identified with this ideal of life. Certainly Spinoza identified human bondage with the dominance of the passions, which man must master in order to be free. But one must not exaggerate the unemotional side of Spinozism so far as to lose sight of its highest ideal of life—the intellectual *love* of God.

In psychology and in popular usage the term apathy denotes merely an absence of feeling or of interest, and is sometimes synonymous with listlessness, or absence of emotional sensibility. In this sense apathy may be a symptom of certain pathological mental conditions, such as melancholy.

APATITE, a widely distributed mineral, which, when found in large masses, is of considerable economic value as a phosphate. It was named from the Greek *ἀπατᾶν,* to deceive, because it had previously been mistaken for other minerals, such as beryl, tourmaline, chrysolite, amethyst, etc. Two chemical varieties of apatite are to be distinguished, namely a fluor-apatite $(CaF)Ca_4P_3O_{12}$, and a chlor-apatite $(CaCl)Ca_4P_3O_{12}$. Apatite frequently occurs as beautifully developed crystals, sometimes a foot or more in length, belonging to that class of the hexagonal system in which there is pyramidal hemihedrism. In this type of symmetry, of which apatite is the best example, there is only one plane of symmetry, which is perpendicular to the hexad axis.

In its general appearance, apatite exhibits wide variations. Crystals may be colourless and transparent or white and opaque, but are often coloured, usually some shade of green or brown, occasionally violet, sky-blue, yellow, etc. Hardness 5, specific gravity 3·2.

With regard to its mode of occurrence, apatite is found under a variety of conditions. In igneous rocks of all kinds it is invariably present in small amounts as minute acicular crystals. The extensive deposits of chlor-apatite near Kragero and Bamle, near Brevik, in southern Norway, are in connection with gabbro, the felspar of which has been altered, by emanations containing chlorine, to scapolite, and titanium minerals have been developed. The apatite occurring in connection with granite and veins of tin-stone is, on the other hand, a fluor-apatite. Special mention may be made here of the beautiful violet crystals of fluor-apatite which occur in the veins of tin-ore in the Erzgebirge, and of the brilliant bluish-green crystals encrusting cavities in the granite of Luxullian in Cornwall. Another common mode of occurrence of apatite is in metamorphic crystalline rocks, especially in crystalline limestones; in eastern Canada extensive veins of apatite occur in the limestones associated with the Laurentian gneisses.

(L. J. S.)

APATURIA, an ancient Greek festival which was held annually by nearly all of the Ionian towns (Herodotus i. 147). At Athens it took place in the month of *Puanepsion* (Oct.–Nov.), and lasted three days, on which occasion the various phratries (*i.e.,* clans) of Attica met to discuss their affairs. The name probably means the festival of "common relationship." On the first day, called *Dorpia,* banquets were held towards evening at

the meeting-place of the phratries or in the private houses of members. On the second, Anarrhusis, a sacrifice of oxen was offered at the public cost to Zeus Phratrios and Athena. On the third day, *Koureōtis,* children born since the last festival were presented by their fathers or guardians to the assembled *phratores,* and, after an oath had been taken as to their legitimacy, their names were inscribed in the register. It was the custom also for boys still at school to declaim poetry, and to receive prizes.

APE, the English name, until the 16th century, for animals of the monkey tribe, and now applied specifically to the tailless representatives of the group. These comprise the great or anthropoid apes of the family *Simiidae,* which include the orang-utan, of Borneo and Sumatra, and the chimpanzee and gorilla, of central Africa, and also the much smaller gibbons (family Hylobatidae), of which about 12 species, all tree-dwellers, are found in south-eastern Asia and the larger East India islands. *See* PRIMATES: *Anthropoid* Apes; CHIMPANZEE; GIBBON; GORILLA; ORANG-UTAN.

APELDOORN, town in the province of Gelderland, Holland, and a junction station, 26½ mi. by rail east of Amersfoort. It is connected by canal north and south with Zwolle and Zutphen respectively. Pop. (1900) 25,834; (1940) 71,158. At Kootwijk (3 mi. away) is a well known radio station.

APELLA, the title of the assembly at Sparta, corresponding to the Ecclesia in other Greek States. Every full citizen who had completed his 30th year was entitled to attend the monthly meetings. The presiding officers were at first the kings, but later the ephors, and the voting was conducted by shouts; in case of doubt the votes were counted. Lycurgus had ordained that the apella must simply accept or reject the proposals submitted to it. The actual debate was confined to the kings, elders, ephors and perhaps the other magistrates. The apella voted on peace and war, treaties and foreign policy in general: it decided which of the kings should conduct a campaign and settled questions of disputed succession to the throne: it elected elders, ephors and other magistrates, and voted on legal proposals.

See G. Gilbert, Constitutional Antiquities of *Sparta* and Athens (Eng. trans., 1895); L. Whibley, Companion to Greek Studies (3rd ed., 1916), with useful bibliography.

APELLES (4th century B.C.), probably the greatest painter of antiquity. He lived in the time of Philip of Macedon and his son Alexander. He was of Ionian origin but became a student at the celebrated school of Sicyon, where he worked under Pamphilus. He thus combined the Dorian thoroughness with the Ionic grace. He became the recognized court painter of Macedon, and his picture of Alexander holding a thunderbolt ranked with the Alexander with the spear of the sculptor Lysippus. Other works of Apelles had a great reputation, such as the portraits of the Macedonians Clitus, Archelaus, and Antigonus, the procession of the high priest of Artemis at Ephesus, Artemis amid a chorus of maidens, a great allegorical picture representing Calumny, and the painting representing Aphrodite rising out of the sea. Of none of these works have we any copy, unless indeed we may consider a painting of Alexander as Zeus in the house of the Vettii at Pompeii as a reminiscence of his work. We are told that he attached great value to the drawing of outlines, practising every day. The tale is well known of his visit to Protogenes, and the rivalry of the two masters as to which could draw the finest and steadiest line. The power of drawing such lines is conspicuous in the decoration of the red-figured vases of Athens. Apelles allowed the superiority of some of his contemporaries in particular matters: according to Pliny he admired the *dispositio* of Melanthius, ie., the way in which he spaced his figures, and the *mensurae* of Asclepiodorus, who must have been a great master of symmetry and proportion. Apelles was also noted for improvements which he introduced in technique. He had a dark glaze, called by Pliny *atramentum,* which served both to preserve his paintings and to soften their colour.

APELLXCON, a wealthy native of Teos, afterwards an Athenian citizen, a famous book collector. He not only spent large sums on his library, but stole original documents from the archives of Athens and other cities of Greece. Being detected, he fled, but returned when Athenion (or Aristion), an opponent of the Romans, had made himself tyrant of the city with the aid of Mithradates. He died a little later, probably in 84 B.C.

Apellicon purchased from the family of Neleus of Scepsis in the Troad manuscripts of the works of Aristotle and Theophrastus (and their libraries), which Theophrastus himself had given to his pupil Neleus. They had been concealed in a cellar and were in a dilapidated condition. Apellicon filled in the lacunae, and brought out a new, but faulty, edition. In 84 Sulla removed Apellicon's library to Rome (Strabo xii. p. 609; Plutarch, *Sulla,* 26). Here the mss. were handed over to the grammarian Tyrannion, who took copies of them, on the basis of which the peripatetic philosopher Andronicus of Rhodes prepared an edition of Aristotle's works. Apellicon's library contained a remarkable old copy of the Iliad.

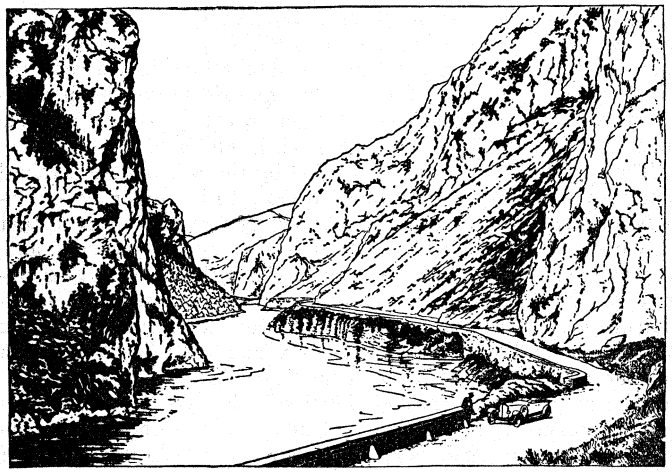
APENNINES, a range of mountains traversing peninsular Italy, forming the backbone of the country (Gr., Ἀπέννινος, Lat. *Appenninus*—in both cases used in the singular). The name probably derives from Celtic pen, a mountain top: it originally belonged to the northern part, from the Maritime Alps to Ancona. Polybius probably first applied it to the whole chain, extending the name as far as Marseille. Classical authors use the name for the whole. The total length is some 800m. and the maximum width 70 to 80m.

Divisions.--Modern geographers divide the range into three parts, northern, central and southern. 1. The Northern Apennines stretch from the Maritime Alps at the Bocchetta dell'Altare, some 5m. W. of Savona on the high road to Turin. They are divided into Ligurian, Tuscan and Umbrian Apennines. The Ligurian Apennines extend as far as the pass of La Cisa in the upper valley of the Magra (anc. *Macra*) above Spezia; at first they follow the curve of the Gulf of Genoa, and then run south-east parallel to the coast. On the north and north-east the Ligurian Apennines give rise to Scrivia (Olubria), Trebbia (*Trebia*) and Taro (*Tarus*), feeders of the Po. The Tanaro (Tanarus), though largely fed by tributaries from the Ligurian Apennines, itself rises in the Maritime Alps. The south side rises steeply from the sea, is fertile and highly cultivated, and has favourite winter resorts (see RIVIERA). Monte Bue reaches 5,915ft. Railways cross from Savona to Turin, from Genoa to Ovada and Asti, the main lines from Genoa to Arquata Scrivia, the junction for Turin and Milan (both the latter pass under the Monte dei Giovi, the ancient Mons Ioventius, by which the ancient Via Postumia ran from Genoa to Dertona), and (a long way farther south-west) that from Spezia to Parma under the pass of La Cisa. All traverse the ridge by long tunnels. The Ligurian Apennines have many hydro-electric plants, and arrangements have been made for interchange between them and the Alpine plants as required.

The Tuscan Apennines extend from the pass of La Cisa to the sources of the Tiber. The main chain continues to run east-south-east across the peninsula. Many streams run north and north-east into the Po, including the Secchia (*Secia*) and Panaro (*Scultenna*); farther east, most of the rivers feed the Reno (anc. Rhenus). The Ronco (Bedesis) and Montone (*Utis*), which flow into the sea together east of Ravenna, were also tributaries of the Po; and the Savio (*Sapis*) and the Rubicon seem to be the only streams from this side of the Tuscan Apennines that ran directly into the sea in Roman days. From the south-west side the Arno (*q.v.*) and Serchio run into the Mediterranean. Railways cross from Pistoia to Bologna and from Florence to Faenza. and a direct line extends from Prato to Bologna. A direct road from Florence to Bologna over the Futa pass is Roman. Monte Cimone reaches 7,103ft. The so-called Alpi Apuane (the *Apuani* were an ancient people of Liguria), a detached chain south-west of the valley of the Serchio, rise to a maximum height of 6,100ft. They contain the famous marble quarries of Carrara. Tuscany, however, is taken up by lower hills, divided from the Apennines by the Arno, Chiana (Clania) and Paglia (*Pallia*). Towards the west they are rich in minerals and chemicals which the Apennines proper do not produce.

The Umbrian Apennines extend from the sources of the Tiber to about the pass of Scheggia near Cagli, where the ancient Via Flaminia crosses the range. Monte Nerone reaches 5,010ft. The

chief river is the Tiber. The Foglia (Pisaurus), Metauro (*Metaurus*) and Esino (anc. Aesis, the boundary of Italy proper, 3rd and 2nd centuries B.C.) run north-east to the Adriatic. The railway crosses from Foligno to Ancona. 2. The Central Apennines stretch as far as the valley of the Sangro (*Sangrus*). To the north are the Monti Sibillini, with highest point Monte Vettore (8,128ft.). Of three parallel chains farther south, the Monti Sabini to the west



THE **CANDIGLIANO RIVER** GORGE NEAR FLORENCE, ONE OF THE PICTURESQUE SPOTS OF THE APENNINES THAT CAN BE REACHED BY MOTOR CAR

has Monte Viglio (7,075ft.), the central chain has Monte Terminillo (7,260ft.), and, to this, Monte Velino (8,160ft.), the eastern chain has the Monte Maiella (M. Amaro 9,170ft.) and the highest summit of all, Gran Sasso d'Italia (9,560ft.). Between the western and central ranges are the plain of Rieti, the valley of the Salto (Himella), and the Lago Fucino; between the central and east the valleys of Aquila and Sulmona. The chief western rivers are the Nera (*Nar*) and Anio, both feeding the Tiber. On the east small rivers flow about 25m. or less to the Adriatic. The Pescara (*Aternus*) and Sangro are more important. Railways cross from Rome to Castelammare Xdriatico via Avezzano and Sulmona: from Orte to Terni and Foligno via the Nera valley; from Terni and the plain of Rieti to Aquila and the valley of the Aterno to Sulmona. The Via Salaria, Via Caecilia and Via Claudia Valeria all ran from Rome to the Adriatic coast. The volcanic mountains of the province of Rome are separated from the Apennines by the Tiber, and the Monti Lepini, or Volscian mountains, by the Sacco and Liri. 3. In the Southern Apennines, south of the Sangro valley, the three parallel chains break into small groups; including the Matese, with Monte Miletto (6,725ft.). The chief rivers on the south-west are Liri or Garigliano (anc. Liris), with tributary the Sacco (Trerus), Volturno (*Volturnus*), Sebeto (Sabatus), Sarno (Sarnus), on the north Trigno (*Trinius*), Biferno (Tifernus), and Fortore (*Frento*). Monte Gargano on the east is completely isolated, and so are the volcanic groups near Naples. Railways cross from Sulmona (N.W.) to Benevento and on to Avellino (S.E.), and from Caianello (S.W.) via Isernia to Campobasso and Termoli (N.E.), from Caserta to Benevento and Foggia, and from Nocera and Avellino to Rocchetta S. Antonio, the junction for Foggia, Spinazzola (for Barletta, Bari, and Taranto) and Potenza. Roman roads followed the same lines, the Via Appia from Capua to Benevento, whence the older road went to Venosa and Taranto and so to Brindisi, while the Via Traiana ran nearly to Foggia and thence to Bari.

The Ofanto (*Audfidus*) reaching the Adriatic near Barletta, is the northern end of the first range of the Lucanian Apennines (now Basilicata), which runs from east to west, while south of the Sele (W.) and Basento (E.), with the railway from Battipaglia via Potenza to Metaponto, the second range runs due north and south to the plain of Sibari (Sybaris). Monte Pollino reaches 7,325ft. The chief western rivers are Sele (Silarus), joined by Negro (Tanager) and Calore (Calor); Bradano (*Bradanus*), Basento (*Casuentus*), Agri (*Aciris*), Sinni (*Siris*) on the east flow into the Gulf of Taranto. South of this the land is too narrow for large streams. The railway south from Sicignano to Lagonegro, up the valley of the Negro, extends to Cosenza, along the line of the Via Popilia, which beyond Cosenza reached the west coast of Terina and thence followed it to Reggio. The Via Herculia, a branch of the Via Traiana, rail from Aequum Tuticum to the ancient Nerulum. On the east the plain of Sibari with the Coseile (Sybaris) and Crati (Crathis) rivers extends half across the peninsula at its narrowest. A railway (with branches north to Castrovillari and south to Cosenza and the Sila) crosses the isthmus to Paola. Here the limestone Apennines proper cease and the granite mountains of Calabria (anc. *Bruttii*) begin. The first group of the granite Apennines beyond this is the Sila with the Botte Donato (6,330ft.). Its forests supplied Greeks and Sicilians with timber for shipbuilding. The railway from Santa Eufemia to Catanzaro and Catanzaro Marina crosses the isthmus, and an ancient road may have run from Squillace to Monteleone. The second group, the southern end of Italy, culminates in the Aspromonte (6,420ft.), in the Sila range east of Reggio di Calabria.

Character. — The forests were probably larger of old. (Pliny mentions especially pine, oak and beech woods); serious attempts at reafforestation have been made but much remains to be done. Summer pasture occurs especially in the Abruzzi: Pliny praises the cheese of the Apennines. In the forests wolves were frequent, and still are found, the flocks being protected by large sheepdogs; bears, known in Roman times, have alinost entirely disappeared, wild goats called rotae, named by Varro, do not occur now.

Snow lies long on the highest Apennines. There are no ininerals but a considerable number of good mineral springs, some thermal (Bagni di Lucca, Montecatini, Monsummano, Porretta. Salsomaggiore, Sila, Telese, etc.), others cool (Nocera, Sangemini, Chianciano, Fiuggi, etc.). (T. A.)

GEOLOGY

The Apennines form a part of the Alpine-Himalayan group of mountains (see ALPS). The exact correlation of the individual units in this south-western section is still uncertain. According to Termier (1911), the Apennines, with the Atlas mountains form a system distinct from and lying between the Alpine and the Dinaride branches. Kober (1923) considers them (Apennine-Atlas) as part of the Dinaride branch, separated from the Alpine by the Corso-Sardinian Massif (Tyrrhenis), an exposed part of an Hercynian Range ("Between Mountains"). According to Argand (1924), the Pennine Zone extends as far south as the Tuscan coast, the rest of the Apennines belonging to the Dinaride branch. There is also a difference of opinion regarding the application of the theory of exotic overthrusts in the Apennines, some authorities considering that a straightforward *in situ* explanation is the more legitimate.

The Apennines consist almost entirely of Triassic, Jurassic, Cretaceous, Eocene and Miocene beds, like the outer zones of the Alps. Remnants of older rocks may be seen in the Calabrian peninsula, Cape Circeo and the island of Zannone, in the Apuan Alps, in the islands off the Tuscan coast and in the Catena Metallifera. These remnants do not all belong to the Apennines. In the south the deposits from the Trias to middle Eocene consist mainly of limestones, and were laid down, with a few interruptions, upon a quietly subsiding sea-floor. Toward the end of the Eocene, the folding which gave rise to the existing chain became marked. The sea grew shallow, the deposits became conglomeratic and shaly, and volcanic eruptions began. Folding and elevation went on until the close of the Miocene period, when a considerable subsidence took place and the Pliocene sea overspread the lower portions of the range. Subsequent elevation, without folding, has raised the Pliocene beds in some cases to over 3,000ft. and they now lie almost undisturbed upon the older folded beds. The last elevation led to the formation of numerous lakes, now filled by Pleistocene deposits. Both volcanic eruptions and movements of elevation continue to the present day around

the shores of the Tyrrhenian sea. In the Northern Apennines the elevation appears to have begun earlier, for here the upper Cretaceous consists largely of sandstones and conglomerates. In Calabria the chain consists chiefly of crystalline and schistose rocks; it is the Mesozoic and Tertiary zone which has here been sunk beneath the sea. Similar rocks are found beneath the Trias farther north in some of the valleys of the Basilicata. Glaciers no longer exist in the Apennines, but Post-Pliocene moraines have been observed in Basilicata.

BIBLIOGRAPHY.—For relations with the Alpine-Himalayan chain *see* ALPS. For detailed Geology see C. S. du Riche Preller, *Italian Mountain Geology* (1924) in which numerous refs. to papers, etc., are given. (J. I. P.)

APEX, the Latin word (pl. apices) for the top, tip or peak of anything. The diminutive, "apiculus," is used in botany of a very small point or tip.

APEX, SOLAR, the point of the heavens towards which the sun's motion relative to the mean of the stars is directed. Its position was indicated approximately by Sir William Herschel in 1783. It is near right ascension 18^h declination $+30°$, not far from Vega, but the position varies considerably according to the class of stars chosen for reference. The speed of the sun's motion is approximately 20 kilometres per second.

APHANITE, a name given to certain igneous rocks which are so fine-grained that their component minerals are not detected by the unaided eye. Although a few authorities still recognize the aphanites as a distinct class, most systematic petrologists have now discarded it and regard these rocks as merely structural facies of other species. Any rock which is compact, crystalline, and fine grained is frequently said to be *aphanitic*.

APHASIA[1], a term used to denote various defects in the comprehension and expression of both spoken and written language which result from lesions of the brain. Aphasic disorders may be classed in two groups: first, receptive or sensory aphasia, which comprises (a) inability to understand spoken language (auditory aphasia), and (b) inability to read (visual aphasia, or *alexia*); second, emissive or motor aphasia, under which category are included (a) inability to speak (motor vocal aphasia, or *aphemia*), and (b) inability to write (motor graphic aphasia, or agraphia). It has been shewn that each of these defects is produced by destruction of a special region of the cortex of the brain, in right-handed people, situated in the left cerebral hemisphere; this is the reason why aphasia is so commonly associated with paralysis of the right side of the body.

Auditory Aphasia. — The auditory speech centre is situated in the posterior part of the first and second temporo-sphenoidal convolutions on the left side of the brain. Hearing is unimpaired but spoken language is quite unintelligible.

Visual **Aphasia** or **Alexia.**—The visual speech centre, which is located in the left angular gyrus, is connected with the two centres for vision which are situated one in either occipital lobe. The individual is not blind, he sees the words and letters perfectly, but they appear to him as unintelligible cyphers. When the visual speech centre is destroyeci, the memories of the visual images of words are obliterated and interference with writing results. On the other hand, when the lesion is situated deeply in the occipital lobe, and does not implicate the cortex, but merely cuts off the connections of the angular gyrus with both visual centres, agraphia is not produced, for the visual word centre and its connection with the graphic centre are still intact.

Motor Vocal Aphasia or **Aphemia.**—The centre for motor vocal speech is situated in the posterior part of the third left frontal convolution and extends on to the foot of the left ascending frontal convolution (Broca's convolution). Complete destruction of this region produces loss of speech, although often a few words, such as "yes" and "no," and, it may be, emotional exclamations such as "Oh, dear!" are retained. In most cases of motor vocal aphasia there is associated agraphia, which is perhaps to be explained by the proximity of the graphic centre. When the lesion is situated below the cortex of Broca's convolution but destroys the fibres which pass from it towards the internal capsule, agraphia is not produced.

Agraphia.—Those who favour the separate existence of a graphic centre locate it in the second left frontal convolution. It may be, however, that the anatomical relationship between the graphic centre and that for the fine movement of the hand is so close that a lesion in this situation which produces agraphia must at the same time cause a paralysis of the hand.

The speech centres are all supplied by the left middle cerebral artery. When this artery is blocked close to its origin by an *embolus* or *thrombus,* total aphasia results It may be, however, that only one of the smaller branches of the artery is obstructed, and, according to the region of the brain to which this branch is distributed, one or more of the speech centres may be destroyed. Occlusion of the left posterior cerebral artery causes extensive softening of the occipital lobe and produces visual aphasia. Further, a tumour, abscess, haemorrhage or meningitis may be so situated as to damage or destroy the individual speech centres or their connecting commissures. The amount of recovery to be expected in any given case depends upon the nature, situation and extent of the lesion, and upon the age of the patient. Even after complete destruction of the speech centres, perfect recovery may take place, for the centres in the right hemisphere of the brain are capable of education. This is only possible in young individuals. In the great majority of instances the nature of the lesion is such as to render futile all treatment directed towards its removal.

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APHELION, in astronomy, that point of the orbit of a planet at which it is most distant from the sun. Apogee, apocentre, aposaturnium, etc. are terms applied to those points of the orbit of a body moving around a centre of force — as the earth or Saturn — at which it is farthest from the central body.

APHEMIA, in pathology, the loss of the power of speech *(see* APHASIA).

APHIDES (pl. of *aphis*), minute insects, often known as plant-lice, blight, or green-fly, belonging to the family *Aphididae* of the order Hemiptera (q.v.). They are characterized by long antennae and legs, two-jointed tarsi with paired claws and a long rostrum ensheathing the mouth-parts. Both winged and wingless forms occur, the wings being transparent with few veins and the hind pair much the smaller. There is usually a pair of abdominal tubes or cornicles through which a waxy secretion is exuded; these insects also secrete "honey-dew," a sweet substance that is voided through the anus and much sought after by ants. Aphides generally pass their life on young shoots and foliage, more rarely on roots, and feed by sucking up the sap through their needle-like mouth-parts. Their life-cycle and reproduction are of a remarkable nature which, briefly, is as follows: The winter is passed as eggs which are laid by the fertilized females; they hatch in spring into wingless females which reproduce by parthenogenesis and bring forth living young. Winged females soon appear which behave likewise and, during the whole summer generation after generation of aphides are produced, all of which are females reproducing living young without the intervention of males. It is only towards the end of the season that males and egg-laying females occur and fertilization takes place. The winged forms are migrants which seek out fresh plants, thus dispersing the species. In some aphides the whole life-cycle is spent on one species of host plant; hut in others definite migration occurs

[1] In 1906 Pierre Marie of Paris expressed views *(La Semaine médicale,* May 23 and Oct. 17 and elsewhere) upon the question of aphasia which are in many respects at complete variance with the classical conception which has been represented in the present article. According to Marie, Broca's convolution plays no special rôle in the function of speech, there are no sensory images of language, and motor aphasia is nothing more than a combination of sensory aphasia and anarthria. These conclusions have been vigorously attached, more especially by Dejerine of Paris (La *Presse mddicale,* July 1906 and elsewhere).

towards autumn, when the aphides leave their summer, or intermediate, host and pass to the winter host upon which the eggs are laid. The bean aphis (*Aphis rumicis*), for example, utilizes the spindle tree as its chief winter host, while in May and June it flies to broad beans, dock, sugar beet, etc., which serve as its intermediate hosts. See also PARTHENOGENESIS and CYTOLOGY.

Considering their sap-sucking habit, capacity for migration and enormous powers of reproduction, it is scarcely remarkable that aphides rank as serious plant pests. Thus, the woolly aphis or American blight, Eriosoma *lanigerum,* is an enemy of apple in many parts of the world, producing gall-like growths on the branches and roots; *Aphis gossypii* is a widely spread pest of cotton and of plants of the cucumber and melon tribe; the hop-damson aphis, Phorodon *humuli,* attacks the hop in summer and the plum and damson in autumn and spring; while the grain aphis, Toxoptera *graminum,* is a severe pest of various cereals in both Europe and North America. Wherever possible, aphides are best controlled by sprays containing nicotine and soft soap, which need to be applied when these insects first appear (see ENTOMOLOGY : *Economic*).

The group *Phylloxerinae* differs from true aphides in that egg-laying is not confined to the fertilized females but is the rule in the parthenogenetic generations also. The *Phylloxera* (q.v.) of the vine and species of *Chermes* (Adelges), with their allies, are well known examples. In *Chermes* the life-cycle is passed on conifers and there are two parallel series of forms differing in habits. One series infests spruce and its cycle is completed in a year, while the other series extends over two years and occurs partly on spruce and partly on larch, pine or fir. (A. D. I.)

APHIS, see APHIDES.

APHONIA, or loss of voice, is a symptom of disease of the larynx or interference with the nervous mechanism which controls its muscles. Of causes in the larynx itself, the commonest is acute catarrhal laryngitis, in the course of a cold, or after overuse of the voice. More serious diseases of the larynx are diphtheria, tuberculosis, syphilis, and cancer, each of which may produce hoarseness or loss of voice when it attacks the vocal cords. Causes outside the larynx are masses pressing on the laryngeal nerves, such as tumours of the thyroid gland and aneurisms of the aorta, and disorders in the brain giving rise to spasm or paralysis of the laryngeal muscles. Aphonia may be a manifestation of hysteria.

APHORISM, a principle expressed tersely in a few telling words or any general truth conveyed in a short and pithy sentence, in such a way that when once heard it is unlikely to pass from the memory. The name was first used in the *Aphorisms* of Hippocrates, a long series of propositions concerning the symptoms and diagnosis of disease and the art of healing and medicine. The term came to be applied later to other sententious statements of physical science, and later still to statements of all kinds of principles. Aphorisms have been especially used in dealing with subjects to which no methodical or scientific treatment was applied till late, such as art, agriculture, medicine, jurisprudence and politics. The *Aphorisms* of Hippocrates form far the most celebrated as well as the earliest collection of the kind. The first aphorism, perhaps the best known of all, which serves as a kind of introduction to the book, runs as follows: — "Life is short, art is long, opportunity fugitive, experimenting dangerous, reasoning difficult: it is necessary not only to do oneself what is right, but also to be seconded by the patient, by those who attend him, by external circumstances." Another famous collection of aphorisms is that of the school of Salerno in Latin verse, in which Joannes de Meditano, one of the most celebrated doctors of the school of medicine of Salerno, has summed up the precepts of this school. The book was dedicated to a king of England. It is a disputed point as to which king, some authorities dating the publication as at 1066, others assigning a later date.

Another collection of aphorisms, also medical and also in Latin, is that of the Dutchman Hermann Boerhaave, published at Leyden in the year 1709; it gives a terse summary of the medical knowledge prevailing at the time, and is of great interest to the student of the history of medicine.

APHRAATES (a Greek form of the Persian name Aphrahat or Pharhādh), a Syriac writer belonging to the middle of the 4th century A.D., who composed a series of 23 expositions or homilies on points of Christian doctrine and practice. The first ten were written in A.D. 337, the following twelve in 344, and the last in 345. The author was early known as *hakkīmā phārsāyā* ("the Persian sage"), was a subject of Sapor II., and was probably of heathen parentage and himself a convert from heathenism. He seems at some time in his life to have assumed the name of Jacob, and is so entitled in the colophon to a ms. of A.D. 512 which contains 12 of his homilies. Hence he was already, by Gennadius of Marseille (before 496), confused with Jacob, bishop of Nisibis; and the ancient Armenian version of 19 of the homilies has been published under this latter name. But (1) Jacob of Nisibis, who attended the Council of Nicaea, died in A.D. 338; and (2) our author, being a Persian subject, cannot have lived at Nisibis, which became Persian only by Jovian's treaty of A.D. 363. That his name was Aphrahat or Pharhādh we learn from comparatively late writers — Bar Bahlul (10th century), Elias of Nisibis (11th), Bar-Hebraeus, and 'Abhd-īshō.' According to a marginal note in a 14th-century ms. (B.M. Orient. 1017), he was "bishop of Mar Mattai," a famous monastery near Mosul; but it is unlikely that this institution existed so early. From the frequency of his quotations, Aphraates is a specially important witness to the form in which the Gospels were read in the Syriac church in his day; Zahn and others have shown that he — mainly, at least — used the Diatessaron.

See the ancient Armenian version of 19 homilies edited, translated into Latin, and annotated by Antonelli (1756); editions by W. Wright (1869), and J. Parisot (with Latin translation 1894). Besides translations of particular homilies by G. Bickell and E. W. Budge, the whole have been translated by *G.* Bert (Leipzig, 1888). Cf. also C. J. F. Sasse, *Proleg. in Aphr. Sapientis Persae sermones homileticos* (Leipzig, 1879); J. Forget, De Vita et *Scriptis* Aphraatis (Louvain, 1882); F. C. Burkitt, Early Eastern Christianity (1904); I. Labourt, *Le Christianisme dans l'empire Perse* (1904); J. Zahn, *Forschungen* I.; "Aphraates and the Diatessaron," vol. ii. pp. 180–186 of Burkitt's Evangelion *Da-Mepharreshe* (Cambridge, 1904); articles on "Aphraates and Monasticism," by R. H. Connolly and Burkitt in Journal *of Theological Studies* (1905), pp. 522–539; (1906), pp. 10–15.

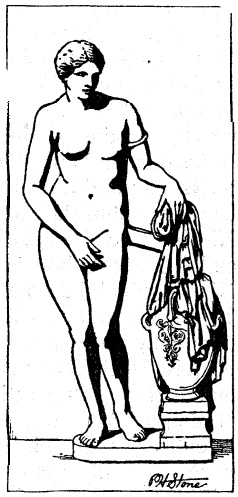
APHRODISIAC, any food, drink or drug which stimulates sexual desire and power. Popularly, but with slight justification, this property is ascribed to stout, red pepper, oysters, hard-boiled eggs and other foods. Several genuine aphrodisiacs are known to medicine, some of which are habitually used in the East, *e.g.,* ginseng; but the preparation and use of the effective aphrodisiacs. such as cantharides and strychnine, is in most western countries the subject of restrictive legislation when not entirely forbidden.

APHRODITE, known as the Greek goddess of love and beauty, the counterpart of the Roman Venus. Although her myth and cult were essentially Semitic, she soon became hellenized and was admitted to a place among the deities of Olympus. Some mythologists hold that there already existed in the Greek system an earlier goddess of love, of similar attributes, who was absorbed by the Asiatic importation; and one writer even altogether denies the oriental origin of Aphrodite. No satisfactory etymology of the name has been given; although the first part is usually referred to aphros ("the sea foam"), it is equally probable that it is of Eastern origin.

Among the Semitic peoples (with the notable exception of the Hebrews) a supreme female deity was worshipped under different names — the Assyrian Ishtar, the Phoenician Ashtoreth (Astarte), the Syrian Atargatis (Derketo), the Babylonian Belit (Mylitta), the Arabian Ilat (Al-ilat). Roscher holds that all these were originally moon-goddesses. This view, however, is not generally accepted on the ground that, in Semitic mythology, the moon is always a male divinity; and that the full moon and crescent, found as attributes of Astarte, are due to a misinterpretation of the sun's disc and cow's horns of Isis. On the other hand, there is some evidence in ancient authorities (Lucian, De Dea Syria, 4) that Astarte and the moon were considered identical.

This oriental Aphrodite was worshipped as the bestower of all animal and vegetable fruitfulness, and under this aspect especially as a goddess of women. This worship was degraded by repulsive

practices (*e.g.*, religious prostitution, self-mutilation), which subsequently made their way to centres of Phoenician influence, such as Corinth and Mount Eryx in Sicily. In this connexion may be mentioned the idea of a divinity, half male, half female, uniting in itself the active and passive functions of creation, a symbol of luxuriant growth and productivity. Such was the bearded Aphrodite of Cyprus, called Aphroditos by Aristophanes according to Macrobius. (Saturnalia, iii. 8.2; see also HERMAPHRODITUS.)



APHRODITE AT THE BATH. AFTER A COPY OF THE ORIGINAL BY PRAXITELES, IN THE VATICAN MUSEUM, ROME

The oriental Aphrodite was closely related to the sea and the element of moisture; in fact, some consider that she made her first appearance on Greek soil rather as a marine divinity than as a nature-goddess. According to Syrian ideas, as a fish-goddess, she represented the fructifying power of water. Her connexion with the sea may be explained by the influence of the moon on the tides and the idea that it came up from the ocean. (See ANADYOMENE.) She is connected with the lower world, and came to be looked upon as one of its divinities. Thus, Ishtar descends to the kingdom of Ilat the queen of the dead, to find the means of restoring her favourite Tammuz (Adon, Adonis) to life. During her stay, all animal and vegetable productivity ceases, to begin again with her return to earth. This legend, which strikingly resembles that of Persephone, probably refers to the decay of vegetation in winter, and the re-awakening of nature in spring (see HYACINTHUS). The lunar theory connects it with the disappearance of the moon at the time of change or during an eclipse.

Another aspect of her character is that of a warlike goddess, armed with spear or bow, sometimes wearing a mural crown, as sovereign lady and protectress of the locality where she was worshipped. Her attributes were the ram, the he-goat, the dove, certain fish, the cypress, myrtle and pomegranate, the animals being symbolical of fertility, the plants remedies against sterility.

The worship of Aphrodite was introduced at an early date into Cyprus, Cythera and Crete by Phoenician colonists, whence it spread over the whole of Greece, and as far west as Italy and Sicily. In Crete she has been identified with Ariadne, who, according to one story, was put ashore in Cyprus, where she died and was buried in a grove called Ariadne-Aphrodite. Cyprus was regarded as her true home by the Greeks, and Cythera was one of the oldest seats of her worship. In both these islands there lingered a definite tradition of a connexion with the cult of the oriental Aphrodite Urania.

In the Iliad, Aphrodite is the daughter of Zeus and Dione, a name by which she herself is sometimes called. In the Odyssey, she is the wife of Hephaestus, her place being taken in the Iliad by Charis, the personification of grace and divine skill. Her amour with Ares, by whom she became the mother of Harmonia, the wife of Cadmus, is famous (Od. viii. 266). From her relations with these acknowledged hellenic divinities it is argued that there once existed a primitive Greek goddess of love. Few traces remain of direct relations of the Greek goddess to the moon, although such possibly survive in her epithets *Pasiphaēs* ("shining on all"), Asteria ("starry") and Urania ("heavenly").

Aphrodite as the goddess of all fruitfulness in the animal and vegetable wcrld is especially prominent. In the Homeric hymn to Aphrodite she is described as ruling over all living things on earth, in the air, and in the water, even the gods being subject to her influence. She is the goddess of gardens, especially worshipped in spring near lowlands and marshes favourable to the growth of vegetation. Her character as a goddess of vegetation is clearly shown in the cult and ritual of Adonis (q.v.) and Attis (qv.). In the animal world she is the goddess of sexual impulse; amongst men, of birth, marriage and family life. Farnell points out that this cult of Aphrodite, as the patroness of married life, is probably a native development of the Greek religion, the oriental legends representing her by no means as an upholder of the purer relations of man and woman. As the goddess of the grosser form of love she inspires both men and women with passion, or the reverse. Upon her male favourites (Paris, Theseus) she bestows the fatal gift of seductive beauty, which generally leads to disastrous results in the case of the woman (Helen, Ariadne), and acts as an intermediary for bringing lovers together. Naturally, a personality invested with such charms was regarded as the ideal of womanly beauty, but it is remarkable that the only probable instance in which she appears as such is as Aphrodite *Morphō* ("the shapely") at Sparta. The function of Aphrodite as the patroness of courtesans represents the most degraded form of her worship as the goddess of love, and is certainly of Phoenician or [Eastern origin. In Corinth there were more than a thousand of these prostitutes or *hierodouloi* ("temple slaves") and wealthy men dedicated their most beautiful slaves to the service of the goddess.

Like her oriental prototype, the Greek Aphrodite was closely connected with the sea. Thus, in the Hesiodic account of her birth, she is represented as sprung from the foam (*aphros*) which gathered round the mutilated member of Uranus, and her name has been explained by reference to this. Further proof may be found in many of her titles—Anadyomend ("rising from the sea") *Euploia* ("giver of prosperous voyages"); *Galēnaia* ("goddess of fair weather") in the attribute of the dolphin, and the veneration in which she was held by seafarers. Aphrodite Aineias, the protectress of the Trojan hero, is probably also another form of the maritime goddess of the East, which originated in the Troad. The title *Ephippos* is connected with the legend of Aeneas, who is said to have dedicated to his mother a statue that represented her on horseback. Remembering the importance of the horse in the cult of the sea-god Poseidon, it is natural to associate it with Aphrodite as the sea-goddess, although it may be explained with reference to her character as a goddess of vegetation, the horse being an embodiment of the corn-spirit (J. G. Frazer, The *Golden* Bough, ii., p. 281, 1900).

Like Ishtar, Aphrodite was connected with the lower world. Thus, at Delphi there was an image of Aphrodite *Epitymbia* ("Aphrodite of the tomb"), to which the dead were summoned to receive libations; the epithets *Tymbōrychos* ("grave-digger"), *Muchia* ("goddess of the depths"), *Melainis* ("the dark one"), the grove of Ariadne-Aphrodite at Amathus, and the myth of Adonis, point in the same direction.

The cult of the armed Aphrodite probably belongs to the earlier period of her worship in Greece, and down to the latest period of Greek history she retained this character in some of the Greek states. The cult is found not only where oriental influence was strongest, but in places remote from it, such as Sparta, where she was known by the name of Areia ("the warlike"). It is possible that the frequent association of Aphrodite with Ares is to be explained by an armed Aphrodite early worshipped at Thebes, the most ancient seat of the worship of Ares.

The most distinctively oriental title of the Greek Aphrodite is Urania, the Semitic "queen of the heavens." It has been explained by reference to the lunar character of the goddess, but more probably signifies "she whose seat is in heaven." Her cult was first established in Cythera, probably in connexion with the purple trade, and at Athens it is associated with the legendary Porphyrion, the purple king. At Thebes, Harmonia (who has been identified with Aphrodite herself) dedicated three statues, of Aphrodite Urania, Pandemos, and Apostrophia ("averter"). There is no doubt that *Pandemos* was originally an extension of the idea of the goddess of family and city life to include the whole people, the political community. Hence the name was supposed to go back to the time of Theseus, the reputed author of the reorganization of Attica and its demes. Aphrodite *Pandemos* was held in equal regard with Aphrodite Urania; she was called *Semnē* ("holy") and was served by priestesses upon whom strict chastity was enjoined. In time, however, the meaning of the term underwent a change, probably due to the philosophers and moral-

ists, by whom a radical distinction was drawn between Aphrodite *Urania* and Aphrodite Pandemos. According to Plato (Symposium, 180), there are two Aphrodites, "the elder, having no mother, who is called the heavenly Aphrodite—she is the daughter of Uranus; the younger, who is the daughter of Zeus and Dione—her we call common." But there is no doubt that the cult of Aphrodite was on the whole as pure as that of any of the other divinities, and although a distinction may have existed in later times between the goddess of legal marriage and the goddess of free love, these titles do not express the idea. Aphrodite *Urania* was represented in Greek art on a swan, a tortoise or a globe; Aphrodite *Pandemos* as riding on a goat, symbolical of wantonness.

To her oriental attributes the following may be added: the sparrow and hare (productivity), the wry-neck (as a love-charm, of which Aphrodite was considered the inventor), the swan and dolphin (as a marine divinity), the tortoise (explained by Plutarch as a symbol of domesticity, but connected by Gruppe with the marine deity), the rose, the poppy, and the lime tree.

In ancient art Aphrodite was at first represented clothed, sometimes seated, but more frequently standing; then naked, rising from the sea, or after the bath. Finally, all idea of the divine vanished, and the artists merely presented her as the type of a beautiful woman, with oval face, full of grace and charm, languishing eyes and laughing mouth, which replaced the dignified severity and repose of the older forms. The most famous of her statues in ancient times was that at Cnidus, the work of Praxiteles, which was imitated on the coins of that town, and subsequently reproduced in various copies, such as the Vatican and Munich. Of existing statues the most famous is the Aphrodite of Melos (Venus of Milo), now in the Louvre, which was found on the island in 1820 amongst the ruins of the theatre; the Capitoline Venus at Rome and the Venus of Capua, represented as a goddess of victory (these two exhibit a lofty conception of the goddess); the Medicean Venus at Florence, found in the porticus of Octavia at Rome and (probably wrongly) attributed to Cleomenes; the Venus stooping in the bath, in the Vatican; and the Callipygus at Naples, a specimen of the most sensual type.

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APHTHONIUS, of Antioch, Greek sophist and rhetorician, flourished in the second half of the 4th century A.D., or even later. We possess by him Προγυμνάσματα, an introductory textbook on rhetoric, with exercises, written in a pure and simple style. The book maintained its popularity as late as the 17th century, especially in Germany. A collection of 40 fables by Aphthonius, after the style of Aesop, is also extant.

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APHTHOUS FEVER: see FOOT AND MOUTH DISEASE.

APHTHOUS STOMATITIS: see THRUSH (disease).

A PIACERE (Ital., at pleasure), a musical term having the same significance as ad *libitum* (*q.v.*).

APICIUS, the name of three celebrated Roman epicures. The second of these, M. Gavius Apicius, who lived under Tiberius (Seneca, *Consol.* ad *Helviam,* 10), invented various cakes and sauces, and is said to have written on cookery. The extant De Re *Coquinaria* (edited by Schuch, 1874), a collection of receipts, ascribed to Caelius Apicius, is founded on Greek originals, and belongs to the 3rd century A.D. It is probable that the real title was Caelii Apicius, Apicius being the name of the work (cf. Taciti Agricola), and De Re Coquinaria, a sub-title.

APICULTURE: see **BEE-KEEPING.**

APION, Greek grammarian and commentator on Homer, born at Oasis in Libya. He was head of the school at Alexandria and led a deputation sent to Caligula (in A.D. 38) by the Alexandrians to complain of the Jews (see Philo, head of the Jewish deputation, Legatio ad *Gaium*). The charges which he brought in his books against the Jews were answered by Josephus in his Contra *Apionem*. He settled at Rome and taught rhetoric till the reign of Claudius. The story of Androclus and the lion, preserved in Aulus Gellius, is from his Αἰγυπτιακά; fragments of his Γλῶσσαι Ὁμηρικαὶ are printed in the *Etymologicum Gudianum*, ed. Sturz (1818).

APIS or **HAPI** (the Bull), a god of the ancient Egyptian Pantheon. His chief centre of worship was Memphis and he was supposed to be the image of the soul of Osiris. He is occasionally represented as a man with the head of a bull. He was also regarded as the reincarnation (or the son) of Ptah—except by Greek writers—and from his posthumous name of Osiris-Apis is derived his other name, Serapis.

APLANATIC REFRACTION, refraction of light, resulting in the occurrence of no spherical aberration. (See OPTICS.)

APLERBECK, a town in the Arnsberg district of Germany, incorporated in 1929 into the city of Dortmund. Pop. was 10,942. Coal-mining is the chief industry.

APLITE, in petrology, the name given to intrusive rock in which quartz and felspar are the dominant minerals. Aplites are usually very fine-grained, white, grey, or flesh-coloured, and their constituents are visible only with the help of a magnifying lens. Dykes and threads of aplite are very frequently to be observed traversing granitic bosses; they occur, also, though in less numbers, in syenites, diorites, quartz-dolerites, and gabbros. Without doubt they have usually a genetic affinity to the rocks they intersect. The aplites of granite areas, for example, are the last part of the magma to Crystallize and correspond in composition to the quartzo-felspathic aggregates which fill up the interspaces between the early minerals in the main body of the rock. They bear a considerable resemblance to the eutectic mixtures which are formed on the cooling of solutions of mineral salts and remain liquid till the excess of either of the components has separated out, finally solidifying en *masse* when the proper proportions of the constituents and a suitable temperature are reached. They show a close relationship to the pegmatites (*q.v.*).

ABNOEA or APNCEA, is a suspension of breathing. A person may voluntarily hold his breath for a limited length of time, as in swimming under water. Respiration stops during swallowing, by a protective reflex which prevents food from entering the windpipe. Other stimuli, such as severe pain, may cause a reflex inhibition of respiration. True apnoea, however, as defined by physiologists, is a standstill of respiration brought about by overventilation of the lungs. The carbon dioxide content of the blood thereby becomes lower than usual and there is no impulse to breathe until it returns to normal. In certain diseases respiration may be irregular, intervals of apnoea alternating with intervals of over-breathing.

APOCALYPSE. The book called the Apocalypse (or "Revelation") of John is the last book in the New Testament Canon as received both in East and West, with the exception of the Syriac-speaking Church, which has never officially accepted it. It professes to be the revelation of Jesus Christ to His servant John in Patmos "to shew . . . the things which must come to pass shortly (Cv τάχει)," and this note of urgency is kept up all through the book. Its date, authority, value, all depend directly upon the view taken of the nature of its composition: it will therefore be convenient to begin by considering the history of its reception and some account of the views about it that have been held in the past.

What effect the Apocalypse had on the Asian Churches to which it was originally addressed we cannot say: in any case Ephesus, Smyrna and Philadelphia remained flourishing centres of Christianity during the 2nd century. Justin Martyr (Dial. 81), a little after 150, quotes our Apocalypse by name as an authority for the thousand years' reign of the Saints with Christ on earth. Irenaeus (Hacr. v. 29), has an extended discussion about the Number of the Beast: already (*i.e.*, A.D. 180) the doctrine that the Day of the Lord is a thousand years has come in, so that Irenaeus has room for regarding the book as referring to a not quite immediate future. The Alexandrians, on the other hand, made some effort to interpret the book allegorically, but even Swete, who describes Origen's interpretations as "often noble and helpful," is obliged to characterize them as "arbitrary." Tyconius the Donatist (about 390) tried an intermediate course: the apocalyptist has sometimes in mind the eternal principle, sometimes the immediate concrete instance, so he passes without indication from "Jerusalem" to the Church, from "Babylon" to the hostile world. A few critics, like Dionysius of Alexandria (247–265), rejected the Apocalypse altogether, mainly on grounds of style, and the impossibility of supposing that it could be by the same author as the Gospel of John. But for the most part Christian interpreters, both before and after the Reformation, saw in the Apocalypse a cryptic history of the past and future of the Christian Church, though they differed fundamentally in details. In modern times the attempt to find real future history in the Apocalypse has been given up; it is realized that the book would have been pointless to those for whom it was written, unless it was meant to predict the then immediate future. The explanation of the imagery has to be found in 1st century conditions.

But even so it is not always easy to explain what is meant. If, for example. ch. xii. (about the Woman clothed with the Sun and her doings) is to be explained as signifying the flight of the Christians of Jerusalem to Pella, or ver. 14 to be an anticipation of the *Disciplina* arcani (so Swete, p. 155), then all that can be said is that the imagery is highly incongruous and inappropriate. On the other hand, ch. xvii. is a vision of imperial Rome on the Seven Hills, the Beast who was and is not, but will be the eighth (*ver.* 11), is surely Nero Redivivus: here the imagery is as clear as anywhere in Apocalyptic literature. There is therefore an element of cryptic history in our book, but that key does not explain everything.

It will be convenient to lay down a few axioms here which justify themselves on simple perusal.

(a) The Apocalypse is full of immense conviction and enthusiasm.

(*b*) It very clearly declares that it is occupied with the things that must shortly come to pass.

(*c*) The vision of the glorified Jesus (i. 9ff.), and many other word-pictures in the book, read like visions or dreams actually experienced—whether they were veridical "revelation" or hallucination.

(d) The use of the Old Testament (many paragraphs are a mosaic of O.T. phrases and images) and the careful workmanship of passages like ch. xvii. show that the book is also partly a literary construction, *i.e.*, almost certainly an interpretation of former apocalyptic pictures, canonical or non-canonical. It should be added further:

(e) The writer feels his word-pictures intensely, but does not realize them pictorially at all: hence extreme "inconsistencies" and mixture of symbolism. "That the right hand (i. 16, 17) holds seven stars does not hinder it from being laid on the Seer for the whole representation is symbol and not art" (Swete, p 19).

(f) There is little progress in the Visions: the *ordo temporum* is *not* preserved. Hence repetitions (as in a dream). The scene shown goes round and round, like the heavenly bodies.

What (c) means in practice to the expositor is that certain images and combinations may have no accessible "explanation." The Apocalyptist had had a vivid picture before his consciousness, and such-and-such a detail in it may have come to him neither from his store of biblical nor of secular images, but from the untraceable sources of true "imagination." (d), on the other hand, means that inasmuch as the original visions were carefully elaborated and meditated upon, the expositor may reasonably investigate probable or demonstrable "sources."

One hitherto neglected source has been brought forward by Franz Boll of Heidelberg in his epoch-making little book called Aus der *Offenbarung Johannis,* published in 1914, viz., the Graeco-Roman Astrology current in the 1st century. Previous expositors, especially Gunkel (1894) and Bousset (1896), had detected an apocalyptic "tradition" coming down from remote Babylonian mythological ideas, but what *conscious* inheritance had an Asiatic Christian of the 1st century from pagan Babylonia? Prof. Boll, who was the leading authority on the astronomical and astrological lore of the post-Alexandrian civilization, may perhaps have had too much confidence in his method, but he proved once for all that contemporary astrological ideas are one of the sources used by "John."

For instance, in vi. 9 "the altar" is mentioned without explanation: "under" it are the souls of the Martyrs, impatient at the delay. They are not merely seen as martyrs' blood, for to each is given a white robe. All this, too, seems to take place in "heaven." Boll answers that it is in heaven, the altar is the constellation Ara in the Milky Way, low down, and the souls are still lower down, nearer the horizon: it is not yet time for them to mount up, but that the Milky Way is the place for pious souls was the teaching of the Stoics (see, *e.g.*, the Somnium *Scipionis*, much the same teaching was afterwards adopted by the Manichees). The most brilliant example of Boll's method is his treatment of ch. xii. What is the Woman clothed with the Sun and the Moon at her feet? Boll answers that it is actually described as a great sign in heaven (ver. 1), and as the sun and moon never leave the Zodiac it must be one of the twelve, *i.e.*, it must be Virgo. Below Virgo is the Dragon, *i.e.*, Hydra. Further, what we call Virgo and the Semites the "Ear of Corn" (*i.e., Spica*) was to the Alexandrians Isis with Horus, and the Hydra-dragon is Typhon, the Nile-Crocodile. So in vv. 15–16, when the scene is transferred to earth and the Dragon makes war with the Woman, his peculiar method is to drown her with a river-flood, which fails because—still more peculiar—the earth swallows the flood. Why? Because, says Boll, we are still dealing with Isis and Typhon, and the Nile-flood, Typhon's weapon, is swallowed by the Egyptian earth.

An objector may say, "Yes, this accounts more or less for the actual imagery of ch. xii., but what has all this heathen mythology to do with Christian doctrine?" We may imagine the reply might be that however much the heathen stories may be corrupted or inadequate they may nevertheless teach true "gnosis" to the Seer, for the Stars themselves have been set in their places by God, doubtless for the edification of the Saints. And the gnosis which the Seer here puts before us is nothing less than the Birth of the Messiah in heaven, before ever the world was. Things were then even as they are now: even in heaven the Adversary was attempting to destroy the foreordained Son of God, but deliverance comes in time and He is kept in safety by God's Throne (where indeed Enoch saw Him, see Enoch xlvi. 1). What happened in heaven is happening now in earth, as the Sign in heaven and the heathen tale tell us. The heavenly Mother of Christ and the Saints ("Holy Spirit" is too technical a term) is now on earth, still persecuted by the Adversary; but all will be well, God will rescue His own in time. This heavenly birth of the heavenly Christ before history began is a stage in the process of thought that led ultimately to the doctrine of the eternal generation of the Son of God. What view the Apocalyptist took, or even what information he had, about the earthly career of Jesus does not appear, except that He was crucified in Jerusalem (xi. 8), and that He died and rose again. He is further called in xiii. 8 "the Lamb slain from the foundation of the world," which seems to indicate' a heavenly career, of which the earthly one was in some sense a mirror, in some sense a fulfilment.

All this may sound fanciful and far-fetched, but at least Boll's way of looking at the text gives a meaning to the actual words

used in ch. xii., words which hitherto had seemed quite meaningless.

We are then to think of the Apocalyptist John as a Christian with a great knowledge of the Scriptures, and some knowledge of heathen astrology, who was sure he had had a vision of Christ, the purpose of which was to exhort his fellow-believers in Asia Minor to hold firm to their faith and hope, for their now long-expected Lord would soon come, there would be no more delay (χρόνος, x. 6). For a short time there would be frightful catastrophes, but they would mostly fall on the persecuting world-power, now as we see in ch. xvii. centred in Rome. He tells us his Visions and gives his Message, but no doubt many a detail is not a reminiscence of his dream, but inserted because it was so written in the oracles which he knows so well by heart.

The difference between ancient and modern expositions is that we must recognize that the expectation did not come true as John had anticipated; and, further, if we accept the general principles of Prof. Franz Boll, we must believe that some of the "signs of the times" from which John drew his inferences were not events of mundane history, but the configuration of the heavens and the astrological lore that men had come to connect with that configuration.

It is noteworthy that while "John" shows on every page familiarity with the wording of the Canonical Books (particularly the Prophets, including Daniel), he does not show great familiarity with the series of Jewish Apocalypses—Enoch, Baruch, Ezra, etc.—which have been so much studied of late years. His quotations from the Bible are not always from the LXX. (see the list in Swete, p. cxxxv. ff., *e.g.*, iii. 7, the key of David, where lxx. of Isa. xxii. 22 has the glory); this may be due to the use of another Greek translation.

The Greek of the Apocalypse is very peculiar. "The Apocalypse of John stands alone among Greek writings in its disregard of the ordinary rules of syntax, and the success with which syntax is set aside without loss of perspicuity or even of literary power" (Swete, p. cxx.). It does not appear to be merely the result of an unlettered Jew trying to write Greek. Many phrases (*e.g.*, i. 4 ἀπὸ ὁ ὢν καὶ ὁ ἦν καὶ ὁ ἐρχόμενος) are quite unparalleled elsewhere: perhaps they were acceptable as ἄρρητα ῥήματα (see 2 Cor. xii. 4).

Be this as it may, the power and attractiveness of the "Book of Revelation" are undeniable. There is in it a personal note that differentiates it from all the other Apocalypses. It is no Seer of ancient times that is speaking, but "I, John, your brother and companion in tribulation": here we have the new voice of Christian inspiration, confident that all the counsel of God has not yet been codified by the great men of old time. And nowhere else among the apocalyptists is there the same direct and pastoral concern for the immediate needs of here and now, that palpitates through the messages to the Seven Churches. So the Christian Apocalypse renews its youth in the hearts of fresh generations of readers, notwithstanding that the clearly taught thousand-year Reign of Christ on earth was rejected by the Church of the 3rd century, and that we in our Copernican world are not expecting "the holy city Jerusalem coming down out of heaven," of which the length and the breadth and the height are equal.

Note on the Number of the Beast.—In Rev. xiii. 18 the Number of the Beast, which certainly in some way typifies the World-Power (*i.e.*, Rome), is given as 666. Codex C and some early Latin texts, including some known to Irenaeus, read 616. This latter number, being less symmetrical, is likely to be the more original. Probably the Number was first associated with Caligula (who wished his statue to be set up in the Temple at Jerusalem, to the horror of pious Jews), for the letters of ΓΑΙΟC ΚΑΙCΑΡ make up 616. Caligula died, and more than a quarter of a century afterwards Nero must have seemed to the persecuted Christians like Antichrist, and (*with* the number 616 already given) it may have been discovered that if you write "Nero Caesar" in Hebrew letters you get 616, or with the name spelt "Neron Caesar" you get 666 (נרון קסר) It should be noted, however, that the spelling in Jewish documents is קיסר. Other Jewish Christians during the horrors of the siege of Jerusalem in 70 may have felt that Titus must be the Antichrist. His name cannot be made to fit, but they may have thought that perhaps it was only a form of the ancient demonic Titans, and TEITAN does make 666. This last name (Teitan) is the solution preferred by Irenaeus (Haer. v. 30). A peculiar explanation given by Beatus (ed. Florez, p. 440), almost certainly from Tyconius, is that the Sign and Number of the Beast in itself signifies Antichrist, for the Monogram of Christ is ☧, and as anti means "opposite" the Monogram of Antichrist will be ⸸, a figure made up of Χ = 600, I = 10, and C = 6, the last being an early form of the *Epistemon*.

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APOCALYPTIC LITERATURE. In the present survey we shall limit ourselves to the great formative periods in this literature—in Judaism from 200 B.C. to A.D. 100, and in Christianity from A.D. 50 to 350 or thereabouts.

The transition from prophecy to Apocalyptic was gradual and already accomplished within the limits of the Old Testament. Apocalyptical elements disclose themselves in the prophetical books of Ezekiel, Joel, Zechariah, while in Isa. xxiv.–xxvii. and xxxiii. we find well-developed Apocalypses; but it is not until we come to Daniel that we have a fully matured example of this class of literature.

We shall now consider (I.) Apocalyptic, its origin and general characteristics; (II.) Old Testament Apocalyptic; (III.) New Testament Apocalyptic.

I. APOCALYPTIC—ITS ORIGIN AND GENERAL CHARACTERISTICS

1. Sources of Apocalyptic.—The origin of Apocalyptic is to be sought in (a) unfulfilled prophecy and in (b) traditional elements drawn from various sources.

(a) The origin of Apocalyptic is to be sought in *unfulfilled* prophecy. Of prime importance here was the non-fulfilment of the greatest of all prophecies—the advent of the Messianic kingdom. Thus, though Jeremiah had promised that after 70 years (xxv. 11, xxix. 10) Israel should be restored to their own land (xxiv. 5, 6), and then enjoy the blessings of the Messianic kingdom under the Messianic king (xxiii. 5, 6), this period passed by and things remained as of old. Haggai and Zechariah explained the delay by the failure of Judah to rebuild the temple, and so generation after generation the hope of the kingdom persisted, sustained most probably by ever-fresh reinterpretations of ancient prophecy, till in the first half of the 2nd century the delay is explained in the Books of Daniel and Enoch as due not to man's shortcomings but to the counsels of God. The 70 years of Jeremiah are interpreted by the angel in Daniel (ix. 25–27) as 70 weeks of years, of which 69½ have already expired, while the writer of Enoch (lxxxv.–xc.) interprets the 70 years of Jeremiah as the 70 successive reigns of the 70 angelic patrons of the nations, which are to come to a close in his own generation.

But the above periods came and passed by, and again the expectations of the Jews were disappointed. Presently the Greek empire of the East was overthrown by Rome, and in due course this new phenomenon, so full of meaning for the Jews, called forth a new interpretation of Daniel. The fourth and last empire which, according to Dan. vii. 19–25, was to be Greek, was now declared to be Roman by the Apocalypse of Baruch (xxxvi.–xl.) and 4 Ezra (x. 60–xii. 35). Once more such ideas as those of "the day of Yahweh" and the "new heavens and a new earth" were constantly re-edited with fresh nuances in conformity with their new settings. Thus the inner development of Jewish Apoca-

lyptic was always conditioned by the historical experiences of the nation.

(b) Another source of Apocalyptic was primitive mythological and cosmological traditions in which the eye of the seer could see the secrets of the future no less surely than those of the past. Thus the six days of the world's creation, followed by a seventh of rest, were regarded as at once a history of the past and a fore-

AFTER AN ENGRAVING BY H. S. BEHAM IN 1539 FOR THE 14TH CHAPTER OF THE REVELATION OF ST. JOHN

GOD IS SITTING UPON A CLOUD WHILE ON EARTH ONE ANGEL IS REAPING AND OTHERS ARE GATHERING GRAPES WHICH THEY CARRY TO THE LAKE UNTIL "BLOOD CAME OUT OF THE WINEPRESS, EVEN UNTO THE HORSE BRIDLES"

casting of the future. As the world was made in six days its history would be accomplished in six thousand years, since each day with God was as a thousand years and a thousand years as one day; and as the six days of creation were followed by one of rest, so the six thousand years of the world's history would be followed by a rest of a thousand years (II. Enoch xxxii., II.–xxxiii. 2).

ii. Object and Contents of Apocalyptic.—The object of this literature in general was to solve the difficulties connected with the righteousness of God and the suffering condition of His righteous servants on earth. In this the Apocalyptists were concerned both with the nation and the individual; and the way in which they solved the difficulty was by teaching that the righteous as a nation should yet possess the earth, even in this world the faithful community should attain its rights in an eternal Messianic kingdom on earth, or else in temporary blessedness here and eternal blessedness hereafter; and that though the individual might perish amid the disorders of this world, he would not fail to attain through resurrection the recompense that was his due in the Messianic kingdom or in heaven itself. Apocalyptic thus forms the indispensable preparation for the religion of the New Testament.

iii. Form of Apocalyptic.—The form of Apocalyptic is a literary form; for we cannot suppose that the writers experienced the voluminous and detailed visions we find in their books. On the other hand the reality of the visions is to some extent guaranteed by the writer's intense earnestness and by his manifest belief in the divine origin of his message. How is this apparent contradiction to be explained? It has in part been explained by Gunkel, who has rightly emphasized that the writer did not freely invent his materials but derived them in the main from tradition, as he held that these mysterious traditions of his people were, if rightly expounded, forecasts of the time to come. Furthermore, the visionary, who is found at most periods of great spiritual excitement, was forced by the prejudice of his time, which refused to acknowledge any inspiration in the present, to ascribe his visionary experiences and reinterpretations of the mysterious traditions of his people to some heroic figure of the past. Moreover, there will always be a difficulty in determining what belongs to his actual vision and what to the literary skill or free invention of the author, seeing that the visionary must be dependent on memory and past experience for the forms and much of the matter of the actual vision.

iv. Apocalyptic as Distinguished from Prophecy.

(a) In *the Nature* of Its Message.—The message of the prophets was primarily a preaching of repentance and righteousness if the nation would escape judgment; the message of the Apocalyptic writers was of patience and trust for that deliverance and reward were sure to come.

(b) By Its Dualistic Theology.—Prophecy believes that this world is God's world and that in this world His goodness and truth will yet be vindicated. Hence the prophet prophesies of a definite future arising out of and organically connected with the present. The Apocalyptic writer, on the other hand, despairs of the present and directs his hopes absolutely to the future, to a new world standing in essential opposition to the present. Here we have essentially a dualistic principle, which shows itself clearly at first in the conception that the various nations are under angelic rulers who are in a greater or less degree in rebellion against God, as in Daniel and Enoch; it grows in strength with each succeeding age, till at last Satan is conceived as "the ruler of this world" (John xii. 31) or "the god of this age" (II. Cor. iv. 4). Under the guidance of such a principle the writer naturally expected the world's culmination in evil to be the immediate precursor of God's intervention on behalf of the righteous, and every fresh growth in evil to be an additional sign that the time was at hand.

(c) By Pseudonymous Authorship.—We have already touched on this characteristic of Apocalyptic. The prophet stood in direct relations with his people; his prophecy was first spoken and afterwards written. The Apocalyptic writer could obtain no hearing from his contemporaries, who held that, though God spoke in the past, "there was no more any prophet." This pessimism and want of faith limited and defined the form in which religious enthusiasm should manifest itself, and prescribed as a condition of successful effort the adoption of pseudonymous authorship.

(d) By Its *Comprehensive* and Deterministic Conception of History.—Apocalyptic took an indefinitely wider view of the world's history than prophecy. Thus, whereas prophecy had to deal with temporary reverses at the hands of some heathen power, Apocalyptic arose at a time when Israel had been subject for generations to the sway of one or other of the great world-powers. Hence to harmonize such difficulties with belief in God's righteousness, it had to take account of the rôle of such empires in the counsels of God, the rise, duration and downfall of each in turn, till finally the lordship of the world passed into the hands of Israel, or the final judgment arrived. These events belonged in the main to the past, but the writer represented them as still in the future, arranged under certain artificial categories of time definitely determined from the beginning in the counsels of God and revealed by Him to His servants the prophets. Determinism thus became a leading characteristic of Jewish Apocalyptic, and its con. ception of history became severely mechanical.

II. OLD TESTAMENT APOCALYPTIC

i. Canonical:—

Isa. ~xi~.–xxv,iixxxiii.; xxxiv.–xxxv. (Jer. xxxiii. 14–26?); Ezek. ii. 8; xxxviii.–xxxix.; Joel iii. 9–17; Zech. xii.–xiv.; Daniel All these are probably pseudepigraphic except the passages from Ezekiel and Joel. Of the remaining passages and books Daniel belongs unquestionably to the Maccabean period, and the rest possibly to the same period, approximately.

ii. Extra-canonical:—

(a) Palestinian (200–100 B.C.): Book of Noah; I. Enoch vi.–xxxvi.; lxxii.–xc.; Testaments of the XII. Patriarchs. (100 B.C. to 1 B.c.): I. Enoch i.–v.; xxxvii.–lxxi.; xci.–civ.; Testaments of the XII. Patriarchs, *i.e.*, T. Lev. x.; xiv–xvi.; T. Jud. xxi. 6–xxiii.; T. Zeb. ix.; T. Dan. v. 6. 7. Psalms of Solomon (A.D. 1–100

and later): Assumption of Moses, Apocalypse of Baruch, 4 Ezra, Greek Apocalypse of Baruch, Apocalypse of Zephaniah, Apocalypse of Abraham, Prayer of Joseph, Book of Eldad and Modad, Apocalypse of Elijah.

(b) Hellenistic: II. Enoch, Oracles of Hystaspes, Testament of Job, Testaments of the III. Patriarchs. Sibylline Oracles (excluding Christian portions).

Book of Noah.—This book has in large measure been incorporated in the Ethiopic Book of Enoch, and can in part be reconstructed from it. The Book of Noah is mentioned in Jubilees x. 13, xxi. 10. Chapters lx., lxv.–lxix. 25 of the Ethiopic Enoch are without question derived from it.

The Hebrew Book of Noah, a later work, is printed in Jellinek's Bet ha-Midrasch, iii. 155–156, and translated into German in Ronsch, Das Buch der *Jubiläen*, 385–387. It is based on the part of the above Book of Noah which is preserved in the Book of Jubilees. The portion of this Hebrew work which is derived from the older work is reprinted in Charles's Ethiopic Version of the Hebrew Book of Jubilees, p. 179.

I. Enoch or the Ethiopic Book of **Enoch.**—This is the most important of all the Apocryphal writings for the history of religious thought. Like the Pentateuch, the Psalms, the Megilloth, and the Pirke Aboth, this work was divided into five parts. The various elements of the book were written by different authors at different dates. vi.–xxxvi. was written before 166 B.C., lxxii.–lxxxii. before the Book of Jubilees, *i.e.*, before 120 B C. or thereabouts, lxxxiii.–xc. about 166 B.C., i.–v., xci.–civ. before 95 B C., and xxxvii.–lxxi. before 64 B.C. There are many interpolations drawn mainly from the Book of Noah.

Testaments of the **XII.** Patriarchs.—This book, in some respects the most important of Old Testament Apocryphs, has only recently come into its own. It is acknowledged by Christian and Jewish scholars alike to have been written in Hebrew in the 2nd century B.C. The Testaments were written about the same date as the Book of Jubilees. These two books form the only Apology in Jewish literature for the religious and civil hegemony of the Maccabees from the Pharisaic standpoint. The ethical character of the book is of the highest type, and its profound influence on the writers of the New Testament is yet to be appreciated. (See TESTAMENTS OF THE XII. PATRIARCHS)

Psalms of Solomon.—The ascription to Solomon is due solely to the copyists or translators, for no such claim is made in any of the psalms. On the whole, Ryle and James are no doubt right in assigning 70–40 B.C. as the limits within which the psalms were written. The authors were Pharisees. Since the Psalms were written in Hebrew and intended for public worship in the synagogues. it is most probable that they were composed in Palestine. (See SOLOMON, THE PSALMS OF.)

The Assumption of Moses.—This book was written between 4 B C. and A.D. 7. As for the author, he was no Essene, for he recognizes animal sacrifices and cherishes the Messianic hope; he was not a Sadducee, for he looks forward to the establishment of the Messianic kingdom (x); nor a Zealot, for the quietistic ideal is upheld (ix), and the kingdom is established by God Himself (x.). He is therefore a Chasid of the ancient type, and glorifies the ideals which were cherished by the old Pharisaic party, but which were now being fast disowned in favour of a more active rôle in the political life of the nation. He pours his most scathing invectives on the Sadducees, who are described in vii. in terms that recall the anti-Sadducean Psalms of Solomon. His object, therefore, is to protest against the growing secularization of the Pharisaic party through its adoption of popular Messianic beliefs and political ideals. (See also MOSES, ASSUMPTION OF.)

Apocalypse of Baruch—The **Syriac.**—This Apocalypse has survived only in the Syriac version. The book treats of the Messiah and the Messianic kingdom, the woes of Israel in the past and the destruction of Jerusalem in the present, as well as of theological questions relating to original sin, free will, works, etc. The views expressed on several of these subjects are often conflicting. We must, therefore, assume a number of independent sources put together by an editor or else that the book is on the whole the work of one author who made use of independent writings but failed to blend them into one harmonious whole. In its present form the book was written soon after A.D. 70. For fuller treatment see BARUCH.

IV. Ezra.—This Apocryph is variously named. Most Latin mss. designate it IV. Ezra; a more appropriate title would be the Ezra Apocalypse and it is usually referred to as such. It is of great importance on account of its very full treatment of the theological questions rife in the latter half of the 1st century of the Christian era. In its present form it was composed A.D. 80–100. For fuller treatment see EZRA.

Apocalypse of Baruch—The Greek.—This book survives in two forms, in Slavonic and Greek. The Slavonic is only of secondary value, as it is merely an abbreviated form of the Greek. As the original work presupposes II. Enoch and the Syriac Apocalypse of *Baruch* and was known to Origen, it was written between A.D. 80 and 200, and nearer the earlier date than the later, as it would otherwise be hard to understand how it came to circulate among Christians. (See BARUCH.)

Apocalypse of Abraham.—This book is found only in the Slavonic, a translation from the Greek. It is of Jewish origin, but in part worked over by a Christian reviser.

Lost Apocalypses: Prayer of Joseph.—An obviously anti-Christian work. (See Schurer[3], iii. 265–266.)

Book of **Eldad** and Modad.—This book was written in the name of the two prophets mentioned in Num. xi. 26–29. It is of minor importance.

Apocalypse of **Elijah.**—This Apocalypse is of Jewish origin, and probably known to St. Paul. (See Schiirer[4], iii. 361–366.)

Apocalypse of Zephaniah.—Possibly of Jewish origin, but its present form is Christian. (See Schdrer, iii. 367–369)

2. Enoch, or the **Slavonic** Enoch, or the Book of the Secrets of **Enoch.**—This new fragment of the Enochic literature was recently brought to light through five mss. discovered in Russia and Servia. The book in its present form was written before AD. 70 in Greek by an orthodox Hellenistic Jew, who lived in Egypt. For a fuller account see ENOCH.

Oracles of **Hystaspes.**—*See* under N. T. Apocalypses, below.

Testament of Job.—M. R. James, *Apocrypha* Anecdota, ii. pp. lxxii.–cii, 104–137, holds that the book in its present form was written by a Christian Jew in Egypt on the basis of a Hebrew Midrash on Job in the 2nd or 3rd century A.D. (See Schurer, iii. 406–407.)

Testaments of the **III.** Patriarchs.—This work was written in Egypt, according to James, and survives also in Slavonic, Rumanian, Ethiopic and Arabic versions. It deals with Abraham's reluctance to die and the means by which his death was brought about. James holds that this book is referred to by Origen (*Hom.* in *Luc.* xxxv), but this is denied by Schiirer, who also questions its Jewish origin. With the exception of ch. x–xi., it is really a legend and not an Apocalypse. The Testaments of Isaac and Jacob are still preserved in Arabic and Ethiopic (see James, *op. cit.* 140–161).

Sibylline Oracles.—Of the books which have come down to us the main part is Jewish, and was written at various dates. iii. 97–829, iv.–v. are decidedly of Jewish authorship, and probably xi.–xii., xiv. and parts of i.–ii. The oldest portions are in iii, and belong to the 2nd century B C.

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III. NEW TESTAMENT APOCALYPTIC

When we pass from Jewish literature to that of the New Testament we enter into a new and larger atmosphere at once recalling and transcending what had been best in the prophetic periods of the past. Again the heavens had opened and the divine teaching come to mankind, no longer merely in books bearing the names of ancient patriarchs, but on the lips of living men, who had taken courage to appear in person as God's messengers before His people. But though Christianity was in spirit the descendant of

ancient Jewish prophecy, it was no less truly the child of that type of Judaism which had expressed its highest aspirations and ideals in pseudepigraphic and Apocalyptic literature.

Early Christianity had a special fondness for this class of literature. It was Christianity that preserved Jewish Apocalyptic, when it was abandoned by Judaism as it sank into Rabbinism, and gave it a Christian character either by a forcible exegesis or by a systematic process of interpolation. Moreover, it cultivated this form of literature and made it the vehicle of its own ideas; its essential teaching was, as that of its Founder, that both worlds were of God and that both should be made God's.

(i.) Canonical:—Apoc. in Mark xiii. (Matt. xxiv., Luke xxi.), 2 Thess. ii., Rev.

(ii.) Extra-Canonical:—Apoc. of Peter, Test. of Hezekiah, Test. of Abraham, Oracles of Hystaspes, Vision of Isaiah, Shepherd of Hermas, V. Ezra, VI. Ezra, Christian Sibyllines, Apocalypses of Paul, Thomas and Stephen, Apocalypses of Esdras, Paul. John, Peter, The Virgin, Sedrach, Daniel, Revelations of Bartholomew, Questions of Bartholomew.

Apocalypse in Mark **xiii.**—According to the teaching of the Gospels the second advent was to take the world by surprise. Only one passage (Mark xiii.—Matt. xxiv.—Luke xxi.) conflicts with this view, and is therefore suspicious. This represents the second advent as heralded by a succession of signs which are unmistakable precursors of its appearance, such as wars, earthquakes, famines, the destruction of Jerusalem and the like. Our suspicion is justified by a further examination of Mark xiii. For the words "let him that readeth understand" (ver. 14) indicate that the prediction referred to appeared first not in a spoken address but in a written form, as was characteristic of Apocalypses. Again, in ver. 30, it is declared that this generation shall not pass away until all these things be fulfilled, whereas in 32 we have an undoubted declaration of Christ: "Of that day or of that hour knoweth no one, not even the angels in heaven, neither the Son, but the Father." On these and other grounds verses 7, 8, 14–20, 24–27, 30, 31 should be removed from their present context. Taken together they constitute a Christian adaptation of an originally Jewish work, written A.D. 67–68, during the troubles preceding the fall of Jerusalem. The Apocalypse consists of three acts: Act i. consisting of verses 7, 8, enumerating the woes heralding the parusia; Act ii. describing the actual tribulation, and Act iii. the parusia itself. (See Wendt, *Lehre* Jesu, i. 12–21; Charles, Eschatology, 325 sqq.; H. J. Holtzmann, N.T. *Theol.*[2] i. 398–405, with literature there given; Canon B. H. Streeter, The Four *Gospels*, 491–494.)

II Thessalonians **ii.**—The earliest form of Pauline eschatology is essentially Jewish. He starts from the fundamental thought of Jewish Apocalyptic that the end of the world will be brought about by the direct intervention of God when evil has reached its climax. But under the influence of the great formative Christian conceptions he parted gradually with the eschatology he had inherited from Judaism, and entered on a progressive development, in the course of which the heterogeneous elements were for the most part silently dropped.

Revelation.—Since this book is discussed separately we shall content ourselves here with indicating a few of the conclusions now generally accepted. The Apocalypse was written about AD. 96. Its object, like other Jewish Apocalypses, was to encourage faith under persecution; its burden is not a call to repentance but a promise of deliverance. It is derived from one author, who has made free use of a variety of elements, some of which are Jewish and consort but ill with their new context. The question of the pseudonymity of the book is still an open one.

Apocalypse of Peter.—The complete text of this book first came to light in 1910. It contains visions in which Christ shows Peter the righteous in heaven and the wicked in hell, where the different grades of sinners endure torment in their respective spheres. It was written between A.D. 100–140, probably in Jerusalem, and is of importance for the history of early Christianity, as it shows the influence of oriental-hellenistic ideas about heaven and hell upon Christian thought.

Testament of **Hezekiah.**—*See* ISAIAH, ASCENSION OF.

Testament of Abraham.—The original form of this book was probably in Hebrew. It belongs to the 1st century A.D., and contains indications of having been written by an Alexandrian Jew. It tells of the archangel Michael taking Abraham to the abodes of the departed; he intercedes for the wicked, who are in consequence pardoned. In the description of Abraham's death the testamentary part is absent; presumably it must have found a place in the book originally.

Oracles of **Hystaspes.**—These now lost oracles were in all probability originally Jewish, and subsequently re-edited by a Christian.

Vision of Isaiah.—This writing has been preserved in its entirety in the Ascension of Isaiah, of which it constitutes ch. vi.–xi. (See ISAIAH, ASCENSION OF.)

Shepherd of Hermas.—This work consists of three parts: Visions concerning the Church; *Commandments* as to what the true Christian should do and not do; *Similitudes*, or parables, mainly of an eschatological character. It was written in Rome between A.D. 130–150. It gives important details about the early Christian community in Rome.

V Ezra.—This book falls obviously into two parts. The first (i. 5–ii. 9) contains a strong attack on the Jews, whom it regards as the people of God; the second (ii. 10–47) addresses itself to the Christians as God's people and promises them the heavenly kingdom. In its present form it may have been written before A.D. 200, though James and other scholars assign it to the 3rd century. Its tone is strongly anti-Jewish.

VI Ezra.—This work consists of ch. xv.–xvi. of IV. Ezra. Its contents relate to the destruction of the world through war and natural catastrophes—for the heathen a source of menace and fear, but for the persecuted people of God one of admonition and comfort. The date of the book is quite uncertain, though several scholars have ascribed it to the 3rd century.

Christian Sibyllines.—It is practically agreed that vi.–viii. are of Christian origin. As for i.–ii., xi.–xiv. most writers are in favour of Christian authorship. A portion of ii. is taken from the Apoc. of Peter, late 2nd or early 3rd century A.D.

Apocalypses of Paul, Thomas and Stephen.—The first is not to be confounded with the Apocalypse mentioned two sections later.

Apocalypse of Esdras.—This Greek production resembles the more ancient fourth book of Esdras in some respects. The book is a poor imitation of the ancient Jewish one. It may belong, however, to the 2nd or 3rd centuries of the Christian era.

Apocalypse of Paul.—This work contains a description of the things which the apostle saw in heaven and hell. Internal evidence assigns it to the time of Theodosius, *i.e.*, about A.D. 388. Where the author lived is uncertain.

Apocalypse of John contains a description of the future state, the general resurrection and judgment, with an account of the punishment of the wicked, as well as the bliss of the righteous. It appears to be the work of a Jewish Christian. The date is late, for the writer speaks of the "venerable and holy images," as well as "the glorious and precious crosses and the sacred things of the churches" (xiv.), which points to the 5th century, when such things were first introduced into churches. It is a feeble imitation of the canonical Apocalypse.

Arabic Apocalypse of Peter contains a narrative of events from the foundation of the world till the second advent of Christ. It is a late production; for Ishmaelites are spoken of, the Crusades and the taking of Jerusalem.

The Apocalypse of the Virgin.—"A late and dreary production" (M. R. James).

Apocalypse of **Sedrach.**—This late Apocalypse, which M. R. James assigns to the 10th or 11th century, deals with the subject of intercession for sinners and Sedrach's unwillingness to die. See James, Texts and Studies, ii. 3. 127–137.

Apocalypse of Daniel.—See Vassiliev's *Anecdota* Graeco-*Byzantina* (1893), pp. 38–44; Uncanonical Books of the Old Test*ament* (Venice, 1901), pp. 237 sqq, 387 sqq.

The Revelations of Bartholomew.—After narrating the pardon obtained by Adam, it is said that the Son, ascending from

Olivet, prays the Father on behalf of His apostles; who consequently receive consecration from the Father, together with the Son and Holy Spirit — Peter being made archbishop of the universe. The late date of the production is obvious.

Questions of St. Bartholomew. — See Vassiliev, *Anec. Graeco-Byzantina* (1893), pp. 10–22. The introduction, which is wanting in the Greek ms., has been supplied by a Latin translation from the Slavonic version (see pp. vii.–ix.). The book contains disclosures by Christ, the Virgin and Beliar and much of the subject-matter is ancient. (R. H. CH.; W. O. E. O.)

APOCATASTASIS, a Greek word used by Aristotle, meaning "re-establishment," used as a technical scientific term for a return to a previous position or condition.

APOCENTRE, the point in any orbit which is farthest from the centre of attraction.

APOCRYPHAL LITERATURE. The word "Apocrypha" comes from the Greek *apocryphos,* "hidden," which is the equivalent of a Hebrew term derived from a root meaning "to store up" (ganaz); it means also "to store up in secret," and in the technical sense, used in reference to books, it meant "to withdraw from use." But the books in reference to which this term was used by the Jewish religious leaders were such as contained heretical teaching; they never used it in reference to the books of the Bible or of our Apocrypha; when they applied the word to any of these it was not to the book as such, but to the particular copy of it, because it happened to be worn by use, or damaged in some way, and therefore was unfit to be used in public service. The Greek word *apocryphos* was originally used of books the contents of which were kept hidden, or secret, because they embodied the special teaching of religious or philosophical sects; it was only the members of these sects who were initiated into the secrets of this teaching. So that both these terms were used in reference to books, which, for different reasons, were withheld from public use. Origen (he died in A.D. 254) was the first to apply the word "apocryphal" to books used by the Church; he says that he borrowed his terminology from the Jews, and his use of *apocryphos* entirely corresponds with the Jewish use of *ganaz.* Both used these terms, respectively, not to the books of the Bible nor to those of the Apocrypha, but to what we call Pseudepigrapha, *i.e.,* largely apocalyptic books, but also many others. It was not until the time of Jerome (he died in AD. 420) that the word "apocryphal" was used in a new sense; he was the first to apply it to the books of our Apocrypha. The term was an unfortunate one to use in reference to these books, and it did not at first command general approval. But by degrees, owing to his great authority on the subject of sacred literature, Jerome's nomenclature was adopted in the Western Church; and this has continued ever since. Thus it has happened that we call the sacred books of the second rank the "Apocrypha," though there is not, nor ever has been, anything "hidden" about them or their teaching.

OLD AND NEW TESTAMENT APOCRYPHAL BOOKS

We shall now proceed to enumerate the apocryphal books; first the Apocrypha Proper, and next the rest of the Old and New Testament apocryphal literature.

1. The *Apocrypha* Proper, or the apocrypha of the Old Testament as used by English-speaking Protestants, consists of the following books: I. Esdras, II. Esdras, Tobit, Judith, Additions to Esther, Wisdom of Solomon, Ecclesiasticus, Baruch, Epistle of Jeremy, Additions to Daniel (Song of the Three Holy Children, History of Susannah, and Bel and the Dragon), Prayer of Manasses, I. Maccabees, II. Maccabees. Thus the Apocrypha Proper constitutes the surplusage of the Vulgate or Bible of the Roman Church over the Hebrew Old Testament. Since this surplusage is in turn derived from the Septuagint, from which the old Latin version was translated, it thus follows that the difference between the Protestant and the Roman Catholic Old Testament is, roughly speaking, traceable to the difference between the Palestinian and the Alexandrian canons of the Old Testament. But this is only true with certain reservations; for the Latin Vulgate was revised by Jerome according to the Hebrew, and, where Hebrew originals were wanting, according to the Septuagint. Furthermore, the Vulgate rejects III. and IV. Maccabees and Psalm cli., which generally appear in the Septuagint, while the Septuagint and Luther's Bible reject IV. Ezra, which is found in the Vulgate and the Apocrypha Proper. Luther's Bible, moreover, rejects also III. Ezra. It should further be observed that the Vulgate adds the Prayer of Manasses and III. and IV. Ezra after the New Testament as apocryphal.

It is hardly possible to form any classification which is not open to some objection. In any case the classification must be to some extent provisional, since scholars are still divided as to the original language, date- and place of composition of some of the books which must come under our classification. We may, however, discriminate (i.) the Palestinian and (ii.) the Hellenistic literature of the Old Testament, though even this distinction is open to serious objections. The former literature was generally written in Hebrew or Aramaic, and seldom in Greek; the latter naturally in Greek. Next, within these literatures we shall distinguish three or four classes according to the nature of the subject with which they deal. Thus the books of which we have to treat will be classed as (a) Historical, (b) Legendary (Haggadic), (c) Apocalyptic, (d) Didactic or Sapiential.

FROM HANS HOLBEIN "HISTORIARUM VETERIS INSTRUMENTI ICONES" 1538

JUDITH WITH THE HEAD OF HOLOFERNES. WHOM SHE SLEW AS HE SLEPT AFTER A BANQUET DURING HIS SIEGE OF THE JEWISH CITY BETHULIA. (BOOK OF JUDITH)

The Apocrypha Proper then would be classified as follows: —

i. Palestinian Jewish Literature: —
Historical: 1 (3) Ezra, I. Macc. Legendary: Baruch, Judith. Apocalyptic: 2 (4) Ezra. *Sapiential:* Ecclesiasticus.

ii. Hellenistic Jewish Literature: —
Historical and Legendary: Additions to Daniel, Additions to Esther, Ep. of Jeremy, II. Macc., Prayer of Manasses. Sapiential: Wisdom.

Since all these books are dealt with in separate articles, they call for no further notice here.

2 (a). *Other* Old Testament Apocryphal Literature: —

(a) Historical: Hist. of Johannes Hyrcanus. (b) Legendary: Bk. of Jubilees. Paralipomena Jeremiae, or the Rest of the Words of Baruch. Martyrdom of Isaiah. Pseudo-Philos Liber Antiquitatum. Bks. of Adam. James and Jambres. Joseph and Asenath. (c) Apocalyptic (see APOCALYPTIC LITERATURE). (d) *Sapiential:* Pirke Abôth.

(a) Historical. — The History of Johnnnes *Hyrcanus* is mentioned in I. Macc. xvi. 23–24, but no trace has been discovered of its existence elsewhere. It must have early passed out of circulation, as it was unknown to Josephus.

(b) Legendary. — The Book of *Jubilees* was written in Hebrew by a Pharisee between the year of the accession of Hyrcanus to the high-priesthood in 135 and his breach with the Pharisees some years before his death in 105 B.C. Jubilees was translated into Greek and from Greek into Ethiopic and Latin. It is preserved in its entirety only in Ethiopic. Jubilees is the most advanced pre-Christian representative of the midrashic tendency, which was

already at work in the Old Testament 1 and 2 Chronicles. As the chronicler rewrote the history of Israel and Judah from the basis of the Priests' Code, so our author re-edited from the Pharisaic standpoint of his time the book of Genesis and the early chapters of Exodus. His object is to prove the everlasting validity of the law, which, though revealed in time, was superior to time. Writing in the palmiest days of the Maccabean dominion, he looked for the immediate advent of the Messianic kingdom. This kingdom was to be ruled over by a Messiah sprung not from Judah but from Levi, that is, from the reigning Maccabean family. This kingdom was to be gradually realized on earth, the transformation of physical nature going hand in hand with the ethical transformation of man. (For a fuller account see JUBILEES, BOOK OF.)

Paralipomena Jeremiae, or the Rest of the Words of Baruch. (See BARUCH.)

Martyrdom of Isaiah.—This Jewish work has been in part preserved in the Ascension of Isaiah. To it belong i. 1, 2^a, 6^b–13^a, ii. 1–8, 10; iii. 12; v. 1^c–14 of that book. It is of Jewish origin, and recounts the martyrdom of Isaiah at the hands of Manasseh. (See ISAIAH, ASCENSION OF.)

Pseudo-Philo's Liber Antiquitaturn **Biblicarum.**—Though the Latin version of this book was thrice printed in the 16th century (in 1527, 1550 and 1599), it was practically unknown to modern scholars till it was recognized by Conybeare and discussed by Cohn in the Jewish Quarterly Review, 1898, pp. 279–332. It is an Haggadic revision of the biblical history from Adam to the death of Saul. Its chronology agrees frequently with the LXX. against that of the Massoretic text, though conversely in a few cases. The Latin is undoubtedly translated from the Greek. Greek words are frequently transliterated. While the LXX. is occasionally followed in its translation of Biblical passages, in others the Massoretic is followed against the EXX., and in one or two passages the text presupposes a text different from both. On many grounds Cohn and James infer a Hebrew original. The eschatology is similar to that taught in the similitudes of the Book of Enoch. In fact, Eth. En. li. 1 is reproduced in this connection. Prayers of the departed are said to be valueless. The book was written after A.D. 70; for, as Cohn has shown, the exact date of the fall of Herod's temple is predicted.

Life of Adam and Eve.—Writings dealing with this subject go back undoubtedly to a Jewish basis, but in some of the forms in which they appear at present they are christianized throughout. The oldest and for the most part Jewish portion of this literature is preserved to us in Greek, Armenian, Latin and Slavonic. The titles of these writings are: "Book of Adam and Eve," also called "The Conflict of Adam and Eve with Satan" (Ethiopic); "The Treasure-cave," *i.e.,* the cave in which the treasures of Paradise are preserved (Syriac); this is closely related to the preceding: "The Testament of Adam" (Syriac); "The Apocalypse of Moses" (Greek), this title is misleading as the book deals entirely with Adam and Eve and their children; largely identical with this is the "Life of Adam and Eve" (Latin). In addition to these there are Slavonic, Armenian and Coptic books dealing with the same subject.

Jannes and Jambres—These two men are referred to in II. Tim. iii. 8 as the Egyptian magicians who withstood Moses. The book may go back to pre-Christian times. (See Schürer[4], iii. 404–405; Ency. Biblica, ii. 2327–2329.)

Joseph and **Asenath.**—The statement in Gen. xli. 45, 50 that Joseph married the daughter of a heathen priest naturally gave offence to later Judaism, and gave rise to the fiction that Asenath was really the daughter of Shechem and Dinah, and only the foster-daughter of Potipherah. The Christian legend, which is no doubt in the main based on the Jewish, is found in Greek, Syriac, Armenian, Slavonic and mediaeval Latin. It is not earlier than the 3rd or 4th century.

(d) *Sapiential.*—The *Pirke Abôth,* a collection of sayings of the Jewish Fathers, are preserved in the 9th Tractate of the Fourth Order of the Mishnah. They are attributed to some 60 Jewish teachers, belonging for the most part to the years A.D. 70–170, though a few of them are of a much earlier date. The book holds the same place in rabbinical literature as the Book of Proverbs in the Bible. The sayings are often admirable. Thus in iv. 1–4, "Who is wise? He that learns from every man. . . . Who is mighty? He that subdues his nature. . . . Who is rich? He that is contented with his lot. . . . Who is honoured? He that honours mankind." (See further PIRKE ABÔTH.)

2 (b). New Testament *Apocryphal* Literature:—

(a) Gospels:—Uncanonical sayings of the Lord in Christian and Jewish writings. Gospel according to the Egyptians. Gospel according to the Hebrews. Protevangel of James. Gospel of Nicodemus. Gospel of Peter. Gospel of Thomas. Gospel of the Twelve. Gnostic gospels of Andrew, Apelles, Barnabas, Bartholomew, Basilides, Cerinthus and some seventeen others.

(b) Acts and Teachings of the Apostles:—Acts of Andrew and later forms of these Acts. Acts of John. Acts of Paul. Acts of Peter. Preaching of Peter. Acts of Thomas. Teaching of the Twelve Apostles. Apostolic constitutions.

(c) Epistles:—The Abgar Epistles. Epistle of Barnabas. Epistle of Clement. "Clement's" 2nd Epistle of the Corinthians. "Clement's" Epistles on Virginity. Clement's Epistles to James. Epistles of Ignatius. Epistle of Polycarp. Pauline Epp. to the Laodiceans and Alexandrians. 3 Pauline Ep. to the Corinthians.

(d) *Apocalypses:* see under APOCALYPTIC LITERATURE.

(a) **Gospels.**—*Uncanonical* Sayings of the Lord in Christian and Jewish Sources.—Under the head of canonical sayings not found in the Gospels only one is found, *i.* e., that in Acts xx. 35. Of the rest the uncanonical sayings have been collected by Preuschen (Reste der *ausserkanonischen* Evangelien, 1901, pp. 44–47). A different collection will be found in Hennecke, *NTliche* Apok. 9–11. The same subject is dealt with by Resch (Agrapha; *aussercanonische Schriftfragmente,*[2] 1906).

To this section belongs also the *Fayum* Gospel Fragment and the Logia published by Grenfell and Hunt. The former contains two sayings of Christ and one of Peter, such as we find in the canonical gospels, Matt. xxvi. 31–34, Mark xiv. 27–30. The papyrus, which is of the 3rd century, was discovered by Bickell among the Rainer collection, who characterized it (Z. f. kath. *Theol.,* 1885, pp. 498–504) as a fragment of one of the primitive gospels mentioned in Luke i. 1. On the other hand, it has been contended that it is merely a fragment of an early patristic homily. (See Zahn, Gesch. *Kanons,* ii. 780–790; Harnack, Texte und *Untersuchungen,* v. 4; Preuschen, *op. cit.* p. 19) The Logia (*q.v.*) is the name given to the sayings contained in a papyrus leaf by its discoverers, Grenfell and Hunt. They think the papyrus was probably written about A.D. 200. According to Harnack, it is an extract from the Gospel of the *Egyptians.* All the passages referring to Jesus in the Talmud are given by Laible, Jesus *Christus im* Talmud, with an appendix, "Die talmudischen Texte," by G. Dalman, 2nd ed. (1901). The first edition of this work was translated into English by A. W. Streane, Jesus *Christ* in the Talmud (1893). In Hennecke's *NTliche* Apok. *Handbuch* (pp. 47–71) there is a valuable study of this question by A. Meyer, entitled Jesus, *Jesu Jünger* und das *Evangelium im* Talmud und *verwandten jüdischen Schriften,* to which also a good bibliography of the subject is prefixed.

Gospel According to the Egyptians.—This gospel circulated among various heretical circles; among the Encratites, Naassenes and the Sabellians. Only three or four fragments survive which show that it was a product of pantheistic Gnosticism. With this pantheistic Gnosticism is associated a severe asceticism. The distinctions of sex are one day to come to an end; the prohibition of marriage follows naturally on this view. Hence Christ is represented as coming to destroy the work of the female (Clem. Alex. *Strom.* iii. 9. 63). Lipsius and Zahn assign it to the middle of the 2nd century. It may be earlier.

Protevangel of James.—This title was first given in the 16th century to a writing which is referred to as The Book of James by Origen. The narrative extends from the Conception of the Virgin to the Death of Zacharias. The author had at his disposal two distinct groups of legends about Mary. One of these groups is certainly of non-Jewish origin, as it conceives Mary as living in

the temple somewhat after the manner of a vestal virgin or a priestess of Isis. The other group is more in accord with the orthodox gospels. The book appears to have been written in Egypt, and in the early years of the 2nd century. For, since Origen states that many appealed to it in support of the view that the brothers of Jesus were sons of Joseph by a former marriage, the book must have been current about A.D. 200. From Origen we may ascend to Clem. Alex. who (*Strom.* vi. 93) shows acquaintance with one of the chief doctrines of the book — the perpetual virginity of Mary. Finally, as Justin's statements as to the birth of Jesus in a cave and Mary's descent from David show in all probability his acquaintance with the book, it may with good grounds be assigned to the first decade of the 2nd century.

Gospel of Nicodemus.—This title is first met with in the 13th century. It is also called The Acts of Pilate. The work gives an account of the Passion (i.–xi.), the Resurrection (xii.–xvi.), and the *Descensus ad Inferos* (xvii.–xxvii). Chapters i.–xvi. are not earlier than the 4th century; xvii.–xxvii. probably about a century later.

Gospel According to the Hebrews. — According to the most recent investigation this Gospel was current among the Nazarenes and Ebionites as early as 100–125, since Ignatius was familiar with the phrase "I am no bodiless demon" — a phrase which, according to Jerome (Comnz. in Is. xviii.), belonged to this Gospel.

The name "Gospel according to the Hebrews" cannot have been original; for if it had been so named because of its general use among the Hebrews, the Hebrews themselves would not have used this designation. It may have been known simply as "the Gospel." The language was Western Aramaic, the mother tongue of Jesus and his apostles. Two forms of Western Aramaic survive: the Jerusalem form of the dialect, in the Aramaic portions of Daniel and Ezra; and the Galilean, in isolated expressions in the Talmud (3rd century), and in a fragmentary jth century translation of the Bible. The quotations from the Old Testament are made from the Massoretic text.

This gospel must have been translated at an early date into Greek, as Clement and Origen cite it as generally accessible, and Eusebius recounts that many reckoned it among the received books. The gospel is synoptic in character and is closely related to Matthew, though in the Resurrection accounts it has affinities with Luke. Like Mark, it seems to have had no history of the birth of Christ, and to have begun with the baptism. (For the literature see Hennecke, *NTliche Apok. Handbuch*, 21–23.)

Gospel of Peter. — Before 1892 we had some knowledge of this gospel. Thus Serapion, bishop of Antioch (A.D. 190–203) found it in use in the church of Rhossus in Cilicia, and condemned it as Docetic (*Eusebius. H. E. vi. 12*). Again, Origen (*In Matt. tom.* xvii. 10) says that it represented the brethren of Christ as his half-brothers. In 1885 a long fragment was discovered at Akhmim, and published by Bouriant in 1892, and subsequently by Lods, Robinson, Harnack, Zahn, Schubert, Swete.

Gospel of Thomas. — This gospel professes to give an account of our Lord's boyhood. This gospel was originally still more Docetic than it now is, according to Lipsius. Its present form is due to an orthodox revision which discarded, so far as possible, all Gnostic traces. Lipsius (Smith's Dict. of Christ. Biog. ii. 703) assigns it to the latter half of the 2nd century, but Zahn (Gesch. Kan. ii. 771), on good grounds, to the earlier half. The latter scholar shows that probably it was used by Justin (Dial. 88). At all events it circulated among the Marcosians (Irenaeus, Haer. i. 20) and the Naasenes (Hippolytus, Refut. v. 7); and subsequently among the Manichaeans, and is frequently quoted from Origen downwards (Honz. I. in Luc.). If the stichometry of Nicephorus is right, the existing form of the book is merely fragmentary compared with its original compass. For literature see Hennecke, *NTliche Apokryphen Handbuch*, 132 seq.

Gospel of the Twelve.—This gospel is not to be identified with the Gospel according to the Hebrews. The only surviving fragments of it have been preserved by Epiphanius (Haer. xxx. 13–16, 22; see Preuschen, *op. cit.* 9–11). It began with an account of the baptism. It was used by the Ebionites, and was written, according to Zahn (*op. cit.* ii. 742), about A.D. 170.

Other Gospels Mainly Gnostic and Almost All Lost. — *Gospel of Andrew.* — This is condemned in the Gelasian Decree, and is probably the gospel mentioned by Innocent (*I. Ep.* iii. 7) and Augustine (*Contra advers. Leg. et Proph. i. 20*).

Gospel of Apelles.—Mentioned by Jerome in his Prooem. ad Matt.

Gospel of Barnabas. — Condemned in the Gelasian Decree (see under BARNABAS ad fin.).

Gospel of Bartholomew. — Mentioned by Jerome in his Prooem. ad Matt. and condemned in the Gelasian Decree.

Gospel of Basilides.—Mentioned by Origen (*Tract. 26 in Matt. xxxiii. 34, and in his Prooem in Luc.*); by Jerome in his Prooem in Matt. (See Harnack i. 161; ii. 536–537; Zahn, Gesch. Kanons, i. 763–774)

Gospel of Cerinthus.—Mentioned by Epiphanius (*Haer. li. 7*).

Gospel of the Ebionites.—A fragmentary edition of the canonical Matthew according to Epiphanius (*Haer.* xxx. 13), used by the Ebionites and called by them the Hebrew Gospel.

Gospel of Eve. — A quotation from this gospel is given by Epiphanius (*Haer. xxvi. 2, 3*) which shows that it was the expression of complete pantheism.

Gospel of James the Less. — Condemned in the Gelasian Decree.

Wisdom of Jesus Christ. — This third work contained in the Coptic ms. referred to under Gospel of Mary gives cosmological disclosures and is presumably of Valentinian origin.

Apocryph of John. — This book, which is found in the Coptic ms. referred to under Gospel of Mary and contains cosmological disclosures of Christ, is said to have formed the source of Irenaeus' account of the Gnostics of Barbelus (*i. 29–31*). Thus this work would have been written before 170.

Gospel of Judas Iscariot.—References to this gospel as in use among the Cainites are made by Irenaeus (*i. 31. 1*); Epiphanius (*xxxviii. 1. 3*).

Gospel, The Living (*Evangelium Vivum*).—This was a gospel of the Manichaeans. See Epiphanius, Haer. lxvi. 2; Photius, Contra *Manich.* i.

Gospel of Marcion. — On this important gospel see Zahn, Gesch. Kanons, i. 585–718.

Descent of Mary. — This book was an anti-Jewish legend representing Zacharias as having been put to death by the Jews because he had seen the God of the Jews in the form of an ass in the temple (Epiphanius, Haer. xxvi. 12).

Questions of Mary (Great and Little). — Epiphanius (*Haer.* **xxvi.** 8) gives some excerpts from this revolting work.

Gospel of Mary.—This gospel is found in a Coptic ms. of the 5th century; it gives disclosures on the nature of matter and the progress of the Gnostic soul through the seven planets.

Gospel of Matthias. — Condemned by the Gelasian Decree.

Gospel of Perfection (*Evangelium perfectionis*). — Used by the followers of Basilides and other Gnostics. See Epiphanius, Haer. xxvi. 2.

Gospel of Philip. — This gospel described the progress of a soul through the next world. It is of a strongly Encratite character and dates from the 2nd century.

Gospel of Thaddaeus.—Condemned by the Gelasian Decree.

Gospel of Thomas. — Of this gospel only one fragment has been preserved in Hippolytus, *Philos. v. 7, pp. 140 seq.* See Zahn, op. *cit.* i. 746 seq.; ii. 768–773; Harnack ii. 593–595.

Gospel of Truth. — This gospel is mentioned by Irenaeus i. 11. 9, and was used by the Valentinians. See Zahn i. 748 sqq.

(b) Acts and Teachings of **the** *Apostles.* — *Acts of Andrew.* — These Acts, which are of a strongly Encratite character, have come down to us in fragmentary condition. They belong to the earliest ages, for they are mentioned by Eusebius, H. E. iii. 25; Epiphanius, *Haer.* xlvii. 1; lxi. 1; lxiii. 2; Philaster, Haer, lxviii., as current among the Manichaeans and heretics. For a complete discussion of the various documents see Lipsius, Apokryphen Apostelgesclzickte, i. 543–622; also James in Hastings' Bible *Dict.* i. 92–93; Hennecke, NT. Apokryphen, in *loc.*

Acts of John.—Written in the 2nd century. The text has been edited most completely by Bonnet, *Acta Apostol. Apocr.*, 1898, 151–216. The contents might be summarized with Hennecke as

follows: Arrival and first sojourn of the apostle in Ephesus (xviii.–lv.); return to Ephesus and second sojourn (history of Drusiana, lviii.–lxxxvi.); account of the crucifixion of Jesus and His apparent death (lxxxvii.–cv.); the death of John (cvi.–cxv.). There are manifest gaps in the narrative.

Acts of Paul.—The author was, according to Tertullian (De Baptism. 17), a presbyter in Asia, who out of honour to Paul wrote the Acts, forging at the same time 3 Corinthians. Thus the work was composed before 190, and, since it most probably uses the martyrdom of Polycarp, after 155. The object of the writer is to embody in St. Paul the model idea of the popular Christianity of the 2nd century. His main emphasis is laid on chastity and the resurrection of the flesh. The tone of the work is Catholic and anti-Gnostic. For the bibliography of the subject see Hennecke, NT. *Apok.* 358–360.

Acts of Peter.—These acts were written not later than A.D. 200; the language (Greek) is modelled on that of the Acts of John. The author was probably a resident in Asia Minor.

Preaching of Peter.—This book (*πέτρου κήρυγμα*) gave the substance of a series of discourses spoken by one person in the name of the apostles. Clement of Alexandria quotes it several times as a genuine record of Peter's teaching. Heracleon had previously used it (see Origen, In Evang. *Johann.* t. xiii. 17). It is spoken unfavourably of by Origen (De Prin. Praef. 8). It was probably in the hands of Justin and Aristides. Hence Zahn gives its date as 90–100 at latest; Dobschutz, as 100–110; and Harnack, as 110–130. The extant fragments contain sayings of Jesus, and warnings against Judaism and Polytheism.

Acts of Thomas.—This is one of the earliest and most famous of the Gnostic Acts. It has been but slightly tampered with by orthodox hands. These Acts were used by the Encratites (Epiphanius, Haer. xlvii. 1), the Manichaeans (Augustine, Contra Faust. xxii. 79), the Apostolici (Epiphanius lxi. 1) and Priscillianists. The work is divided into 13 Acts, to which the Martyrdom of Thomas attaches as the 14th.

The more important of the works so far dealt with are published in English by M. R. James, *The Apocryphal New* Testament (1924). See THOMAS, SAINT.

Teaching of the Twelve Apostles (Didache).—This important work was discovered by Philotheos Bryennios in Constantinople and published in 1883. Since that date it has been frequently edited. The bibliography can be found in Schaff's and in Harnack's editions. The book divides itself into three parts. The first (i.–vi.) contains a body of ethical instruction which is founded on a Jewish and probably pre-Christian document which forms the basis also of the Epistle of Barnabas. The second part consists of vii.–xv., and treats of church ritual and discipline; and the third part is eschatological and deals with the second Advent. The book is variously dated by different scholars: Zahn assigns it to the years A.D. 80–120; Harnack to 120–165; Lightfoot and Funk to 80–100; Salmon to 120. (See Salmon in Dict. of Christ. Biog. iv. 806–815, also article DIDACHE.)

Apostolical Constitutions.—For the various collections of these ecclesiastical regulations—the Syriac Didascalia, Ecclesiastical Canons of the Holy *Apostles, etc.*—*see* separate article.

(c) Epistles.—The Abgar Epistles.—These epistles are found in Eusebius (HE. i. 3), who translated them from Syriac. They are two in number, and purport to be a petition of Abgar Uchomo, king of Edessa, to Christ to visit Edessa, and Christ's answer, promising after his ascension to send one of his disciples, who should "cure thee of thy disease, and give eternal life and peace to thee and all thy people." Lipsius thinks that these letters were manufactured about the year 200. (See *Dict.* Christ Biog. iv. 878–881, with the literature there mentioned.) The above correspondence, which appears also in Syria, is inwoven with the legend of Addai or Thaddaeus. The best critical edition of the Greek text will be found in Lipsius, *Acta Apostolorum* Apocrypha, 1891, pp. 279–283. (See also ABGAR.)

Epistle of Barnabas.—The special object of this epistle was to guard its readers against the danger of relapsing into Judaism. The date is placed by some scholars as early as 70–79, by others as late as the early years of the emperor Hadrian, 117. The text has been edited by Hilgenfeld in 1877, Gebhardt and Harnack in 1878, and Funk in 1887 and 1901. In these works will be found full bibliographies. (See further BARNABAS.)

Epistle of Clement.—The object of this epistle is the restoration of harmony to the church of Corinth, which had been vexed by internal discussions. The epistle may be safely ascribed to the years 95–96. The writer was in all probability the bishop of Rome of that name. He is named an apostle and his work was reckoned as canonical by Clement of Alexandria (Strom. iv. 17. 105), and as late as the time of Eusebius (H.E. iii. 16) it was still read in some of the churches. Critical editions have been published by Gebhardt and Harnack, Patr. Apost. *Op.*, 1876, and in the smaller form in 1900, Lightfoot,[2] 1890, Funk,[2] 1901. The Syriac version has been edited by Kennett, *Epp.* of St. Clement to the Corinthians in Syriac, 1899, and the Old Latin version by Morin, *S. Clementis* Romani ad *Corinthios epistulae* versio Latina *antiquissima*, 1894. Greek text and English transl. by Kirsopp Lake in Laeb's Classical Library.

"Clement's" *2nd Ep.* to the Corinthians.—This so-called letter of Clement is not mentioned by any writer before Eusebius (H.E. iii. 38. 4). It is not a letter but really a homily written in Rome about the middle of the 2nd century. The writer is a Gentile. Some of his citations are derived from the Gospel to the Egyptians. Kirsopp Lake, op. *cit.*

"Clement's" Epistles *on* Virginity.—These two letters are preserved only in Syriac which is a translation from the Greek. They are first referred to by Epiphanius and next by Jerome. Critics have assigned them to the middle of the 2nd century. They have been edited by Beelen, Louvain, 1856.

Clement's Epistles to James.—On these two letters which are found in the Clementine Homilies, see Smith's Dict. of Christian *Biography*, i. 559, 570, and Lehmann's monograph, Die *Clementi*schen Schriften, Gotha, 1867, in which references will be found to other sources of information.

Epistles of *Ignatius*.—There are two collections of letters bearing the name of Ignatius, who was martyred between 105 and 117. The first consists of seven letters addressed by Ignatius to the Ephesians, Magnesians, Trallians, Romans, Philadelphians, Smyrneans and to Polycarp. The second collection consists of the preceding extensively interpolated, and six others of Mary to Ignatius, of Ignatius to Mary, to the Tarsians, Antiochians, Philippians, and Hero, a deacon of Antioch. The latter collection is a pseudepigraph written in the 4th century or the beginning of the 5th. The authenticity of the first collection also has been denied, but the evidence appears to be against this contention. The literature is overwhelming in its extent. See Zahn, Patr. Apost. Op., 1876; Funk,[2] Die apostol. *Väter*, 1901; Lightfoot,[2] Apostolic *Fathers*, 1889. Kirsopp Lake, op. *cit.*

Epistle of *Polycarp*.—The genuineness of this epistle stands or falls with that of the Ignatian epistles. See article in Smith's Dictionary of Christian Biography, iv. 423–431; Lightfoot, Apostolic Fathers, i. 629–702; Kirsopp Lake, op. *cit.*, also POLYCARP.

Pauline Epistles to the Laodiceans and tfze Alexandrians.—The first of these is found only in Latin. This, according to Lightfoot (see *Colossians*,[8] 272–298) and Zahn, is a translation from the Greek. Such an epistle is mentioned in the Muratorian canon. (See Zahn, *op. cit.* ii. 566–585) The Epistle to the Alexandrians is mentioned only in the Muratorian canon. (See Zahn ii. 586–592.)

For the Third Epistle of Paul to the Corinthians, and Epistle from the Corinthians to Paul, see under "Acts of Paul" above.

(R. H. CH.; W. O. E. O.)

APOCYNACEAE, the dog-bane family, a numerous group of dicotyledonous plants, composed chiefly of tropical twining shrubs but including also various trees and perennial herbs, all with a milky often poisonous juice. The leaves are simple, entire and usually opposite; the flowers are regular, sympetalous, with the parts in fours or fives and are borne either singly or clustered in cymes or panicles. The anthers are arrow-shaped and pointed, and the granular pollen is often glutinous; the ovary is mostly superior, with two or more carpels. There are about 180 genera and 1,400 species, comparatively few of which are found in cool

temperate regions. In the British Isles the family is represented by the greater and the lesser periwinkle (Vinca major and V. minor). the latter of which has run wild in the eastern United States. Of some 60 species representing the family in North America, only about six are found as far north as New York and adjacent Canada. The best known of these are the American dog-bane (*Apocynum androsaemifolium*) and the Indian hemp (A. cannabinum). Several tropical genera yield rubber (Landlophia, Cardopinus, Funtumia, Urceola, Willoughbya, etc.); others are source of drugs (*Aspidosperma, Strophanthus, Alstonia, Allamanda,* etc.). Some are exceedingly poisonous, notably the ordeal-tree (Tanghinia), of Madagascar; the manghas-tree (*Cerbera*), of tropical Asia; and the Bushman's poison (*Acocanthera*), of South Africa. Other widely known plants of this family are the oleander (Nerium oleander); the temple-tree or frangipani (*Plumeria acuminata*); the crape-jasmine (*Tabernaemontana* coronaria); the star-jasmine (*Trachelospermum jasminoides*); and the Chilian jasmine (*Mandevilla suaveolens*). The Natal-plum (Carissa *grandiflora*) and several other species produce edible fruits and many are showy ornamental plants. (See DOG-BANE; INDIAN HEMP; OLEANDER; PERIWINKLE.)

APOCYNUM is the dried root of Apocynum *cannabinum,* also known as American hemp, Canadian hemp and dogbane. The only official preparation for use as a drug is the fluid extract prepared from the powdered root. The dose is five minims (0·3cc.) for therapeutic purposes. Its action in this dosage is to stimulate directly the heart muscle and the constricting muscles of the blood-vessels, thus producing a stronger and slower heart beat and a rise in blood pressure. It also increases the output of urine in certain conditions, notably cardiac dropsy. In larger doses it is a powerful gastro-intestinal irritant, producing vomiting and purging. It closely resembles digitalis in its effect, except that it is not accumulated in the body as is digitalis. Its use is limited to cases of cardiac dropsy where digitalis has failed or has produced undesirable effects.

APODICTIC, a logical term, applied to judgments which are necessarily true, as of mathematical conclusions. The term in Aristotelian logic is opposed to dialectic, as scientific proof to probable reasoning. Kant contrasts apodictical with problematic and assertorical judgments. The apodictic judgment has the form "S must be P." It does not really express greater certainty than the assertorical judgment ("S is P") or the problematic judgment ("S may be P"), as Kant thought, but indicates a closer connection with other beliefs already entertained by the assertor. Hence its frequent use to express a judgment inferred from other judgments that imply it.

APOGEE, in astronomy, that point in the orbit of the moon which is farthest from the earth, the distance being 253,000 miles. (See MOON.)

APOLDA, a town in the *land* of Thuringia in central Germany, 9 mi. E.N.E. of Weimar. Pop. (1939) 27,789. Christian Zimmermann (1759–1842) introduced hosiery and cloth manufacture and the town has an important wool and silk industry. It has also dye-works, bell foundries and manufactures of engines, bicycles, cardboard and food products. It also trades in grain, leather, horses and cattle, and in woollen yarn.

APOLPSTAS, a tribe or small group of tribes of South American Indians, regarded as forming an independent linguistic stock. The Apolistas lived in the first half of the 19th century, near Apolo in the province of Caupolican, in Bolivia. on the eastern slopes of the Andes in the latitude of the northern end of lake Titicaca. Their original home is unknown. They have been so long under the influence of the missions, that even in the early 19th century, nothing of their original culture survived.

See A. D'Orbigny, *L'Homme Americain* (Paris, 1839); N. Armentia, *Relacion historica* de *las Misiones* Franciscanas de *Apolobamba* (La Paz, 1903); E. Nordenskiold, *Beiträge zur Kenntnis einiger Indianerstämme des Madre* de *Dios* Gebietes (Ymer, 1905, vol. xxv., pp. 265–312).

APOLLINARIS, "the Younger" (died A.D. 390), bishop of Laodicea in Syria. He collaborated with his father, Apollinaris the Elder, in reproducing the Old Testament in the form of Homeric and Pindaric poetry, and the New Testament after the fashion of Platonic dialogues, when the Emperor Julian had forbidden Christians to teach the classics. In his eagerness to combat Arianism he went so far as to deny the existence of a rational human soul in Christ's human nature, this being replaced in Him by a prevailing principle of holiness, to wit the Logos.

It was held that the system of Apollinaris was really Docetism (see DOCETAE). The position was accordingly condemned by several synods and in particular by that of Constantinople (A.D. 381). Apollinaris had a considerable following, which after his death divided into two sects, the more conservative taking its name (Vitalians) from Vitalis, bishop of Antioch, the other (Polemeans) adding the further assertion that the two natures were so blended that even the body of Christ was a fit object of adoration. The Apollinarian type of thought persisted in what was later the Monophysite school.

Although Apollinaris was a prolific writer, scarcely anything has survived under his own name. But a number of his writings are concealed under the names of orthodox Fathers, long ascribed to Gregory Thaumaturgus. These have been collected and edited by Hans Lietzmann.

Apollinaris must be distinguished from the bishop of Hierapolis who bore the same name, and who wrote one of the early Christian "Apologies" (c. 170).

BIBLIOGRAPHY—*See* A. Harnack, History *of* Dogma, vols. iii. and iv. passim; R. L. Ottley, The Doctrine of the Incarnation; G. Voisin, *L'Apollinarisme* (Louvain, 1901); H. Lietzmann, *Apollinaris von* Laodicea *und* seine *Schule* (Tuebingen, 1905).

APOLLINARIS, SULPICIUS, a grammarian of Carthage, who flourished in the 2nd century A.D. He taught Pertinax and Aulus Gellius, who speaks of him in the highest terms (iv. 17). He is the reputed author of the metrical arguments to the Aeneid and to the plays of Terence and (probably) Plautus (J. W. Beck, De *Sulpicio* Apollinari, 1884).

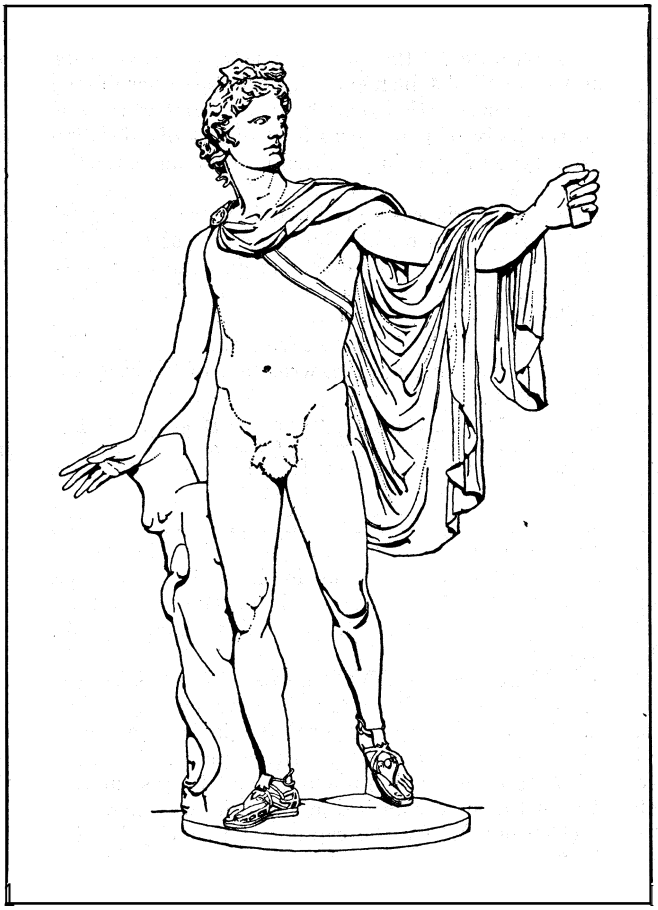
APOLLINARIS SIDONIUS, GAIUS SOLLIUS (c. 430–487 or 488), Christian writer and bishop, was born in Lyons about A.D. 430. He married (about 452) Papiania, the daughter of Avitus, who was consul and afterwards emperor. He enjoyed the favour of Majorianus and Anthemius, and in 472, more for his political than for his theological abilities, he was made bishop of Arverna (Clermont). On the capture of that city by the Goths in 474 he was imprisoned; but he was afterwards restored to his bishopric by Euric, king of the Goths. He died in A.D. 487 or 488. His extant works are his Panegyrics on different emperors (in which he draws largely upon Statius, Ausonius and Claudian); and nine books of Letters and Poems, whose chief value consists in the light they shed on the political and literary history of the 5th century. The Letters, which are very stilted, reveal Apollinaris as a man of genial temper, fond of good living and of pleasure. The best edition is that in the *Monumenta Germaniae Historica* (Berlin, 1887), which gives a survey of the manuscripts.

Apollinaris Sidonius (the names are commonly inverted by the French) is the subject of numerous monographs, historical and literary. S. Dill, *Roman Society in the Last Century of the Western Empire* (1899), and T. Hodgkin, Italy and Her Invaders, vol. vii. (2nd ed. 1899), contain interesting sections on Apollinaris.

APOLLO, in Greek mythology, one of the most important and many-sided of the Olympian divinities. The least improbable etymology of the name (Ἀπόλλων, Ἀπέλλων) is perhaps that of Usener, who connects it with an obsolete Greek verb meaning "to drive away" (evil or disease; *cf.* Lat. *pellere*). Roscher's derivation of all the functions assigned to him from the idea of a single original light or sun god has not found general acceptance, although no doubt some features of his character can be readily explained in this manner.

According to the legend, Apollo was the son of Zeus and Leto The latter, pursued by the jealous Hera, after long wandering found shelter in Delos, where she bore a son, Apollo, under a palm-tree at the foot of Mt. Cynthus. Before this, Delos had been a barren, floating rock, but now became stationary, being fastened down by chains to the bottom of the sea. Apollo was born on the seventh day of the month, and this day and the 20th, the days of the new and full moon, were ever afterwards held sacred to him.

In Homer Apollo appears only as the god of prophecy, the sender of .plagues, and sometimes as a warrior. Elsewhere he is the god of agriculture and of vegetation generally. He was called Smintheus, generally explained as "destroyer of mice," to which epithet, however, some modern enquirers attach a totemistic significance. Valleys and groves were under his protection, and certain trees and plants, especially the laurel, were sacred to him.



BY COURTESY OF THE VATICAN MUSEUM, ROME

THE APOLLO BELVEDERE, DISCOVERED IN THE RUINS OF ANTIUM IN A.D. 1485

This famous statue, a little larger than life sire, represents the god as a being of perfect physical beauty. The left hand and right forearm have been restored

As the god of agriculture and vegetation he is naturally connected with the course of the year and the arrangement of the seasons, so important in farming operations, and becomes the orderer of time (*Horomedōn,* "ruler of the seasons"), and frequently appears on monuments in company with Horai.

Apollo is also the protector of cattle and herds and is himself spoken of as a keeper of flocks, to which point the legends of his service as a herdsman with Laomedon and Admetus. Here probably also is to be referred the epithet Lukeios, which, formerly connected with λυκ ("shine") and used to support the conception of Apollo as a light-god, is now generally referred to lukos ("wolf") and explained as he who keeps away the wolves from the flock. In accordance with this, the epithet *lukēgenēs* will not mean "born of" or "begetting light," but rather "born from the she-wolf," in which form Leto herself was said to have been conducted by wolves to Delos. The consecration of the wolf to Apollo is probably the relic of an ancient totemistic religion.

With the care of the fruits of the earth and the lower animals is associated that of the highest animal, man, especially the youth on his passage to manhood. As such Apollo was *kourotrophos* ("rearer of boys") and patron of the palaestra. In many places gymnastic contests formed a feature of his festivals, and he himself was proficient in athletic exercises. Thus he was supposed to be the first victor at the Olympic games; he overcame Hermes in the foot-race, and Ares in boxing.

The transition is easy to Apollo as a warlike god; in fact, the earlier legends represent him as engaged in strife with Python, Tityus, the Cyclopes, and the Aloidae (*q.v.*). He is Boedromios ("the helper"), Eleleus ("god of the war-cry") and the paean was said to have been originally a song of triumph composed by him after his victory over Python. In Homer he frequently appears on the field, like Ares and Athene, bearing the aegis (*q.v.*) to frighten the foe. This aspect is confirmed by the epithets Argurotoxos ("god of the silver bow"), and Hekatebolos ("the shooter from afar"), and his statues are often equipped with the accoutrements of war, whence some have derived his name from apollunai as the god of "destruction" (Apollyon).

The fame of the Pythian oracle at Delphi, connected with the slaying of Python by the god immediately after his birth, gave especial prominence to the idea of Apollo as a god of prophecy. Python, always represented in the form of a snake, is the symbol of the old earth divinity whose home was the place of "enquiry" (*puthesthai*). When Apollo Delphinios with his worshippers from Crete took possession of the earth-oracle Python, he received in consequence the name Pythios. That Python was no fearful monster, symbolizing the darkness of winter which is scattered by the advent of spring, is shown by the fact that Apollo was considered to have been guilty of murder in slaying it and compelled to wander for a term of years and expiate his crime by servitude and purification. In the solar explanation, the serpent is the darkness driven away by the rays of the sun. (On the Delphian cult of Apollo and its political significance, see AMPHICTYONY, DELPHI, ORACLE.) Apollo's oracles, which he did not deliver on his own initiative, but as the mouthpiece of Zeus, were infallible; but the human mind was not always able to grasp their meaning, hence he was called *Loxias* ("crooked, ambiguous"). To certain favoured mortals he communicated the gift of prophecy (Cassandra, the Cumaean sibyl, Helenus, Melampus, and Epimenides). Although his favourite method was by word of mouth, yet signs were sometimes used; thus Calchas interpreted the flight of birds; burning offerings, sacrificial barley, the arrow of the god, dreams and the lot, all played their part in communicating the will of the gods.

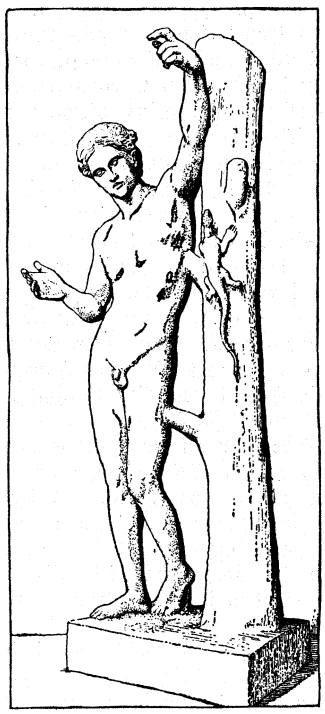
Closely connected with the god of oracles was the god of the healing art, the oracle being frequently consulted in cases of sickness. These two functions are indicated by the titles Iatromantis ("healer and seer") and Oulios, probably meaning "health-giving," rather than "destructive." This side of Apollo's character does not appear in Homer, where Paieon is mentioned as the physician of the gods. Here, as in the case of Aristaeus (*q.v.*), the question arises whether Paean (or Paeon) was originally an epithet of Apollo, subsequently developed into an independent personality, or an independent deity merged in the later arrival. Apollo is further supposed to be the father of Asclepios (Aesculapius), whose ritual is closely modelled upon his. The healing god could also prevent disease and misfortune of all kinds; hence he is alexikakos and *apotropaios* ("averter of evil"). Further, he is able to purify the guilty and to cleanse from sin. Such a task could be fitly undertaken by him, since he himself underwent purification after slaying Python.

The same element of enthusiasm that affects the priestess of the oracle at Delphi produces song and music. The close connection between prophecy and song is indicated in Homer (Odyssey, viii. 488), where Odysseus suggests that the lay of the fall of Troy by Demodocus was inspired by Apollo or the Muse. The metrical form of the oracular responses at Delphi, the important part played by the paean and the Pythian nomos ("strain") in his ritual, contributed to make Apollo a god of song and music, friend and "leader of the Muses" (*Mousagetēs*). He plays the lyre at the banquet of the gods, and causes Marsyas to be flayed alive because he had boasted of his superior skill in playing the flute, and the ears of Midas to grow long because he had declared in favour of Pan, who contended that the flute was a better instrument than Apollo's favourite lyre.

A less important aspect of Apollo is that of a marine deity, due to the spread of his cult to the Greek colonies and islands. As such, his commonest name is Delphinios, the "dolphin god," in whose honour the festival Delphinia was celebrated in Attica.

This cult probably originated in Crete, whence the god in the form of a dolphin led his Cretan worshippers to the Delphian shore, where he bade them erect an altar in his honour. He is *Epibatērios* and *Apobatērios* ("embarker" and "disembarker"), and *Nasiōtas* ("the islander") These maritime cults of Apollo are probably due to his importance as the god of colonization, who accompanied emigrants on their voyage.

As *Aguieus* ("god of streets and ways"), in the form of a stone pillar with painted head, placed before the doors of houses, he let in the good and kept out the evil, and as *Prostatērios* he "stands before the house" as its protector. Lastly, as the originator and protector of civil order, Apollo was regarded as the founder of cities and legislation. Thus, at Athens, Apollo *Patrōös* was known as the protector of the Ionians, and the Spartans referred the institutions of Lycurgus to the Delphic oracle.



AFTER A MARBLE COPY IN THE LOUVRE
THE APOLLO SAUROCTONUS (LIZARD KILLER,, ONE OF THE MOST NOTABLE OF THE WORKS OF THE ANCIENT GREEK SCULPTOR, PRAXITELES

As to Roscher's derivation of all Apollo's functions from the conception of an original light and sun god it cannot be shown that on Greek soil Apollo originally had the meaning of sun god; in Homer, Aeschylus and Plato, the sun god Helios is distinctly separated from Phoebus Apollo; the constant epithet Phoebus, usually explained as the brightness of the sun, may equally well refer to his physical beauty or moral purity; *lukēgenēs* has already been noticed. It is not until the beginning of the 5th century B.C. that the identification makes its appearance. The idea was taken up by the Stoics, and in the Roman period generally accepted. But the fact of the gradual development of Apollo as a god of light and heaven, and his identification with the foreign sun gods, is no proof of an original Greek solar conception of him.

The most usual attributes of Apollo were the lyre and the bow; the tripod especially was dedicated to him as the god of prophecy. Among plants, the bay, used in expiatory sacrifices, and also for making the crown of victory at the Pythian games, and the palm-tree under which he was born in Delos, were sacred to him; among animals and birds, the wolf, the roe, the swan, the hawk, the raven, the crow, the snake, the mouse, the grasshopper and the griffin—a mixture of the eagle and the lion, evidently of Eastern origin. The swan and grasshopper symbolize music and song; the hawk, raven, crow and snake have reference to his functions as the god of prophecy.

The chief festivals held in honour of Apollo were the Carneia, Daphnephoria, Delia, Hyacinthia, Pyanepsia, Pythia, and Thargelia *(see* separate articles).

Among the Romans the worship of Apollo was adopted from the Greeks. There is a tradition that the Delphian oracle was consulted as early as the period of the kings during the reign of Tarquinius Superbus. In 430 B.C. a temple was dedicated to Apollo on the occasion of a pestilence, and during the second Punic War (in 212 B.C.) the *Ludi Apollinares* were instituted in his honour. But it was in the time of Augustus, who considered himself under the special protection of Apollo and was even said to be his son, that his worship developed and he became one of the chief gods of Rome. After the battle of Actium, Augustus enlarged his old temple, dedicated a portion of the spoil to him, and instituted quinquennial games in his honour. He also erected a new temple on the Palatine hill and transferred the secular games, for which Horace composed his *Carmen Saeculare,* to Apollo and Diana.

Apollo was represented more frequently than any other deity in ancient art. As Apollo *Aguieus* he was shown by a simple conic pillar; the Apollo of Amyclae was a pillar of bronze surmounted by a helmeted head, with extended arms carrying lance and bow. There were also rude idols of him in wood *(xoana),* in which the human form was scarcely recognizable. In the 6th century B.C., his statues of stone were naked, stiff and rigid in attitude, shoulders square, limbs strong and broad, hair falling down the back. In the riper period of art the type is softer, and Apollo appears in a form which seeks to combine manhood and eternal youth. His long hair is usually tied in a large knot above his forehead The most famous statue of him is the Apollo Belvedere in the Vatican (found at Antium, 1485), an imitation, belonging to the early imperial period, of a bronze statue representing him, with aegis in his left hand, driving back the Gauls from his temple at Delphi (279 B C); or, according to another view, fighting with the Pythian dragon. In the Apollo Citharoedus or Mousagetes in the Vatican, he is crowned with laurel and wears the long, flowing robe of the Ionic bard, and his form is almost feminine in its fulness; in a statue at Rome of the older and more vigorous type he is naked and holds a lyre in his left hand; his right arm rests upon his head, and a griffin is seated at his side. The Apollo Sauroctonus (after Praxiteles), copied in bronze at the villa Albani in Rome and in marble at Paris, is a naked, youthful, almost boyish figure, leaning against a tree, waiting to strike a lizard climbing up the trunk. The gigantic statue of Helios (the sun-god), "the Colossus of Rhodes," by Chares of Lindus, celebrated as one of the seven wonders of the world, is unknown to us. Bas-reliefs and painted vases reproduce the contests of Apollo with Tityus, Marsyas, and Heracles, the slaughter of the daughters of Niobe, and other incidents in his life.

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APOLLODORUS, an Athenian painter, who flourished at the end of the 5th century B.C. He is said to have introduced great improvements in perspective and chiaroscuro.

APOLLODORUS, of Carystus in Euboea, one of the most important writers of the New Attic comedy, who flourished at Athens between 300 and 260 B.C. He is to be distinguished from an older Apollodorus of Gela (342–290), also a writer of comedy, a contemporary of Menander. He wrote 47 comedies and obtained the prize five times. Terence borrowed his *Hecyra* and *Phormio* from the Ἑκυρά and Ἐπιδικαζόμενος of Apollodorus.

BIBLIOGRAPHY.—Fragments in Koch, *Comicorum Atticorum Fragmenta,* ii. (1884); *see* also Meineke, *Hzstorza Critica Comicorum Graecorum* (1839).

APOLLODORUS *(c.* 144 B.C.), an Athenian grammarian, pupil of Aristarchus and Panaetius the Stoic. There is extant under his name a treatise on the gods and the heroic age, entitled Βιβλιοθήκη, a valuable authority on ancient mythology. Modern critics are of opinion that, if genuine, it is an abridgment of a larger work by him (Περὶ θεῶν)

BIBLIOGRAPHY.—Edition, with commentary, by Heyne (1803); text by Wagner (1894) *Mythographi Graeci,* vol. i. (Teubner series); text and Eng. trans. by Sir J. G. Frazer (Loeb series, 1921). Amongst other works by him of which only fragments remain, collected in Müller, *Fragmenta Historicorum Graecorum,* may be mentioned: Χρονικά, a work on chronology from the fall of Troy to 144 B.C. (Diels, in *Rhein. Mus.,* xxxi. 1f), Περιήγησις, a gazetteer written in iambics; Περὶ Νεῶν, a work on the Homeric catalogue of ships (B.

Niese in *Rhein Mus.*, xxxii. 306) and a work on etymology (Ἐτυμολογίαι). *See* Schwarz in Pauly-Wissowa pp. 2857–75; also F. Jacoby, Apollodors Chronik (1902); J. Nicole, *Le Procès de Phidias (d'après un papyrus inédit)* (Geneva, 1910).

APOLLODORUS, of Damascus, a famous Greek architect, who flourished during the 2nd century A.D. He was a favourite of Trajan, for whom he constructed the stone bridge over the Danube (A.D. 104–05). He also planned a gymnasium, a college, public baths, the Odeum and the Forum Trajanum, within the city of Rome; and the triumphal arches at Beneventum and Ancona. The Trajan column in the centre of the Forum is the first triumphal monument of the kind. On the accession of Hadrian, Apollodorus was banished, and, shortly afterwards, being charged with imaginary crimes, put to death (Dio Cassius lxix. 4). He also wrote a treatise on *Siege Engines* (Πολιορκητικά), which was dedicated to Hadrian.

APOLLONIA, the name of more than thirty cities of antiquity. The most important are the following: (1) Apollonia κατ' Ἐπίδαμνον or πρὸς Ἐπιδάμνῳ, now Pollina, on the right bank of the Aous in Illyria, founded by the Corinthians and Corcyraeans. It soon became prosperous as the most convenient link between Brundusium and northern Greece, and later as one of the starting-points of the Via Egnatia. Towards the close of the Roman republic it was a seat of literature and philosophy. Here Augustus was being educated when the death of Caesar called him to Rome. It seems to have sunk with the rise of Aulon, and few ruins remain. (2) A Thracian city on the Black sea (afterwards Sozopolis, and now Sizeboli), colonized by Milesians, and famous for its colossal statue of Apollo by Calamis, which Lucullus removed to Rome.

APOLLONIUS, surnamed ὁ δύσκολος ("the Crabbed"), a grammarian of Alexandria, who lived in the reigns of Hadrian and Antoninus Pius. He was the founder of scientific grammar and is styled *grammaticorum princeps* by Priscian, who based his own work on that of Apollonius. Four of his works are extant: *On Syntax,* ed. Bekker (1817); and three smaller treatises, on *Pronouns, Conjunctions,* and *Adverbs,* ed. Schneider (1878).

Grammatici Graeci, i. in Teubner series; Egger, *Apollonius Dyscole* (1854).

APOLLONIUS, surnamed "the Effeminate," a Greek rhetorician of Alabanda in Caria, who flourished about 120 B.C. Among his pupils was Mark Antony.

APOLLONIUS, surnamed "the Sophist," of Alexandria, a grammarian, who probably lived towards the end of the 1st century A.D. He was the author of a Homeric lexicon (Λέξεις Ὁμηρικαί), the only work of the kind we possess. His chief authorities were Aristarchus and Apion's Homeric glossary.

BIBLIOGRAPHY.—Edition by Villoison (1773), I. Bekker (1833); Leyde, *De Apollonii Sophistae Lexico Homerico* (1885); E. W. B. Nicholson on a newly discovered fragment in *Classical Review* (Nov. 1897).

APOLLONIUS MOLON (flourished *c.* 70 B.C.), a Greek rhetorician, who settled at Rhodes. He twice visited Rome as an ambassador, and Cicero and Caesar went to Rhodes to take lessons from him. He endeavoured to moderate the florid Asiatic style and cultivated an "Atticizing" tendency. He wrote on Homer, and, according to Josephus, attacked the Jews.

BIBLIOGRAPHY.—*See* C. Mueller, *Fragmenta Historicorurn Graecorum,* iii.; *E.* Schuerer, *History of the Jewish People,* iii. (Eng. trans. 1886).

APOLLONIUS OF PERGA (PERGAEUS), Greek geometer of the Alexandrian school, was probably born some twenty-five years later than Archimedes, *i.e.* about 262 B.C. He flourished in the reigns of Ptolemy Euergetes and Ptolemy Philopator (247–205 B.C.). His treatise on *Conics* gained him the title of the Great Geometer, and is that by which his fame has been transmitted to modern times. All his numerous other treatises have perished, save one, and we have only their titles handed down, with general indications of their contents, by later writers, especially Pappus. After the *Conics* in eight Books had been written in a first edition, Apollonius brought out a second edition, considerably revised as regards Books i.–ii., at the instance of one Eudemus of Pergamum; the first three books were sent to Eudemus at intervals, as revised, and the later books were dedicated (after Eudemus's death) to King Attalus I. (241–197 B.C.). Only four Books have survived in Greek; three more are extant in Arabic; the eighth has never been found. Books v.–vii. were translated into Latin by Giacomo Alfonso Borelli and Abraham Ecchellensis from the free version in Arabic made in 983 by Abu'l Fath of Ispahan and preserved in a Florence ms. But the best Arabic translation is that made as regards Books i.–iv. by Hilal b. Abi Hilal (d. about 883), and as regards Books v.–vii. by Thâbit b. Qurra (826–901). Halley used the latter version for his translation of Books v.–vii., but the best ms. (Bodl. 943) is still unpublished except for a fragment of Book v., published by L. Nix with German translation (Drugulin, Leipzig, 1889). Halley added in his edition (1710) a restoration of Book viii.

The degree of originality of the *Conics* can best be judged from Apollonius's own prefaces. Books i.–iv. form an "elementary introduction," *i.e.* contain the essential principles; the rest are specialized investigations in particular directions. For Books i.–iv. he claims only that the generation of the curves and their fundamental properties in Book i. are worked out more fully and generally than they were in earlier treatises, and that a number of theorems in Book iii. and the greater part of Book iv. are new. That he made the fullest use of his predecessors' works, such as Euclid's four books on Conics, is clear from his allusions to Euclid, Conon and Nicoteles. The generality of treatment is indeed remarkable; he gives as the fundamental property of all the conics the equivalent of the Cartesian equation referred to *oblique* axes (consisting of a diameter and the tangent at its extremity) obtained by cutting an oblique circular cone in any manner, and the axes appear only as a particular case after he has shown that the property of the conic can be expressed in the same form with reference to any new diameter and the tangent at its extremity. On the basis of the form of the fundamental property (expressed in the terminology of the "application of areas") Apollonius called the curves for the first time by the names *parabola, ellipse, hyperbola.* Books v.–vii. are clearly original. Apollonius's genius takes its highest flight in Book v., where he treats of normals as minimum and maximum straight lines drawn from given points to the curve (independently of tangent properties), discusses how many normals can be drawn from particular points, finds their feet by construction, and gives propositions determining the centre of curvature at any point and leading at once to the Cartesian equation of the evolute of any conic.

The other treatises of Apollonius (each in two Books) mentioned by Pappus are—1st, Λόγου ἀποτομή Cutting off a Ratio; and, Χωρίου ἀποτομή Cutting off an Area; 3rd, Διωρισμένη τομή Determinate Section; 4th, Ἐπαφαί Tangencies; 5th, Νεύσεις Inclinations; 6th, Τόποι ἐπίπεδοι Plane Loci.

An Arabic version of the first was found towards the end of the 17th century in the Bodleian library by Dr. Edward Bernard, who began a translation of it; Halley finished it and published it with a restoration of the second (1706). A restoration of the third was given by Robert Simson, *Opera quaedam reliqua* (Glasgow, 1776).

Tangencies embraced the following general problem:—Given three things (points, straight lines or circles) in position, to describe a circle passing through the given points, and touching the given straight lines or circles. The most difficult case, and the most interesting historically, is when the three given things are circles. This problem, which is sometimes known as the Apollonian Problem, was proposed by Vieta in the 16th century to Adrianus Romanus, who gave a solution by means of a hyperbola. Vieta himself solved it by elementary methods and restored the whole treatise of Apollonius in *Apollonius Gallus* (Paris, 1600); an interesting account of the problem is given by J. W. Camerer in *Apollonii Pergaei de tactionibus quae supersunt, ac maxime Lemmata Pappi in hos Libros, cum Observationibus, etc.* (Gothae, 1795.) A restoration of the fifth has been given by Samuel Horsley (1770), and one of the sixth by Robert Simson (Glasgow, 1749).

Other works of Apollonius are referred to by ancient writers,

vix. (1) Περὶ roil πυρίου *On the Burning-Glass,* where the focal properties of the parabola probably found a place; (2) Περὶ τοῦ κοχλίου On *the Cylindrical Helix* (mentioned by Proclus); (3) a comparison of the dodecahedron and the icosahedron inscribed in the same sphere; (4) Ἡ καθόλου πραγματεία, perhaps a work on the general principles of mathematics in which were included Apollonius's criticisms and suggestions for the improvement of Euclid's *Elements;* (5) Ὠκυτόκιον (quick bringing-to-birth), in which, according to Eutocius, he showed how to find closer limits for the value of π than the 33 and $3\frac{10}{71}$ of Archimedes; (6) an arithmetical work (as to which *see* PAPPUS) on a system of expressing large numbers in language closer to that of common life than that of Archimedes' *Sand-reckoner,* and showing how to multiply such large numbers; (7) extensions of the theory of irrationals expounded in Euclid, Book x. *(see* extracts from Pappus's comm. on Eucl. x., preserved in Arabic snd published by Woepcke, 1856). Lastly, in astronomy he is credited by Ptolemy with an explanation of the motion of the planets by means of epicycles and eccentric circles; he also made researches in the lunar theory, for which he is said to have been called Epsilon (ϵ).

The editions of the Conics include, besides Halley's monumental edition of all seven Books (Oxford, 1710), Commandinus's Latin Translation (1566), and Barrow's edition (1675), of the first four Books, and Heiberg's definitive text of the same Books, with Eutocius's commentary, etc. (Leipzig, 1891–93). There is a German translation by H. Balsam (1861), and an edition in modern notation, with introduction, etc., by T. L. Heath (Cambridge, 1896); *see* also *H.* G. Zeuthen, *Die Lehre von den Kegelschnitten im Altertum* (Copenhagen, 1886 and 1902). (T. L. H.)

APOLLONIUS OF RHODES (RHODIUS), a Greek epic poet and grammarian, of Alexandria, who flourished under the Ptolemies Philopator and Epiphanes (222–181 B.C.). He was the pupil of Callimachus, with whom he subsequently quarrelled. In his youth he composed the work for which he is known, *Argonautica,* an epic in four books on the legend of the Argonauts. In 196, Ptolemy Epiphanes appointed him librarian of the museum, which office he probably held until his death. As to the *Argonautica,* Longinus' *(De Sublim.,* p. 54, 19) and Quintilian's (*Instit., x.* 1, 54) verdict of mediocrity seems hardly deserved; it possesses a certain simplicity and contains some beautiful passages. There is a valuable collection of scholia. The work, highly esteemed by the Romans, was imitated by Virgil *(Aeneid,* iv.), Varro Atacinus, and Valerius Flaccus. Marianus (about A.D. 500) paraphrased it, in iambic trimeters. Apollonius also wrote epigrams; grammatical and critical works; and Κτίσεις ("the foundations of cities").

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APOLLONIUS OF TRALLES (in Caria), a Greek sculptor, who flourished in the 2nd century B.C. With his brother Tauriscus, he executed the marble group known as the Farnese Bull, representing Zethus and Amphion tying the revengeful Dirce to the horns of a wild bull.

FROM "PHILOSTRATE DE LA VIE D'APOLLONIUS THIANEEN," 1599

APOLLONIUS OF TYANA. THE NEO-PYTHAGOREAN PHILOSOPHER AND MYSTIC

APOLLONIUS OF TYANA, a Greek philosopher of the Neo-Pythagorean school, born a few years before the Christian era. He studied at Tarsus and in the temple of Asclepius at Aegae, where he devoted himself to the doctrines of Pythagoras and adopted the ascetic habit of life. He travelled through Asia and visited Nineveh, Babylon and India, imbibing oriental mysticism. The narrative of his travels given by his disciple Damis and reproduced by Philostratus is so full of the miraculous that many have regarded him as an imaginary character. On his return to Europe he was received with reverence as a magician. He himself claimed only the power of foreseeing the future; yet in Rome it was said that he raised from death the body of a noble lady. In the halo of his mysterious power he passed through Greece, Italy and Spain. It was said that he was accused of treason both by Nero and by Domitian, but escaped by miraculous means. Finally he set up a school at Ephesus, where he died, apparently aged 100. The work of Philostratus is generally regarded as a religious work of fiction.

See F. C. Baur, *Apollonius von Tyana und Christus,* ed. Ed. Zeller (Leipzig, 1876—an attempt to show that Philostratus's story is merely a pagan counterblast to the New Testament history); J. Jessen, *Apollonius v. Tyana und sein Biograph Pkilostratos* (Hamburg, 1885); D. M. Tredwell, *Sketch of the Life of Apollonius* of *Tyana* (New York, 1886); J. Gottsching, *Apollonius von Tyana* (1889); *B.* L. Gildersleeve, *Essays and Studies* (New York, 1890); J. A. Froude, *Short Studies,* vol. iv.; *G.* R. S. Mead, *Apollonius of Tyana* (1901); Philostratus's *Life of Apollonius* (Eng. trans. New York, 1905); M. Wundt, *Apollonius von Tyana—Prophetic und Mythenbildung* (1906); *O.* de B. Priaulx, *The Indian Travels of Apollonius* (1873); F. W. G. Campbell, *Apollonius of Tyana* (1908). Translations by J. S. Phillimore (1912) and F. C. Conybeare (1912) (Loeb series). *See* also NEO-PYTHAGOREANISM.

APOLLONIUS OF TYRE, a mediaeval tale supposed to be derived from a lost Greek original. The earliest mention of the story is in the *Carminn* (Bk. vi. 8, ll. 5–6) of Venantius Fortunatus, in the second half of the 6th century, and the romance may well date from three centuries earlier. It bears a marked resemblance to the *Antheia and Habrokomes* of Xenophon of Ephesus. The story relates that King Antiochus, maintaining incestuous relations with his daughter, kept off her suitors by asking them a riddle, which they must solve on pain of losing their heads. Apollonius of Tyre solved the riddle, which concerned Antiochus's secret. He returned to Tyre, and, to escape the king's vengeance, set sail in search of a place of refuge. In Cyrene he married the daughter of King Archistrates, and presently, on receiving news of the death of Antiochus, departed to take possession of the kingdom of Antioch, of which he was, for no clear reason, the heir. On the voyage his wife died, or rather seemed to die, in giving birth to a daughter, and the sailors demanded that she should be thrown overboard. Apollonius left his daughter, named Tarsia, at Tarsus in the care of guardians who proved false to their trust. Father, mother, and daughter were only reunited after 14 years' separation and many vicissitudes. The earliest Latin ms. of this tale, preserved at Florence, dates from the 9th or 10th century. The pagan features of the supposed original are by no means all destroyed. The ceremonies observed by Tarsia at her nurse's grave, and the preparations for the burning of the body of Apollonius's wife, are purely pagan. The riddles that Tarsia propounds to her father are obviously interpolated. They are taken from the *Enigmata* of Caelius Firmianus Symposius. The many inconsistencies of the story seem to be best explained by the supposition (E. Rohde, *Der griechische Roman,* 2nd ed., 1900, pp. 435 et seq.) that the Antiochus story was originally entirely separate from the story of Apollonius's wanderings, and was clumsily tacked on by the Latin author. The romance kept its form through a vast number of mediaeval re-arrangements, and there is little change in its outlines as set forth in the Shakespearian play of *Pericles.*

BIBLIOGRAPHY.—The Latin tale is preserved in about 100 mss., and was printed by M. Velser (Augsburg, 1595), by J. Lapaume in *Script. Erot.* (Didot, Paris, 1856), and by A. Riese in the *Bibl. Teubneriana* (1871, new ed. 1893). The most widespread versions in the middle ages were those of Godfrey of Viterbo in his *Pantheon* (1185), uhere it is related as authentic history, and in the *Gesta Romanorunt* (cap. 153), which formed the basis of the German folk-tale by H. Steinhöwel (Augsburg, 1471), the Dutch version (Delft, 1493), the French in *Le Violier des histotres romaines* (Paris, 1521), the Fnglish, by Laurence Twine (London, 1576, new ed. 1607), also of the Scandinavian, Czech, and Hungarian tales.

In England a translation was made as early as the 11th century (ed. B. Thorpe, 1834, and J. Zupitza in *Archiv fur neuere Sprachen,* 1896); there is a Middle English metrical version (J. O. Helliwell, *A New Boke about Shakespeare,* 1850), by a poet who says he was vicar oi Wimborne; John Gower uses the tale as an example of the seventh deadly sin in the eighth book *of* his *Confessio Amantis;*

Robert Copland translated a prose romance of *Kynge Apollyne of Thyre* (Wynkyn de Worde, 1510) from the French; *Pericles* was entered at Stationers' Hall in 1607, and was followed in the next year by George Wilkins's novel, *The Painfull Adventures of Pericles, Prynce of Tyre* (ed. Tycho Mommsen, Oldenburg, 1857), and George Lillo drew his play *Marina* (1738) from the piece associated with Shakespeare. *See* A. H. Smyth, *Shakespeare's Pericles and Apollonius of Tyre* (Philadelphia, 1898); Elimar Klebs, *Die Erzahlung von A. aus Tyrus* (Berlin, 1899); S. Singer, *Apollonius von Tyrus* (Halle, 1895).

APOLLBS, an Alexandrian Jew, came to Ephesus, where he expounded in the synagogue the Messianic prophecies of the Old Testament. He was versed in the Scriptures and had been in touch with the movement inaugurated by John the Baptist. Priscilla and Aquila convinced him that the predictions had been fulfilled in Jesus (Acts xviii.). Perhaps, like the followers of John in xix. 1–5, he then received Christian baptism. This interpretation assumes that the writer of Acts, who says that Apollos taught "the things concerning Jesus," means "the things concerning the Christ." Strictly interpreted the phrase seems to imply that Apollos knew the teaching of Jesus, with which he may have been in contact in Galilee, but not its consummation in the Resurrection faith of the early Church. Encouraged by the Christians of Ephesus he went to Corinth, where he proclaimed with vigour and success that the Messiah was Jesus. One of three (or four) parties which developed in the Corinthian Church claimed him as its founder (I. Cor. i. 10–12). Paul recognized his work generously. Apollos had watered his plant (iii. 6). It is a natural deduction from the origin of Apollos and his distinctive teaching that he had affinities with the Alexandrian school of Judaism represented by Philo. Some scholars have supposed that he wrote the anonymous Epistle to the Hebrews, which has similar affinities, but this is a guess and improbable. From I. Cor. xvi. 12 we learn that he returned to Ephesus and was there with Paul. (W. K. L. C.)

APOLLYON. In Job. xxvi. 6; xxviii. 22; the Hebrew word *Abaddon* (destruction) is coupled with Sheol (the grave) and death. In Rev. ix. 11, a wicked angel presides over all the powers of the abyss, and is called Abaddon. The Greek name Apollyon (Ἀπολλύων, destroyer) is the equivalent.

APOLOGETICS seeks to state grounds for faith in God, in Christ, in the Bible and in the Church; although Protestantism seriously lowers the importance of Church teaching ("General Councils may err and sometimes have erred," say the Anglican Articles); and modern apologists—from a convergence of reasons—propose a more moderate estimate of the Bible also. Again, the basis of apologetics may be placed in reason, or in conscience, or in experience, or (in some sense) in authority—or in a combination of several factors; even the most authoritarian of Churches, the Roman Catholic, claims to build on the foundation of reason and conscience. Historically, the apologetic debate has meant, first, the elaboration of an appeal to miracle, and, later, the subordination of that appeal to something possibly vaguer but more inward. On one side there is the impression made by the unique figure of Jesus Christ; on the other side there are the experiences of the religious life. This two-fold appeal is held to be conclusive.

Apologetics and Philosophy.—It would be odious, at least for Protestants, to affirm one type of philosophy to be orthodox and to condemn all others. Yet certain types of philosophy can only by a *tour* de force be combined with religious belief—*e.g.*, materialism, where materialism is seriously maintained, or the blend of materialism with agnosticism known as naturalism. Briefly Christianity postulates a spiritual philosophy. On the other hand, a philosophy which lays down the law concerning all things human and divine is a dangerous ally for faith. Not infrequently apologetics are treated with contempt in journalism; the same attitude is observable in Albrecht Ritschl himself, whom critics in England tend to regard as the apologist par excellence and to blame correspondingly. The facts are summarized in the present writer's Albrecht Ritschl and his School, chap. i. None the less, the apologist regards his task as sacred—"*by* demonstration of the truth, commending himself to every man's conscience in the sight of God."

Apologetics in the Christian Scriptures.—The Old Testament does not argue in support of its beliefs, unless when the Wisdom literature seeks to rebut moral difficulties (cf. T. K. Cheyne, Job and Solomon; A. S. Peake, Problem of *Suffering* in the Old Testament). The New Testament supplies materials for the apologist (*e.g.*, references to "mighty works" in the words of Jesus), but its own appeal is predominantly that of the preacher or prophet. The identification of Christ with the Logos foreshadowed in Paul and in Heb. i. 2, and clinched in the Johannine prologue (John i. 1. etc.), afforded an important clue to the Greek-Christian mind. Quite as important for later thinking (*e.g.*, Thomas Aquinas) has been the "Natural Theology" of Rom. i. 20. Again, what might almost be called the "Natural Religion" of Rom. ii. 14 repudiates in advance the conception of mind as—prior to experience—a tabula *rasa;* moral law is inscribed there "by nature." Also the "great word conscience" is as characteristic of Paul as of Hebrews. Perhaps there are touches of Stoicism in these Pauline utterances; certainly there are hints of a spiritual philosophy. E. F. Scott's important Apologetic of the New Testament gives a wide extension to the term.

The Early Apologetic Period.—The young Christian Church stood face to face with Greek philosophy—past its prime, but still immensely strong. Friendship was inevitable; and the Church borrowed, as Harnack has observed, mainly from Platonism in doctrine and in ethics mainly from Stoicism. (Very early, too, libertarian free-will came to be asserted against the Gnostics.) Justin Martyr, the leading apologist, had before his conversion belonged in turn to each of these schools. Inevitably there arose a tendency to stress the contacts between Christianity and the higher Hellenism while ignoring differences; some modern censures of this tendency are unduly severe. "Logos" was the watchword both of Justin and of the "Christian Platonists of Alexandria," Clement and Origen; though in the end, having done its work as a friendly intermediary between Christianity and Hellenism, Logos was bowed out of the great creeds. During this period the appeal to miracle was hampered (it has been suggested) by the prevalent belief in magic—supernatural happenings could be discounted, if they were so common. The appeal to prophecy—*i* e., to fulfilled predictions, and therefore to a miracle of foreknowledge—is stated by the very greatest minds (*e.g.*, Athanasius) with an unhesitating confidence that impresses every modern reader as naive. The conquest of the civilized world by Christianity was certainly not exclusively due to its arguments; nor could Christians wish it to have been so; but neither as historians nor as Christians can we undervalue such a figure as Origen. The brilliant but harsher figure of Tertullian has several peculiarities: the (Stoical) appeal from philosophy to the plain man, the tendency to paradox (Credo *quia* impossibile; the quotation, if inexact, does Tertullian no injustice), and, in a different vein, the assertion of the anima *naturaliter* Christiana. Occasionally, the "natural immortality" of the soul is displaced by the thought that eternal life even physically is God's supernatural gift; *e.g.*, in the lay apologist Arnobius. Until the Church's triumph, apologetic work other than evidential was very necessary for refutation of slanders and in protest against persecution. Even afterwards, when the Christianized empire was suffering from barbarian inroads, Orosius, Salvian and Augustine (The City of God) found it needful to argue, on different lines, that Christianity had not brought disaster, but had mitigated it or redeemed from it.

The Middle Period.—During the whole of the middle ages, Western Christendom was dominated, though incompletely, by the superb genius of Augustine. Apologetically, as well as doctrinally, he is hard to reduce to a unity. A thread, if not of scepticism, at least of authoritarianism, has been detected in him (Ego vero evangelio *non* crederem nisi me catholicae ecclesiae commoveret *auctoritas*). Further he is the heir, in a more positive sense, of (neo)Platonism with its intellectual appeal; and his experience of sin and grace revives Pauline Christianity, if it hardens still further the grim doctrine of predestination and practically nullifies free will. The Christian Church, so recently persecuted, was not long enthroned before it began to persecute in its turn. For this new departure, also, Augustine unhappily accepted a share of responsibility.

How could there be living apologetics in centuries which

appealed not to reason or conscience, but to force? For one thing, the Jew remained anti-Christian. For another, Mohammed launched a non-Christian religion of immense power upon the Eastern world. Jew and Muslim had to be met in argument (*e.g.*, the Pugio Fidei of Raymond Martini, *c.* 1280). For another thing still. the paganism of antiquity was never entirely forgotten; Abelard (d. 1142) wrote a Dialogue between a Jew, a Philosopher and a *Christian.* Yet, while three religions were "at daggers drawn," there was an immense movement pervading all three in favour of the philosophy of Aristotle. This is one of the most extraordinary features in the history of the human mind; and its apologetic and theological consequences could not but be great. It is easy to underestimate the activity of thought during the flowering times of the middle ages (cf. R. L. Poole, Illustrations of the History of *Mediaeval* Thought and Learning, ed. 2); perhaps because outsiders interpret the Catholic ethos too narrowly, perhaps because moderns ascribe the conditions of their own day to earlier and freer generations. Anselm (d. 1109), one of the fathers of Scholasticism, throws himself into the problems both of Theism and of Christian doctrine with the air of a man determined on making new discoveries; and he thanks God at the end for what he believes to be new and also true results.

The mediaeval world studied the problem of the relations between philosophy and theology as a problem concerning "faith" and "reason." Augustine, and after him Anselm, quoting Isa. vii. 9, in the Latin translation derived from the LXX. reading — "If ye will not believe, ye shall not know" — proclaimed an absolute harmony of the two, on *the* condition that assent to authoritative teaching came first, whereupon reason was sure to confirm it in every detail. Aquinas (d. 1274), following his master Albert the Great, took a different line. To his own mind, probably, the new positions constituted a better way of harmonizing reason and faith; whether that claim is correct or is baseless, the positions were new. Rational argument (but not Anselm's ontological proof; its ingenuities were too wiredrawn for the sober mind of Aquinas) demonstrates God and immortality. The characteristic contents of revelation are supernatural mysteries — undiscoverable beforehand by reason, and never fully intelligible even as revealed. There are all the materials here for later developments; *e.g.,* for the systematic separation of the truths regarded as demonstrable by reason (God, Freewill, Immortality) under the name Natural Theology (used in this technical sense perhaps only from Christian Wolff, 1679–1754, onwards); and yet, Aquinas has not affirmed that all "revealed" doctrines are in the special sense mysterious. Again, there are materials in Aquinas for isolating "miracles" and "prophecies" as the Christian evidences proper; but it did not enter into any mediaeval mind to summarize the evidences so coldly. That remained for a later and less dogmatic period. Still further, Aquinas has something besides argument to proclaim. Faith is a virtue, and exists as such in two forms—*acquisita,* which rests upon conditions of human effort, and infusa, which is the higher gift of God. This is an Augustinian thought. It may be transformed into an appeal away from bare argument to religious and moral experience; or it may imply submission to mere authority. Either way, it constitutes a noteworthy supplement to argumentative apologetics. An earlier mediaeval writer, Alexander of Hales (d. 1245), quoted by R. Franks in History of the Doctrine of the Work of Christ, I. pp. 228–29, expresses a similar thought in almost startling terms: "There are reasons for the things to be believed which are strong and apparent, such as those showing in what ways God is and is one and is omnipotent, which the philosophers prove by many reasons; and there are reasons for things which are to be believed which are not apparent but weak according to human reason, such as . . . Anselm introduces in Cur Deus Honto. . . . Nevertheless, reasons of this kind when informed through faith infused by God . . . appear necessary." According to C. R. S. Harris, Duns Scotus, the great rival and critic of Aquinas, practically concurred with the Dominican's views concerning the basis of belief. Other interpreters had attached more importance to the critical elements in Duns, whose tendency at least is to fall back upon Church authority as a remedy against rational doubt; this tendency passes on from Realist Duns to William of Occam and other Nominalist schoolmen. Its climax is a doctrine of "two truths." A thing may be false in philosophy, true in theology. Only one obscure churchman of the second rank, Robert Holkot, is said to have definitely recommended this refuge of lies; Pomponazzi, who repeated the suggestion, was a Renaissance sceptic. In modern times, the Vatican Council (1870) definitely adopted the main theses of Thomist apologetics.

Modern Period. — At the Reformation the appeal of religion displaced, for a generation or more, evidential inquiries; while the counter-Reformation exhibits a religious rallying to the principle of authority. The implicit logic of early Protestantism found expression in the somewhat later formula, *e.g.,* Westminster Confession of Faith, 1647, which defines the ultimate ground of belief as the "inward" witness of the Holy Spirit "with the Word of God." We may paraphrase as follows: A spiritual experience, notably the experience of forgiveness, is generated by the Bible and commends the Bible for acceptance in all its parts. This formulation is directed not against rationalism, but against the subordination of the Bible to the Church. It did not yet occur to orthodox Protestantism that religion permits — still less, that it requires — a distinction between the letter and the spirit.

In the post-Reformation Church of Rome we meet with a world-genius in Apologetics, as in other fields, in Blaise Pascal (1623–62). His *Pensées,* published posthumously, seems to have been meant for a systematic treatise, but it has come to us in fragments. It borrows its material (as industrious editors have shown) from very few sources — the *Pugio* Fidei, M. de Montaigne, P. Charron. Ideas as well as learning are largely Montaigne's. The latter's cheerful man-of-the-world scepticism is transfigured in Pascal to a deep distrust of human reason, in part, perhaps, from anti-Protestant motives. Further it is fallen man whom he pursues with his fierce scorn; his view of man's nature — intellect as well as character — is to be read in the light of his unflinching Augustinianism. Once again, Pascal, unlike most apologists, belongs to the small company of saintly souls. This philosophical sceptic is full of humble joy in salvation. Pascal earned great admiration from Calvinists; in his own communion he belonged to a section of opinion which was authoritatively condemned.

In the Dutchman, Hugo Grotius, one of the founders of International Law, rational apologetics disentangle themselves from the deeper or vaguer appeals of early Protestantism (De *Veritate Christianae* Religionis, 1627).

It did not follow from the success of the Protestant movement in several great countries that persecution, even in these countries, was at an end. Its major forms became rarer; but minor disabilities remained for nonconforming elements of society. Moreover, the wars of religion constituted another unhappy form of the appeal to force, the peace of Westphalia terminating 30 years of barbarism in an illogical geographical compromise; while in England what is known as the Great Rebellion, with its afterpiece the Revolution of 1688, provoked a similar recoil from religious zeal. The change by which the phrase "Natural Religion" — invented apparently on the Continent as a reproachful designation for the teaching of Lord Herbert of Cherbury, father or grandfather of Deism — came into use on the Christian side as a term of praise foreshadows significantly the temper of the 18th century. Doctrinal emphasis was to slacken: argument was to become clear and definite: and the age of Reason — as it styled itself — was at least to witness the triumph of pedestrian common sense. While on the Continent G. W. Leibnitz (1646–1716), representing the Platonizing inheritance (while quoting Trinity and Eucharist as "mysteries"), had raised anew the problem of Theodicy, and had sought to solve it by asserting that the evil of the finite universe must have been reduced to the lowest practicable dimensions — Leibnitz believed in hell! — by the wisdom and goodness of God, Locke's empiricism was much more congenial to the age. He dealt directly with theology in his *Reasonableness* of Christianity (1695) — a favourite and often repeated thesis. While Locke is prepared to admit mysteries, the illustration which he names is the nature

of angels; what can the human mind know of such beings, apart from revelation? When an unwelcome deistic admirer of Locke (Toland) proclaims that Christianity is Not Mysterious (1696), and plainly enough if indirectly—it was still unsafe to be outspoken—attacks the doctrine of the Trinity, a new edge is put upon Locke's theses.

Frequently, deism served as a mask for more thorough-going rejection of religious belief; although the deists of genius, Voltaire and J. J. Rousseau (who both visited England), were in their different ways sincere; as also was the formidable agitator Tom Paine. In France on Lockian principles, Materialism (de la Mettrie) and Atheism (Holbach, 1723–89) came to find advocates. And already from the start of the deistic controversy in England, every apologetic position had been challenged. Thomas Woolston (1669–1731), taking a leaf out of the Church's book, allegorized: but he allegorized away the miracles. Antony Collins (1676–1729), the friend of Locke, eulogized *Freethinking*, allegorized the prophecies, had doubts about freewill, and about the natural immortality of souls; David Hume (1711–76) found miracles "incredible" (R. C. Trench) if Spinoza had proclaimed them "impossible"; John Toland (1670–1722). a ragged scholar, announced that *Christianity* was Not *Mysterious;* Matt. Tindal, an Oxford don (1657?–1733), that Christianity was as Old as *the* Creation (was in fact neither more nor less than deism); and Dodwell the younger, with a sneer, that Christianity was Not Founded *upon* Argument (1741). Apart from lesser apologists, individual points were handled by William Law (1686–1761), the brilliant and saintly non-juror (The Case of Reason—surely your boasted reason has failed! if we are in so evil a plight); by Bp. Berkeley the philosopher (*Alciphron*); by the great scholar Bentley; by Samuel Clarke. The really classical reply, however, was by Bp. Joseph Butler (1692–1752). It is interesting to study in detail which deistic positions Butler deems worthy of notice, and which he simply ignores. He is as clumsy as Pascal was graceful, but his personality has charm. In a few incidental words he has perfectly described himself as one who writes "with simplicity and in earnest." The three Sermons *on Human* Nature (1726), while not easy to classify as a piece of philosophy, revived the ethic of duty; to be revived again by Immanuel Kant (1724–1804), and later still by Thomas Carlyle (1795–1881), who—along with the anti-Christian "Exodus from Hounsditch" of Sartor Resartus—stood for a vague but intense moral Theism, which had powerful effects. Part I. of Butler's Analogy (1736) restates Natural ("or essential") Religion as necessarily including divine punishment, on the analogy of present facts. Here, perhaps, Butler is weightiest of all, and also—in that age of easy-going optimism—is most isolated. He might have said, with Ps. cxix., "My flesh trembleth for fear of Thee, and I am afraid of Thy judgments." The formal evidences of Christianity (Analogy part II. chap. 7) are conceived by Butler very much as by his contemporaries—miracles, prophecy ("Prophecy is history written beforehand"), and some vaguer supplements. Unfortunately (writing of course before Hume) Butler blunderingly denies that there is need of specially good evidence if we may reasonably hope to vindicate a miracle narrative. The same error is repeated, in reply to Hume, by George Campbell of Aberdeen (1719–96); the theory of probabilities is full of traps which have caught many an acute mind. The error of Butler and Campbell is corrected, with moderation and good taste, in J. S. Mill's Logic (1843); and, from him or from others, the correction has been accepted by later orthodox apologists. (See DEISM.)

Valuable work in scholarship was done, with an apologetic interest, in the Arian or Unitarian Nathaniel Lardner's credibility of the Gospel History (1727–55). Considerably later than either Butler or Lardner, Archdeacon William Paley restates the traditional apologetic neatly and clearly, but with no really fresh insight. In his Natural *Theology* (1802) he concentrates on the design argument. In *Moral* Philosophy (1785) he stands for a theological utilitarianism. In the Evidences of *Christianity* (1794) he stresses the honest testimony of the apostles to Christ's resurrection.

Yet, long before Paley wrote, the spirit of the age of common sense had begun to flag. In the Evangelical revival, for much good and for some evil, "enthusiasm" had come back to the world. Influenced by Thomas Erskine (1788–1870) and by the evangelical Quaker Joseph John Gurney (1788–1847), Thomas Chalmers (1780–1847)—leader of the evangelical revival in Scotland—stated Internal alongside of External Evidences for Christianity. This was a repetition, with whatever changes, of the doctrine of the testimony of the Holy Spirit; and it was an anticipation of modern appeals to religious experience. The process of disparaging miraculous ("external") evidence had begun; Bible miracles, great and small, were still unhesitatingly accepted as facts. So long as evangelical religion continued to be, what Jean Ingelow once called it, "as the river of God" in England—the solitary great spiritual force—its prestige carried with it (along with a sharply-cut doctrine of penal atonement) the attitude which S. T. Coleridge's posthumous Confessions of an *Inquiring* Spirit (1840) stigmatized as "bibliolatry."

The recoil from the 18th century might demand a deeper type of reason. Here Coleridge (1772–1834) was conspicuous; if strong evangelical elements were also present in him. F. D. Maurice (1805–72) was powerfully influential within somewhat narrower limits; Charles Kingsley called him "master," and R. H. Hutton was inspired by him. Bp. B. F. Westcott (1825–1901) reveals markedly the critical and scholarly interest, and his apologetic concern never slumbers; if obscure in thought, he was saintly in character. The supreme modern representative of Platonizing philosophies was the great German thinker G. W. F. Hegel (1770–1831), who inspired new orthodoxies but also inspired D. F. Strauss and helped to inspire the radical New Testament criticism of F. C. Baur (1792–1860) of Tiibingen, and—more than once and in more than one direction—has told upon the theology of the English-speaking world.

Again, the recoil from the 18th century might make for greater recognition of Church authority—in the Church of Rome, Ultramontanism, heralded by Bonald and de Maistre, which has achieved such triumphs; in Anglicanism, the Oxford Movement of John Keble (1792–1866), J. H. (afterwards Cardinal) Newman (1801–90) and E. B. Pusey (1800–82) etc.; its waves of influences pervade the Anglican communion and extend well beyond it. A. M. Fairbairn (Catholicism, Roman *and* Anglican, ch. v.; and elsewhere) and E. A. Abbott (Philomythus, and elsewhere) suspect Newman of a sceptical leaven and extend the criticism to Butler's doctrine of "probability." Another of the Oxford converts to Rome, W. G. Ward (1812–82), made vigorous contributions to natural theology.

Fresh Issues.—In the 19th century, Agnosticism was added to the list of non-Christian theories. It owes something to the negative side of Kant's critical philosophy. Sir Wm. Hamilton, and Dean Mansel (Limits of *Religious Thought,* 1858) took it up as a Christian apologetic; a similar apologetic is much more attractively stated in Tennyson's poem In Memoriam (1849). Herbert Spencer's First Principles (1862), quoting Mansel at some length, detached the system from its supposed Christian affinities; and finally the word agnostic was coined by the brilliant champion of Darwinism, T. H. Huxley (1825–95). There are differences between Huxley's agnosticism and Spencer's; yet, while shrinking from saying "There is no God," both alike say not merely "I do not know" but "I know that no human mind ever can know." If this is not dogmatism, what is? (See AGNOSTICISM.)

Huxley also carried on a vigorous polemic against the Christian miracles in detail, while refusing to join in wholesale a *priori* rejection such as Hume's, or such as underlies Strauss's "mythical" theory in his Life of *Jesus* (1835–36 and later). R. C. Trench (Notes *on the* Miracles, 1846; in the Introduction) made the telling criticism that Strauss has sentenced every narrative before hearing the evidence, though his excuses for rejection vary from time to time. An apologetic, which is to claim the right so to criticize assailants, must in fairness be prepared to view some—perhaps many—Gospel tales of wonder as legendary accretions. More sweeping rejection of miracles occurs again in a brief but emphatic footnote to T. H. Green's (longer) *Introduction* to Hume (1874)—reiterating Hume's thesis, while rebuking Hume's

sophistical philosophy for its failure to vindicate in earnest the thought of unalterable natural law. A longer footnote in A. v. Harnack's (larger) History of *Dogma* (1885, vol. i. of Eng. Trans. from 2nd ed. 1894, p. 65), with a partial admission that there is evidential value in the gospel healings, pleads eloquently for dissociating Christianity from reliance on miracle. A. Ritschl's school book, Unterricht in der Christlichen Religion (1875) had affirmed that "he who is conscious of miracle in his own experience will not be troubled by its appearance in others." The close of Hume's Essay *on* Miracles strikes a similar note—with a sneer; the Christian writer is profoundly in earnest. And probably Christians will do well to hesitate before banishing "miracle" from the vocabulary of religion. John Wendland's new theory of the miraculous (Eng. Trans. Miracles and Christianity) as "God's originality"—so **A.** E. Garvie sums it up—may be viewed as a theological interpretation of "emergent" evolution. It perhaps vindicates the thought of Incarnation as what has been termed "the Crown of science"; it gives less promise of rescuing individual miracle narratives. Contemporary criticisms of the idea of natural law—conspicuous in James Ward's Naturalism and Agnosticism (1899) and *The Realm* of *Ends* (1911)—raise their own difficulties; and they do not appear to have been exploited in defence of the miraculous. Perhaps the last occasion upon which a first-rate Protestant mind repeated the old Thomist apologetic was in J. B. Mozley's Bampton Lecture of 1865 On Miracles. Mozley's view of revelation is set aside by A. B. Bruce in ***The*** Chief End of Revelation (1881) as "the doctrinaire theory," and during a whole generation Bruce's writings, not without traces of an internal development, held the field as a statement of the Christian apology.

Modern Apologetics **and** Philosophy,—Superficially regarded philosophy ebbs and flows, whatever progress the debate may reveal to speculative insight. Some notes may be added on a few special points. (a) Freewill is generally assumed on the Christian side (R. C. Church; Scottish philosophy; H. Lotze; J. Martineau; W. G. Ward. Not in a libertarian sense; Leibnitz. New and obscure issues raised by Kant). But there is no continuous tradition or steady trend of discussion. (b) Personal immortality is affirmed as philosophically certain by the Church of Rome and by many Protestant writers. Others teach "conditional immortality." Others base the hope upon faith in the resurrection of Christ. (c) Theodicy—the tradition of Leibnitz—is preserved (on libertarian lines) by Martineau (A Study of Religion, 1883). See abo F. R. Tennant's Origin *and* Propagation of Sin (1902). Others (especially P. T. Forsyth, passim) find in the gospel of redemption the true theodicy.

Apologetics **and** Physical Science.—(a) Copernicanism has won its battles even in the Church of Rome; books which had long occupied a place in the Index have been removed from it. It is not certain that the shock of Copernicanism on supernatural Christianity is exhausted. (b) Geology has also won its battles, and few now try to harmonize it with Genesis, although the celebrated W. E. Gladstone, for whom The Impregnable Rock continued to be Holy Scripture, praised the careful work (R.C.) of Reusch. (c) Evolution came down from the clouds when C. Darwin and A. R. Wallace succeeded in displacing the naive conception of special creation by belief in the origin of species out of other species through a process of natural law. This gave immense vogue to wider and vaguer theories of evolutionary process, notably to H. Spencer's grandiose cosmic formula in terms of mechanism. Here the apologist may himself seek, following John Fiske, to philosophize evolution as a re-statement of natural theology, hinting at personal immortality. Similarly, Tennyson's *In* Memoriam blends with its agnosticism a hopeful view of evolution—"one God, one law, one element and one far-off divine event."

As far as pure science goes, the inference from science in favour of materialism has visibly lost much of its plausibility, and Protestant apologists would probably be prepared to accept in advance all verified discoveries as belonging to a different region from that of faith. Roman Catholic apologetic prefers to negotiate in detail.

Apologetics **and** History.—History brings us nearer the heart of the Christian position. (a) Old Testament criticism won startling victories towards the end of the 19th century. It blots out much supposed knowledge, but throws a vivid light on the reconstrued process of history. Most Protestants accept the general scheme of criticism; those who hang back make not a few concessions. The Roman Catholic Church again prefers an attitude of reserve. (b) New Testament criticism raises even more delicate issues. Positively it may be affirmed that the recovered figure of the historical Jesus is the greatest asset in the possession of modern Christian theology and apologetics. The "Lives" of Christ, Roman Catholic and Protestant, "critical" (D. F. Strauss, **A.** Renan, etc., etc.) and "believing," imply this at least. Negatively, "unchallenged historical certainties" are becoming few in number; though the Tiibingen criticism of F. C. Baur and his school—important as the first scientific attempt to conceive New Testament conditions and literature as a whole—has been abandoned. The synoptic gospels are now treated with respect in responsible quarters. But not all quarters are responsible; and in the effort to grasp scientifically, *i.e.,* accurately, the amazing facts of Christ and primitive Christianity, every imaginable hypothesis is canvassed. "Modernism" appeared within the Church of Rome—where authority condemned it—as well as in Protestantism; it tends to transform some or many doctrines into symbols. The criticism of the Fourth Gospel remains full of uncertainties; but there is less and less tendency to maintain literal authorship by the son of Zebedee. (c) New Testament history. The apologist must maintain (1) that Jesus of Nazareth is a real historical figure—a point never doubted by Strauss although denied by some modern advocates of a mythical theory; (2) that Jesus is knowable (not one "of whom we really know very little"—B. Jowett) in His teaching, example, character, historical personality; and that He is full of moral splendour. On the other hand, faith has no special interest in claiming that we can compose a biographical study of the development of Jesus. Certainly no early writer thought of providing material for such use. Yet the fascination of the subject will always revive the attempt. If it succeeds, there will be a new line of communication along which that great personality will tell on men's minds and hearts. If it fails—there are other channels; character can be known and trusted even when we are baffled by a thing necessarily so full of mystery as the development of a personality. **(3)** Apologists maintain that Jesus "claimed" Messiahship. There are speculative constructions of gospel history which eliminate that claim; and no doubt apologetics could restate its position in a changed form if the paradox of to-day became accepted as historical fact to-morrow. The central apologetic thesis is the uniqueness of the "only-begotten"; perhaps here "the supernatural" passes into the substance of Christian faith. And most probably the description of Jesus as thus unique will continue to be associated with the allegation—He told us so; He claimed Messiahship and "died for the claim." (See preface to 5th ed. of Ecce Homo.) Nor did so superhuman a claim crush Him, or deprive His soul of its balance. He imparted to the title a grander significance out of the riches of His personality. (4) In the light of this the "argument from prophecy" is reconstructed. It ceases to lay much stress upon coincidences between Old Testament predictions or "types" and events in Christ's career. It becomes the assertion: historically, providentially, the expectation of a unique religious figure arose—"the" Messiah; and Jesus gave Himself to be thought of as that great figure. (5) It is also claimed as certain that Jesus had marvellous powers of healing. More reserve is being shown towards the "nature miracles."

In view of the claims of Jesus, different possibilities arise. (i.) The evangelists impute to Him a higher claim than He made. This may be called the rationalistic solution; with sympathy for Christ's ethical teaching, there is relief at minimizing His great claim. So, brilliantly, Wellhausen's Gospel commentaries and *Introduction,* or K. Lake and Foakes Jackson. (ii.) The claim was fraudulent (Reimarus; apparently hinted also in Renan). This is a counsel of despair. (iii.) He was an enthusiastic dreamer, expecting the world's end. Here we have the central clue to

Jesus's teaching, according to Joh. Weiss; but more so in edition I. of his epoch-making *Die Predigt Jesu vom Reiche Gottes*, 1892, than in his later, also important, writings. The eschatological idea becomes the clue to Jesus's whole personality in A. Schweitzer's brilliant *Von Reimarus zu Wrede*, Eng. trans. *Quest of the Historical Jesus;* both these writers were personally Christians of the radical school. This the apologist will recognize as the most plausible hostile alternative. He is bound to admit an element of illusion in Christ's vision of the future; but he will contend that the apocalyptic form did not destroy the spiritual content of Christ's revelations—nay, that it was itself the vehicle of great truths. So he will argue as the essence of the matter that (iv.) He who has occupied Christ's place in history, and won such reverence from the purest souls, was what He claimed to be, and that His many-sidedness comes to focus and harmony when we recognize Him as the Christ of God and the Saviour of the world.

To a less extent, similar problems and alternatives arise in regard to the Church:—Catholicism a compromise between Jewish Christianity and Pauline or Gentile Christianity (F. C. Baur, etc.); Catholicism a Hellenizing of Christianity (A. Ritschl, E. Hatch, A. Harnack); the Catholic Church for good and evil the creation of St. Paul (P. Wernle, H. Weinel); the Church supernaturally guided (R. C. apologetic; in a modified degree High Church apologetic); essential—not necessarily exclusive—truth of Paulinism, essential error in first principles of Catholicism (Protestant apologetic).

BIBLIOGRAPHY.—The classics of apologetic literature and the leading representative men of different periods have been named above. The best modern theology generally reveals the apologetic interest without being technically a contribution to apologetics; but it is too extensive for enumeration here. The following historical works, however, may be mentioned: J. Oman, *Problem of Faith and Freedom;* F. W. Macran, *English Apologetic Theology*. For the 18th century *see* Mark Pattison in *Essays and Reviews* and Leslie Stephen, *English Thought in the Eighteenth Century;* for the 19th century, V. F. Storr, *The Development of English Theology in the Nineteenth Century*. (*See* also THEOLOGY.) (*R.* MA.)

APOLOGUE, a short fable or allegorical story, meant to serve as a pleasant vehicle for some moral doctrine or to convey some useful lesson. One of the best known is that of Jotham in the Book of Judges (ix. 7–15); others are "The City Rat and Field Rat," by Horace, "The Belly and its Members," by the patrician Menenius Agrippa in the second book of Livy, and perhaps most famous of all those of Aesop. The term is applied more particularly to a story in which the actors or speakers are taken from the brute creation or inanimate nature. But an apologue is distinguished from a fable in that there is always some moral sense present, which there need not be in a fable. It is generally dramatic, and has been defined as "a satire in action." Martin Luther thought so highly of apologues as counsellors of virtue that he edited and revised Aesop and wrote a characteristic preface to the volume. The origin of the apologue is extremely ancient and comes from the East. Veiled truth was often necessary in the East, particularly with the slaves, who dared not reveal their minds too openly. It is noteworthy that the two fathers of apologue in the West were slaves, namely Aesop and Phaedrus. La Fontaine in France, Gay and Dodsley in England, Gellert, Lessing, and Hagedorn in Germany; Tomas de Iriarte in Spain, and Krilov in Russia are leading modern writers of apologues. Length is not an essential matter in the definition of an apologue. Those of La Fontaine are often very short, as for example, "Le Coq et la Perle." On the other hand, in the romances of Reynard the Fox we have mediaeval apologues arranged in cycles and attaining epical dimensions.

A work by P. Soullé, *La Fontaine et ses devanciers* (1866), is a history of the apologue from the earliest times until its final triumph in France.

APOLOGY, in its usual sense, an expression of regret for something which has been wrongfully said or done; a withdrawal or retraction of some charge or imputation which is false. For the legal significance of this *see* LIBEL AND SLANDER.

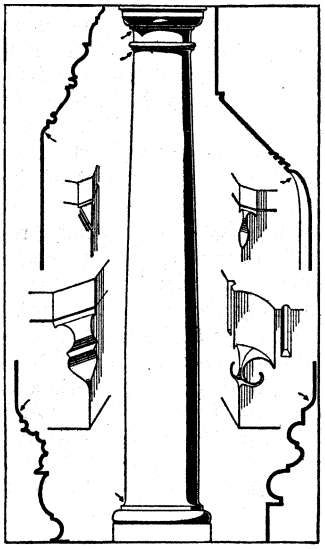
The word "apology" or "apologia" is also used in the sense of defence or vindication, the only meaning of the Greek ἀπολογία, especially of the defence of a doctrine or system, or of religious or other beliefs, etc., *e.g.,* Justin Martyr's *Apology* or J. *H.* Newman's *Apologia pro vita sua. (See* APOLOGETICS.)

APOMORPHINE is used chiefly as an emetic. Its action is on the vomiting centre in the brain and not as a local irritant in the stomach. It works rapidly and should be given by hypodermic injection. The dose is about five milligrams ($\frac{1}{12}$ grain). After injection there is almost immediate nausea followed in about five minutes by vomiting. It is most often used in acute alcoholism and after the ingestion of poisons. The symptoms of an overdose are depression, weakness and respiratory paralysis.

APONEUROSIS, in anatomy, a membrane separating the muscles from each other.

APOPHOROMETER. This apparatus is used for the identification of minerals by means of sublimation (*q.v.*) and has the advantage over the ordinary blowpipe (*q.v.*) tests. It consists of an electrically-heated platinum ribbon, on which the substance under examination is spread, enclosed between two watch glasses. The whole may if necessary be placed in *vacuo* or surrounded by an inert gas.

APOPHTHEGM, a short and pointed utterance. Such sententious remarks as "knowledge is power" are apophthegms. They become "proverbs" by age and acceptance. Plutarch made a famous collection in his *Apophthegmata Laconica.*



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ARROWS INDICATE THE APOPHYGE

APOPHYGE, in architecture, the outward concave sweep sometimes found at the top and bottom of the shaft of a column; also any similar form in a wall or vase, etc.

APOPHYLLITE, a mineral often classed with the zeolites, since it behaves like these when heated before the blowpipe and has the same mode of occurrence; it differs, however, from the zeolites proper in containing no aluminium. It is a hydrous potassium and calcium silicate, $H_7KCa_4(SiO_3)_8+4\frac{1}{2}H_2O$.

Apophyllite always occurs as distinct crystals, which belong to the tetragonal system. The form is either a square prism terminated by the basal planes, or an acute pyramid. A prominent feature of the mineral is its perfect basal cleavage, on which the lustre is markedly pearly, presenting, in white crystals, somewhat the appearance of the eye of a fish after boiling, hence the old name fish-eye-stone or ichthyophthalmite for the mineral. On other surfaces the lustre is vitreous.

Apophyllite is a mineral of secondary origin, commonly occurring, in association with zeolites, in amygdaloidal cavities in basalt and melaphyre. Magnificent groups of greenish and colourless tabular crystals, the crystals several inches across, were found, with flesh-red stilbite, in the Deccan traps of the western Ghâts, near Bombay, during the construction of the Great Indian Peninsular railway. Groups of crystals of a beautiful pink colour have been found in the silver veins of Andreasberg in the Harz and of Guanajuato in Mexico. (L. J. S.)

APOPHYSIS, in anatomy, a bony protuberance; also a botanical term for the swelling of the spore-case in certain mosses.

APOPLEXY, a sudden loss of consciousness, of sensibility, and of movement without any essential modification of the respiratory and circulatory functions, occasioned by some brain disease. The commonest causes are haemorrhage from rupture of a large cerebral artery, or its blockage by a clot formed elsewhere in the circulation (embolism) or local clotting due to disease of the vessel wall itself. A characteristic apoplectic attack presents the following phenomena: the individual falls down suddenly and lies without sense or motion, except that his pulse keeps beating and his

breathing continues. He appears to be in a deep sleep, from which he cannot be roused; the breathing is laboured and stertorous, and is accompanied with puffing out of thr cheeks; the pulse may be beating more strongly than natural, and the face is often flushed. The reflexes are abolished. Although apoplexy may occur without paralysis, and paralysis without apoplexy, there is in most cases definite evidence of paralysis atfecting usually one side of the body in addition to the coma Thus the pupils are unequal; there may be asymmetry of the face, or the limbs may be more rigid or flaccid on one side than on the other. These signs of localized disease enable a distinction to be made from the coma of narcotic poisoning and alcoholic intoxication. It must be borne in mind that a person smelling strongly of liquor and found lying in the street in a comatose state may be suffering from apoplexy, and the error of sending a dying man to a police cell may be avoided by this knowledge. If the fit is only moderately severe, the reflexes soon return, and the patient may in a few hours show indications of returning consciousness by making some movements or opening his eyes when spoken to, although later it may be found that he is unable to speak, or may be paralysed or mentally afflicted (see PARALYSIS). In severe cases the coma deepens and the patient dies, usually from interference with the breathing, or, less commonly, from arrest of the heart's action. Apoplexy may be rapidly fatal but very seldom is instantly fatal.

Treatment.— The patient should be placed in the recumbent position with the head and shoulders slightly raised. He should be moved as little as possible from the place where the attack occurred. The medical man who is summoned will probably give the following directions: an ice-bag to be applied to the head; a few grains of calomel or a drop of croton oil in butter to be placed on the tongue, or an enema of castor oil to be administered. He may find it necessary to draw off the water with a catheter. The practice of blood-letting, once so common in this disease, is seldom resorted to, although in some cases, where there is very high arterial tension and a general state of plethora, it might be beneficial. Depletives are not employed where there is evidence of failure of the heart's action, indeed the cautious administrations of stimulants may be necessary, either subcutaneously or by the mouth (if there exist a power of swallowing), together with warm applications to the surface of the body.

APOROSE, a biological term meaning imperforate, or not porous: there is a group of corals called Aporosa.

APOSIOPESIS, a rhetorical device by which the speaker or writer stops short and leaves something unexpressed, but yet obvious, to be supplied by the imagination. The unfinished first sentence in "As for the clergy ——No; if I say a word against them, I'll be shot" (*Tristram Shandy*) is an example.

APOSTASY, a term generally employed to describe a complete renunciation of the Christian faith, or even an exchange of one form of it for another, especially if the motive be unworthy. In the first centuries of the Christian era, apostasy was most commonly induced by persecution, and was indicated by some outward act, such as offering incense to a heathen deity or blaspheming the name of Christ. In the Roman Catholic Church the word is also applied to the renunciation of monastic vows (apostasis a *monachatu*), and to the abandonment of the clerical profession for the life of the world (apostasis a *clericatu*).

A POSTERIORI: see A PRIORI AND A POSTERIORI.

APOSTIL or **POSTIL,** properly a gloss on a scriptural text, particularly on a gospel text, hence any explanatory note on other writings. The word is also applied to a general commentary, and also to a homily or discourse on the gospel or epistle appointed for the day. The word in Mediaeval Latin was *postilla,* and this has been taken to represent post *illa* sc. verba *textus, i.e.,* "after these words of the text."

APOSTLE (one sent on a mission, an envoy, as in Isa. xviii. 2), a term used in the New Testament and in Christian literature generally, in an increasingly technical sense, for a special envoy of Jesus Christ. In its first and simplest form, the idea is present already in Mark iii. 14 f., where from the general circle of his disciples Jesus "made twelve that they should be with him, and that he might from time to time send them forth (ἵνα ἀποστέλλῃ) to preach and to have authority to cast out demons." Later on (vi. 6 ff.) Jesus begins actually to "send forth" the Twelve, two by two: and it is relative to this mission (vi. 30) they are for the first time described as "apostles" or missionary envoys. Matthew (x. 1 ff.) blends the calling of the Twelve with their actual sending forth, while Luke (vi. 13) makes Jesus himself call them "apostles" (see Luke xi. 49, "prophets and apostles," where Matt. xxiii. 34, has "prophets and wise men and scribes," cf. xiii. 34, "those sent on mission"). But it is doubtful whether Jesus ever used the term for the Twelve any more than for the "seventy others" whom he "sent forth" later (Luke x. 1). The Fourth Gospel never so describes them. It simply has "a servant is not greater than his lord, neither an apostle (envoy) greater than he that sent him" (xiii. 16); and applies the idea of "mission" alike to Jesus (cf. Heb. iii. 1, "Jesus, the apostle . . . of our profession") and to his disciples, generally, as represented by the Twelve (xvii. 18, with 3, 6 ff.). But while ideally all Christ's disciples were "sent" with the Father's Name in charge, there were different degrees in which this applied in practice; and so we find "apostle" used in several senses.

In the Apostolic age itself, "apostle" often denoted simply an "envoy," commissioned by Jesus Christ to be a primary witness and preacher of the Messianic Kingdom. This sense was shown by Lightfoot (commentary on Galatians) to exist in the New Testament, *e.g.,* in I. Cor. xii. 28 f., Eph. iv. 11, Rom. xvi. 7, Rev. ii. 2; and his view has since been emphasized by the discovery of the Teaching of the Twelve Apostles (see DIDACHĒ), with its itinerant order of "apostles." These together with "prophets" (cf. Eph. ii. 20, iii. 5) and "teachers," constituted a *charismatic* and unordained ministry of the Word, in some part of the Church (in Syria?) even during the early sub-apostolic age. Paul, our earliest witness, also (I. Cor. xv. 5 ff.) seems to quote the language of Palestinian tradition, in saying that Christ "appeared to Cephas; then to the Twelve; then . . . to James; then to the apostles one and all (τοῖς ἀποστόλοις πᾶσι); and last of all . . . to me also." The appearance to "all the Apostles" must refer to the final commission given by the risen Christ to certain assembled disciples (Acts i. 6 ff., cf. Luke xxiv. 33), including not only the Twelve and the Lord's brethren (i. 13 f.), but also some of the Seventy. Of this inner circle of personal disciples during Jesus's earthly ministry, we get a further glimpse in the election of one from their number to fill Judas's place among the Twelve (i. 21 ff.), as the primary official witnesses of Messiah and his resurrection. Many of the 120 then present (Acts I. 1 j) must have been disciples who by recent commission had been made "apostles." Among such were Judas Barsabbas and Silas (Acts xv. 22, cf. i. 23), if not also Barnabas (I. Cor. ix. 6) and Andronicus and Junias or Junia (Rom. xvi. 7). If Junia be correct, a woman might be an "apostle" or primary missionary.

So far, we gather that the original Palestinian type of apostleship meant simply (a) personal mission from the risen Christ (cf. I. Cor. ix. 1), following on (b) personal intercourse with Jesus in his earthly ministry. It was pre-eminence in the latter qualification that gave the Twelve their special status among apostles (Acts i. 26, ii. 14, vi. 2; in Acts generally they are simply "the apostles"). Conversely, it was Paul's lack in this respect which lay at the root of his difficulties as an apostle.

It is possible, though not certain, that even those Judaizing missionaries at Corinth whom Paul styles "false-apostles" or, ironically, "the superlative apostles" (II. Cor. xi. 5, 13; xii. 11), rested part of their claim to superiority over Paul on (b), possibly even as having done service to Christ when on earth (II. Cor. xi. 18, 23). There is no sign in II. Cor. that they laid claim to (a). If this be so, they were "Christ's apostles" only indirectly, "through men" (as some alleged touching Paul, cf. Gal. i. 1), *i.e.,* as sent forth on mission work by certain Jerusalem leaders with letters of introduction (II. Cor. iii. 1).

The Twelve.—When Jesus selected an inner circle of disciples for continuous training by personal intercourse, his choice of 'twelve" had direct reference to the tribes of Israel (Matt. xix. 28; Luke xxii. 30). This gave them a symbolic or representative character as a closed body (cf. Rev. xxi. 14), marking them off

as the primary leaders and authority (cf. Acts ii. 42, "the apostles' teaching") among the "disciples" or "brethren," when these began to assume the form of a community or church. Naturally, then, they took the lead, collectively—in form at least though really the initiative lay with one or two of their own number, Peter in particular. The process of differentiation from their fellow-apostles was furthered by the concentration of the Twelve, or at least of their leaders (*cf.* Gal. i. 19), in Jerusalem, for a considerable period (Acts viii. 1, cf. xii. 1 seq.; an early tradition specifies twelve years). Other apostles soon went forth on their mission to "the cities of Israel" (Matt. x. 23, cf. Acts ix. 31 seq.), and so exercised but little influence on the central policy of the Church. Hence their shadowy existence in the New Testament, though Matt. x. 5–42, read in the light of the *Didachē,* may help us to conceive their work in its main features.

"Pillar" Apostles.—But differentiation between apostles existed among the Twelve also. There were "pillars," like Peter and John (and his brother James until his death), who often determined matters of grave moment, as in the conference with Paul in Gal. ii. g. Such pre-eminence was but the sequel of personal distinctions rooted in the preparatory days of discipleship; and it warns against viewing the primitive facts touching apostles in the official light of later times.

The same lesson emerges when we note that one such apostolic "pillar" stood outside the Twelve altogether, viz., James, the Lord's brother (Gal. ii. g, cf. i. 19); and further, that "the Lord's brethren" seem to have ranked above "apostles" generally, being names between them and Peter (in I. Cor. ix. 5). That is, they too were apostles, with the addition of a certain personal distinction.

Such personal pre-eminence has left its marks on the lists of the Twelve in the New Testament. Thus Peter, James, John, Andrew, always appear as the first four, though the order varies, Mark representing relative prominence during Christ's ministry, and Acts (i. 13) actual influence in the Apostolic Church (cf. Luke viii. 51, ix. 28).

Paul, the "Apostle of the Gentiles."—So far apostles are only of the Palestinian type, taken from among actual hearers of the Messiah and with a mission primarily to Jews—apostles "of the circumcision." Now, however, emerges a new apostleship; that to the Gentiles (Gal. ii. 7–9). With the change of mission goes also some change in the type of missionary or apostle. Of this type Paul was the first, and he remained its primary, and in some senses its only, example. Though he could claim, on occasion, to satisfy the old test of having seen the risen Lord (I. Cor. ix. 1, cf. xv. 8), he himself laid stress not on this, but on the revelation within his own soul of Jesus as God's Son, and of the Gospel latent therein (Gal. i. 16). Here lay both his qualification and his credentials, once the fruits of the divine inworking were manifest in the success of his missionary work (Gal. ii. 8 seq.; I. Cor. xi. 1 *seq.;* II. Cor. iii. 2 seq., xii. 12). But this new criterion of apostleship was capable of wider application, one dispensing altogether with vision of the risen Lord—which could not even in Paul's case be proved so fully as for the original apostles—but appealing to the "signs of an apostle" (I. Cor. ix. 2; II. Cor. xii. 12), the tokens of spiritual gift visible in work done, and particularly in planting the Gospel in fresh fields (II. Cor. x. 14–18). It may be in this wide charismatic sense that Paul uses the term in I. Cor. xii. 28 f., Eph. ii. 20, iii. 5, iv. 11. That he used it in senses differing with the context is proved by I. Cor. xv. g, where he styles himself "the least of apostles," although in other connections he claims the very highest rank, co-ordinate even with the Twelve as a body (Gal. ii. 7 seq.), in virtue of his distinctive Gospel.

This poict of view was not always shared even in circles appreciative of his actual work. To many he seemed but a fruitful worker within lines determined by "the twelve apostles of the Lamb" as a body (Rev. xxi. 14). So we read of "the plant (Church) which the twelve apostles of the Beloved shall plant" (*Ascension* of Isaiah, iv. 3); "those who preached the Gospel to us (especially Gentiles) . . .; unto whom He gave authority over the Gospel, being twelve for a witness to the tribes" (Barn. viii. 3, cf. v. g, cf. *The* Preaching of Peter in Clem. Alex.). Later on, however, his own claim told more and more on the Church's mind, and his epistles were read in church as a collection styled simply "the Apostle."

As the primary medium of the Gentile Gospel (Gal. i. 16, cf. i. 8, ii. 2) Paul had no peers, unless it were Barnabas, who shares with him the title "apostle" in Acts xiv. 4, 14—possibly with reference to the special "work" on which they had recently been "sent forth by the Spirit" (xiii. 2, 4).

In the sub-apostolic age, the class of "missionaries" enjoying a charisma conceived to convey apostolic commission through the Spirit, soon became distinguished from "apostles" (cf. Hermas, Sim. ix. 15. 4, "the apostles and teachers of the message of the Son of God," so 25. 2; in 17. 1 the apostles are reckoned as twelve). The title became confined by usage to the Twelve as a body, or to them and Paul (*e.g.,* in Clement and Ignatius), as reverence for these latter grew in connection with their story in the Gospels and in Acts. Thus Eusebius describes as "evangelists" (cf. Philip the Evangelist in Acts xxi. 8, also Eph. iv. 11, 2 Tim. iv. 5) those who "occupied the first rank in the succession to the Apostles" in missionary work (*Hist.* Eccl. iii. 37, cf. v. 10). Yet the adjective "apostolic" was applied to men like Polycarp and even to a certain Alexander, martyred at Lyons in A.D. 177 (Eus. v. 1).

The *authority* attaching to apostles was essentially spiritual in character and in the conditions of its exercise. Anything like officialism among his followers was alien to Jesus's own teaching (Matt. xxiii. 6–11). All Christians were "brethren," and the basis of pre-eminence among them was service. But the personal relation of the original apostles to Jesus himself gave them a unique fitness as authorized witnesses, from which flowed naturally, by spiritual influence, such special forms of authority as they came gradually to exercise in the early Church. "There is no trace in Scripture of a formal cominission of authority for government from Christ Himself" (Hort., *Chr.* Eccl. p. 84) given to apostles, save as representing the brethren in their collective action. Even the "resolutions" (*dogmata*) of the Jerusalem conference were not set forth by the apostles present simply in their own name. They expressed "a claim to deference rather than a right to be obeyed" (Hort, *op. cit.* 81–85). Such was the kind of authority attaching to apostles, whether collectively or individually. It was not a fixed notion, but varied in quantity and quality with the growing maturity of converts. This is how Paul conceives the matter. The exercise of his spiritual authority is not absolute, lest he "lord it over their faith"; consent of conscience or of "faith" is ever requisite (II. Cor. i. 24; cf. Rom. xiv. 23). But the principle was elastic in application, and would take more. patriarchal forms in Palestine than in the Greek world. So the notion of formal or constitutional authority attaching to the apostolate, in its various senses, is an anachronism for the apostolic age. The tendency, however, was for their authority to be conceived more and more on formal lines, and finally as absolute.

This change of conception fostered the notion of a devolution of apostolic powers to successors, constituted by act of ordination. "The doctrine of Apostolic Succession," says Dr. Sanday (The Primitive Church *and* Reunion, 1913, p. 81) "represents a real continuity, expressed in the relative and symbolical form appropriate to the time." In its earliest form it meant re-emergence in others of the apostolic spirit of missionary enthusiasm (Euseb. iii. 37, v. 10). Of apostolic succession in grace conferred by ordination, there is no suggestion before Irenaeus. Clement of Rome (xliv. 2) refers simply to the succession of one set of men to another in an office of apostolic institution. Nor is there even in Irenaeus any idea of sacerdotal grace attaching to the succession in apostolic truth. But once the idea of supernatural grace going along with office as such arose in connection with successio ab apostolis, the full development of the doctrine was but a matter of time. (See C. H. Turner, The Early History of the *Church* and the *Ministry,* ed. Swete, 1918.)

Individual Apostles.—Here the striking thing is the little known of most of the Twelve after the opening of Acts: which suggests doubts as to their ex *officio* influence and authority qua apostles (cf. Rev. xxi. 14).

Andrew (a Greek name): brother of Simon Peter, of Bethsaida on the Lake of Galilee. He had been a disciple of John the Baptist, through whom he first met Jesus (John i. 35–44). After his definite call he lived for a time with Peter and their fishing partners James and John (Luke v. 10), at Capernaum (Mark i. 16 ff. 29). In the gospel story he is present on some important occasions as one of an inner circle among the Twelve (Mark xiii. 3; John vi. 8, xii. 22). In the Fourth Gospel he appears in close association with Philip, his fellow-townsman (vi. 8, xii. 22), whose friendly human spirit he may have shared. After the fall of Jerusalem he seems to have gone with John to the region of Ephesus (Mur. Canon). Later traditions make him preach in Scythia, and suffer crucifixion at Patras in Achaea, on a cross of the form called *decussata* (X) and commonly known as "St. Andrew's cross." His Acts and Gospel were declared apocryphal by the Decretum *Gelasii.* His festival is Nov. 30.

Bartholomew: In the New Testament he appears only in the lists of apostles, always after Philip. This suggests that the name, "son of Tolmai," describes him who is called in John i. 45 ff. Nathanael, who was Philip's special friend, and reappears in xxi. 2, while "Bartholomew" is absent from this Gospel. The legends touching him are various and confused (see Eus. v. 10, Lipsius in Dict. of Chr. Biog. *s.v.,* and M. R. James, *The* Apocryphal N.T., which last may also be consulted for his Gospel). His festival is Aug. 24.

James, Son of Zebedee: Elder brother of John, since he stands before him in the Gospels, save in Luke viii. 51, ix. 28 (cf. Acts i. 13)—where James' early martyrdom (Acts xii. 2) probably affects the perspective. If their mother Salome (Mark xv. 40, Matt. xxvii. 56) was a sister of Mary the mother of Jesus (*cf.* John xix. 25), they were his cousins; and this would suit her requesting special privileges for them in the Messianic Kingdom (Matt. xx. 20 f.) as well as her ministering to Jesus and the Twelve (Mark xv. 40 f., Luke vii. 3) of her means. Perhaps one of them was the companion of Andrew in John i. 35–40. For what was common to him and his brother, including the sobriquet "Boanerges," see JOHN. From his being singled out by Herod Agrippa for martyrdom (in A.D. 44, Acts xii. 2) we may infer that his zealous spirit (Luke ix. 52 ff.) made him a marked leader in the early Jerusalem Church. The legends touching him are not to be trusted (cf. Hastings' *Dict.* of *the* Bible).

James, Son of Alphaeus, as distinct from the last: otherwise unknown. Can he have been brother to the "Levi, son of Alphaeus" of Mark ii. 14 (cf. Matt. x. 3, where "Matthew [= Levi] the Tax-collector" immediately precedes "James the son of Alphaeus")? (cf. JAMES.)

John: see special article.

Judas, Son of James, in Luke's lists (vi. 16, Acts i. 13), instead of Thaddaeus, both probably being names of the same man. Perhaps = "Judas, not Iscariot" in John xiv. 22. In the Edessene Abgar legend (Eus. i. 13) "Judas, who also is Thomas" (see below) sends as envoy ("apostle") Thaddaeus, "one of the Seventy[n]—perhaps a way of removing Thaddaeus from the Twelve in favour of Lebbaeus, whom the "Western" text substituted.

Judas Iscariot: see special article.

Matthew: see special article.

Nathanael (see above "Bartholomew"): in John xxi. 2 he is described as of Cana in Galilee.

Peter: see special article.

Philip: the fifth in all lists (Matt. x. 3; Mark iii. 18; Luke vi. 14; Acts i. 13). He is a mere name in the Synoptics, but rather prominent in the Fourth Gospel. There he is "of Bethsaida, the city of Andrew and Peter"; like them he first meets Jesus when a disciple of the Baptist "beyond Jordan"; and at once he introduces Nathanael to Jesus (John i. 43–45; cf. 28). His close association with Andrew continues in this Gospel (xii. 21 seq., cf. vi. 5, 8). Philip is also one of the few interlocutors in John xiv. (8 seq.). The character suggested by all these passages is one marked by quick and large human sympathies, a friendly man. Some see in the similarity of characteristics between him and Philip the Evangelist in Acts proof that the picture of the Apostle in the Fourth Gospel has been coloured by confusion with the latter, who seems to have been a prominent figure in the region where this Gospel took shape. Such confusion arose later on (see Eus. iii. 31, 39, v. 24, cf. Clem. Alex. Strom. iii. 6), and may make the Apostle's residence in Asia Minor doubtful (yet see Lightfoot, Coloss. 45 seq.); but hardly warrants the inference as to the Fourth Gospel (*cf.* the two "Johns" s.v. JOHN). Philip appears in various late apocryphal writings (see *e.g.* M. R. James, The Apocryphal N.T.), probably with no historical basis.

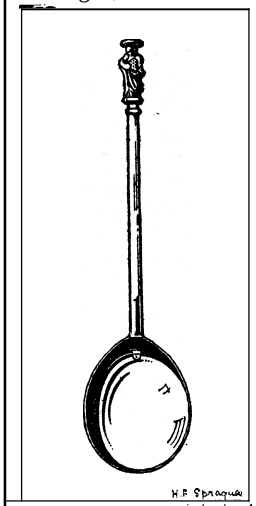
Simon, the Cananaean = "the Zealot" (as Luke vi. 15, Acts i. 13) in Aramaic, a name borne by those burning with patriotic anger against the Roman domination and inclined to a policy of force. Whether Simon had actually been one of them is not clear. If so, his fidelity to Jesus is a tribute to his Master's spiritual power.

Thaddaeus: perhaps the Greek name (? = Theudas, so Dalman, *Words* of *Jesus,* p. 50) of "Judas (son) of James" (above). In legend he is the missionary of Edessa (Eus. i. 13): see above "Judas."

Thomas: interpreted in John xi. 16, xx. 24, xxi. 2 by "Didymus" or "Twin," and there playing a significant part as a type of serious minded loyalty in the face of hard daunting facts. In John xiv. 22 Syr. Sin. reads Thomas for Judas, possibly with reference to his questioning mind (xx. 24 seq.), cf. Judas above. For his story outside the New Testament, see THOMAS, ST.

BIBLIOGRAPHY.—In England the modern treatment of the subject dates from J. B. Lightfoot's dissertation in his Commentary on Galatians, to which F. J. A. Hort's The Christian Ecclesia added elements of value; see also T. M. Lindsay, The Church and The *Ministry,* and arts. in Hastings' *Dict. of the Bible* and the *Encyc. Biblica;* H. Monnier, La Notion de Papostolat, des origines *à Irenée* (Paris, 1903); A. Harnack, The Constitution and Law of the Church (1910); The Early History of the *Church* and *the Ministry,* ed. H. B. Swete (1918); C. Gore, *The Church and the Ministry* (1919). The later legends and their sources are examined by Lipsius, Die Apok. Apostelgeschichten (1881–), and T. Schermann, *Propheten- und Apostellegenden* (Leipzig, 1907), cf. F. Haase, Apostel u. *Evangelisten in* dem Orient (Miinster, 1922). (J. V. B.)

APOSTLE SPOONS, a set of spoons, usually of silver or silver gilt, with the handles terminating in figures of the apostles, each bearing their distinctive emblem. They were common baptismal gifts during the 15th and 16th centuries. See C. G. Rupert, Apostle Spoons (Oxford. 1929)



COURTESY OF METROPOLITAN MUSEUM OF ART

A SILVER-GILT APOSTLE SPOON OF THE 15TH CENTURY

The figure is that of St. Peter and is topped by an eagle seal

APOSTOLIC CANONS, a collection of 85 rules for the regulation of clerical life, appended to the 8th book of the *Apostolical Constitutions.* The canons may be a little later in date than the preceding Constitutions, but they are evidently from the same theological circle. (See APOSTOLIC CONSTITUTIONS.)

APOSTOLIC CONSTITUTIONS, a collection of ecclesiastical regulations in eight books, the last of which concludes with the 85 Canons of the Holy Apostles, in Greek, Διαταγαί or Διατάξεις τῶν ἁγίων ἀποστόλων διὰ Κλήμεντος τοῦ Ῥωμαίων ἐπισκόπου τε καὶ πολίτου. Καθολικὴ διδασκαλία. By their title the Constitutions profess to have been drawn up by the apostles, and to have been transmitted to the Church by Clement of Rome; sometimes the alleged authors are represented as speaking jointly, sometimes singly. From the first they have been very variously estimated; the *Canons,* as a rule, more highly than the rest of the work. The most extravagant estimate of all was that of Whiston, who calls them "the most sacred standard of Christianity, equal in authority to the Gospels themselves, and superior in authority to the epistles of single apostles, some parts of them being our Saviour's own original laws delivered to the apostles, and the other parts the public acts of the apostles." (Historical preface to Primitive Christianity *Revived,* pp. 85–86.) Others, however, real-

ized their composite character from the first, and by degrees some of the component documents became known. Bishop Pearson was able to say that "the eight books of the Apostolic Constitutions have been after Epiphanius's time compiled and patched together out of the didascaliae or doctrines which went under the names of the holy apostles and their disciples or successors" (Vind. *Ign.*, i., cap. 5); whilst a greater scholar still, Archbishop Usher, had already gone much further. Writing in 1644, and forestalling the results of modern critical methods, he had concluded that their compiler was none other than the compiler of the spurious Ignatian epistles (*i.e.*, the epistles in the longer of the two Greek versions). The Apostolical Constitutions, then, are spurious, and they are one of a long series of documents of like character.

These documents are the outcome of a tendency which is found in every society, religious or secular, at some point in its history. The society begins by living in accordance with its fundamental principles. By degrees these translate themselves into appropriate action. Difficulties are faced and solved as they arise; and when similar circumstances recur they will tend to be met in the same way. Thus there grows up by degrees a body of what may be called customary law. Plainly, there is no particular point of time at which this customary law can be said to have begun. To all appearances it is there from the first in solution and gradually crystallizes out; and yet it is being continually modified as time goes on. Moreover, the time comes when the attempt is made, either by private individuals or by the society itself, to put this "customary law" into writing. Now when this is done, two tendencies will at once show themselves. (a) This "customary law" will at once become more definite: the very fact of putting it into writing will involve an effort after logical completeness. There will be a tendency on the part of the writer to fill up gaps; to state local customs as if they obtained universally; to introduce his personal equation, and to add to that which is the custom that which, in his opinion, ought to be. (b) There will be a strong tendency to fortify that which has been written with great names, especially in days when there is no very clear notion of literary property. This is done, not with any really deliberate consciousness of fraud, but rather to emphasize the importance of what was written, and the fact that it was no new invention of the writer's. In a non-literary age fame gathers about great names; and that which, ex hypothesi, has gone on since the beginning of things is naturally attributed to the founders of the society. Then come interpolations to make this ascription more probable, and the prefixing of a title, then or subsequently, which states it as a fact. This is precisely the way in which the Apostolical Constitutions and other kindred documents have come into being. They contain evidence of the greatest value as to the order of the Church in early days; evidence, however, which needs to be sifted with the greatest care, since the personal preferences of the writer and the customs of the local church to which he belongs are continually mixed up with things which have a wider prevalence. The earliest collections of this kind, which are known to us, are the *Didachē* or Teaching of the Twelve Apostles, itself compiled from earlier materials, and dating from about 120 (see DIDACHĒ); *The* Apostolic *Church* Order dating from about 300 and containing older fragments of Church law, including parts of the *Didachē;* and the Didascalia *Apostolorum,* originally written in Greek, but known through a Syriac version and a fragmentary Latin one published by Hauler. It is of the middle of the 3rd century—in fact, a passage in the Latin translation seems to give us the date A.D. 254. It emanates from Palestine or Syria, and is independent of the documents already mentioned; and upon it the Constitutions themselves very largely depend (see also under HIPPOLYTUS, CANONS OF).

The Constitutions fall into three main divisions. (1) The first of these consists of books i.–vi., and throughout runs parallel to the Didascalia. (2) Then follows book vii., the first 31 chapters of which are an adaptation of the *Didachē,* while the rest contain various liturgical forms of which the origin is still uncertain. (3) Book viii. is more composite and falls into three parts. The first two chapters, *περὶ χαρισμάτων,* may be based upon a lost work of St. Hippolytus, otherwise known only by a reference to it in the preface of the Verona Latin Fragments; and an examination shows that this is highly probable. The next section, cc. 3–27, *περὶ χειροτονιῶν,* and cc. 28–46, *περὶ κανόνων* is twofold, and is evidently that upon which the writer sets most store. The apostles no longer speak jointly, but one by one in an apostolic council, and the section closes with a joint decree of them all. They speak of the ordination of bishops (the so-called Clementine Liturgy is that which is directed to be used at the consecration of a bishop, cc. 5–15), of presbyters, deacons, deaconesses, sub-deacons and lectors, and then pass on to confessors, virgins, widows and exorcists; after which follows a series of canons on various subjects, and liturgical formulae. The third section consists of the Apostolic Canons already referred to, the last and most significant of which places the Constitutions and the two epistles of Clement in the canon of Scripture, and omits the Apocalypse. They are derived in part from the preceding Constitutions, in part from the canons of the councils of Antioch, 341, Nicaea, 325, and possibly Laodicaea, 363.

Who, then, is the author of the Constitutions, and what can be inferred with regard to him? (1) By separating off the sources which he used from his own additions to them, it at once becomes clear that the latter are the work of one man: the style is unmistakable, and the method of working is the same throughout. The compiler of books i.–vi. is also the compiler of books vii. and viii. (2) As to his theological position, different views have been held. He betrays a strong subordinationist tendency, together with a denial of a human soul to Christ, and the like, which suggest not indeed Arianism but an inclination towards Arianism; and his polemic is directed against the dying heresies of the 3rd century. All this points to the position of a "conservative" or semi-Arian of the East, one who belongs, perhaps, to the circle of Lucian of Antioch and writes before the time of Julian. It is hard to think of any other time or circumstances in which a man could write like this. (3) The indications of *time* have been held to point to a different conclusion. In the cycle of feasts occur the names of several which are probably of later date—*e.g.*, Christmas and St. Stephen, which were introduced at Antioch c. A.D. 378 and 379 respectively; and Epiphanius (*c.* A.D. 374) appears to be unacquainted with it; he still quotes from the Didascalia, and elaborately explains it away where it is contrary to the usages of his own day. But as regards the former point, it is possible that the Apostolical Constitutions gave rise to these festivals; or, on the other hand, that the two passages were subsequently introduced either by the writer himself or by some other hand, when the last book of the Constitutions was being used as a law-book. And as regards the latter, the fact that Epiphanius does not use the Constitutions is no proof that they had not yet been compiled. (4) As to the region of composition there is no real doubt. It was clearly the East, Syria or Palestine. Many indications are against the latter, and Syria is strongly suggested by the use of the Syro-Macedonian calendar. Moreover, the writer represents the Roman Clement as the channel of communication between the apostles and the Church. This fact both supplies him with the name by which he is commonly known, Pseudo-Clement, and also furnishes corroboration of his Syrian birth; since the other spurious writings bearing the name of Clement, the Homilies and Recognitions, are likewise of Syrian origin.

It seems clear, then, that the compiler was a Syrian, and that he also wrote the spurious Ignatian epistles; he was likewise probably a semi-Arian of the school of Lucian of Antioch. His date is given by Harnack as A.D. 340–360, with a leaning to 340–343; by Lightfoot as the latter half of the 4th century; by Brightman, 370–380; by Maclean, 375; and by Funk as the beginning of the 5th century.

BIBLIOGRAPHY.—Funk, *Die Apostolischen Canonen* (1891); Brightman, *Liturgies Eastern and Western* (1896); Wordsworth (Bishop of Salisbury), *The Ministry of Grace* (1901); Maclean, *Recent Discoveries illustrating Early Christian Worship* (1904); and references to Continental writers in Herzog-Hauck, *Realencyklopiidie.* An English translation of *Ap. Const.*, bk. viii., is included in Clark's "Ante-Nicene Christian Library."

APOSTOLIC FATHERS, a term used to distinguish those early Christian writers who were believed to have been the per-

sonal associates of the original apostles. While the title '(Fathers" was given from at least the beginning of the 4th century to church writers of former days, as being the parents of Christian belief and thought for later times, the expression "Apostolic Fathers" dates only from the latter part of the 17th century. Here already appears the doubt as to how many writers can claim the title, a doubt which has continued ever since, and makes the contents of the "Apostolic Fathers" differ so much from editor to editor.

The degree of historic claim which these various writings have to rank as the works of Apostolic Fathers varies greatly on any definition of "apostolic." Originally the epithet was meant to be taken strictly, viz., as denoting those whom history could show to have been personally connected, or at least coeval, with one or more apostles; so that editions tended to vary with the historical views of editors. But the convenience of the category "Apostolic Fathers" to express not only those who might possibly have had some sort of direct contact with apostles—such as "Barnabas," Clement, Ignatius, Papias, Polycarp—but also those who seemed specially to preserve the pure tradition of apostolic doctrine during the sub-apostolic age, has led to its general use in a wide and vague sense.

Conventionally, then, the title denotes the group of writings which, whether in date or in internal character, are regarded as belonging to the main stream of the church's teaching during the period between the apostles and the apologists (*i.e.,* to *c.* A.D. 140), and which therefore represent the momentous process of transition from the type of teaching in the New Testament to that which meets us in the early Catholic Fathers, from the last quarter of the 2nd century onwards. The oldest writings in the group, those which are best entitled to their name in any strict sense, are epistles, and in this respect also akin to apostolic writings. The authors (especially Ignatius and Polycarp) are conscious of the gulf between themselves and apostles like Peter and Paul in claim to authority; thus Polycarp, in explaining that he writes to exhort the Philippians only at their own request, adds, "for neither am I, nor is any other like me, able to follow the wisdom of the blessed and glorious Paul" (iii.2). The *Epistle of Clement* conforms more to the elaborate and treatise-like form of the *Epistle to the Hebrews,* on which it draws so largely; and the same is true of "Barnabas." But one and all are influenced by study of apostolic epistles, and witness to the impression which these produced on the men of the next generation. Unconsciously, too, they correspond to the apostolic type of writing in another respect, viz., their occasional and practical character. They are evoked by pressing needs of the hour among some definite body of Christians and not by any literary motive. They are veritable "human documents," with the personal note running through them. They are personal expressions of Christianity, in which are discernible also specific types of local tradition. To such spontaneous actuality, a large part of their interest and value is due.

Nor is this quality really absent even from the writing which is least entitled to a place among Apostolic Fathers, the *Epistle to Diognetus.* This beautiful picture of the Christian life as a realized ideal, and of Christians as "the soul" of the world, though in form addressed to an individual, is in spirit so personal a testimony to what the Gospel has done for the writer and his fellow Christians, that it is akin to the piety of the Apostolic Fathers as a group.

If thus related to the apologists of the middle of the 2nd century, the *Epistle to Diognetus* has also points of contact with one of the most practical and least literary writings found among our Apostolic Fathers, viz., the homily originally known as the *Second Epistle of Clement (see* CLEMENTINE LITERATURE). In all probability we have here the earliest extant sermon preached before a Christian congregation, about A.D. 120–140. Homily passes into allegory and recorded vision in the *Shepherd of Hermas,* which as a literary whole dates from about A.D. 140, but probably represents a more or less prolonged prophetic activity on the part of its author, the brother of Pius, the Roman bishop of his day (*c.*139–154). The prophetic and apocalyptic note, which characterizes Hermas among the Apostolic Fathers is a genuinely primitive trait and goes far to explain the vogue which the *Shepherd* enjoyed in the generations immediately succeeding, as also the influence of its disciplinary policy, which is its prophetic "burden" *(see* HERMAS, SHEPHERD OF).

We come finally to the anonymous *Teaching of the Twelve Apostles* and Papias's *Exposition of Oracles of the Lord,* so far as this is known to us. The former, besides embodying catechetical instruction in Christian conduct (the "Two Ways"), which goes back in substance to the early apostolic age and is embodied also in "Barnabas," depicts in outline the fundamental usages of church life as practised in some conservative region about the last quarter of the 1st century and perhaps even later. The whole is put forth as substantially the apostolic teaching (*Didachē*) on the subjects in question. This is probably a bona fide claim. It expresses the feeling common to the Apostolic Fathers and general in the sub-apostolic age, at any rate in regions where apostles had once laboured, that local tradition, as held by the recognized church leaders, did but continue apostolic doctrine and practice *(see* DIDACHĒ).

The question of external form passes readily over into that of the *internal character and spirit.* As Lightfoot points out, however, personality, with its variety of temperament and emphasis, largely colours the Apostolic Fathers, especially the primary group. Clement has all the Roman feeling for duly constituted order and discipline; Ignatius has the Syrian or semi-oriental passion of devotion, showing itself at once in his mystic love for his Lord and his over-strained yearning to become His very "disciple" by drinking the like cup of martyrdom; Polycarp is, above all things, steady in his allegiance to what had first won his conscience and heart, and his "passive and receptive character" comes out in the contents of his epistle. Of the rest, whose personalities are less known to us, Papias shares Polycarp's qualities and their limitations, the anonymous homilist and Hermas are marked by intense moral earnestness, while the writer to Diognetus joins to this a profound religious insight.

When, however, we examine the doctrinal contents of these writings, we find that the perspective of the Gospel was seriously changed and its most distinctive features obscured. This was specially the case with the experimental doctrines of grace. Here the central glory of the Cross as "the power of God unto salvation" suffered some eclipse, although the passion of Christ was felt to be a transcendent act of Divine Grace in one way or another. But even more serious was the loss of an adequate sense of the contrast between "grace" and "works" as conditions of salvation.

In attempting a final estimate of their *value for the historian to-day,* we may sum up under these heads: ecclesiastical, theological, religious. *(a)* As a mine of materials for reconstructing the history of church institutions they are invaluable, and that largely in virtue of their spontaneous character, with no view to the public generally or to posterity. *(b)* Theologically, as a stage in the history of Christian doctrine, their value is as great negatively as positively. Impressive as is their witness to the persistence of the apostolfc teaching in its essential features, amidst all personal and local variations, perhaps the most striking thing about these writings is the degree in which they fail to appreciate certain elements of the apostolic teaching as embodied in the New Testament. This negative aspect has a twofold bearing. Firstly, it suggests the supernormal level to which the apostolic consciousness was raised at a bound by the direct influence of the Founder of Christianity, and justifies the marking-off of the apostolic writings as a canon, or body of Christian classics of unique religious authority. To this principle Marcion's Pauline Canon is a witness, though in too one-sided a spirit. Secondly, it means that the actual development of ecclesiastical doctrine began, not from the apostolic consciousness itself, but from a lower level, that of the inadequate consciousness of the sub-apostolic church. This theological "retrogression" is of much significance for the history of dogma. *(c)* On the other hand, there is great religious and moral continuity, beneath even theological discontinuity, in the life working below all conscious apprehension of the deeper ideas involved (E. von Dobschiitz, *Christian Life in the Primitive Church,* 1905). There is continuity in character; the Apostolic Fathers strike us as truly good men, with a goodness

raised to a new type and power. This is what the Gospel of Christ aims chiefly at producing as its proper fruit; and the Apostolic Fathers would have desired no better record than that they were themselves genuine "epistles of Christ."

BIBLIOGRAPHY.—The most useful edition for ready reference, containing texts and translations, is that of Kirsopp Lake in the *Loeb Classical Library* (1912); and Lightfoot's one-volume edition, *The Apostolic Fathers* (1891) is still useful. The most important complete editions in modern times are those of Funk (1901); Lightfoot (1885 ff.); and Gebhardt, Harnack, and Zahn (jointly, 1875 ff.).

APOSTOLICI, APOSTOLIC BRETHREN. This name has been applied to certain sects which sought to imitate the manner of life of the Apostles of Christ. The first of these were celibate communists in Asia Minor during the 4th and 5th centuries. They professed an ascetic rigidity of morals (Epiphanius, *Haereses*, 61) and are also called *Apoctactites* or *Renuntiatores*. The name is also applied to sects with Manichean principles which appeared in western Germany and France in the 12th century. More properly, the name is applied to the *Order of Apostles* or *Apostolic Brethren* which appeared in the second half of the 13th century in Italy.

This was a product of the mystic fermentation which proceeded from exalted Franciscanism and from Joachimism *(see* FRATICELLI and JOACHIM OF FLORIS). The order of the Apostles was founded about 1260 by a young workman from the environs of Parma, Gerard Segerelli (or Segalelli), who had been barred from the Franciscan order. He attempted to imitate the external aspects of Christ's life, and was followed by a throng of men and women, peasants and mechanics. They lived in absolute poverty, chastity, and idleness, begging, and preaching repentance. They were condemned by the Second Ecumenical Council of Lyons (1274) and by Pope Honorius IV (1286). The Council of Chichester (1289) took measures against the *Apostles* of England. In 1290 Pope Nicholas IV fulminated a new bull against them. Repressions followed and on July 18, 1300, Segerelli was finally burned at the stake in Parma.

They had had close relations with the dissident Franciscans, but the Spirituals often disavowed them, especially when the sect, which in Segerelli's time had had no very precise doctrinal character, became with Dolcino frankly heterodox. Dolcino of Novara was brought up at Vercelli, and had been an "Apostle" since 1291. Thrice he fell into the hands of the Inquisition, and thrice recanted. But immediately after Segerelli's death he gave himself out as an angel sent from God to elucidate the prophecies. Soon he founded an *Apostolic congregation* at whose head he placed himself. He taught almost the same principles of devotion as Segerelli, but the Messianic character which he attributed to himself, the announcement of a communistic millennia1 kingdom, and, besides, an aggressive anti-sacerdotalism, gave to Dolcino's sect a clearly marked character, analogous only to the theocratic community of the Anabaptists of Munster in the 16th century. On June 5, 1305, Pope Clement V., recognizing the impotence of the ordinary methods of repression, issued bulls for preaching a crusade against the Dolcinists. But four crusades, directed by the Bishop of Vercelli, were required to reduce the little army of the heresiarch, entrenched in the mountains in the neighbourhood of Vercelli. Not till March 23, 1307, were the sectaries definitively overcome. The Catholic crusaders seized Dolcino in his entrenchments on Mt. Rubello. At Vercelli he suffered a horrible punishment. He was torn in pieces with red-hot pincers—the torture lasting an entire day. Dante mentions Dolcino's name *(Inferno*, c.xxviii.), and his memory is not yet completely effaced in the province of Novara. The "Apostles" continued their propaganda in Italy, Languedoc, Spain and Germany. They were constantly attacked by the Inquisition; but the movement lingered on to the beginning of the 15th century.

APOSTOLIC MAJESTY, a title borne by the kings of Hungary. In A.D. 1001 it was conferred by Pope Silvester II. upon St. Stephen (975–1038), the first Christian king of Hungary, in return for his zeal in seeking for the conversion of the heathen. It was renewed by Pope Clement XIII. in 1758 in favour of the Fmpress Maria Theresa and her descendants, and borne by the emperors of Austria as kings of Hungary until 1918.

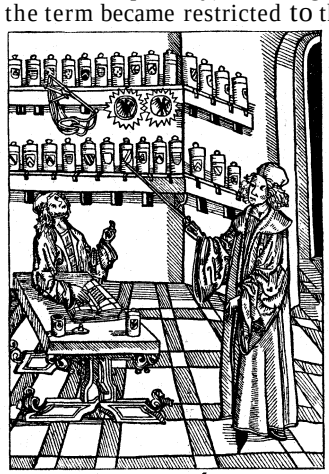
APOSTOLIUS, MICHAEL (died *c.* 1480), a Greek theologian and rhetorician of the 15th century. When, in 1453, the Turks conquered Constantinople, his native city, he fled to Italy, and there obtained the protection of Cardinal Bessarion. He afterwards retired to Crete, where he earned a scanty living by teaching and by copying manuscripts. Many of his copies are still to be found in the libraries of Europe. One of them, the *Icones* of Philostratus at Bologna, bears the inscription: "The king of the poor of this world has written this book for his living."

Of his numerous works a few have been printed: Παροιμίαι (Basel, 1538), now exceedingly rare; a collection of proverbs in Greek, of which a fuller edition appeared at Leyden, "Curante Heinsio," in 1619; "Oratio Panegyrica ad Fredericum III." in Freher's *Scriptores Rerum Germanicarum*, vol. ii. (Frankfort, 1624); Georgii Gemisthi Plethonis et Mich. Apostolii, *Orationes funebres duae in quibus de Immortalitate Animae exponitur* (Leipzig, 1793); and a work against the Latin church and the council of Florence in Le Moine's *Varia Sacra*.

APOSTROPHE, the name given to an exclamatory rhetorical figure of speech; it means also the sign (') for the omission of a letter or letters, *e.g.*, in "don't" (Gr. ἀποστροφή, turning away). In physiology, "apostrophe" is used more precisely in its literal meaning of "turning away," *e.g.*, for movement away from the light.

APOTACTITES or **APOTACTICI,** a sect of early Christians, who renounced all their worldly possessions (Gr. ἀποτακτός set apart). *(See* APOSTOLICI *ad init.*)

APOTHECARY, by derivation, a warehouseman (ἀποθήκη, a store or repository). During the middle ages the application of the term became restricted to those who prepared and sold drugs, and is employed in that sense today in America, Scotland and on the Continent. In England, however, the apothecary has become a general medical practitioner. The Apothecaries' Society of London by royal charters and acts of parliament exercises the power of granting licences to practise medicine.



FROM "LE JARDIN DE SANTÉ," C. 1510
A DOCTOR OF THE MIDDLE AGES IN HIS LABORATORY

From early records we learn that the different branches of the medical profession were not regularly distinguished in England till the 16th century when separate duties were assigned to them, and peculiar privileges were granted to each. In 1518 the physicians of London were incorporated, and the Company of Barber-Surgeons incorporated originally in 1461 but without disciplinary powers, were reincorporated in 1540 and given these powers. But, independently of the physicians and surgeons, there were a great number of irregular practitioners, who were more or less molested by their legitimate rivals, and it became necessary to pass an Act in 1543 for their protection and toleration. As many of these practitioners kept shops for the sale of medicines, the term "apothecary" was used to designate their calling.

For the next two centuries the status of apothecaries underwent gradual consolidation and they acquired additional powers until in 1815 the Society of Apothecaries was given powers of examination by act of Parliament. Armed with these the society insisted on courses of medical study in candidates for its licence to practise. In common with all other licensing bodies the curriculum it imposes and the examination3 it conducts are subject to scrutiny and approval by the General Medical Council.

The Apothecaries' Society is governed by a master, two wardens and 21 assistants. The members are divided into three grades, yeomanry or freemen, the livery, and the court. The hall of the society, situated in Water Lane, London, and covering about three-quarters of an acre, was acquired in 1632. It was destroyed by the Great Fire, but was rebuilt about ten years later, and enlarged in 1786. This is the only property possessed by the society. In 1673, the society established a botanic and physic garden at Chel-

sea, and in 1722 Sir Hans Sloane, who had become the ground owner, gave it to the society on the condition of presenting annually to the Royal Society 50 dried specimens of plants till the number should reach 2,000. This condition was fulfilled in 1774. Owing to the heavy cost of maintenance and other reasons, the "physic garden" was handed over in 1902, with the consent of the Charity Commissioners, to a committee of management, to be maintained in the interests of botanical study and research.

See C. *R.* B. Barrett, *The History of the Society of Apothecaries of London* (1905).

APOTHEOSIS, literally deification (Gr. ἀποθεοῦν, to make a god, to deify). The term properly implies a clear polytheistic conception of gods in contrast with men, while it recognizes that some men cross the dividing line. It is characteristic of polytheism to blur that line in several ways. Thus the ancient Greek religion was especially disposed to belief in heroes and demigods. Founders of cities, and even of colonies, received worship; the former are, generally speaking, mythical personages and, in strictness, heroes. But the worship after death of historical persons, such as Lycurgus, or worship of the living as true deities, *e.g.,* Lysander and Philip II. of Macedon, occurred sporadically even before Alexander the Great's (*q.v.*) conquests brought Greek life into contact with oriental traditions. It was inevitable, too, that ancient monarchies should enlist polytheistic conceptions of divine or half-divine men in support of the dynasties; "Seu deos regesve *canit deorum Sanguinem,*" Horace (Odes, iv. 2, ll. 13, 14) writes of Pindar; though the reference is to myths, yet the phrase is significant. Whatever part vanity or the flattery of courtiers may have played with others, or with Alexander, it is significant that the dynasties of the Seleucids (*q.v.*) and Ptolemies (*q.v.*), Alexander's successors, claim divine honours of some sort. Theocritus (Idyll 17) hails Ptolemy Philadelphus as a demigod, and speaks of his father as seated among the gods along with Alexander (on Alexander as a god, with reference to special political reasons, see *Camb. Anc. Hist.* VI.). Ancestor worship, or reverence for the dead, was a third factor. It may work even in Cicero's determination that his daughter should enjoy ἀποθέωσις as he writes to Atticus—or receive the "honour" of consecrntio (fragment of his De *Consolatione*). Lastly, we need not speak of mere sycophancy. Yet it was common; Verres was worshipped before he was impeached!

The Romans had, up to the end of the republic, accepted only one official apotheosis: the god Quirinus, whatever his original meaning, having been identified with Romulus. But the emperor Augustus carried on the tradition of ancient statecraft by having Julius Caesar recognized as a god (*divus Iulius*), the first of a new class of deities proper (divi). The tradition was steadily followed and was extended to some women of the imperial family and even to imperial favourites. Worship of an emperor during his lifetime, except as the worship of his *genius,* was in general confined to the provinces. Apotheosis, after his death, being in the hands of the senate, did not at once cease, even when Christianity was officially adopted. The Latin term is *consecratio,* the Greek ἀποθέωσις, probably a coinage of the Hellenistic epoch, and occasionally used in a weakened sense. The squib of the philosopher Seneca on the memory of Claudius (d. A.D. 54), *Apocolocyntosis* ("pumpkinification"), is evidence that, as early as Seneca's lifetime, apotheosis was in use for the recognition of a departed emperor as a god. It also indicates how much contempt might be associated with this pretended worship. The people, says Suetonius (*Jul. Caes.* c. 88), fully believed in the divinity of Julius Caesar, hinting at the same time that this was by no means the case with the majority of the apotheoses subsequently decreed by the senate. Yet we hear that Marcus Aurelius was..still worshipped as a household divinity in the 4th century, and was earlier believed to impart revelations in dreams (*Vit.* M. *Ant.* c. 18). Antinous, the favourite of Hadrian, was adored in Egypt a century after his death (Origen, Contra *Celsum,* iii. 36). The ceremonies attendant on an imperial apotheosis are very fully described by Herodianus (bk. iv. c. 2) on occasion of the obsequies of Severus, which he appears to have witnessed. The most significant was the liberation, at the moment of kindling the funeral pyre, of an eagle which was supposed to bear the emperor's soul to heaven. Sharp-sighted persons had actually beheld the ascension of Augustus (Suet. *August.* c. 100) and of Drusilla, sister of Caligula. Representations of apotheoses occur on several works of art; the most important are the apotheosis of Homer on a relief in the Townley collection of the British Museum, that of Titus on the arch of Titus, and that of Augustus on a magnificent cameo in the Louvre. (See ANCESTOR-WORSHIP.)

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APPALACHIAN MOUNTAINS, the general name of a mountain system in North America, partly in Canada, but mostly in the United States, extending from Newfoundland, Gasp6 peninsula and New Brunswick, 1,500m. south-westward to Central Alabama. The whole system may be divided into three great regions: the northern, from Newfoundland to the Hudson river; the *central,* from the Hudson valley to that of New river (Kanawha), in Virginia and West Virginia; and the southern, from New river onwards. The northern region includes the Shickshock mountains and Notre Dame range in Quebec, scattered elevations in Maine, the White mountains and the Green mountains; the central comprises, besides various minor groups, the Valley ridges between the front of the Allegheny plateau and the Great Appalachian valley, the New York and New Jersey highlands and a large portion of the Blue ridge; and the southern consists of the prolongation of the Blue ridge, the Unaka range, and the Valley ridges adjoining the Cumberland plateau, with some lesser ranges. The Appalachian belt includes, with the ranges enumerated above, the plateaus sloping southward to the Atlantic in New England, and south-eastward to the border of the coastal plain through the central and southern Atlantic States; and on the north-west, the Allegheny and Cumberland plateaus declining toward the Great Lakes and the interior plains. A remarkable feature of the belt is the longitudinal chain of broad valleys—the Great Appalachian valley—which in the southerly regions divides the mountain system into two subequal portions, but in the northernmost lies west of all the Appalachian ranges, and separates them from the Adirondack group.

The mountain system has no axis of dominating altitudes, but in every portion the summits rise to rather uniform heights, and especially in the central region, the various ridges and intermontane valleys have the same trend as the system itself. None of the summits reaches the region of perpetual snow. Mountains of the Long range in Newfoundland reach heights of nearly 2,000feet. In the Shickshocks the higher summits rise to about 4,000ft. elevation. In Maine four peaks exceed 3,000ft., including Katahdin (5,273ft.); in the White mountains a number of summits rise above 5,000ft., including Mount Washington (6,293 ft.). In the Green mountains the highest point, Mansfield, is 4,406ft.; and a number of other heights exceed 3,000feet. The Catskills are not properly included in the system. The Blue ridge, rising in southern Pennsylvania and there known as South mountain, attains in that State elevations of about 2,000ft.; southward to the Potomac its altitudes diminish, but 30m. beyond again reach 2,000feet. In the Virginia Blue ridge the highest peaks are: Mary's rock, 3,523ft.; peaks of Otter, 4,001 and 3,875; Stony Man, 4,031; Hawks Bill, 4,066. In Pennsylvania the summits of the Valley ridges rise generally to about 2,000ft., and in Maryland Eagle rock and Dans rock are conspicuous points reaching 3,162ft. and 2,882ft. above the sea. In the southern region of the Blue ridge are Grandfather mountain (5,964ft.), with three other summits above 5,000 and a dozen more above 4,000. The Unaka ranges (including the Black and Smoky mountains) have 18 peaks higher than 5,000feet. In the Black mountains, Mitchell (the culminating point of the whole system) attains an altitude of 6,684 ft.; Hairy Bear, 6,681; Balsam Cone, 6,645; Black Brothers, 6,690 and 6,620; and Hallback, 6,403. In the Smoky mountains are Clingmans dome, 6,644 ft.; Guyot, 6,636; Alexander. 6,447; Leconte, 6.612; Curtis, 6,588, with several others above 6,000 and many higher than 5,000.

In the central regions the streams heading in the Allegheny plateau run south-eastward into the Atlantic, and cut through the ranges by great gorges that are popularly called "water-gaps"; but south of New river the Appalachian ranges are drained westward by the Cumberland and Tennessee rivers, finally reaching the Gulf of Mexico. In the northern section the water-parting lies on the inland side of the mountainous belt, the main lines of drainage running from north to south.

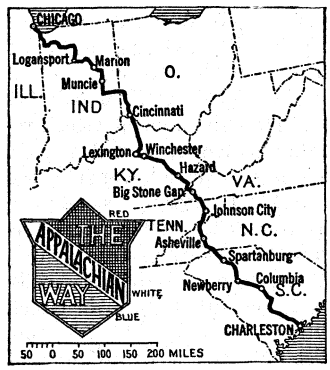
Geology.—The rocks of the Appalachian belt fall naturally into two divisions: ancient (pre-cambrian) crystallines, including marbles, schists, gneisses, granites and other massive igneous rocks, and a great succession of paleozoic sediments. The crystallines are confined to the portion of the belt east of the Great valley where paleozoic rocks are always highly metamorphosed and occur for the most part in limited patches, excepting in New England and Canada, where they assume greater areal importance, and are besides very generally intruded by granites. The paleozoic sediments, ranging in age from cambrian to permian, occupy the Great valley, the Valley ridges and the plateaus still farther west. They are rarely metamorphosed to the point of recrystallization, though locally shales are altered to roofing slates, sandstones are indurated, and coals, originally bituminous, are changed to anthracite in northern Pennsylvania and to graphite in Rhode Island. The most striking and uniformly characteristic geologic feature of the mountains is their internal structure, consisting of innumerable parallel, long and narrow folds, always closely appressed in the eastern part of any cross-section (Piedmont plateau to Great valley), less so along a central zone (Great valley and Valley ridges), and increasingly open on the west (Allegheny and Cumberland plateaus).

Folding of the rocks resulted from the operation of great compressive forces acting tangentially to the figure of the earth. Extensive and deep-seated crumpling was necessarily accompanied by vertical uplift throughout the zone affected, but once at least since their birth the mountains have been worn down to a lowland, and the mountains of to-day are the combined product of subsequent uplift of a different sort and dissection by erosion. The crosswise courses of the greater rivers result from the rivers being older than the mountains, which indeed have been produced by circumdenudation. The present longitudinal valleys were determined by the outcrop of soft shales or soluble limestones, and the parallel ridges upheld by hard sandstones or schists. Parallelism of mountain ridges and intervening valleys is thus attributable to the folding of the rocks, but the origin of the interior structure of the mountains is to be kept distinct from the origin of the mountains as features of topography.

Forests.—The region is well covered with forests yielding quantities of valuable timber, especially in Canada and northern New England. The most valuable trees for lumber are spruce, white pine, hemlock, cedar, white birch, ash, maple and basswood; all excepting pine, hemlock and poplar are ground into wood pulp for the manufacture of paper. In the central and southern parts of the belt, oak and hickory constitute valuable hardwoods, and certain varieties of the former furnish quantities of tan bark. The tulip tree produces a good clear lumber known as white wood or poplar, and is also a source of pulp. In the south both white and yellow pine abound.

Influence on History.—For a century the Appalachians were a barrier to the westward expansion of the English Colonies; the continuity of the system, the bewildering multiplicity of its succeeding ridges, the tortuous courses and roughness of its transverse passes, a heavy forest and dense undergrowth all conspired to hold the settlers on the seaward-sloping plateaus and coastal plains. The confinement of the Colonies between an ocean and a mountain wall led to the fullest occupation of the coastal border of the continent, which was possible under existing conditions of agriculture, conducing to a community of purpose, a political and commercial solidarity, which would not otherwise have been developed. In contrast to this complete industrial occupation, the French territory beyond the mountains was held by a small and very scattered population, its extent and openness adding materially to the difficulties of a disputed tenure, Bearing the brunt of the contests against the French as they did, the Colonies were undergoing preparation for the subsequent struggle with the home Government. In the War of Independence, the American armies fought toward the sea with the mountains at their back protecting them against Indians leagued with the British.

See Topographic maps and Geologic Folios of the **U.S.** Geological Survey; B. Willis, "The Northern Appalachians," and C. W. Hayes, "The Southern Appalachians," both in *National Geographic Monographs,* vol. i.; and chaps. iii., iv. and v. of E. C. Semple, *American History and its Geographic Conditions* (Boston, 1903).



APPALACHIAN WAY, a highway connecting Chicago, Illinois, with Charleston, South Carolina. It is about 650m. long and is for the most part paved or improved except in south-eastern Kentucky. It runs from the Great Lakes across the Ohio River valley, through the picturesque Appalachian mountains to the Atlantic ocean at Charleston. Cincinnati, Lexington, Big Stone Gap, Asheville, Spartanburg and Columbia are some of the cities that lie along its course.

APPANAGE or **APANAGE,** in its original sense the means of subsistence given by parents to their younger children as distinct from the rights secured to the eldest born by the custom of primogeniture. In its modern usage it is practically confined to the money endowment given to the younger children of reigning or mediatized houses in Germany and Austria, which reverts to the state or to the head of the family on the extinction of the line of the original grantee. In English history the system of appanages never played any great part, and the term is now properly applied only to the appanages of the crown: the duchy of Cornwall, assigned to the king's eldest son at birth, or on his father's accession to the crown, and the duchy of Lancaster. In the history of France, however, the appanage was a very important factor. The word denotes in very early French law the portion of lands or money given by fathers and mothers to their sons or daughters on marriage, and usually connotes a renunciation by the latter of any future inheritance; or it may denote the portion given by the eldest son to his brothers and sisters when he was sole inheritor. The word *apanage* is still employed in this sense in French official texts of some *Customs;* but it was in old public law that it received its definite meaning and importance. Under the kings of the third dynasty the division of the kingdom among the sons of the dead monarch, which had characterized the Merovingian and Carolingian dynasties, ceased. The eldest son alone succeeded to the crown; but at the same time a custom was established by which the king made territorial provision suitable to their rank for his other children or for his brothers and sisters; custom forbade their being left landless. Lands and lordships thus bestowed constituted the appanages, which interfered so greatly with the formation of ancient France. While the persevering policy of the Capets, which aimed at reuniting the great fiefs, duchies, countships, baronies, etc., to the domain of the crown, gradually reconstructed for their benefit a territorial sovereignty over France, the institution of the appanage periodically subtracted large portions from it. Louis XI., in particular, had to struggle against the appanaged nobles. The old law, however, never abolished this institution. The Edict of Moulins (1566) maintained it, as one of the exceptions to the inalienability of the crown-lands; only it was then decided that daughters of France should be appanaged in money, or that if, in default of coin, lands were assigned to them, these lands should be redeemable by the crown in perpetuity. The efforts of the kings to minimize this evil, and of the old jurisprudence to deal with the matter, resulted in two expedients: (1) the reversion of the appanage to the crown was secured as far as possible, being declared inalienable and transmissible only to male descendants in the male line of the person appanaged; (2) originally the person appanaged had possessed all the rights of a duke or count—that is to say, in the middle ages nearly all the attributes of sovereignty; the more

important of these attributes were now gradually reserved to the monarch, including public authority over the inhabitants of the appanage in all essential matters. However, it is evident from the letters of appanage, dated April 1771, in favour of the count of Provence, how many functions of public authority an appanaged person still held. The Constituent Assembly, by the law dated Nov. 22, 1790, decided that in future there should be no appanages in real estate, and that younger sons of monarchs, married and over 25 years of age, should be provided for by yearly grants (*rentes apanagères*) from the public funds. The laws of Aug. 13 and Dec. 21, 1790, revoked all the existing appanages, except those of the Luxembourg Palace and the Palais Royal. To each person hitherto appanaged an annual income of one million *livres* was assigned, and two millions for the brothers of the king. All this came to an end with the monarchy. Napoleon, by the *sénatus-consulte* of Jan. 30, 1810, resolved to create appanages for the emperor's princely descendants, such appanages to consist for the most part of lands on French soil. The fall of the Empire again annulled this enactment. The last appanage known in France was that enjoyed by the house of Orleans. Having been re-established, or recognized as still existing, by the Restoration, it was formally confirmed by the law of Jan. 15, 1825. On the accession of Louis Philippe it was united to the national property by the law of March 2, 1832.

See the Essai sur *les* apanages ou mtmoires *historiques de leur établissement,* attributed to Du Vaucel (c. 1780). (J. P. E.)

APPAREL (Fr. *appareil,* from Low Lat. *adpariculare,* to make fit or equal), equipment, outfit, things furnished for the proper performance of anything, now chiefly used of dress. The word is also applied to orphreys (q.v.).

APPARITIONS. An apparition, strictly speaking, is merely an appearance apprehended in perception when a stimulus acts on any of the senses. But in ordinary usage the word apparition denotes a perception (generally through the sense of sight) which cannot, as a rule, be shown to be occasioned by an object in external nature. We say "as a rule" because many so-called apparitions are merely illusions; *i.e.,* misinterpretations of actual objects, as when a person in a bad light sees a number of small children leading a horse, and finds, on nearer approach, that he sees two men carrying bee-hives suspended from a pole. Again, Sir Walter Scott's vision of Byron, then lately dead, proved to be a misinterpretation of certain plaids and cloaks hanging in the hall at Abbotsford, or so Sir Walter declared. Had he not discovered the physical basis of this illusion (which, while it lasted, was an apparition, technically speaking), he and others might have thought that it was an apparition in the popular sense of the word, a ghost. In popular phraseology a ghost is understood to be a phantasm produced in some way by the spirit of a dead person, the impression being usually visual, though the ghost, or apparition, may also affect the sense of hearing (by words, knocks, whistles, groans and so forth), or the sense of touch, or of weight, as in the case of the "incubus." In ordinary speech an apparition of a person not known to the percipient to be dead is called a wraith, in the Highland phrase, a spirit of the living. The terms *ghost* and wraith involve the hypothesis that the false perceptions are caused by spirits, a survival of the archaic animistic hypothesis (see ANIMISM), a hypothesis as difficult to prove as to disprove. Apparitions, of course, are not confined to anthropomorphic phantasms; we hear of phantom coaches (sometimes seen, but more frequently heard), of phantom dogs, cats, horses, cattle, deer, and even of phantom houses.

Whatever may be the causes of these and other false perceptions—most curious when the impression is shared by several witnesses—they may best be considered under the head of hallucination (*q.v.*). Hallucinations may be pathological; *i.e.,* the result of morbid conditions of brain or nerve, of disease, of fever, of insanity, of alcoholism, of the abuse of drugs. Again, they may be the result of dissociation, or may occur in the borderland of sleep or waking, and in this case they partake of the hallucinatory nature of dreams (*q.v.*). Again, hallucinations may, once or twice in a lifetime, come into the experience of the sane, the healthy, and, as far as any tests can be applied, of the wide-awake. In such instances the apparition (whether it take the form of a visual phantasm, of a recognized voice, of a touch, or what not) may be coincidental or non-coincidental. The phantasm is called coincidental if it represents a known and distant person who is later found to have been dying or in some other crisis at the moment of the percipient's experience. When the false perception coincides with nothing of the sort, it is styled non-coincidental. Coincidental apparitions have been explained by the theory of telepathy (*q.v.*), one mind or brain impressing another in some unknown way so as to beget an hallucinatory apparition or phantasm. On the evidence, so far as it has been collected and analysed, it seems that the mind which, on the hypothesis, begets the hallucinations, usually does so without *conscious* effort (see SUBLIMINAL SELF). There are, however, a few cases in which the experiment of begetting, in another, an hallucination from a distance, is said to have been experimentally and consciously made, with success.

If the telepathic theory of coincidental hallucinations be accepted, we have still to account for the much more common non-coincidental apparitions of the living who do not happen to be in any particular crisis. In these instances it cannot be demonstrated that telepathy has not been at work, as when a person is seen at a place which he thought of visiting, but did not visit. F. W. Myers even upheld a theory of psychorhagy, holding that the spirits of some persons have a way of manifesting themselves at a distance by a psychic invasion. This involves, as he remarked, paleolithic psychology, and the old savage doctrine of animism, rather than telepathy (see Myers, Human Personality). Of belief in coincidental hallucinations or wraiths among savages, records are scanty; the belief, however, is found among Maoris and Fuegians (see Lang, Making of Religions). The perception of apparitions of distant but actual scenes and occurrences is usually called clairvoyance (*q.v.*). The belief is also familiar under the name of second sight (see SECOND SIGHT), a term of Scots usage, though the belief in it, and the facts if accepted, are of world-wide diffusion. The apparitions may either represent actual persons and places, or may be symbolical, taking the form of phantasmic lights, coffins, skeletons, shrouds and so forth. Again, the appearances may either represent things, persons and occurrences of the past, or on the other hand of the present (clairvoyance), or of the future (see PREMONITION). When the apparitions produce themselves in given rooms, houses or localities, and are exhibited to various persons at various times, the locality is popularly said to be haunted by spirits, that is, of the dead, on the animistic hypothesis (see HAUNTINGS). Like the other alleged facts, these are of world-wide diffusion, or the belief in them is world-wide, and peculiar to no race, age, or period of culture. A haunted place is a centre of permanent possibilities of hallucinations, or is believed to be so. A distinct species of hauntings are those in which unexplained sounds and movements of objects, apparently untouched, occur. The German term Poltergeist (*q.v.*) has been given to the supposed cause of these occurrences where the cause is not ascertained to be sportive imposture. In the performances of modern spiritualists the Poltergeist appears, as it were, to be domesticated, and to come at the call of the medium.

An intermittent kind of ominous haunting attached, not to places, but to families, is that of the banshee (Celtic) or family death omen, such as the white bird of the Oxenhams, the Airlie drummer, the spectral rider of Clan Gilzean, the rappings of the Woodde family. These apparitions, with fairies and *djinns* (the Arab form of fairy), haunt the borderland between folk-lore and psychical research.

So far we have been concerned with spontaneous apparitions, or with the belief in them. Among induced apparitions may be reckoned the materialized forms of spiritual *séances,* which have a material basis of veils, false moustaches, wigs and the corpus vile of the medium. It is also possible that mere expectancy and suggestion induce hallucinatory perceptions among the members of the circle. That apparitions of a sort can be induced by hypnotic and post-hypnotic suggestion is certain enough (see HYPNOTISM). Savages produce apparitions in similar ways by sug-

gestion, accompanied by dances, fumigations, darkness, fasting, drugs, and whatever can affect the imaginations of the onlookers (see MAGIC). Both in savage and civilized life, some persons can provoke themselves into beholding apparitions usually fantastic, but occasionally coincidental, by sedulously staring into any clear deep water, a fragment of rock crystal, a piece of polished basalt or obsidian, a mirror, a ring, a sword blade, or a glass of sherry (see CRYSTAL GAZING). Indeed any object, a wall, the palm of the hand, the shoulder-blade-bone of a sheep, may be, and has been used to this end (see DIVINATION).

Almost all known apparitions may be classed under one or other of the categories given, whether they be pathological, coincidental or spontaneous, induced, permanently localized, or sporadic. (See SPIRITUALISM and PSYCHICAL RESEARCH.) (A. L.)

APPARITOR or **APPARATOR,** an attendant who executed the orders of a Roman magistrate; hence a beadle in a university, a pursuivant or herald; particularly, in English ecclesiastical courts, the official who serves the processes of the court and causes defendants to appear by summons.

APPASSIONATA (Ital., impassioned), a musical term which may apply either to the nature of a piece (*e.g.,* Beethoven's Sonata Appassionata, op. 57) or, in its adverbial form *appassionato*, to the required manner of its performance.

APPEAL. In the old English common law the term "appeal" was used to describe a process peculiar to English criminal procedure. It was a right of prosecution possessed as a personal privilege by a party individually aggrieved by a felony, a privilege of which the Crown could not directly or indirectly deprive him, since he could use it alike when the prisoner was tried and acquitted, and when he was convicted and pardoned. It was chiefly known in practice as the privilege of the nearest relation of a murdered person. In its usual modern sense the term appeal is applied to the proceeding by which the decision of a court of justice is brought for review before another tribunal of higher authority.

IN GREAT BRITAIN

During the middle ages full scope was afforded for appeals from the lower to the higher authorities in the church. In matters ecclesiastical, including those matrimonial, testamentary and other departments, which the church ever tried to bring within the operation of the canon law, there were various grades of appeal, ending with the pope. The claims of the church to engross appeals in matters trenching on the temporal rights of princes led to continual conflicts between church and State, terminated in England at the Reformation by the suppression in 1534 of appeals to Rome, which had previously been discouraged by legislation of Edward III. and Richard II.

In temporal, as distinct from spiritual matters, it became customary for ambitious sovereigns to encourage appeals from the courts of the Crown vassals to themselves as represented by the supreme judges, and Charlemagne usually enjoys the credit of having set the example of this system of centralization by establishing *missi dominici*. It is not improbable that his claim was suggested or justified by the practice of the Roman empire, to the sovereignty whereof he claimed to be successor.

When the royal authority in England grew strong as against that of the tenants in *capite*, the king's courts in England were more effectively organized, and their net swept wider so as to draw within their cognizance matters previously adjudged in courts baron or courts leet or in the county court, and they acquired authority to supervise and review the decisions of the inferior and local courts, to control and limit their claims to exercise jurisdiction, and to transfer causes from the local to the royal courts. The machinery by which this process was usually effected, under the common law, was not by what is now known as appeal, but by the process of certiorari or writs of error or prohibition. Recourse was also had against the decisions of the royal courts by appeal to the great council of the king, or to parliament as a whole. Since the reign of Henry VIII, the supremacy of the king's courts over all causes, as well ecclesiastical as civil, has been completely established and they have effectually asserted the power to regulate and keep within their proper jurisdiction all other tribunals within the realm Since that date the organization of judicial tribunals has gradually been changed and improved with the object (1) of creating a judicial hierarchy independent of executive control; (2) of ensuring that all decisions on questions of law shall be co-ordinated and rendered systematic by correction of the errors and vagaries of subordinate tribunals; and (3) of securing so far as possible uniformity in the judicial interpretation and administration of the law, by creating a supreme appellate tribunal to whose decisions all other tribunals are bound to conform.

Appeals from Justices of the Peace.—The decisions of justices of the peace sitting as courts of summary jurisdiction are subject to review on questions of law only by the High Court of Justice. This review is in a sense consultative, because it is usually effected by means of a case stated by the justices at the request of the aggrieved party, in which are set forth the facts as determined by the justices, the questions of law raised and their decision thereon, as to the correctness whereof the opinion of the High Court (in this case, the divisional court) is invited. A point of fact not taken before the justices cannot be taken on appeal. The procedure is equally open in criminal and civil matters brought before the justices. But when the justices decline to state a case for the opinion of the High Court, the latter, if review seems desirable, may order the justices to state a case, unless, indeed, the power to state a case is discretionary. And the High Court has also power to control the action of justices by prohibiting them from acting in a case beyond their jurisdiction, ordering them to exercise jurisdiction where they have improperly declined (mandamus), or bringing up for review and quashing orders or convictions which they have made in excess of jurisdiction, or in cases in which interested or biassed justices have adjudicated (certiorari). None of these regulative processes exactly corresponds to what is popularly known as an appeal, but in effect if not in form an appeal is thus given.

There is also another form of appeal, in the fullest sense of the term, from the decision of justices sitting as a court of summary jurisdiction to the justices of the same county sitting in general or quarter sessions, or in the case of a borough to the recorder as judge of the borough court of quarter sessions. This form of appeal is in every case the creation of statute: and even in text-books it is hardly possible to find a really complete list of the matters in respect of which such appeal lies. But as regards criminal cases there is an approximately general rule, given by s. 19 of the Summary Jurisdiction Act 1879, viz. that an appeal to quarter sessions lies from the conviction or order of a court of summary jurisdiction directing imprisonment without the option of a fine as a punishment for an offence, or for failing to do or to abstain from doing any act required to be done or left undone other than an order for the payment of money, or to End sureties or give security or to enter into a recognizance, or a conviction made on a plea of guilty or admission of the truth of the matter of complaint. The right of appeal to quarter sessions is extended by the Criminal Justice Administration Act 1914, s. 37 (1) to any person aggrieved by any conviction of a court of summary jurisdiction in respect of any offence, who did not plead guilty or admit the truth of the information. There is also a right of appeal where a person after pleading guilty or admitting the truth of the information is convicted (Criminal Justice Act 1925, s. 25).

As a general rule, subject to particular statutory exceptions, appeals of this kind are by way of re-hearing, *i.e.,* the actor or prosecutor must before the appellate tribunal call his witnesses and prove his case just as if no previous hearing had taken place (Halsbury, Laws of England, vol. xix. s. 1373). The only limit is that the appellant must confine himself to the grounds of appeal stated in the notice of appeal given by him. An appeal of this kind lies from any court of petty session, including of course, the court of a stipendiary magistrate.

Appeals from Justices in Quarter Sessions.—This tribunal has under the commission of the peace and under statute power to refer questions of difficulty arising before it for decision to the High Court. The old mode of exercising this power was by sending on to assizes indictments raising difficult questions which had

been presented at quarter sessions. The High Court has *ex officio* power to transfer such indictments where the nature of the case and the demands of justice call for such transfer. The quarter sessions had also power under statute on trying an indictment to refer to the court for Crown cases reserved (Crown Cases Act 1848, abolished by the Criminal Appeal Act 1907) questions of law which had arisen at the trial, and in all civil cases the quarter sessions has power of its own volition and subject to no direct compulsion to consult the High Court on legal questions of difficulty which have arisen. Cntil 1894 this jurisdiction was regarded as consultative only. It was and is exercised by stating the facts, of which the court of quarter sessions is the sole judge, and indicating the questions of law arising on the facts, and the view of quarter sessions thereon, and inviting the opinion of the High Court. Under the Judicature Act 1925 (by s. 25 [1]) every case stated is deemed to be an appeal and is to be heard and determined accordingly. In hearing the appeal, the divisional court may draw any inferences of fact which might have been drawn in the court of quarter sessions, and may give any judgment or make any order which ought to have been made, and may decide all questions of costs. When a court of quarter sessions has heard an appeal from a court of summary jurisdiction, either party, being aggrieved by the decision as being wrong in law, may call for a special case for the opinion of the High Court (Criminal Justice Act 1925, s. 20). If the court of quarter sessions refuses to state a case, it may be compelled to do so by the High Court.

Appeals from County Courts.—Any party to an action or matter in a county court who is dissatisfied with the determination or direction of the judge in law or equity, or upon the admission or rejection of any evidence, may appeal against the decision in the following cases: (1) if the amount of claim or counter-claim in the proceeding exceeds £20; or (2) in all equity matters or cases in which an injunction has been given; or (3) in actions to recover possession of land where questions of title are involved (County Courts Act 1888, s. 120). In the case of a claim below £20 no appeal lies except by the leave of the county court, and in such a case, the county court judge may give leave on the terms, *e.g.*, that the appellant shall in any event pay the respondent's costs of the appeal.

These appeals are heard in the king's bench division by a divisional court except in the case of appeals from judgments of a county court sitting in the exercise of admiralty jurisdiction, which are heard by two or more judges sitting in the probate, divorce and admiralty division, and in the case of an appeal from a county court judge sitting as arbitrator under the Workmen's Compensation Acts, when an appeal lies direct to the court of appeal. A divisional court usually consists of two judges, but the president of the division to which the court belongs may increase the number. Where there is a difference of opinion between two judges constituting a divisional court the junior judge sometimes withdraws his judgment and allows the judgment of his learned brother to overrule or affirm the judgment appealed from as the case may be. But the view has been expressed that in case there is a difference of opinion the judgment below should be allowed to stand. The chancery division has never sat to hear appeals from a county court exercising equity jurisdiction; but at times, by *prohibition* or certiorari has, in effect, reviewed or restrained excess of jurisdiction by county courts in equity matters.

The decision of the High Court on county court appeals is final unless an appeal to the court of appeal is brought by leave of that court or of the High Court (Judicature Act 1925 s. 31 [1] [f]). The application for leave to appeal may be made ex parte.

The appeal is by notice of motion which must state the grounds of the appeal, and must be given within 21 days from the date of the judgment or order complained of (Or. 59, r. 10). An appeal does not necessarily stay execution, but execution may be stayed if the value of the property affected by the judgment is secured. Security for the costs of an appeal may be ordered, but poverty is not of itself sufficient to justify an order for security if there are reasonable grounds for appealing.

The destination of appeals from county courts is controlled by various statutes. Appeals under the Workmen's Compensation Acts go direct to the court of appeal, while an appeal from a county court judge exercising his admiralty jurisdiction is heard by a divisional court in the admiralty division of the High Court. Appeals from county courts in bankruptcy are heard by a divisional court in the chancery division, whose decision is final unless leave is given to appeal either by that court or the court of appeal.

The judges of the king's bench have no power to review the decision of a county court judge on any question of fact unless, indeed, it can be said that he has misdirected himself as to certain evidence in which case a new trial may be ordered. This limitation of the right of appeal has often been made the subject of unfavourable comment, and has given rise to the suggestion that there is such a thing as "county court" as distinguished from "High Court" justice.

Appeals from Inferior Courts of Civil Jurisdiction.—Appeals from the local courts of record which still survive in certain cities, towns and districts are in a somewhat anomalous position. The general rule is that, unless a statute regulates such appeal, it may be brought in the king's bench division of the High Court on notice of motion in any case in which, before the Judicature Acts, the court of king's bench could have reviewed the decision of the inferior court by writ of error. The history of this question is dealt with in *Darlow* v. *Shuttleworth,* 1902, 1 K.B. 721.

In the case of the mayor's court of London, under the local and general statutes regulating that court an appeal lay to the king's bench division, but where there was "error" on the face of the proceedings of the mayor's court the appeal lay direct to the court of appeal as successor of the court of exchequer chamber. Now, however, the mayor's court having been abolished and merged in the mayor's and city of London court, appeals therefrom are dealt with as appeals from a county court. Appeals from the Liverpool court of passage and from the chancery courts of the duchies of Lancaster and Durham lie by statute direct to the court of appeal (Judicature Act 1925, s. 28).

An appeal from the decision of a master of the king's bench involving any question of practice or procedure lies to a judge in chambers, and from the judge in chambers (with leave) to the court of appeal. Where, however, a master in chambers gives judgment on an issue tried by him, whether by consent or by order, an appeal from his decision lies to a divisonal court, which tribunal may review his findings both on questions of law and on questions of fact.

Appeals from an official or special referee are regulated by Or. 59A of the Rules of the Supreme Court which gives an absolute right of appeal from an official referee to the judge in court in the chancery division, and to a divisional court in the king's bench and probate, etc., division. An appeal must be launched within six weeks, and the tribunal considering it may reverse or vary the finding of the official referee or send the matter back to him or to any other referee for further consideration.

Appeals in Criminal Cases Tried on **Indictment.**—Until 1907 it may be said that no appeal lay from a conviction upon indictment save that there was an appeal on questions of law arising at the trial. But the procedure was intricate and technical, being either (1) by writ of error, issued by the consent of the attorney-general (expressed by his *fiat*), to review errors of law appearing in the record of the trial, or (2) by special case, stated by the judge presiding at the trial, with respect to a question of law raised at the trial. These appeals were heard by the king's bench division. Meanwhile there had been a considerable development of public opinion in favour of the establishment of criminal appeal, which resulted in the Criminal Appeal Act which was passed in 1907. By this act a court is established consisting of the lord chief justice and eight judges of the king's bench division, the jurisdiction of the court for Crown cases reserved being transferred to the new court. The court to be duly constituted must consist of an uneven number of judges, not less than three. Its sittings are held in London unless special directions are given by the lord chief justice that it shall sit at some other place. The opinion of the majority of those hearing the case determines any question before the court, and judgment is pronounced by the president (who is the lord chief justice or senior member present), unless in questions of law, when, if it is convenient that separate

judgments should be pronounced by the members of the court, they may be so pronounced. The judgment of the court of criminal appeal is final, except where the decision involves a point of law of exceptional public importance, and a certificate must be obtained from the attorney-general to that effect. The court of criminal appeal is a superior court of record. An appeal may be made either against conviction or against sentence. A person convicted on indictment may appeal either on a question of law alone or of fact alone, or on a question of mixed law and fact. On a point of law a prisoner has an unqualified right of appeal, on a question of fact or of mixed law and fact there is a right of appeal only if leave be obtained from the court of criminal appeal or a certificate be granted by the judge who tried the prisoner that it is a fit case for appeal. The court may allow the appeal if they think that the verdict of the jury should be set aside because it is unreasonable, or because it cannot be supported having regard to the evidence, or that the judgment should be set aside on the ground of a wrong decision on any point of law, or that on any ground there was a miscarriage of justice. Power is given to the court to dismiss the appeal if they consider that no substantial miscarriage of justice has occurred, even though they are of opinion that the point raised in the appeal might be decided in favour of the appellant. If the appeal is against the sentence passed at the trial it may be quashed by the appeal court and such other sentence (whether more or less severe) warranted in law by the verdict substituted. Notice of appeal or notice of application for leave to appeal must be given within ten days of the date of conviction; where a conviction involves sentence of death or corporal punishment the sentence must not be executed until after the expiration of ten days, and if notice of appeal is given, not until after the determination of the appeal or the final dismissal of the application for leave to appeal. The act gives the court power to order any witnesses who would have been compellable witnesses at the trial to attend and be examined before the court, and to receive the evidence, if tendered, of any witness who is a competent but not compellable witness. Any question involving prolonged examination of documents or accounts or any scientific or local investigation may be referred to a special commissioner appointed by the court, and the court may act on the report of that commissioner. An appellant is given the right to be present on the hearing of his appeal, if he desires it, except where the appeal is on some ground involving a question of law alone, but rules of court may provide for his presence in such a case, or the court may give him leave. The act requires shorthand notes to be taken of the proceedings at the trial of any person, who, if convicted, would have a right to appeal under the act. Nothing in the act affects the prerogative of mercy, and the home secretary may, if he thinks fit, at any time refer a case to the court of criminal appeal. If the attorney-general certifies that a decision of the court of criminal appeal involves a point of law of exceptional public importance an appeal lies to the House of Lords at the instance of the prosecutor or the defendant. The necessary certificate must be applied for within seven days of the date of the decision (Criminal Justice Act 1925, s. 16).

Appeals from Judges of the King's Bench, Chancery and Probate, Divorce and Admiralty Divisions of the High Court. — Appeals from all the divisions of the High Court lie to the court of appeal, which, next to the House of Lords, is the most important tribunal of appeal from the purely British point of view. Its constitution is to be found in the Judicature Act 1925, ss. 6–8. It consists of certain ex *officio* judges and five ordinary judges, who are called lords justices of appeal. The *ex officio* members are the lord chancellor, who is president of the court, any ex lord chancellor, any lord of appeal in ordinary, who at the date of his appointment would have been qualified to be appointed an ordinary judge of the court of appeal, or who, at that date, was a judge of that court. The lord chief justice, the master of the rolls and the president of the probate division are also ex *officio* members of this tribunal. Any barrister of not less than 15 years standing and any judge of the High Court is qualified for appointment as a lord justice. The lord chancellor may request any judge of the High Court to sit in the court of appeal. Further he may ask, but, of course, cannot compel any retired lord justice or judge of the High Court to sit in the court.

Normally, the court of appeal sits in two divisions. The master of the rolls usually presides in the first court, and a senior lord justice in the second. Matters are generally so arranged that a court consisting of two common law and one equity lord justice hears appeals from the king's bench, while chancery appeals are heard and decided by two equity and one common law lord justice. For the decision of a case of great importance, the president will sometimes summon the whole court.

Sometimes judgment is given immediately upon the conclusion of the arguments. In important cases, however, the lords justices often reserve judgment and put their reasons into writing. When a large number of American lawyers visited this country in 1926, a distinguished American judge who had been listening to a case in the court of appeal was heard to express his astonishment at judgment being delivered orally immediately after the conclusion of the arguments. In his State of the Union, he said, to reserve judgment was the universal practice.

Jurisdiction of the Court of Appeal. — The jurisdiction of the court of appeal is as prescribed in the Judicature Act 1925, s. 26 et seq. It exercises all jurisdiction and powers formerly vested in the lord chancellor and the court of appeal in chancery when exercising appellate jurisdiction (s. 26 (2 a)) and all jurisdiction and powers formerly vested in the court of exchequer chamber (s. 26 (2 b)), which court considered writs of error from the old court of king's bench, the court of common pleas and the exchequer chamber. The court of appeal also hears appeals in admiralty (formerly heard by the privy council) and appeals from any order in lunacy made by the lord chancellor or any other person having jurisdiction in lunacy, which formerly lay to the king's council as a matter of prerogation (s. 26 (2) (c)). The court also has jurisdiction (under special statutes) to hear appeals (a) from any decision of the High Court upon cases stated under various tax acts, relating to trademarks, (b) from the railway and canal commissioners and (c) under the Workmen's Compensation and Agricultural Holdings Acts.

The principal function of the court is to hear appeals from "any judgment or order of any division of the High Court" (s. 27 (1)). All such judgments or orders can be appealed except any judgment of the High Court in any criminal cause or matter (s. 31 (1) (a)); an order allowing an extension of time for appealing from a judgment or order (ib. (b)); an order of a judge giving unconditional leave to defend; a decision of the High Court declared by statute to be final (ib. (d)); an order absolute for the dissolution or nullity of a marriage in favour of any party who having had time and opportunity to appeal from the decree *nisi* on which the order was founded has not appealed *(ib. (c))*. No appeal lies without leave of the divisional court or of the court of appeal from the determination by a divisional court of any appeal to the High Court, *e.g.*, an appeal from a county court (ib. (f)); without leave of the judge in chambers, or of the court of appeal from any order made in chambers (other than an order relating to practice or procedure) where no application has been made to discharge the order to the judge in court or to a divisional court (ib. (g)).

Again, no appeal lies without the like leave from an order made by consent or as to costs only which are left to the discretion of the court (ib. (h)). It will be seen that the legislature has absolutely prevented an appeal in a number of cases, and has allowed it, with leave, in others. Interest reipublicae *ut* sit *finis litium;* but it is obvious that there may be cases in which although the subject matter of the dispute is negligible or very small, some question of principle is involved. And this is often the case in appeals from county courts.

Appeals in Interlocutory Matters. — No appeal lies without the leave of the judge or of the court of appeal from any interlocutory order or interlocutory judgment made or given by a judge except in certain cases (to be mentioned presently). The question whether an order or judgment is interlocutory or final is for the court of appeal to decide (Judicature Act 1925, s. 68

(2)), but the test of finality is—Does it, as made, finally dispose of the rights of the parties? The principal exceptions (to be found in s. 31 (1) (2) of the Judicature Act 1925) are where the liberty of the subject or the custody of infants is concerned; where an injunction or the appointment of a receiver is granted or refused; in the case of a decree *nisi* in a matrimonial cause, or a judgment or order in an admiralty action determining liability; in the case of an order on a special case stated under the Arbitration Act 1889. With regard to decisions of the High Court in relation to election petition these cannot be appealed except with leave of the High Court. Finally, no appeal lies to the court of appeal from any decision of a divisional court on a point of law arising in any probate causes or matter.

Every motion for a new trial or to set aside a verdict in any cause or matter in the High Court in which there has been a trial thereof or of any issue therein with a jury falls to be heard in the court of appeal (Judicature Act 1875, s. 30 (1)). The court of appeal also hears appeals from convictions of indictment at common law in relation to the non-repair or obstruction of any highway, public bridge or navigable river (ib. s. 29).

In matters of practice and procedure every appeal from a judge comes before the court of appeal (Judicature Act 1925, s. 31 (3)). These appeals which are usually from a judge sitting in chambers are generally heard by two members of the court of appeal, and do not lie except with leave of the judge who made the order or of the court of appeal. To this, however, there is one notable exception, viz., that if a judge in chambers refuses unconditional leave to defend, the defendant may appeal without leave. On the other hand, if he does give unconditional leave to defend, his order is final. As to what are matters of "practice and procedure," the reader is referred to the Yearly Practice (1928).

Procedure on Appeals.—Procedure on appeal is regulated by rules of court (notably R.58). Notice of motion must be given, in interlocutory matters within 14 days, and in final matters within six weeks of the decision complained of. At the hearing the court may allow further evidence to be called, but this power is rarely exercised, and after a cause or matter has been heard on the merits, is admitted on special grounds only. The court will "jealously scrutinize" any point taken on appeal which was not taken in the court below. Upon hearing the appeal the court may order a new trial instead of reversing the judgment below. Provision is also made by the rules for a cross appeal by the respondent. The court may summon assessors who are experts on the matters of fact or science involved in the appeal., This power is often exercised in admiralty cases.

With a view to preventing a multiplicity of appeals, there is power to order security for costs of an appeal in certain cases. It will generally be ordered where an appellant is out of the jurisdiction, and where it is shown that the appellant, if unsuccessful, would be unable to pay costs (unless, indeed, the poverty of the appellant is due to the wrongful act of the respondent), but it will not be ordered where the liberty of the subject is in question.

The court of appeal may make any order which it deems just as to the costs of the whole or any part of an appeal, except possibly in the case of certain appeals in matters on the Crown side of the High Court, as to which some doubt still exists. In practice the costs follow the event, unless the court in a particular case makes an order to the contrary.

A decision of the court of appeal is final in appeals from the High Court in bankruptcy, unless leave be given to appeal to the House of Lords (Bankruptcy Act 1914, s. 108), and in divorce appeals, except where the decision either is upon the grant or refusal of a decree for dissolution or nullity of marriage, or for a declaration of legitimacy, or is upon any question of law on which the court gives leave to appeal (Supreme Court of Judicature Act 1925, s. 27 (2)); but no further appeal to the House of Lords lies, even with leave of the court of appeal, on appeals from the High Court sitting as a court of appeal from county courts in bankruptcy. With these exceptions there is now a right of appeal from every order of the court of appeal to the House of Lords.

The House of Lords.—The House of Lords has for centuries been the court of last resort, and is still the final court of appeal from the chief courts in England, Scotland and Northern Ireland The origin of the appellate jurisdiction of the House of Lords was undoubtedly of that partly feudal and partly popular character already alluded to, which made the suitor seek from the high court of parliament the justice denied elsewhere in the baronial courts or by the king's judges. The lords exercised the mixed function of jurymen and judges, and, as in judgments on impeachment, might be influenced by private or party considerations, debating and dividing on the question before the House. A revolution was silently accomplished, however, by which the function of reviewing the decisions of the courts fell entirely to the lawyers raised to the peerage, while the unprofessional lords only attended to give the sanction of a quorum to the proceedings, and the House has always had the right to invoke the assistance of the judges of the superior courts to advise on the questions of law raised by an appeal. The letters and memoirs, so late as Queen Anne's reign, show that party or personal influence and persuasion were employed to procure votes on appeals, as they have been in later times on railway or other local bills. The last instance probably in which a strong division of opinion was manifested among the unprofessional lords was the celebrated Douglas cause in 1769, when the House was addressed by the dukes of Newcastle and Bedford, but was led by the authoritative opinion of Lord Mansfield on the effect of the evidence—an opinion which was treated rather as that of a political partisan than of a judge. The case of Daniel O'Connell and others, brought up on writ of error from the queen's bench in Ireland in 1844, may be said to have finally established the precedent that the judgments of the House of Lords were to be given solely by the law lords.

By the Appellate Jurisdiction Act 1876 and an amending act of 1887, the appellate business of the House of Lords is conducted solely by the law lords, though lay peers may still sit (*Bradlaugh* v. *Clarke,* 1882, 8 App. Cas. 354). No appeal may be heard or determined except in the presence of not less than three of the following persons:—(1) the lord chancellor; (2) the lords of appeal, four of whom are appointed under the act from among persons who hold, or have held, high judicial office, or, at the date of appointment, have been in practice for not less than 15 years as barristers in England or Ireland, or as advocates in Scotland (see also the Appellate Jurisdiction Act 1913, providing for the appointment of two additional lords of appeal); (3) such peers of parliament as hold, or have held, high judicial office. By "high judicial office" is meant the office of lord chancellor of Great Britain or Ireland, lord of appeal in ordinary, paid judge of the judicial committee or member of that committee, or judge of one of the superior courts of Great Britain or Ireland.

An appeal lies to the House of Lords (1) from any order or judgment of the court of appeal in England except as above stated; (2) from a judgment or order of any court in Scotland or Northern Ireland from which error or an appeal to the House of Lords lay by common law or statute immediately before Nov. 1, 1876. As regards Southern Ireland, the right of appeal from the court of appeal in Ireland was taken away by the Government of Ireland Act 1920. Appeal now lies from that part of Ireland, by leave, to the privy council. Appeals are heard from the court of criminal appeal where the attorney-general has certified that a point of law of general public importance is involved. The House of Lords has an indirect power by standing orders to admit appeals from Scotland or Northern Ireland which under former law or practice could not be admitted (Appellate Jurisdiction Act 1876, s. 12). The proceedings are commenced by petition of appeal, which must be lodged with the clerk of the parliaments within one year from the date of the last judgment it appealed from. Security for costs (£200) must be given by bond or lodgment of the money, unless dispensed with by the House on the ground of poverty (act of 1893). Each party lodges a printed case signed and certified by counsel, containing a résumé of the matters to be discussed and of the contentions for or against the allowance of the appeal. The hearing is before three or more law lords, who may

call in nautical assessors in admiralty cases (acts of 1893 and 189.4). It is not public in the full sense of the term, as persons not concerned in the appeal can attend only by consent of the House. The House pronounces the judgment which in the opinion of the majority of the law lords should have been pronounced below, and has jurisdiction in the case of all appeals to give or refuse costs to the successful party. The costs of the appeal if given are taxed by the officers of the House. The jurisdiction as to costs does not directly arise under any statute (see West Ham *Guardians* v. Bethnal Green Churchwardens, 1896, A.C. 477).

The procedure adopted on the hearing of an appeal in the House of Lords is somewhat remarkable. Cases are heard in the chamber itself, the law lords being provided with small tables near the bar of the House, the lord chancellor, in his robes, usually presiding. The peers do not give judgments in the strict sense: they make speeches, after which the lord chancellor, proceeding to the woolsack, puts the question to the vote.

Appeals to the **King** in Council (The Privy Council).—The decisions of ecclesiastical courts when acting within the limits of their jurisdiction, and the decisions of courts in the king's dominions outside Great Britain, and of courts in foreign countries set up under the Foreign Jurisdiction Acts, cannot be dealt with by the House of Lords or any of the ordinary tribunals of any part of Great Britain. The power once claimed by the court of king's bench in England to control the courts of Ireland has lapsed, and its power to intervene in colonial cases is limited to the grant of the writ of *habeas* corpus to a possession in which no court exists having power to issue that writ or one of like effect (Habeas Corpus Act 1862). As regards all British possessions, the appeal to the king in council is in its origin and nature like that of the provincials unto Caesar, and flows from the royal prerogative to admit appeals. With the growth of the British empire it has been found necessary to create a comparatively constant and stable tribunal to advise the king in the exercise of this prerogative. For this purpose the judicial committee of the privy council was created in 1833. In 1851, and again in 1870, it was reorganized, and by acts of 1876, 1887, 1898, 1908 and 1913 it received its present form. The committee consists of the president of the council, and of the following persons, if privy councillors—the lord chancellor and ex-chancellors of Great Britain and of Ireland, the four lords of appeal in ordinary, the lords justices of appeal in England or retired lords justices of appeal in England, and persons who hold or have held the office (a) of judge of the High Court of Justice or the court of appeal in England or Ireland, or of the court of session in Scotland; (b) any person who is or has been chief justice or a judge of the Supreme Court of Canada or of a superior court of any province of Canada, of any of the Australian States (except Fiji and Papua), or of any other British possessions fixed by Order jn Council, or chief justice or justices of the High Court of Australia, or chief justice or judges of the Supreme Court of Newfoundland or the Supreme Court of South Africa. The number of persons of this class who may be members at once is limited to seven (Appellate Jurisdiction Act 1913, s. 3 (1)); (*c*) provision is also made for the payment of two privy councillors who have been judges in India who attend the privy council.

Numerous as are the members of the committee, the quorum is three. One or more of the lords of appeal in ordinary usually attend at every hearing, but the composition of the committee is very fluctuating. Appeals from the British dominions abroad lie in criminal as well as civil matters. The right of appeal is regulated as to most possessions by order in council, and in some cases is limited by imperial or colonial statute. Appeals are on fact as well as on law, but the committee rarely if ever disturbs the concurrent judgments on facts of two colonial courts. In the case of admiralty appeals from colonial or consular courts, naval assessors may be called in. The committee also hears (with the aid of ecclesiastical assessors) appeals from ecclesiastical courts. The judgment of the committee is in the form of a report and advice to the king, which is read by one of the members sitting, and no indication is given as to whether the members present are unanimous. Effect is given to the advice by Orders in Council dismissing or allowing the appeal, and giving direction as to the payment of costs and as to the further proceedings to be taken in the colonial courts.

The procedure of the committee is on the same lines as that on appeals to the House of Lords; no well-arranged code of practice existed however up to the end of 1908, and new rules were then being proposed on the subject. The appeal is commenced by a petition of appeal, and by the giving of security for costs. In colonial appeals printed cases are lodged containing a summary of the contentions of the parties, and with this a printed copy of the record of the proceedings and documents used in the courts appealed from. The hearing is in the privy council chamber and is not public. When an appeal is called on, the counsel and parties are summoned into the chamber, and when the arguments are concluded they are requested to retire. The appeals to the king in council from colonial States having a federal constitution, like Canada and Australia, stand in an exceptional position. The act creating the Supreme Court of Canada purports to make the decision of that court final. But it is still the practice to admit by special leave a prerogative appeal from the court, and to entertain appeals from courts of the provinces of Canada direct to the king in council, without requiring them to go to the Supreme Court. The constitution of the Australian Commonwealth contemplates (s. 73) the possibility of restricting appeals to the king in council from the supreme courts of Australia, and s. 74 forbids appeals to the king in council except by leave of the High Court of Australia from decision of that court on any question however arising as to the limits inter se of the constitutional powers of the commonwealth and those of any State or States, or as to the limits inter se of the constitutional powers of any two or more States. The exact effect of these enactments and of Australian legislation under s. 73 is a matter of controversy. **A** convenient list of the Statutory Rules and Orders which now regulate appeals from the various colonies and dominions will be found in the supplement to Halsbury's Laws of England (1928), p. 607. (W. V. B.)

IN THE UNITED STATES

The question of appeals in the United States is complicated by the fact that each of the 48 States is an independent judicial unit, each having its own system of courts and its own system of procedure. The court systems and the procedural rules of the States often differ radically. In addition the Federal Government has a system of courts, culminating in the Supreme Court of the United States, with special and unique features. Limitations of space prevent a full report on each separate system.

Court Structure.—The justice of the peace court to be found ordinarily in each township is the lowest trial court. Next above it in importance is the district or county court, whose jurisdiction usually covers one county. The highest trial court, that of unlimited jurisdiction, is commonly termed the "superior court," or "circuit court," although the name "supreme court" is used in New York. One such court is found sufficient in the smaller States. The larger States have several, each of which has a jurisdiction extending over several counties. In a number of States there is but one appellate court, ordinarily called the "supreme court," but many States have two or more appellate courts.

A litigant who is dissatisfied with the decision of a justice of the peace may remove his case to the proper district or county court where it is tried de novo; that is, his case is treated as if brought in the higher court in the first instance. From this court, the case may be appealed to the appellate court where the trial below is reviewed to ascertain if error was committed or injustice has resulted. Cases in the superior court may likewise be appealed to the appellate court.

Multiple Appellate Courts.—In the larger States a single appellate court has been found incapable of handling all the appeals docketed. Various means of reducing this burden have been adopted. Some States deny the right of appeal in unimportant cases by permitting appeals only when the amount involved exceeds a certain specified minimum. But this plan has met with strenuous opposition from those who believe that every litigant should have the right to have his cause passed upon by more than one judge. Other jurisdictions have set up a system of inter-

mediate courts. Each of these courts is generally called a "court of appeals," although in New York, this is the term given the court of last resort while the intermediate courts are termed "appellate divisions." There may be only one intermediate court, or several, each of which has jurisdiction over a county or other territorial subdivision of the State.

The question of allocating cases on appeal between the intermediate appellate courts and the court of last resort presents a difficult problem. Provisions are to be found making the decision of the intermediate court final in certain specified actions. Other cases go directly to the court of last resort without the intervention of the intermediate court. In New York, for example, an appeal from a sentence of death is taken from the court of original jurisdiction to the Court of Appeals. In many actions there is a double appeal, first to the intermediate court and then to the court of last resort. Some States provide that in case of a disagreement in the intermediate court, that court may certify the case to the higher court. And finally many States provide that the court of last resort may order a case transferred to it from the intermediate court, if it believes that the case contains questions of sufficient importance to deserve its attention.

This system of intermediate appellate courts is open to two objections. As it is very difficult to formulate rules for distributing appeals between the intermediate and the supreme court which will be free from obscurity and doubt, each court is forced to spend a disproportionate part of its time in deciding whether it has jurisdiction to hear the appeal. But perhaps a more serious objection is the possibility in almost every case of a double appeal. It has not been demonstrated that a better quality of justice is obtained by subjecting a cause to the review of two appellate courts. And it is apparent not only that litigation is unduly prolonged, but that the expenses of litigation to the individual parties and to the community are increased. Further, public esteem for the courts is lessened by frequent reversals of a lower appellate court by the supreme court.

Divisional Appellate Courts.—The system used in England for handling the burden of cases on appeal has been adopted with satisfactory results in some States. Under this system questions of jurisdiction are avoided by providing but one supreme court with various divisions. Thus a supreme court consisting of nine judges would be divided into three divisions of three judges each. Appeals may be allocated among the divisions by giving each jurisdiction over appeals from a certain territorial sub-division of the State. An alternative plan is to assign cases arbitrarily to each division as it finds its docket clear. There would be a double appeal only when a case is re-argued before the entire court. This ordinarily would happen only when an important constitutional problem is involved or a division of opinion occurs in one of the divisional courts.

Appellate Court Judges.—An interesting variation is found in the number of judges composing the different State supreme courts. The minimum number is three, which is found sufficient in five States. Twenty States have courts composed of five judges, two, of six judges, 15, of seven judges, and three, of eight judges. The courts of Oklahoma and Washington are composed of nine judges, but this number is required because these courts sit in divisions. The situation in New Jersey is unique. Its court of last resort, the Court of Errors and Appeals, is composed of sixteen judges, of whom ten are lawyers and six are laymen. (N.J. Const., Art. VI., Section II., Par. 1.)

The decision of the court is controlled by a majority vote; hence it is desirable that the court consist of an odd number of judges. It sometimes happens that, through sickness or other disability, the court is reduced to an even number. To meet such a situation power is given a few supreme courts to call a judge from one of the intermediate appellate courts, or from the highest trial court, to sit temporarily. And since vacancies on the supreme court bench are usually filled by members from these courts, this plan provides excellent training for future supreme court judges. Lacking such a provision there is a possibility that the supreme court will be evenly divided. In such a situation the judgment appealed from is affirmed but no principle is settled.

Procedure on Appeal.—In order to understand appeal procedure, it must be appreciated that courts of common law and courts of chancery were once (and still are in some States) separate entities. Each system of courts had different procedural devices for perfecting an appeal. A litigant, wishing to secure a review of an adverse judgment at common law, petitioned the proper appellate court for a writ of error. This writ commanded the lower court to transfer the record of the case to the higher court for examination. The appellate court then had the power to consider only errors of law appearing on the record proper. As the record proper consisted only of the summons and its return, the pleadings, the verdict and the judgment, the scope of the appellate court's review was necessarily extremely limited. But at an early date the procedural device known as the "bill of exceptions" was invented to provide a means of incorporating into the record proper the errors committed during the trial.

Equitable causes in chancery were reviewed by means of an "appeal in equity." This device was simpler and more efficient than a writ of error. The pleadings and other documents were removed to the appellate court for a rehearing of the case. The appellate court was not forced to confine its attention to the record proper. The facts found as well as the law propounded by the lower court could be examined. In fact, except for the rule that new evidence could not be given on appeal, the rehearing partook more of the nature of a trial *de novo* than of an examination merely for the detection of error.

In most non-code States, where law courts are still separate and distinct from the chancery courts, both the writ of error and the appeal in equity are to be found essentially in the form described above. In the code States, where the courts of law and courts of chancery have been blended into one, the tendency is to provide but one procedural process for the perfecting of an appeal. This process is in essence a compromise, having some features both of the writ of error and of the appeal in equity.

Other methods of obtaining a judicial review of a cause at early common law were by means of the prerogative writs of *certiorari, mandamus* and prohibition. In most States these writs are still employed. Each of these writs is issued upon a petition to an appellate court and each contains a command to a lower court. The writ of *certiorari* orders the cause transferred to the higher court for further proceedings. This writ can be used only when a writ of error could not be issued, as when an accidental destruction of the record proper prevents its certification to the appellate court. The writ of mandamus compels the performance of some act refused by the lower court. The writ of prohibition prevents a lower court from acting beyond its statutory jurisdiction. It should be noted that these three writs are issued only in the sound discretion of the court, whereas writs of error and appeals in equity are ordinarily matters of right to the litigants.

A further method of obtaining an appellate review is provided in some States by means of a "certified case." During the trial of an action, a difficult question of law may arise which, when answered, is decisive of the case. The trial judge may then "certify" the case to the supreme court by stating the question of law for its determination. All trial proceedings are stayed until the appellate court gives its answer. An analogous method is to permit the two opposing counsel at the trial to submit an agreed statement of facts to the supreme court. The court then decides the law applicable to these facts. Such a procedure will be used only when the facts are clear and the dispute centres on a question of law.

Procedural **Steps** on Appeal.—The steps which a party, by his attorney, must take to bring his case before the appellate court are many and technical. Under typical procedure the defeated party would proceed as follows: 1. File a written motion for a new trial with the trial judge. Many supreme courts will not hear an appeal unless the trial judge has first denied a motion for a new trial. 2. Give notice to the other party of his intention to prosecute an appeal. 3. Provide security for the costs on appeal in case the appeal should be unsuccessful. This security, ordinarily a bond with two sureties is required unless the appellant appeals *in forma pauperis*. To do this he must take

an oath that he is financially incapable of providing proper security. 4. Execute a supersedeas bond. In most States such a bond is required to prevent the execution of the judgment appealed from. By the bond the appellant binds himself to pay the full amount of such judgment as may be finally rendered against him. 5. Prepare a bill of exceptions. It is by means of this device that a review of errors occurring during the trial may be secured on a writ of error. In the bill of exceptions each error asserted and upon which he intends to rely on appeal is set out separately. Errors not assigned are disregarded by the appellate court. 6. Prepare a record or case on appeal. This record contains, in addition to the record proper, the bill of exceptions, and a report of the testimony given at the trial or so much of it as is relevant to the errors assigned. 7. Submit his record or case on appeal for the approval of the trial judge. The judge examines the record to ascertain whether it gives an accurate history of the trial. If so the papers are transmitted to the supreme court. If not the appellant must make the necessary revision. 8. Prepare a brief. The purpose of the brief is to assist the appellate court in reaching a decision by presenting in concise form the question in controversy with supporting arguments. The appellate court does not consider assigned errors not supported by arguments in the brief. The preparation of a brief often involves a great amount of labour. In the famous case of Willett v. Herrick, 258 Mass. 585, 1,595 pages of brief (printed quarto-size paper) were filed for the appellants and 1,107 pages for the appellees. 9. Present the case orally before the supreme court. The appellant is usually entitled to open and close the argument. If the appellate docket is crowded a time limit is placed on the argument. Thirty minutes for each side is a common provision. The appellate justices are privileged to ask questions of the attorneys regarding any point in the case.

The supreme court reaches its decision at a conference of its members, and one judge is assigned to write an opinion. If the court is divided, one or more dissenting opinions may be filed. In unimportant cases the decision may be announced without the writing of an opinion.

Reversals for Errors.—A trial judge in the course of a trial is called upon to make many decisions upon procedural matters. He must interpret the complicated and technical rules of evidence. Often his rulings must be made with little time for reflection. If the case is tried before a jury he must instruct it as to the substantive law of the case. It is a vain hope that a trial will be conducted without some error, no matter how learned the trial judge may be. Hence if the appellate court granted a new trial for every error committed by the trial court, litigation would never end. The following principles have been adopted by every appellate court to avoid such a situation: 1. The appellate court will consider only such objections as were raised in the lower court. This rule forces counsel to call the alleged error to the attention of the trial judge, thus giving him an opportunity to rectify the mistake without subjecting the parties to the expense and delay of an appeal. 2. The appellate court will not consider invited errors. Thus if the appellant requests the judge to give a certain instruction to the jury, he cannot complain if the instruction given proves erroneous. Without such a rule, clever counsel could intentionally lead a trial judge into error. 3. The appellate court will not reverse for an error which does not operate to the prejudice of some substantive right of the appellant. This so-called "harmless error" rule has now been enacted by statute in many States. As the word "prejudicial" cannot be limited as to degree, it is natural that the same error may be held harmless by one court and prejudicial by another. A striking instance of this has occurred. The Missouri supreme court took the narrow view that the omission of the word "the" from a criminal indictment was prejudicial and reversed the conviction. (State v. Campbell, 210 Mo. 202.) Other courts have held this error harmless.

A narrow view presumes all errors to be prejudicial until the appellee proves them harmless. But the modern and more liberal tendency of the courts is to regard all errors as harmless until the appellant affirmatively proves them prejudicial. It is doubtful if the situation of the famous case of Hopt v. Utah could now be repeated. Hopt committed a murder in the territory of Utah and was sentenced by the local court to be hanged. On appeal to the U.S. Supreme Court, the conviction was reversed because of a procedural error. Twice more the murderer was convicted and twice more the conviction was reversed on technical grounds. After the fourth trial had resulted in a conviction, the Supreme Court found the trial free from judicial error. It was seven years after the murder that Hopt finally paid the penalty for his crime. (See Hopt v. People of Utah, 104 U.S. 63; 110 U.S. 574; 114 U.S. 488; 120 U.S. 430.)

Suggested Reforms in Procedure.—In recent years many reforms have been suggested to meet the widespread criticism of appellate procedure in the United States. It is more than likely that revolutionary changes will appear in some of the States in the next few years. The procedural devices involved in perfecting an appeal could be made less complicated. More States might well abolish the distinction between the writ of error and an appeal in equity. The labour of preparing the record or case on appeal could be materially reduced. New evidence, either documentary or oral, could profitably be admitted on appeal. The whole object of appellate review should be changed from a proceeding mainly for the detection of error, to a rehearing of the cause with a view to its final disposition on its merits. Then the litigants and the community would be saved the expense of a new trial, and the pressure on the overcrowded trial courts would be relieved.

U.S. Supreme Court.—The Supreme Court of the United States, by reason of its dignity, the learning and prominence of its members, and the extent of the power it wields, is one of the world's most important tribunals. The founders of the republic foresaw that many delicate questions would arise regarding the balance of power between the States and the Federal Government. They also foresaw that disputes between States, and between citizens of different States, were inevitable. A tribunal was necessary to restrain the state legislatures and the Federal Congress from enacting statutes repugnant to the Federal Constitution. These various problems were largely judicial in nature. Accordingly the Federal Constitution provided that "the judicial power of the United States shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish." (Article III., Section 1.)

Justices of the United States Supreme Court.—The justices of the Supreme Court are appointed by the President, but his appointments must be confirmed by a two-thirds vote of the Senate. (Constitution, Article III., Section 2.) Sincere efforts are made to secure the best legal talent available. The appointments are kept singularly free from political considerations. While Chief Justice Taft was president, he appointed six justices, of whom three were Republicans and three Democrats. Of the five justices appointed by President Lincoln, only two were from his own party. A notable exception to this tendency was the case of President Jackson, who appointed five justices, all of whom were members of his party. Likewise the justices of the Supreme Court have been successful in excluding political considerations from their decisions. Many instances may be found where justices have held unconstitutional statutes sponsored by their own party. In one case, a justice voted to hold unconstitutional a bill which he as a cabinet officer had vigorously favoured. The justices of the Supreme Court hold office for life or during good behaviour. (U.S. Constitution, Article II., Section 1.) This is contrary to the situation in many States where judges are elected for comparatively short periods by popular vote. The security which each justice of the Supreme Court feels in his term of office is an important factor in inducing his freedom from political control.

Many States provide for the compulsory retirement of judges upon reaching a certain age. In New York judges must retire at the age of 70, often at the time when they are capable of rendering their greatest service to the community. (N.Y. Constitution, Article VI., Section 12.) Since the Federal Constitution provides that the justices of the Supreme Court shall hold office during good behaviour, an attempt by Congress to force compulsory retirement would be unconstitutional. But Congress in 1867 provided for voluntary retirement with full compensation

when the age of 70 is reached. (16 Statutes at Large, 45.) Ten justices have availed themselves of this provision.

A justice of the Supreme Court is removable only upon impeachment. The proceedings consist of a formal trial before the U 5. Senate, and a two-thirds vote is required for conviction. In the 140 years of the Supreme Court's existence, impeachment proceedings have been brought against only one justice, and his trial resulted in an acquittal.

During the first 100 years of the Supreme Court's existence each justice was required to preside over the local Federal courts. As the country developed westward, and as the amount of Federal litigation increased, this duty became more and more onerous. This system forced the justices to spend a disproportionate amount of their time in travel to the consequent neglect of their main function at Washington. Agitation against this practice of circuit riding finally resulted in its abandonment in 1891. At that time nine intermediate appellate courts known as the "Circuit Courts of Appeals" were established to hear appeals from the local district courts. (26 Statutes at Large, 826.)

Jurisdiction of the Supreme Court.—The Supreme Court hears cases on appeal from the final courts of the State and from the Federal courts. But it is not every case which may be appealed to the Supreme Court. As most of the State courts have difficulty in keeping up with their dockets, it is obvious that drastic limitations are necessary to prevent the one tribunal which hears cases from the entire country from being overwhelmed with litigation. The first limitation is imposed by the Federal Constitution. Article III., Section 2, provides that "the Supreme Court shall have appellate jurisdiction, both as to law and fact, with such exceptions, and under such regulations as the Congress shall make." This has been interpreted to mean that the Supreme Court has no appellate jurisdiction unless and until it is specifically granted by Congress. Jurisdiction has been granted by various acts of Congress. The Supreme Court hears appeals from (1) the State courts of last resort, (2) the Federal district courts, and (3) the Federal circuit courts of appeals and other special Federal courts such as the Court of Claims and the Court of Customs Appeals.

Appeals from State Courts.—The Supreme Court hears no appeals from State courts unless a Federal question is involved. Such is the case when there is involved: (1) the validity of a treaty or statute of the United States (2) the repugnancy of a State statute to the Federal Constitution or (3) "when any title, right, privilege or immunity specially set up by a party under the Constitution, or any treaty or statute of, or commission held or authority exercised under, the United States." Appeals are matters of right to the litigant in two situations only: (1) when a State court has held a treaty or statute of the United States invalid and (2) when, on the question of the repugnancy of a State statute to the Federal Constitution, the statute was held valid by the State court. In all other cases, which must be brought by petition for a writ of certiorari, the Supreme Court, may, in its discretion, refuse to hear the cause. (U.S. Code, Title 28, Section 344.)

Appeals from District Courts.—In 1925 the jurisdiction of the Supreme Court over appeals from the Federal district courts was greatly restricted. This jurisdiction is now limited to five narrow classes of cases arising under five Federal statutes. (U.S. Code, Title 28, Section 238.)

Appeals from the Circuit Courts of Appeals.—Likewise in 1925, appeal to the Supreme Court from the Circuit Courts of Appeals as a matter of right was limited to one situation only; when the Circuit Court of Appeals has held a State statute invalid as repugnant to the Federal Constitution. But a litigant may petition the Supreme Court for a writ of certiorari by which the cause will be removed from the Circuit Court of Appeals to the Supreme Court. A review on writ of certiorari is not a matter of right, but lies within the sound judicial discretion of the court. (U.S. Code, Title 28, Section 347.)

The tendency of recent years has been toward a decided reduction in the number of cases which can be appealed as a matter of right to the Supreme Court with a corresponding increase in its discretionary jurisdiction. As a result the number of appeals docketed now closely approximates the working capacity of the court. For the first time in years the court during its 1927 term was able to reach in course cases docketed for that term.

Constitutional Questions.—Problems of the greatest importance confront the Supreme Court when constitutional questions are raised. The exercise of the power to hold State or Federal statutes unconstitutional may profoundly affect the entire social structure. It has been the exercise or non-exercise of this power which has at times subjected the court to public criticism. This criticism becomes especially severe when the court holds a statute unconstitutional by a majority of only one vote as in the income tax case. (Pollock *v.* Farmers' Loan and Trust Co., 1j8 U.S. 601.) These five to four decisions have caused some agitation to require a vote by a majority larger than one to hold a statute unconstitutional. Ohio in its State Constitution provides that its supreme court shall hold no law unconstitutional if more than one judge dissents. (Article IV., Section 2. See Jones v. Zangerle, 159 N.E. 564.) The legislatures of Nebraska and North Dakota have adopted similar provisions, but similar legislation restricting the power of the Supreme Court of the United States has failed of adoption.

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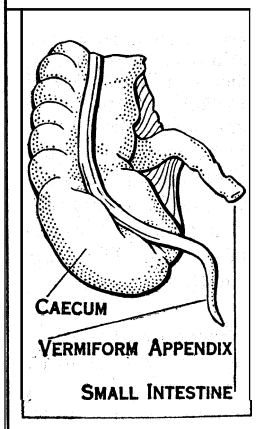
APPEARANCE, in law, the coming into court of either of the parties to a suit; the formal act by which a defendant submits himself to the jurisdiction of the court. (See PRACTICE AND PROCEDURE.)

APPENDICITIS, inflammation of that part of the intestine known as the "appendix." It has no single cause. Frequently its origin is quite obscure, but the starting point may be the impaction of a pin, shot-corn, tooth-brush bristle, or a fish-bone in the appendix. In many cases a patch of mortification with perforation of the appendix is caused by the presence of a hard faecal concretion, or "stercolith," which from its size, shape and appearance has been mistaken by a casual observer for a date-stone or cherry-stone. The condition is more often met with in the young than the old, and in boys rather than girls; and in some families there is a strange predisposition towards it. Inflammation started in the appendix is liable to spread to the peritoneum, and herein lie the gravity of the affection and the indication for treatment. The symptoms vary from "indigestion," and slight pain and sickness, which pass off in a few short days, to an exceedingly violent illness, which may cause death in a few hours. Pain is usually first felt in the belly, low down on the right side or across the region of the navel; sometimes, however, it is diffuse, and at other times it is scarcely complained of. There is some fever, the temperature rising to 101° or 102° F., with nausea, and very likely with vomiting. The abdomen is tender to pressure, and the tenderness may be referred to the spot mentioned above. Some swelling may also be made out in that region. The attack may last for two, three or four days, and then subside. There are, however, other cases less well defined, in which the mischief pursues a latent course, producing little more than a vague abdominal uneasiness, until it suddenly advances into a violent stage. In some chronic cases the trouble continues, on and off, for months or even for years.



THE LARGE INTESTINE, SHOWING POSITION OF THE VERMIFORM APPENDIX WHOSE INFLAMMATION IS TERMED APPENDICITIS

Many valuable lives are needlessly lost from appendicitis every year, chiefly due to ignorance and delay in diagnosis and treat-

ment. The significance of abdominal pain, especially in children, is not sufficiently recognized by the public. Time is wasted on purgatives and sedatives, both of which do much harm, for the former precipitate perforation and hasten the spread of the disease; and the latter, by relieving pain, mask the symptoms and often lead to fatal delay in treatment. No one can tell whether an attack is going to subside under medical treatment or proceed with great rapidity to a fatal issue. The risk of immediate operation is practically negligible, whereas that of waiting is great and uncertain. The experience of surgeons all over the world shows that there is practically no mortality from operations for appendicitis undertaken within 12 or even 24 hours of the onset of the attack, whereas the death-rate for operations delayed until the third or fourth day is about 10%.

Palliative Treatment. — When symptoms suggestive of acute appendicitis develop it is of vital importance to put the patient to bed and give him nothing but water until the diagnosis has been made and an operation can be performed. When, for some reason, an operation cannot be performed, complete rest and careful diet must be continued until the attack has subsided. Only liquids are given by the mouth, and purgatives and sedatives are entirely avoided; but local sedatives may be applied to the abdomen.

Operation. — It is a common mistake that the patient needs elaborate preparation for an operation for appendicitis, but fortunately this is not the case, and the rapid progress of an acute attack will not allow of it. A valvular incision, which should leave no weakness of the abdominal wall, is made over the site of the appendix; the latter is removed and the wound completely closed except in late cases, when abscess or peritonitis has developed, in which temporary drainage may be necessary. In very late grave cases with abscess formation, the surgeon has sometimes to be content with mere drainage, deferring the removal of the appendix to a later date. Appendicitis usually recurs with increasing frequency and severity, therefore it is generally agreed that when an attack has subsided it is wise to remove the appendix soon, in a quiet interval, in order to prevent the recurrence of a grave or fatal attack. It is, however, a foolish policy to defer operation when an opportunity offers of having it performed early in an attack.

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APPENDICULATA, a zoological name introduced by E. Ray Lankester, and employed to denote the large group of animals comprising the Annelida, Arthropoda and Rotifera: all animals composed of a larger or smaller number of hollow rings, each ring possessing typically a pair of hollow lateral appendages, moved by intrinsic muscles and penetrated by blood-spaces. The group is also sometimes called the Annulata, but both terms are now obsolete.

APPENZELL, a canton of north-east Switzerland, entirely surrounded by that of St. Gall; both were formed out of the dominions of the prince abbots of St. Gall, whence the name Appenzell (abbatis *cella*). It belongs to the limestone zone on the north side of the main alpine lines. The culminating point is Santis, 8,216ft., in the south of the canton. It is watered mainly by two streams that descend from Santis, the Sitter and its tributary the Urnäsch. By the middle of the 11th century the abbots of St. Gall had established their power in the land later called Appenzell. But as early as 1377, this portion of the abbots' domains formed an alliance with the Swabian free imperial cities and adopted a constitution of its own. In 1411 Appenzell was placed under the "protection" of the Swiss Confederation, of which it became a member in 1513. Religious differences broke up the land after the Reformation into two portions. each called *Rhoden,* a term said to mean a "clearing." From 1798 to 1803 Appenzell, with the other domains of the abbot of St. Gall, was formed into the canton Santis of the Helvetic Republic, but in 1803, on the creation of the new canton of St. Gall, shrank back within its former boundaries.

The north and west portion (or *Ausser Rhoden*) has a total area of 94 sq.mi., with a population (1941 census) of 44,710, mainly German-speaking Protestants. Its political capital is Trogen, though the largest town is Herisau (1941, 12,737). Ausser Rhoden is divided into three administrative districts, comprising 20 communes, and manufactures cotton goods, muslins and embroidery. It sends one member (elected by the *Landsgemeinde*) to the federal *Ständerat* and three to the federal Nationalrat (elected by a direct popular vote).

The south or more mountainous portion of Appenzell (*Inner Rhoden*), has a total area of 67 sq.mi., with a population (1941 census) of 13,388, practically all German-speaking Roman Catholics. Its political capital is Appenzell (*q.v.*). It is largely pastoral with numerous summer pastures (see ALP). Inner Rhoden is extremely conservative, and has the reputation of always rejecting any federal *Referendum.* For similar reasons it has preserved many old customs and costumes. It sends one member (named by the Landsgemeinde) to the federal *Ständerat,* and one to the federal Nationalrat, while it forms but a single administrative district, though divided into six communes.

BY COURTESY OF THE SWISS FEDERAL R R.

A GIRL OF APPENZELL DRESSED IN FESTIVAL COSTUME

To the outer world the canton of Appenzell is best known by its institution of *Landsgemeinden,* or primitive democratic assemblies held in the open air. This institution is of immemorial antiquity, and the meetings in both portions are always held on the last Sunday in April. The Landsgemeinde is the supreme legislative authority. Various old-fashioned ceremonies are observed at the meetings and each member appears with his girded sword. The existing constitution of Inner Rhoden dates mainly from 1872, and that of Ausser Rhoden from 1876. The meeting for Inner Rhoden is held at Appenzell, that for Ausser Rhoden alternately at Hundwil (near Herisau) and at Trogen.

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APPENZELL, political capital of the Inner Rhoden half of the Swiss canton of Appenzell, in a smiling green hollow on the left bank of the Sitter, formed by union of mountain torrents from the Säntis; by light railways 12½ mi. from St. Gall past Gais or 20½ mi. past Herisau. Pop. 4,893, mostly German-speaking Roman Catholics. It has a stately modern church (attached to a Gothic choir), a small but very ancient chapel of the abbots of St. Gall (whose summer residence was this village), and two Capuchin convents (one for men, founded in 1588, and one for women, founded in 1613). Among the archives, kept in the sacristy of the church, are banners captured by Appenzellers, among them one taken in 1406 at Imst, near Landeck, with the inscription Hundert *Teufel.* In the principal square the Landsgemeinde (or cantonal democratic assembly) is held on the last Sunday in April. Pastoral occupation and embroidery work employ the people. 2½ mi. by road and rail south-east of Appenzell is Weissbad, a goat's whey cure establishment, while 1½ hours above it is the quaint little chapel of Wildkirchli, built (1648) in a rock cavern, on the way to the Santis.

APPERCEPTION, in psychology, a term used to describe the presentation of an object, on which attention is fixed, in relation to the previous experiences of the mind as a whole. The word was first used by Leibniz, practically in the sense of the modern Attention (*q.v.*), by which an object is apprehended as "not-self" and yet in relation to the self. In Kantian terminology apperception is (1) *transcendental*—the perception of an object as

involving the consciousness of the pure self as subject, and (2) empirical—the cognition of the self in its concrete existence. In (1) apperception is almost equivalent to self-consciousness; the existence of the ego may be more or less prominent, but it is always involved. According to J. F. Herbart (*q.v.*) apperception is that process by which an aggregate or "mass" of presentations becomes systematized by the accretion of new elements, either sense-given or supplied by the inner workings of the mind. He thus emphasizes in apperception the connection with self as the result of all its previous experience. Hence in education the teacher should fully acquaint himself with the mental development of the pupil, in order that he may make full use of what the pupil already knows.

Apperception is thus a general term for all mental processes in which a presentation is brought into connection with already existent and systematized ideas, and is thus classified, explained, or, in a word, understood. Thus a new scientific phenomenon is usually assimilated to other phenomena already analysed and classified. The whole intelligent life of man is, consciously or unconsciously, a process of apperception, inasmuch as every act of attention involves the appercipient process.

See K. Lange, Ueber Apperception (6th ed. rev. Leipzig, 1899), trans. E. E. Brown (Boston, 1893); G. F. Stout, Analytic Psychology, bk. ii. ch. viii. 1st ed. (1896), later ed. (1902); E. N. MacQueen, The Distribution of Attention (1917).

APPERLEY, CHARLES JAMES (1777–1843), English sportsman and sporting writer, better known as "Nimrod," the pseudonym under which he published his works on the chase and the turf. The most important of his works are: Remarks on *the* Condition of *Hunters,* the *Choice* of Horses, etc. (1831); The *Chase,* the *Turf* and the Road (originally written for the *Quarterly* Review) (1837); Memoirs of the Life of the Late *John Mytton* (1837); Nimrod's Northern Tour (1838); Nimrod Abroad (1842); *The* Horse and the *Hound* (a reprint from the 7th edition of *The* Encyclopedia Britannica) (1842); Hunting Reminiscences (1843).

APPERT, FRANÇOIS (d. 1840), French inventor, discovered the method of preserving food by enclosing it in hermetically sealed tins, and wrote a book entitled Art de conserver *les* substances *animales* et *végétales.*

APPETITE, an emotion of distinctive conscious quality, accompanying the anticipation, acquisition and assimilation of food or other objects of desire. Physiologists have shown that the conscious experience of appetite is quite different from hunger, both with respect to the sensations involved and also with respect to the mechanisms involved in the genesis of the sensations (see HUNGER). A psychological view of appetite maintains that it is one of the two basic, compound emotions, the other being love. Appetite emotion is said to have two parts, or aspects: desire, or active appetite emotion; and satisfaction, or passive appetite emotion (see EMOTIONS, ANALYSIS OF). Desire consists of compliance with hunger pangs, and dominant drive for food. Satisfaction consists of successful dominance over hunger pangs, made possible by simultaneous compliance with the food eaten. Hunger pangs are regarded as the inherent stimulus mechanism which compels the brain and body to act in a certain way, and so build up the psychoneural pattern of appetite emotion in the brain centres. Once appetite emotion is learned, it is felt toward money, clothes and material possessions of all sorts.

See A. J. Carlson, The Control of Hunger in Health and Disease; W. M. Marston, Emotions of *Normal* People.

ABPIA, VIA, a high road from Rome to Campania and lower Italy, constructed 312 B.C. by the censor Appius Claudius Caecus. It first ran only to Capua (132m.) but was prolonged to Beneventum, Venusia, Tarentum and Brundisium, probably reaching the last-named place by 244 B.C. The original road was no doubt only gravelled (glarea strata); in 298 B.C. a footpath was laid saxo *quadrato* from the Porta Capena of Rome to the temple of Mars, about 1m. from the gate. Three years later, however, the whole road was paved with *silex,* from the temple to Bovillae, and in 191 B.C. the first mile from the gate to the temple was similarly treated. The first few miles are flanked by tombs, etc. (See L. Canina, *Via* Appia, Rome, 1853.) To Terracina it was almost straight, with steep gradients in the Alban hills. Aricia still has one of its fine embankments. At Forum Appii it entered the Pomptine marshes; that this portion (19m. long, hence called Decennovium) belonged to the original road was proved by the discovery at Ad Medias (Mesa) of a milestone of about 250 B.C. A still older road ran along the foot of the Volscian mountains, past Cora, Norba and Setia; this served as the post road until the end of the 18th century. At the time of Strabo and Horace, however, it was the practice to travel by canal from Forum Appii to Lucus Feroniae; Nerva and Trajan paved the road and repaired the bridges in this section. Theodoric in A.D. 486 made similar repairs, but in the middle ages it was impassable and was only renewed by Pius VI. The older road crossed the back of the hill at the foot of which Terracina stands. Beyond Fundi it passed through the mountains to Formiae, thence by Minturnae and Sinuessa (towns of the Aurunci which had been conquered in 314 B.C.) to Capua.

Between Capua and Beneventum (32m.) the road passed near the defile of Caudium. (See CAUDINE FORKS.) The modern high road follows the ancient line, and three well-preserved bridges still serve it. The part from Rome to Beneventum is described by Sir R. Colt Hoare, Classical *Tour* through Italy, p. 57 seq. (London, 1819). (See T. Ashby's *Mélanges* de *l'École Française* de Rome [1903], p. 375 seq.) From Beneventum to Brundisium by the Via Appia, through Venusia and Tarentum, was 202m. Hardly any traces of the ancient road are now to be seen. A shorter route, more fitted for mule traffic, though Horace drove along part of it,[1] ran by Aequum Tuticum, Aecae, Herdoniae, Canusium, Barium and Gnatia; it was made into a main road by Trajan, and took the name Via Traiana. There are important remains of bridges along it. (See T. Ashby and R. Gardner, Papers, British School, Rome viii. [1916], 104 seq.) The original road between Beneventum and Aeclanum (15m.) was restored by Hadrian. Under Diocletian and Maximian a road (the Via Herculia) was made from Aequum Tuticum to Pons Aufidi near Venusia, where it crossed the Via Appia and went on into Lucania, through Potentia and Grumentum, to join the Via Popilia near Nerulum. Though it must have lost much of its importance through the construction of the Via Traiana, the last portion from Tarentum to Brundisium was restored by Constantine about A.D. 315.

The Via Appia was the most famous of Roman roads; Statius calls it *longarum* regina *viarum,* the queen of long-distance roads. It was administered under the empire by a curator of praetorian rank, as were the other important roads of Italy. Milestones and other inscriptions about its repair are known.

APPIAN of Alexandria (Gr. *Ἀππιανός*), Roman historian, flourished during the reigns of Trajan, Hadrian, and Antoninus Pius. He tells us that, after having filled the chief offices in his native place, he repaired to Rome, where he practised as an advocate. When advanced in years he obtained, by the good offices of his friend Fronto, the dignity of imperial procurator—it is supposed in Egypt. His work (*Ῥωμαικά*) in 24 books, written in Greek, is rather a number of monographs than a connected history. It gives an account of various people and countries from the earliest times down to their incorporation into the Roman empire. Besides a preface, there are extant 11 complete books and considerable fragments. In spite of its unattractive style, the work is very valuable, especially for the period of the civil wars.

Editio princeps, 1551; Schweighäuser, 1785; Bekker, 1852; Mendelssohn, 1878–1905. English translations: by W. B., 1578 (black letter); J. D[avies], 1679; H. White, 1899 (Bohn's Classical Library); bk. i. ed. by J. L. Strachan-Davidson, 1902.

APPIANI, ANDREA (1754–1817), the best fresco painter of his age, was born at Milan. He was made pensioned artist to the kingdom of Italy by Napoleon, but lost his allowance after the events of 1814 and fell into poverty. His best pieces, which are in the church of Santa Maria presso San Celso and the

[1] From Beneventum he followed the Via Appia to Aeclanium: thence, leaving the main road, he went to the left to Auscdlum ("quod versu dicere non est," *i.e.,* which will not go into a hexameter), the mod Ascoli Satriano, by a by-road, later called Via Aurelia Aeclanensis, and on to Herdoniae, where he joined the line of the later Via Traiana.

royal palace at Milan, almost rival those of his great master Correggio. He is known as "the elder," to distinguish him from his great-nephew Andrea Appiani (1817–65), an historical painter at Rome. Other painters of the same name were Niccolo Appiani (c. 1510) and Francesco Appiani (1704–1792).

APPIN, coast district, Argyllshire, Scotland, bounded west by Loch Linnhe, south by Loch Creran, east by Benderloch and Lorne districts, and north by Loch Leven. It measures 14 mi. N.E.—S.W. by 7 mi. in breadth. The coast is beautiful, and inland the country is rugged and mountainous. The streams Coe and Laroch flow into Loch Leven, Duror and Salachan into Loch Linnhe, and Iola and Creran into Loch Creran. The leading industry is slate and granite quarrying. Ballachulish, Duror and Appin are the principal villages. Ballachulish and Port Appin are ports of call for steamers, and the L.M.S. branch line from Connel Ferry to Ballachulish runs through the coast land. Appin was the country of a branch of the Stewarts.

APPLAUSE, the expression of approval by clapping of hands, or otherwise. Among civilized nations applause has been subject to certain conventions. The Romans had a set ritual of applause for public performances, expressing degrees of approval: snapping the finger and thumb, clapping with the flat or hollow palm, waving the flap of the toga, or a handkerchief. At the close of the play, the chief actor called out "Valete et plaudite!" and the audience chanted their applause. This was often organized and paid for. When Christianity became fashionable the customs of the theatre were transferred to the churches. Paul of Samosata encouraged the congregation to applaud his preaching by waving linen cloths. Applause of the rhetoric of popular preachers became an established custom destined to disappear under the influence of a more reverent spirit. The institution of the claque, people hired by performers to applaud them, discredited the custom, and indiscriminate applause has been felt as an intolerable interruption to serious performances.

APPLE, the domesticated form of *Malus* pumila with possible admixture of other Malus species, members of the pomoideae division of the family Rosaceae. It is the most widely cultivated and best known tree fruit of temperate climates.

The apple thrives in favourable localities and sites from approximately 30° to 60° latitude both north and south of the equator. It may be grown to a limited extent, but not very successfully, at high elevations closer to the equator than 30° north or south, but since it requires a considerable period of dormancy (generally a total of at least 1,200 hours per year under 45° F. or 7° C.) culture in areas lacking a distinct winter period is unsuccessful. Northward, culture is limited by low winter temperatures and shortness of the growing season. Temperatures of −40° F. will seriously injure or kill trees of most varieties. A period of approximately 100 days free of killing frost is required for even the hardiest, early maturing varieties to develop a crop.

History.—*Malus* pumila, the species from which cultivated varieties are mainly derived, is native in southeastern Europe and southwestern Asia. These apples were undoubtedly used for food by the earliest inhabitants, and improved selections had been made and varieties were recognized in Europe more than 2,000 years ago. Cato (3rd century B.C.) recognized seven different apple varieties. Apples were carried by the Romans throughout much of Europe, including Britain, and may in fact have been in many parts even earlier. Hundreds of varieties were recognized in Europe prior to the settlement of the Americas.

The earliest settlers in the new world took with them both seed and propagating wood of the better European varieties, and apple culture thus spread in those parts of America, where the fruit was adapted as rapidly as settlement occurred. The apple was also carried eastward into India, China and Japan long ago.

Sites for Apple Orchards.—Apples thrive best in a moderately deep, well-drained soil. It is important that the orchard be located so that the hazard of spring frosts and, in cold districts, unusually low winter temperatures, be avoided. For this reason, many of the important apple areas are located on the windward side of large bodies of water, or on the foothills of mountain ranges, and particularly to the south and east of mountain ranges which tend to give protection from cold north to northwest winds.

COURTESY OF THE BUREAU OF PLANT INDUSTRY, U.S. DEPARTMENT OF AGRICULTURE

PICKING APPLES IN A WESTERN U.S. ORCHARD. PICKING CONTAINERS ARE METAL WITH CANVAS BOTTOMS WHICH PERMIT EMPTYING WITH MINIMUM BRUISING OF FRUIT

Diseases and Insect Pests.—In all parts of the world, extensive spraying is required to produce high quality fruits free of blemishes caused by diseases and insect pests. The most serious insect pest in most parts of the world is the codling moth (*Carpocapsa* pomonella), the common apple worm. This insect causes loss wherever apples are grown. Spraying with arsenate of lead from once or twice in very cool districts to as high as 8 to 10 times in certain warm, dry. districts may be necessary to protect the fruit. Other serious insect pests include San Jose scale (*Aspidiotus perniciosus*) and several other scale insects, rosy aphis (*Anuraphis roseus*), woolly aphis, various species of mites or so-called red spiders, and a number of less important insect species. The most serious and widespread disease is apple scab (Venturia *inaequalis*) caused by a fungus that attacks the leaves and fruit; it is mainly controlled by spraying with various forms of sulphur. Various canker diseases affect apples in many parts of the world. Cedar rust (*Gymnosporangium juniperi-virginianae*) and bitter rot (Glomerella cingulata) are additional important apple diseases in parts of the United States. Brown rot (*Sclerotinia* fructigena) of apples is a serious disease in England and on the continent of Europe.

Characteristics of Production in Various Parts of the World.—Europe.—Central Europe, including France, Germany. Switzerland, northern Italy and the northern Balkan countries, is a region of heavy production, but with relatively few areas where intensive production practices are followed. Most of the trees are on land used for livestock pasture, and management is based mainly on pasture requirement rather than on the needs of the trees. Most of the orchards are unsprayed, and the fruit produced is seriously blemished by insects and diseases. Much of it is used for cider making, particularly in France. For the region as a whole, apples are largely consumed in the area where grown. A few districts have more intensive production practices, and pack and ship fruit out of the local area. The most important of these districts are in Switzerland, in the territory of Trentino (Tirol), Italy, and in the Danube basin in Yugoslavia. Rumania and Hungary. Extensive apple planting, with good quality varieties, is carried on in the Ukraine and North Caucasus regions of the U.S.S.R.

In England, Kent is by far the most important apple producing county. Great Britain as a whole produces less than half the apples it consumes. Belgium and the Netherlands produce some apples for export, although apples are also imported, particularly in late winter. For Europe as a whole, a large proportion of the apples—almost half—are of the cider varieties, and are used for making fermented beverages. In only a few areas are intensive production practices followed, similar to those prevailing in the principal producing areas of the United States, Canada, Australia, New Zealand and Argentina.

North America.—The United States produces about one-fourth to one-third of the world's apple crop. While commercial orchards occur in 42 of the 48 states, the most important areas of production are in the valleys of the Columbia river and its tributaries in Washington, Oregon and Idaho, in the areas lying south or east of the Great Lakes, in Michigan, Ohio, Pennsylvania and New York, and in the foothills of the Appalachian mountains, and adjacent valleys from Massachusetts southwestward to North Carolina, particularly in Pennsylvania, West Virginia and Virginia. Other important areas are in the Ohio and Missouri river valleys and in the coastal areas of central California. Principal Canadian production is in the valleys of the Columbia river and tributaries of British Columbia, and in Ontario and Nova Scotia in the east.

Asia.—Japan and Korea developed considerable apple production in the 20th century, all being used in those countries. No data are available on production in China and India, though production in certain areas reaches appreciable proportions.

Southern Hemisphere.—Important apple production occurs in Australia, New Zealand, Argentina and Chile, these countries exporting considerable quantities to northern markets, particularly Great Britain. The crop is harvested mainly in March and reaches northern markets when local supplies are largely exhausted. Principal production in Australia is in the southeastern provinces of Tasmania and Victoria. In Argentina, principal production is in the Rio Negro valley and on delta lands adjacent to Buenos Aires. The main apple production of Chile is near Santiago.

Varieties.—Apple varieties are all vegetatively propagated by budding or grafting. and do not reproduce true to type from seed. Most of them originated from chance seedlings possessing superior qualities. Extensive programs of breeding to develop varieties having superior qualities either in fruit or in disease resistance or hardiness of trees have been carried on especially in the United States, England, Germany, Sweden and U.S.S.R.

During the past 2,000 years, tens of thousands of seedling apples have been propagated and named as varieties throughout the apple growing countries of the world. More than 7,000 varieties have been recorded in the United States alone. Only a few of these have stood the test of time and become important in production. In any apple growing section, several varieties should be grown to provide for adequate cross-pollination of the bloom, and to provide for a succession in time of ripening. Leading varieties in some of the important apple producing countries are as follows:

United States: Western areas—Delicious, Winesap, Yellow Newtown, Rome Beauty, Jonathan, Gravenstein.
Northeastern areas—McIntosh, Baldwin, Rhode Island Greening, Northern Spy, Wealthy, Delicious.
Central Atlantic areas—York Imperial, Stayman Winesap, Winesap, Delicious, Rome Beauty, Ben Davis, Grimes Golden, Yellow Transparent.
Central states—Rome Beauty, Grimes Golden, Jonathan, Stayman Winesap, Delicious, Winesap, Ben Davis, Yellow Transparent.
Canada: British Columbia—McIntosh, Jonathan, Delicious, Wealthy, Yellow Newtown, Winesap, Rome Beauty.
Eastern Canada—Baldwin, Rhode Island Greening, Stark, Northern Spy, McIntosh, Ben Davis, Wealthy, King, Cox's Orange, Golden Russet.
Great Britain: Dessert varieties—Cox's Orange, Worcester Pearmain, Beauty of Bath, James Grieve, Blenheim, Allington Pippin, Gladstone.
Cooking varieties—Bramley Seedling, Newtown Wonder, Lane's Prince Albert, Lord Derby, Lord Grosvenor, Keswick, Bismark, Miller Seedling.
Australia: Sturmer Pippin, Scarlet Pearmain, Jonathan, Cleopatra, Cox's Orange, Rome Beauty, Dunn's Seedling, Granny Smith.
New Zealand: Sturmer Pippin, Jonathan, Delicious, Dunn's Favorite, Cox's Orange, Dougherty, Statesman, Cleopatra, London Pippin.
Italy: Kalterer Bohmer, Canada Reinette, Golden Winter Pearmain, Rosso Nobile, Gravenstein, Napoleon, White Winter Colville.
Switzerland: Boskoop, Golden Pearmain, Danzega, Kantapfel, Gravenstein.
U.S.S.R.: Extensive tests are being made of American varieties. Varieties most widely grown at present are as follows:
Crimea areas: Sinap, Sari-Sinap, Sudak-Sinap, Kara-Sinap, Kandil-Sinap, Reinette d'Orleans.
Central Asia (Turkestan): Champagner-Reinette, Golden Grim, Reinette d'Orleans, Reinette Simirenko.
Central Russia: Antonowka.
Argentina: In older orchards—Cara Sucia, Blanquita, Rayada, Mitre, Huidobro.
In young orchards—Delicious, Jonathan, King David.

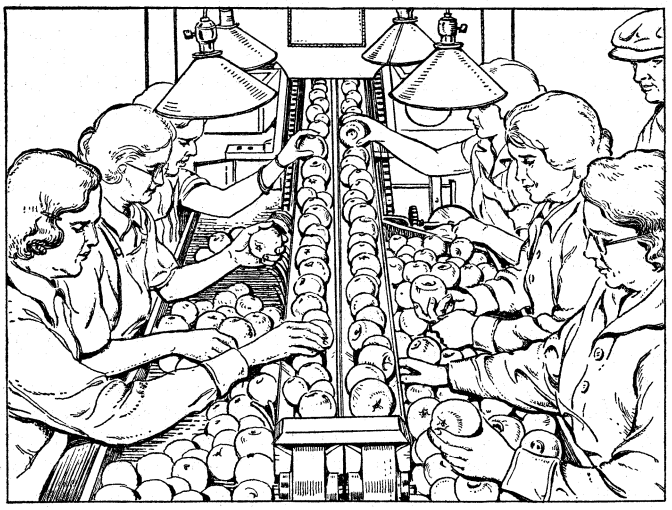
Storage and Handling.—Varieties ripening during late summer are generally of poor storage quality, and are consumed shortly after they mature. Varieties which ripen in late fall may be stored for periods ranging from six weeks to as long as nine months for the best keeping sorts handled by the best methods. For long holding, temperatures only slightly above the freezing point of the fruit (apples freeze at about 28.5° F. or −2° C.) are desirable for fruit from most sections. Thus such fruit generally holds best at temperatures of 30° to 32° F., in artificial cold storage. Fruit from some areas having a cool growing season, as in England and other similar areas, may develop breakdown if held near freezing, and holds better at 36° to 40° F. Most American apples are stored near 32° F. For home storage, apples should be kept as cool as possible, but above the point of freezing. When held at higher temperatures, apples ripen and soften rapidly, ultimately becoming mealy, and soon losing much of their characteristic flavour.

Wrapping apples in paper impregnated with mineral oil, or placing such paper in the packages in contact with the fruit, prolongs the holding season for most varieties through delaying the occurrence of a surface blackening or breakdown known as storage scald.

Utilization.—Apples are eaten fresh to a large extent, but also are adapted to a wide range of culinary uses. Apple pie, apple sauce and baked apples are favourite dishes in the United States. Apple juice (unfermented) is popular in America. Fermented juice (apple cider) utilizes an important part of European production. Apple butter and apple jelly are important both in the home and in commercial channels. Apple vinegar is another important product.

Apples are commercially canned and dehydrated to a large extent in the United States. Frozen apples are largely used in the baking and restaurant trade.

World Production.—During the decade prior to World War II, total apple production in the countries for which data were available ranged between a low of 374,000,000 bu. (1932) and a high of over 500,000,000 bu. (1937). These figures do not



COURTESY OF THE BUREAU OF PLANT INDUSTRY, U.S. DEPARTMENT OF AGRICULTURE

SORTING AND GRADING APPLES IN A MODERN PACKING HOUSE

include U.S.S.R., India and China, but do include all other important apple producing countries.

Average Annual Production of Apples in Leading Countries, 1931–37 inclusive (in bushels)

United States	161,833,000	Austria	8,668,000[2]
France—		Australia	10,261,000
cider varieties	81,282,000	England and Wales—	
dessert varieties	6,642,000	cider varieties	3,170,000
Germany	46,200,000	dessert varieties	8,461,000
Switzerland	19,034,000	Rumania	7,621,000[2]
Canada	13,427,000	Yugoslavia	5,782,000
Italy	12,712,000	Japan	5,449,000
Czechoslovakia	11,028,000	Spain	5,409,000
Poland	11,206,000[1]		

[1]Approximation. [2]Average of six years.

Countries having important apple production, but totalling less than those listed, include Argentina, Belgium, Chile, Korea, Estonia, Finland, Greece, Luxembourg, Mexico, Netherlands, New Zealand, Eire, Sweden and Norway. The U.S.S.R. has extensive apple production, estimated to be at least 50,000,000 bu. per year, though exact production figures were not available at the time of World War II. India and China also produce considerable quantities for local consumption.

(J. R. MAG.)

APPLEBY, municipal borough and county town of Westmorland, England, on the L.M.S.R. and a branch of the L.N.E.R. Pop. (1938) 1,575. It is placed in the richly-wooded valley of the Eden, flanked on the north-east by spurs of Milburn forest and Dufton and other fells, which rise to 2,600 ft. Appleby is not mentioned in any Saxon records, but after the Conquest it rose to importance as the head of the barony of Appleby which extended over the eastern portion of the present county of Westmorland. This barony formed part of the province of Carlisle granted by Henry I. to Ranulf Meschin, who erected the castle at Appleby and made it his place of residence. The castle, placed on a hill above the town, was rebuilt in the 17th century. It retains a fine Norman keep and is surrounded by a double moat, reminiscent of its position near the Border. Appleby is a borough by prescription; and the burgesses were given the customs of York by Henry II. The impoverishment caused by Scottish raids led to its decline in the later middle ages. Writers of the 16th and 17th centuries speak of it as a poor and insignificant village. The castle was held for the royalists in the civil wars by Sir Philip Musgrave, and was the residence of Anne, Countess of Pembroke, the last of the family of Clifford, which possessed great estates in this part of England. Incorporated in 1885, Appleby is a milk centre, though the principal trade is agriculture.' Area, 2.9 sq.mi.

APPLEGARTH, ROBERT (1834–1925), English trade union leader, was the son of a Sheffield quartermaster. After emigrating to the United States he returned to England and became the general secretary of the new Amalgamated Society of Carpenters and Joiners in 1862. He became the chief member of the group of officials, later called the "junta," which imposed a new structure and policy upon the British trade-union movement. Other prominent members were William Allan (engineers), Daniel Guile (ironfounders), and Edwin Coulson (bricklayers). The new unions, in direct contrast to the old, had high friendly benefits and high subscriptions, rising to one shilling a week in some cases. Almost absolute authority was granted to the central office, which was, for the first time, equipped with a regular staff, and a policy of conciliation and co-operation with the employers was pursued. In 1872, perceiving that the victory of his new principles was now assured, Applegarth resigned his office and entered business. But to the end of his very long life he retained an interest in Labour affairs and his advice was treated with great respect.

BIBLIOGRAPHY.—*See* A. W. Humphrey, *Robert Applegarth* (1913); S. and B. Webb, *History of Trade Unionism* (latest *edn.* 1920); R. W. Postgate, The *Builders' History* (1923).

APPLETON, DANIEL (1785–1849), U.S. publisher, was born Dec. 10, 1785, at Haverhill. Mass. He first sold dry goods in Haverhill. Boston and New York but a few years after he settled in New York began to import English books and to sell them in his store.

It was not long before the book trade had superseded his other merchandise altogether. and in 1831 he began to publish books, his first being *Crumbs from the Master's Table,* a small collection of religious essays. In 1838 he made his son William a partner and the firm became known as D. Appleton & Company. Appleton was a leader in the field of publication of juvenile books and of works in Spanish for sale in Latin America.

Appleton turned the business over to his son in 1848 and died in New York city, March 27, 1849.

APPLETON, NATHAN (1779–1861), American merchant and politician, was born in New Ipswich (N.H.), Oct. 6, 1779. He was educated in the New Ipswich academy, and in 1794 entered mercantile life in Boston, in the employment of his brother. Samuel (1766–1853), a successful and benevolent man of business, with whom he was in partnership from 1800 to 1809. He co-operated with Francis C. Lowell and others in introducing the powerloom and the manufacture of cotton on a large scale into the United States, a factory being established at Waltham (Mass.) in 1814, and another in 1822 at Lowell (Mass.), of which city he was one of the founders. He was a member of the general court of Massachusetts in 1816, 1821, 1822, 1824 and 1827, and in 1831–33 and 1842 of the national House of Representatives, in which he was prominent as an advocate of protective duties. He died in Boston, July 14, 1861.

His son, THOMAS GOLD APPLETON (1812–1884), who graduated at Harvard in 1831, had some reputation as a writer, an artist and a patron of the fine arts, but was better known for his witticisms, one of which, the oft-quoted "Good Americans, when they die, go to Paris," is sometimes attributed to Oliver Wendell Holmes. He published some poems, and, in prose, *Nile Journal* (1876), *Syrian Sunshine* (1877), *Windfalls* (1878), and *Chequer-Work* (1879).

See memoir of Nathan Appleton by R. C. Winthrop (1861); Susan Hale's *Life and Letters of Thomas Gold Appleton* (1885).

APPLETON, a city of Wisconsin, U.S.A., on the lower Fox river, about 90 mi. N.W. of Milwaukee, near Lake Winnebago, the largest and one of the most beautiful lakes of the state; the county seat of Outagamie county. It is on Federal highway 41, and is served by the Chicago and North Western, the Chicago, Milwaukee and St. Paul and the Soo Line railways; and by steamboats on the river, connecting with lake steamers at Green Bay.

The population was 25,267 in 1930 and 28,436 in 1940 by federal census.

The city is attractively laid out on high bluffs above the river. It is the centre of a rich livestock and dairy section, and has large paper mills and other factories, utilizing power developed from the Fox river.

Lawrence college (chartered 1847) occupies a campus of 6 ac. in the heart of the city. The college was founded in 1846 by a gift of $10,000 from Amos Adams Lawrence (1814–86), a merchant of Boston, to the local conference of the Methodist Episcopal Church, and was opened in 1849. In 1940–41 the enrolment was 673.

Appleton was settled in 1833 and incorporated as a village in 1853. The villages of Grand Chute and Lawesburg were consolidated with it to form a city, which was chartered in 1857. Appleton also, like the college, was named after a Boston merchant, Samuel Appleton, who owned part of the original town plot and contributed generously to the college library.

APPLIED MECHANICS: *see* POWER TRANSMISSION.

APPLIED PSYCHOLOGY is that branch of technical service in which the facts and methods of the science of psychology are applied to the practical affairs of life. Its boundary lines are vague because it merges imperceptibly into the realm of the pure science of psychology, and especially because the range of possible and actual applications is so extensive. In fact, just as everyone considers himself somewhat of a psychologist, so everyone considers himself somewhat of an applied psychologist. For these reasons applied psychology has suffered probably more than other applied sciences from the practices of pretenders and charlatans. The popular conception formed from these contacts is liable to be cheap and erroneous.

History of Applied **Psychology.**—The very beginnings of applied psychology are discoverable in the work of Charles Dar-

win, who, in the realm of organic life, sought out variations from individual to individual and from species to species, and emphasized the importance of these variations. Francis Galton extended the search for variation into the realm of mental life *(Inquiries into Human Faculty,* 1883), and found individual differences as interesting and as significant as those found by Darwin in physical forms and behaviour. The earliest differences pointed out by Galton had some practical bearing, although it remained for Cattell, Binet and their followers to seek and measure differences in human traits which have a more immediate practical application, such as the differences in intelligence, reaction time, judgment, etc.

The first clearly formed applications of psychology arose with the recognition that differences among individuals and among groups meant differences in adjustment to situations in everyday life. and that improvements in adjustment must come either through a control of environmental influences or through a modification of the individual or the group. Experimental laboratory methods were applied directly to the measurement of the sensory capacities, memory, attention and fatigue of school children in the field of education. As the inadequacies and limitations of these purely scientific procedures revealed themselves in the practical setting, methods were devised to meet practical needs more directly. Foremost among the pioneers were Binet and Simon, who developed tests for the measurement of intelligence by departing from traditional laboratory technique and building tests out of the experiences of the everyday life of the child *(The Development of Intelligence in Children,* 1905); and Cattell, who originated the order of merit method for the measurement of mental products (*The Psychological Researches of James McKeen Cattell,* 1914). Credit should be given also to the so-called efficiency engineers who analysed industrial tasks and measured the efficiency of different individuals to perform them. They have contributed largely to the development of applied psychology by their attitude toward practical problems.

The **Rôle of** Measurement **in** Applied Psychology. — The most outstanding characteristic of applied psychology is the part played by measurement, which takes two forms: (1) The tests or instruments for the measurement of individual, group, class, sex and race differences in capacity and achievement. (2) Statistical methods needed for the standardization and validation of the tests and for the analysis and synthesis of the variable products yielded by the tests. The construction of tests has become a highly technical task, and their proper administration and interpretation require special psychological training. The statistical methods of treating biological data have been modified and developed *(see* the works of Karl Pearson, Charles Spearman and T. L. Kelley) to meet the special requirements for the measurement of general tendencies of behaviour and their inter-relationships.

Divisions of Applied **Psychology.**—Certain arbitrary, but well-recognized divisions of the field of applied psychology have developed through the demands of practical life and through the expression of interests of investigators. This classification is neither logical nor complete, and will be reconstructed and expanded as the number of applied psychologists increases and as research data accumulate. The major divisions are *Educational Psychology, Vocational Psychology, Industrial Psychology, Business Psychology, Legal Psychology* and *Medical Psychology.* In addition to these there are other less well defined or less active divisions, such as the psychology of religion and the psychology of aesthetics. Then, there are the more highly specialized fields which do not readily fall into any of the above major or minor classes, such as the psychology of music, the psychology of athletics, the psychology of play, military psychology, the psychology of the deaf, the blind and the otherwise handicapped. Finally, there are innumerable special psychological problems growing out of the daily life of the individual which have significance for his success, and warrant systematic investigation, such as the psychology of suggestion, of morale, of automobile and aeroplane accidents, and the psychological effects of drugs and stimulants. The characteristics of the major divisions will be indicated.

Educational Psychology. — The field of education represents the first practical activity in which psychology was systematically applied. So numerous and important have these applications become that "the act of teaching is now generally recognized to be based primarily upon the science of psychology." It forced attention upon the individual as the unit for instruction, and impelled educators to adapt their methods of teaching to suit him. Furthermore, it brought about the analysis of such school subjects as arithmetic into a large number of simple processes and operations, each of which must be cared for in the programme of instruction.

Along with this recognition of the individual, there goes the need for facilitating his progress and for measuring the rate of his progress. The facts of learning especially are constantly being canvassed for means of improving the conditions for learning, and elaborate test instruments are being devised for the measurement of pupils' achievement. Such facts as distribution of learning time, amount to be learned at a given time, the use of recitations, and other aids to learning are known to every teacher. Almost as widespread is the use of the various handwriting, composition, drawing and other scales for measuring accomplishment of school children. *(See* EDUCATION: *Psychology and Ancillary Sciences.)*

Vocational Psychology is concerned with the selection and guidance of individuals with respect to the vocation for which they are best fitted. Guidance and selection, to be adequately administered, require the analysis of the various occupations to determine the qualities that are needed for success in them, and the construction of measuring instruments to test for the presence of these qualities in the individual. The greatest progress has been made in the direction of finding the amount of intelligence that is required for various vocations, and in measuring the degree of intelligence that a person possesses. It is possible at present to estimate with some assurance the minimum of intelligence required for success in college work, for success in the professions, and for success in some of the skilled and unskilled trades. Satisfactory tests have also been devised for more highly specialized capacities, such as musical ability, motor skills and executive ability. The measurement of the traits of character and temperament which are recognized to play a vital part in success in life offers more serious difficulties than the measurement of the intellectual traits, and little can be done for practical guidance in these respects at present. In a somewhat similar state is the effort to measure interest, although some progress is being made through the simple listing of interests in specific situations, and then weighing them empirically according to their prognostic value for a given vocation.

Vocational psychology should be credited with the demonstration of the inadequacy of many widely used vocational devices, such as the analysis of handwriting, physiognomy, interviews and letters of application.

Industrial Psychology embraces the problem of so fitting the worker to his work that the maximum of production shall be obtained with the least expenditure of energy. This branch of applied psychology has been influenced to a great degree by the efficiency engineers, and it is they who have set many of the problems which have engaged the interests of the psychologist. Foremost among these problems are the economies to bc gained by the analysis of work by means of time and motion studies. They reveal waste of motion through the improper placing of materials, improperly directed movements and the uneconomical routing of work generally. Laboratory and field studies have shown the economies of properly distributed work and rest schedules, and of the control of such environmental conditions as ventilation, illumination and distracting noises. The results of attention to such matters, when measured in terms of output of work, have shown surprisingly large percentages of increase. These changes have been found in most cases to produce their effects gradually, a period of six months being required in certain instances to attain the total benefit from a change of work schedule. Not all the changes introduced into working conditions by the efficiency engineer are justified on psychological grounds.

Too high a degree of specialization and standardization of function may lead to a monotonous routine that requires some corrective in the best interests of the worker. From the standpoint of the applied psychologist, more attention should be paid to the satisfaction to which the worker is entitled than is generally paid to that important matter *(see* INDUSTRIAL PSYCHOLOGY).

Business Psychology. — This branch of applied psychology should include all problems concerned with the distribution of goods. After deducting, however, all questions of selection of employés, and all questions of production, there remains primarily the task of acquainting the public with the goods that are available for distribution, namely, advertising and selling. Of these, advertising has received by far the major interest. This is primarily due to the fact that good advertising lends itself readily to study and analysis, both in the field and in the laboratory, while good selling remains a more intangible quality. The greatest contribution of psychology to advertising is to be found in the motivation of behaviour,—the fact that behaviour is determined by a series of causes, some of which are within the control of the advertiser. Thus, the desire for self-assertion, for protection, for comfort, etc., are played upon effectively in the sale of a great variety of commodities. All the facts of attention, perception, memory, feeling, belief and suggestion which have been accumulated over years of laboratory work are applicable directly to the problem of getting the attention of the reader, making a permanent impression upon him, and leading him to a favourable reaction toward a given product. Field studies of the reactions of people to such mediums as the *Saturday Evening Post* have revealed much valuable information concerning the manner in which the attitude of the reader may be affected by the use of colour, of large space, of unique illustrations, of so-called preferred positions on the page and in the medium itself. All the psychological principles which have been applied to advertising are equally applicable to the problems of selling, except that greater flexibility is possible because of the direct contact between salesman and customer *(see* PSYCHOLOGY OF ADVERTISING).

Legal Psychology. — Modern psychology, as the study of human behaviour, has many points of contact with the law, although relatively few of them have been developed. As far as prevention of crime is concerned, psychological analysis has thrown much light upon its determinants. Discarding the notion of responsibility as it is usually conceived, it has sought causes and contributing factors. Contrary to common opinion, such hereditary factors as defective intelligence are found to play a minor rôle, while social inheritance and environmental factors play a major part. Even among the environmental forces, poverty is of slight influence compared with defective discipline in the home. A psychological analysis of preventive measures at present in force shows their weaknesses and suggests methods for their improvement. The establishment of psychological clinics in connection with the courts and within the larger prisons furnishes the means of analysing causes of crime, and of determining a prison régime in accordance with the needs of the individual prisoner.

The most interesting applications of psychology to the law are to be found in the field of evidence. The great work of Wigmore *(Principles of Judicial Proof,* 1913) has shown the need of a sound conception of psychology in the interpretation of evidence. Every bit of evidence is definitely limited in its range and validity by the sensory capacity, the perceptual power, the ability to judge and remember on the part of the observer. Since these functions vary greatly from individual to individual, it follows that evidence must be evaluated upon a knowledge of the limitations of the individual who is giving it.

The use of various devices for detecting guilt or deception depends upon the influence of the consciousness of deception upon such psychological processes as blood pressure, breathing, psychogalvanic reaction and the speed of articulation. In laboratory tests of such methods a surprising degree of accuracy in the detection of deception is attained. The principles underlying these procedures have not yet attained sufficient scientific support to justify their use in the courts for the determination of guilt.

Medical Psychology. — Psychology and medicine have been closely associated for more than 50 years, and important contributions have been made in the field of mental diseases by both physicians and psychologists. In spite of this, there has grown up no body of information definitely labelled as medical psychology, nor a group of specialists similar to those in the fields of industrial and vocational psychology. There are the psychiatrists and psychopathologists, who are interested in mental and nervous diseases from the medical rather than from the psychological point of view, and there are the specialists in abnormal psychology, who are usually psychologists. There is no provision in most medical schools for training in general psychology which would create the psychological point of view, and bring the physician and psychologist into closer contact.

The elaborate system of psychoanalysis for the diagnosis and treatment of patients grew up without adequate contact with normal psychology, and many conflicts and misunderstandings have resulted therefrom. Numerous important contributions to theory and practice in relation to mental disease have been made by psychologists from time to time, while hospitals and research institutions are coming to recognize the significance of psychological tests, and in some cases have appointed psychologists upon their staffs.

Organizations and Publications. — A number of organizations have been established for the promotion of applied psychology, and for establishing contact between the psychologist and the problems of business and industry. Best known among these are the National Institute of Industrial Psychology (London), the Psychological Corporation and the Personnel Research Federation (New York city). The International Conference of Psychotechnics is a permanent organization which meets annually in different countries. As the name implies, it is truly international in scope, with German, French and English as the recognized languages for communication. In many countries there are institutions for promoting some special phase of applied psychology, as vocational guidance.

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APPOGGIATURA, a musical term for a melodic ornament, a grace-note prefixed to a principal note and printed in small character (from Ital. *appoggiare,* to lean upon). The effect is to shorten the principal note, by taking away the time-value of the *appoggiatura* prefixed to it. There are two kinds, the long *appoggiatura,* now usually printed as played, and the short, where the suspension of the principal note is scarcely perceptible; the latter is now often called (not quite accurately) an *acciaccatura* (*q.v.*).

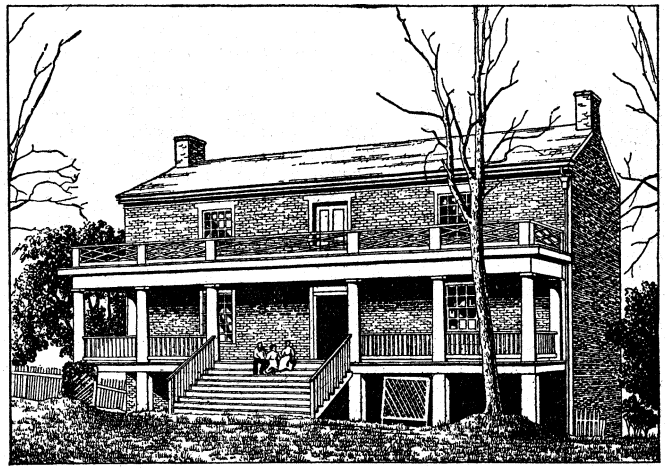
APPOINTMENT, POWER OF, in English law, an authority reserved by or limited to a person by a legal instrument, to dispose, either wholly or partially, either for his own benefit or

for that of others, of an interest in property which is not his own under that instrument. Such powers are either general or limited. A general power is one which the appointor may exercise in favour of any person he pleases. It is obvious that such a power is very nearly equivalent to ownership, and consequently the property involved shares the liabilities of ownership as regards execution of judgments, bankruptcy and death duties. A limited power is one which can only be exercised in favour of certain specified persons or classes, but by the Powers Amendment Act 1874 the donee of the power is no longer obliged to appoint a share to each object of the power.

By the Wills Act 1837 a will made pursuant to the requirements of that statute shall be a valid execution of a power of appointment by will, notwithstanding that some additional form or solemnity is required by the instrument creating the power (see WILL). As regards appointments by deed, the Law of Property Amendment Act 1859 enacts that a deed attested by two witnesses shall, so far as execution and attestation go, be a valid exercise of a power to appoint by deed. The courts of equity also will interfere in some cases of defective execution in order to carry out the intentions of the settlor where the defect is not of the essence of the power, but is a mere formality.

A power of appointment if exercised must be exercised bona *fide*, otherwise it will be void as fraudulent. Where an execution is partly fraudulent and partly valid the court will, if possible, separate the two and only revoke that which is fraudulent; if, however, the two parts are not separable the whole is void. By s. 157 of the Law of Property Act 1925 protection is given to a purchaser in good faith. The doctrine of Election applies to appointments under powers.

The appointment must in law be read into the instrument creating the power in lieu of the power itself. Thus an appointor under a limited power cannot appoint to any person to whom the donor could not have appointed by reason of the rule against perpetuities, but this is not so in the case of a general power, for there the appointor is virtually owner of the property appointed. In applying this rule to appointments a distinction arises between powers created by deed and will, for a deed speaks from the date of its execution but a will from the death of the testator. and



BY COURTESY OF THE REVIEW OF REVIEWS (NEW YORK)

THE HOME OF WILMER PCLEAN AT APPOMATTOX WHERE. ON APRIL 9, 1865, GEN. LEE AND LT.-GEN. GRANT SIGNED THE TERMS OF SURRENDER THAT ENDED THE CONFEDERACY AND BROUGHT THE CIVIL WAR TO A CLOSE. NEGOTIATIONS TOOK PLACE IN THE FRONT ROOM TO THE LEFT OF THE CENTRAL DOORWAY

so limitations bad when the will was made may have become good when it comes into operation. Since the Conveyancing Act 1881 (now Law of Property Act 1925, s. 155, 156) all powers may be released by the donees thereof, unless the power is coupled with a trust in respect of which there is a duty cast on the donee to exercise it; and this is so even though the donee gets a benefit by such release as one entitled in default of appointment, for this is not a fraud upon the power.

APPOMATTOX, a village of Appomattox county, Virginia, U.S.A., 25 mi. E. of Lynchburg. Population was 992, by 1940 federal census. It is served by the Norfolk and Western railway. The old village of Appomattox Court House, 3 mi. N.E., was the scene of the surrender of the Confederate Army of Northern Virginia under General Robert E. Lee to the Federal forces under Lieutenant General U. S. Grant on Sunday, April 9, 1865. The terms were: "the officers to give their individual paroles not to take up arms against the government of the United States until properly exchanged, and each company or regimental commander to sign a like parole for the men of their commands." Appomattox Court House, virtually deserted after removal of the county seat to the new town of Appomattox in 1892, was made a national historical monument in 1930; the national park service then began restoration of the village to its 1865 appearance.

APPONYI, ALBERT, COUNT (1846–1933), Hungarian statesman, the most distinguished member of an ancient noble family, dating back to the 13th century, and son of the chancellor Gyorgy Apponyi (1808–99) and the accomplished and saintly Countess Julia Sztáray, was born at Pest on May 29, 1846. Educated at the Jesuit seminary at Kalksburg and at the universities of Vienna and Pest, a long foreign tour completed his curriculum, and at Paris he made the acquaintance of Montalembert, a kindred spirit, whose influence on the young Apponyi was permanent. He entered parliament in 1872 as a liberal Catholic, attaching himself at first to the Deák party; but the feudal and ultramontane traditions of his family circle profoundly modified, though they could never destroy, his popular ideals. On the break up of the Deák party he attached himself to the conservative group which followed Baron Pál Senynyey (1824–88) and eventually became its leader. Until 1905 Count Albert was constantly in opposition, but in May of that year he consented to take office in the second Wekerle ministry. From 1906–10 he was Minister of Education in the Wekerle Cabinet. He succeeded Kossuth as president of the party of Hungarian Independence and advocated universal suffrage. At the outbreak of the World War he adopted the standpoint of a "truce of God" with regard to all internal dissensions. He retired into private life after the outbreak of the revolution of Oct. 1918. In 1919 he was elected as a non-party deputy to the National Assembly and was head of the Hungarian peace delegation in Paris. He became a member of the League of Nations Union and in 1924 and 1925 represented Hungary at the Assemblies of the League of Nations, where his magnetic oratory made a great impression. He stood above rather than outside party politics, and his authority as the "Grand Old Man" of the nation carried unusual moral weight. He died Feb. 7, 1933.

His published works include *Recollections of a Statesman* (1912); "Die rechtliche Natur der Beziehungen zwischen Osterreich und Ungarn" in the *Osterreichische Rundschau* (vol. 28); in Hungarian: *My Memoirs: 50 years*, vol. 1; *Youth, 25 years in Opposition* (1922). Two volumes of parliamentary speeches were published (1897) relating to the 25 years' activity mentioned in the first volume of the Memoirs.

APPORTIONMENT, distribution or allotment in proper shares; a term used in law in a variety of senses. (1) Sometimes it is employed roughly and with no technical meaning to indicate the distribution of a benefit (*e.g.*, salvage, damages under the Fatal Accidents Act 1846, s. 2), or liability (*e.g.*, general average contributions, or tithe-rent charge) or the incidence of a duty (*e.g.*, obligations as to the maintenance of highways). (2) In its strict legal interpretation apportionment falls into two classes "apportionment in respect of estate" and "apportionment in respect of time."

Apportionment in Respect of Estate may result either from the act of the parties or from the operation of law. Where a lessee is evicted from, or surrenders or forfeits possession of, part of the property leased to him he becomes liable at common law to pay only a rent apportioned to the value of the interest which he still retains. So where the person entitled to the reversion of an estate assigns part of it, the right to an apportioned part of the rent incident to the whole reversion passes to his assignee. The assignee of the reversion of part of demised premises could not, at common law, re-enter for breach of a condition, inasmuch as a condition of re-entry in a lease could not at common law be apportioned. But this has now been altered by statute both

in England (Law of Property Act 1925, s. 140), and in many colonies (*e.g.*, Ontario, Rev. Stats., 1914, c. 150; Barbados, No. 12 of 1891, s. 9; Nova Scotia, 210 R.S. of 1923; Victoria, 2733 of 1915, Stats. pt. vii; Manitoba, No. 2 of 1927). On the release from a rent charge of part of the land charged therewith, the lands not so released remain liable to a part only of the rent charge proportionate to their value unless the owners of such lands concur in the release of the rest of the lands originally liable, when the whole rent charge will be payable out of the lands not released (Law of Property Act, 1925 s. 70).

The Minister of Agriculture and Fisheries is now empowered to apportion rents of every kind, on the application of any persons interested in the lands and in the rents (ib. ss. 191, 192).

Apportionment by Operation of Law may be brought about where by act of law a lease becomes inoperative as regards its subject matter, or by the "act of God" (as, for instance, where part of an estate is submerged by the encroachments of the sea). To the same category belongs the apportionment of rent which takes place under various statutes (*e.g.*, the Lands Clauses Consolidation Act 1845, s. 119, when land is required for public purposes; the Agricultural Holdings Act 1923, s. 27, in case of a tenant from year to year receiving notice to quit part of a holding).

Apportionment in Respect of Time.—At common law, there was no apportionment of rent in respect of time. Such apportionment was, however, in certain cases allowed in England by the Distress for Rent Act 1737, and the Apportionment Act 1834, and is now allowed generally under the Apportionment Act 1870. Under the statute (s. 2) all rents, annuities, dividends, and other periodical payments in the nature of income, whether reserved or made payable under any instrument in writing or otherwise, are, like interest on money lent, to be considered as accruing from day to day and to be apportionable in respect of time accordingly. Persons entitled to apportioned parts of rent have the same remedies for recovering them when payable as they would have had in respect of the entire rent; but a lessee is not to be liable for any apportioned part specifically. The rent is recoverable by the heir or other person who would, but for the apportionment, be entitled to the entire rent, and he holds it subject to distribution (s. 4). The Apportionment Act 1870 does not extend to annual sums made payable in policies of insurance (s. 6). Apportionment under the Act can be excluded by express stipulation.

The apportionment created by this statute is "apportionment in respect of time." The cases to which it applies are mainly cases of either (A) apportionment of rent due under leases where at a time between the dates fixed for payment the lessor or lessee dies or some other alteration in the position of parties occurs; or (B) apportionment of income between the representatives of a limited owner and the remainder-man when the limited interest determines at a time between the date when such income became due.

(A) With regard to the former of these classes it may be noticed that although apportioned rent becomes payable only when the whole rent is due, the landlord, in the case of the bankruptcy of an ordinary tenant, may prove for a proportionate part of the rent up to the date of the receiving order (Bankruptcy Act 1914, Sched ii. r. 20); and that a similar rule holds good in the winding up of a company (in re *South Kensington* Co-Operative Stores 1881, 17 Ch.D. 161); and further that the Act of 1870 applies to the liability to pay as well as to the right to receive rent (in re Wilson [1893], 62 L.J.Q.B. 628, 632). Accordingly where an assignment of a lease is made between two half-yearly rent days, it has been held that the assignee is not liable to pay the full amount of the half-year's rent falling due on the rent day next after the date of the assignment, but only an apportioned part of that half-year's rent computed from the last mentioned date (*Glass* v Patterson, 1902, 2 Ir. R. 660).

(B) All dividends payable by public companies are apportionable, whether paid at fixed periods or not, unless the payment is, in effect, a payment of capital (s. 5).

(C) In deciding on the real character of the payment the Court has regard to all the circumstances under which it is made, and more especially the powers and intention of the company in making the distribution. Where stocks representing capital are sold with an accrued or accruing dividend, the Courts of Equity disregarded, except in special circumstances, the claims of persons entitled to income to have an apportionment of capital so realized made in their favour. The Act of 1870 has been held not to have altered this rule.

The Apportionment Act 1870 extends to Scotland and Ireland (but see IRELAND). It has been followed in many of the British colonies (Burge, Foreign and Colonial Laws, iv., Pt. II. by Bewes, 620).

An equitable apportionment apart from statute law arises, also, where property is bequeathed on trust to pay the income to a tenant for life, and the reversion to others, and the realisation of the property in the form of a fund capable of producing income is postponed for the benefit of the estate. In such cases there is an ultimate apportionment between the persons entitled to the income and those entitled to the capital of the accumulations for the period of such postponement.

See Stroud, ***Jud. Dict.***, *s.v.* "Apportion"; Bouvier, ***Law Dict.***, *s.v.* "Apportionment"; ***Ruling Cases***, tit. "Apportionment"; Foá, ***Landlord and Tenant*** (6th ed., 1924); Williams, ***Real Property*** (1926).

The term Apportionment is used in the United States to indicate the obligation of Congress to re-assign among the states the numbers of members of the House of Representatives to which they are entitled following each decennial census. Such an apportionment was not made on the basis of the census of 1920, being the first time Congress so failed to act following a census. It also is used to indicate the action of state legislatures in districting and re-districting congressional, legislative, judicial and other seats and of city councils and commissions in taking similar action on local offices. Often the term re-apportion is used, to distinguish from the apportionment already in effect.

APPORTIONMENT BILL, an act passed by the Congress of the Cnited States after each decennial census to determine the number of members which each State shall send to the House of Representatives. The ratio of representation fixed by the original constitution was 1 to 30,000 of the free population, and the number of the members of the first House was 65. As the House would. at this ratio, have become unmanageably large, the ratio was raised after each subsequent census through that of 1910 (see accompanying table). No reapportionment was made following the 14th census. But in 1929 a new system provided that the number of seats should be held at 433 and that the redistribution should be carried out mathematically.

Under	Census.		Apportionment Effective		Whole number of representatives.
	Year.	Population.	rear.	Ratio.	
Constitution			1789	30,000	65
First census	1790	3,929,214	1793	33,000	105
Second census	1800	5,308,483	1803	33,000	141
Third census	1810	7,239,881	1813	35,000	181
Fourth census	1820	9,633,822	1823	40,000	213
Fifth census	1830	12,866,020	1833	47,700	240
Sixth census	1840	17,069,453	1843	70,680	223
Seventh census	1850	23,191,876	1853	93,423	234
Eighth census	1860	31,443,321	1863	127,381	241
Ninth census	1870	38,558,371	1873	131,425	292
Tenth census	1880	50,155,783	1883	151,911	325
Eleventh census	1890	62,622,250	1893	173,901	356
Twelfth census	1900	75,568,686	1903	194,182	386
Thirteenth census	1910	91,972,266	1913	211,877	435
Fourteenth census	1920	105,710,620	.	..	435
Fifteenth census	1930	122,775,046	1933	279,712	435

If a State has received an increase in the number of its representatives and its legislature does not pass an apportionment bill before the next congressional election, the votes of the whole State elect the additional members on a general ticket and they are called "congressmen-at-large."

The same term is applied to the acts passed by the State legislatures for correcting and redistributing the representation of the

counties. Such acts are usually passed at decennial intervals, more often after the Federal census, but the dates may vary in different States. The State representatives are usually apportioned among the several counties according to population, not geographical position. The electoral districts so formed are expected to be equal in proportion to the number of inhabitants; but this method has led to much abuse in the past, through the making of unequal districts for partisan purposes. (See GERRYMANDER.)

APPOSITION, a grammatical term used of a noun when it is employed as complement to a preceding noun or noun clause. The word also signifies an oral examination; "Speech-day" at St. Paul's School, London is known as Apposition.

APPRAISER, one licensed to set a value upon real or personal property. In England, appraisers are usually auctioneers also, and the name itself has given place, to a great extent, to that of "valuer." One who exercises the calling of appraiser or valuer, and who makes any valuation chargeable with stamp duty, must take out an appraiser's licence, costing £2 per annum, unless he is licensed as an auctioneer or house-agent. (See VALUATION.)

In the United States appraiser is a term often used to describe a person specially appointed by a judicial or quasi-judicial authority to put a valuation on property or land. Appraisers of imported goods appointed by the customs court (formerly boards of general appraisers) have extensive functions in administering the customs laws of the United States. Merchant appraisers are sometimes appointed temporarily under the revenue laws to value where there is no resident appraiser without holding the office of appraiser (*U.S.* Rev. *Stats.* § 2609).

APPREHENSION, in psychology, a term applied to a mode of consciousness in which nothing is affirmed or denied of the object in question, but the mind is merely aware of ("seizes") it. "Judgment" (says Reid, ed. Hamilton, i. p. 414) "is an act of the mind specifically different from simple apprehension or the bare conception of a thing"; and again, "Simple apprehension or conception can neither be true nor false." This distinction provides for the large class of mental acts in which we are simply aware of or "take in" a number of familiar objects, about which we in general make no judgment unless our attention is suddenly called by a new feature. Or again two alternatives may be apprehended without any resultant judgment as to their respective merits. Similarly G. F. Stout points out that while we have a very vivid idea of a character or an incident in a work of fiction, we can hardly be said in any real sense to have any belief or to make any judgment as to its existence or truth. With this mental state may be compared the purely aesthetic contemplation of music, wherein apart from, say, a false note, the faculty of judgment is for the time inoperative. To these examples may be added the fact that one can fully understand an argument in all its bearings without in any way judging its validity.

Without going into the question fully, it may be pointed out that judgment and apprehension are distinguishable but not separable. Together with every apprehension there is judgment of some sort in a greater or less degree of prominence. Judgment and apprehension are in fact psychologically distinguishable merely as different, though connected, activities of consciousness. Professor Stout further investigates the phenomena of apprehension, and comes to the conclusion that "it is possible to distinguish and identify a whole without apprehending any of its constituent details." On the other hand, if the attention focuses itself for a time on the apprehended object, there is an expectation that such details will as it were emerge into consciousness. Hence he describes such apprehension as "implicit," and in so far as the implicit apprehension determines the order of such emergence he describes it as "schematic." A good example of this process is the use of formulae in calculations; ordinarily the formula is used without question; if attention is fixed upon it, the steps by which it is shown to be universally applicable emerge and the "schema" is complete in detail.

With this result may be compared Kant's theory of apprehension as a synthetic act by which the sensory elements of a perception are subjected to the formal conditions of time and space.

See **G.** F. Stout, *Analytic Psychology (1896)*; F. Brentano, *Psychologie* (bk. ii. ch. vii.), and *Vom Ursprung sittlicher Erkenntnis;* B. Titchener, *Outlines of Psychology* (1902), and text-books of psychology. Also *see* PSYCHOLOGY. (A. WO.)

APPRENTICESHIP. The idle or industrious apprentice, fed, clothed and lodged by his master, was learning his craft at least 100 years before 1383 when apprenticeship was first noticed in an act of parliament. In the 12th century the craftsmen of the towns were associated in gilds for their mutual protection, for the advancement of their crafts, and later to hinder competition from those who were not free of the town. The gild (*q.v.*), which was a form of the mediaeval corporation or *universitas,* consisted of masters and apprentices, the masters being those who were skilled in an art, a science or a craft, and the apprentices those who were learning its mysteries. Thus barristers were apprenticed to the law, *apprenticii* ad *legem,* just as the sons of freemen might be apprenticed to a slater, a carpenter or an armourer.

The **Gild** Apprentices.—The gilds concerned themselves closely with the enrolment and training of the apprentices. No master was allowed to take more apprentices then he could properly train, and the method of training was rigidly prescribed, even to the tools which should be used and the manner in which they should be handled. The period of apprenticeship was almost invariably seven years. When the full apprenticeship had been served the apprentice became a journeyman working for wages, or practised his craft as a master with his own journeymen and spprentices.

Having obtained certain privileges, including the exclusive right to practise a particular craft in a town or locality, the gilds began to use these privileges in an arbitrary and exclusive manner. As early as 1437 a statute was promulgated against the "unlawful and unreasonable ordinances" made by gilds "for their singular profit snd to the common hurt and damage of the people." To avoid the overstocking of a trade, or often to preserve their monopoly, the number and proportion of apprentices were definitely limited. At Newcastle, for example, a slater could not take a second apprentice until the first was in his last year, while the common practice was to allow one apprentice to every two or three journeymen. Difficulties were placed in the way of those who had served their apprenticeship and wished to become masters; and attempts were made to reserve the full freedom of the craft to those born in the gild. The result of these and other restrictive measures was the tendency which became marked at the end of the 15th and the beginning of the 16th centuries for journeymen to set up as masters outside the towns, free of all gild and municipal restrictions. The craft gilds' monopoly was further weakened by the growth of such new trades as the hardware, cutlery and textile trades in towns such as Birmingham, Sheffield and Manchester, which were under manorial control; by the rise of the merchant companies, and later by the confiscation of the gilds' religious property in the time of Henry VIII. and Edward VI. The decline of the gilds and the loosening of their authority brought about the Statute of Labourers and Apprentices in 1563.

Gild apprenticeship had already been regulated in part by successive Statutes of Labourers. The statute of 1563, so far as it was concerned with apprenticeship, gave statutory authority to a system which was beginning to break up, and at the same time substituted uniformity for a number of conflicting local variations. The statute, therefore, was primarily a consolidating enactment and produced no revolutionary changes. The act prescribed seven years at least as the period of apprenticeship, the term to extend until the apprentice was 24 years old; no boy could be apprenticed who was not a yeoman's son or had been engaged in agriculture; and no person might exercise a craft unless he had been apprenticed. Every master with three apprentices was compelled to keep at least one journeyman. Justices of the peace were bidden to administer the statute, and at first Elizabeth's attempt to perpetuate this gild apprenticeship seemed likely to be successful. The jolly pictures of apprentice life to be seen on the boards of the Southwark theatres, the ballads and rhymes of the apprentice who married his master's daughter, and the roystering apprentice mobs

of London during the Civil War represent the apprentice system as it existed, at least in London, during the 17th century. But the apprentice laws were not popular. The judges carefully limited their operation to the crafts named in the statute, or those existing in Elizabeth's time.

Decay of Gild Apprenticeship.—Gild apprenticeship, or as it might now be termed, domestic apprenticeship, rapidly declined during the 18th century. The introduction of machinery in the great new manufacturing industries which were outside the scope of the apprentice laws, the growing dislike of all restrictions under freedom of trade, and the rise of capitalism, led to the repeal in 1814 of the important parts of the statute of 1563. A man might now exercise any craft or trade be pleased, whether he had been an apprentice or not.

The Act of 1814 marked the end of compulsory apprenticeship, and (although it was not appreciated at the time) of domestic apprenticeship also. Long before 1814 in trades which were outside the scope of the apprenticeship laws a new kind of apprenticeship had come into being. The apprentice no longer lived without wages and under the personal control of his master, but served under a strict apprenticeship contract and lived with his parents and received wages. Despite the introduction of machinery and the increasing subdivision of labour, apprenticeship in its new form persisted as an important element in the industrial organization of the country. Although skilled handicraftsmen were no longer employed on all forms of productive work, there were still trades dependent for their existence on the individual skill of the craftsman. But at the end of the 19th and the beginning of the 20th centuries apprenticeship was threatened from another quarter. Employers became less willing to spend time and money on the training of apprentices which the specialization of processes and the speeding up of production had rendered more difficult and more expensive. The trade unions realizing that the employment of cheap juvenile labour needed protection, called in aid the time-honoured methods of the gilds and of the apprentice laws, and imposed restrictions on the number and proportion of apprentices and the conditions of their employment, which bear a curious resemblance to those which were imposed by the officers of the gild some six or seven hundred years before.

Effects of the World War.—The future of apprenticeship was in doubt when the outbreak of the World War seemed likely to sweep it away. The withdrawal of men from industry and the introduction of intensive specialization for increasing output at all costs enhanced the value of the journeymen's time and limited the field in which apprenticeship training could be given. In the engineering industry, for example, the proportion of boys and men employed increased between July 1914 and April 1917 from 14% to 21%. Again the high wages offered for repetition work of an apparently unskilled character prejudiced boys against apprenticeship with its low starting wages. At the end of the war period, therefore, the future of apprenticeship, and with it the future supply of skilled men was in the balance. Thousands of skilled men had been definitely lost to industry; the supply of apprentices had dwindled and boys had become accustomed to the higher economic standard of the young unskilled worker.

The period of industrial confusion which succeeded partially obscured the problems of apprenticeship, but the British Government saw that if industry was to regain the position which it held before the war every effort had to be made to secure a future supply of skilled men. With this end in view the interrupted apprenticeship scheme was launched, the main object of which was to bring back into the skilled trades those whose apprenticeships had been interrupted by the war. Most of these men were now above the normal age of apprenticeship and many had incurred family responsibilities and could not be expected to return to employment at apprentice wages. With the financial assistance granted by the Exchequer under the scheme employers were able to pay to these ex-service apprentices wages approximating to those which they would have received if their services had not been interrupted by the war. Directly or indirectly about 100,000 apprentices were prevented from drifting into unskilled or semi-skilled employment. Within the general scheme separate schemes for the various industries concerned were drafted by joint committees of employers and workers after useful enquiries into trade customs and practices. In Great Britain appreaticeship has now regained the place which it held before the war as the normal method of recruiting and training young workers for certain of the more important trades in the country, and is still playing an important part in the industrial life of the community.

Varieties of Apprenticeship in Great Britain.—Apprenticeship is the most usual method in Great Britain of recruiting and training the skilled worker in the engineering and allied industries, shipbuilding, building, electrical contracting, wood-working, printing, pottery, glass, scientific instrument making and the baking industries, as well as in the mercantile marine and in the manufacture and supply of electricity and gas. Girls are employed as apprentices mainly in the clothing and distributive trades. In other important industries, such as the textile industries, in which modern methods of manufacture require a comparatively short period of training, a second method of entry usually known as "learnership" is common. The difference between an apprentice and a learner is that in the case of the learner there is merely a tacit or implied understanding that the employer shall provide facilities for learning some branch of a particular trade; the employer does not undertake to teach or to retain the young worker for the whole of the period necessary for the learning of the trade. A third method of entry is termed "upgrading." In certain trades in which the introduction of machinery has reduced the amount of skill required, or in which men work in groups, unskilled men who have acquired some degree of skill by working in association with skilled men are in time "upgraded." In several industries two or three of these methods of entry to the ranks of the skilled men are to be found side by side in different occupations; in some industries skilled workers may be recruited by way either of apprenticeship or learnership. Often it is difficult to distinguish between the looser forms of apprenticeship and the stricter forms of learnership. It is estimated that about one-seventh of the youths under 21 in industrial occupations in Great Britain in 1928 were serving recognized apprenticeships, and probably about one-fifth were receiving a systematic training either as apprentices or as learners.

There are several different kinds of apprenticeship in common use. The ordinary apprentice is known as the "trade apprentice." The "pupil apprentice" has usually received a post-primary education and is given a wider training in order to qualify him for posts of responsibility. The "student apprentice" has received a full-time technical education at a university or technical institution or school and his training is designed to fit him for higher positions on the commercial or technical staff. Premiums are usually required by employers from pupil and student apprentices, but the custom of demanding premiums from trade apprentices has died out except in certain trades and districts.

Indentured Apprenticeship.—Apprenticeship under written agreements, and particularly indentures, is becoming increasingly infrequent, and this has given rise to some misunderstanding. It is often thought that there can be ne apprenticeship without a written document. In Great Britain, however, at the present time, most apprenticeships are based on verbal agreements. It is estimated that rather less than one-third of the youths receiving some form of systematic industrial training in Great Britain are apprenticed under indentures or formal agreements. Indentured apprenticeship is most frequently found in the printing and shipbuilding industries, in the mercantile marine, and in certain occupations in the glass and chemical industries. It is more common in southern than in northern districts.

Indentures, which are normally in the form of deeds, contain a number of provisions setting out in some detail the conditions of employment. They must contain an undertaking by the employer to train the apprentice, and on the part of the apprentice to serve the employer. It is usual to provide also for the term of apprenticeship, for the wages to be paid in each year of apprenticeship, and for the trade which the apprentice is to be taught, while the boy's parent or guardian is commonly bound as a third party to the agreement. In addition the apprentice may be re-

quired to attena specified technical classes, or restrained from working for another employer, or even prohibited from joining a trade union for industrial purposes. The indentures may also provide for the apprentice to be "stood off" with or without wages if the employer has no work for him, or for the binding of a fourth and independent party to secure the proper training of the apprentice. Written agreements which are not "indentures" are usually much simpler, and may contain nothing more than the undertaking of the employer to teach and of the apprentice to serve.

The age of entry into apprenticeship is from 14 to 16½, the usual age being from 15½ to 16½. In many cases there is thus a gap of a year and a half or more between the time of leaving school (boys leave the primary schools at the end of the term in which they attain the age of 14) and entry into apprenticeship, while boys who leave secondary schools at 16 or 16½ may find themselves too old to become apprentices in certain industries. The period of apprenticeships varies; it is usually from five to seven years, the shorter period being the more common. In a particular industry the period is often customary or traditional, and is not necessarily the time required to train a boy in a given occupation under modern conditions.

Wages of British Apprentices. — The wages paid to apprentices are based on the principle that in the first years of apprenticeship the apprentice is not an asset but a liability. Apprentices' wages vary widely from industry to industry and from district to district, but are always considerably below those of boys who are not employed under a definite system of training. In 1925 the average wage for the apprentice in his first year varied according to the industry and occupation, from 8s. 8d. to 12s. 4d., and in the last year from 19s. 9d. to 38s. 7d. There is usually a standard rate for each year of apprenticeship which is commonly a fixed proportion of the approved journeyman's rate.

Employers usually recruit their apprentices from among boys who apply at the works, preference being given to boys who are related to or are recommended by their workers, and particularly by their foremen. The actual selection is often left to the foreman. In some cases apprentices are selected from among the boys already employed on unskilled or semi-skilled work. Many employers are beginning to realize that it is worth their while to adopt more scientific methods based on vocational selection according to industrial fitness and promise, or involving educational or vocational tests. More attention is also being given to the training of apprentices. The traditional method is to place the boy under the care of a journeyman or the supervision of a foreman, or to employ him as a mate. But employers are appreciating more and more that the best kind of training is a judicious mixture of technical instruction and workshop training. An increasing number of employers are making use of the facilities provided by local education authorities. The "sandwich" system is sometimes adopted, under which the apprentice spends alternate periods at technical classes and in the works, or the apprentices may be released on one or two half days a week or allowed to leave work early in order to attend classes; or classes may be established in the works with or without the local education authority's help.

Joint Industrial Agreements. — In many industries the conditions of employment of apprentices is the subject of special consideration by employers' organizations and trade unions or of joint agreement between employers and workers. Employers' organizations are sometimes inclined to leave questions of apprenticeship to their individual members, but rules affecting apprenticeship or learnership are made by most trade unions whose members are engaged in the skilled occupations. These rules are often embodied in joint agreements. A number of joint industrial councils have concerned themselves with apprenticeship, and several trade boards (which have the power subject to the approval of the minister of labour to fix minimum rates of wages for apprentices and learners) have prepared schemes for the training of apprentices. It is sometimes thought that the rules of trade unions, whether or not they are embodied in joint agreements with employers' organizations, in so far as they tend to restrict the number of apprentices to journeymen that may be employed, have unduly limited the recruitment of apprentices, but it is doubtful whether in fact, except in certain cases, they have had this effect.

British Law Relating to Apprenticeship. — In order to make a contract of apprenticeship enforceable a written agreement is necessary if the period of apprenticeship is more than one year, but indentures are only necessary in exceptional cases where they are specifically required by statute. Indentures of apprenticeship, with certain statutory exceptions, are required to bear a stamp to the value of 2s. 6d. An infant cannot be bound without his own consent, but he can bind himself without his parents' consent. The validity of the contract depends upon whether it is on the whole beneficial to the apprentice. An agreement empowering the employer to stop work or withhold wages at his own option would probably not be regarded as beneficial. The apprentice must be taught the whole and not merely a branch of the trade to which he is bound. He cannot normally be dismissed for misconduct which is not of a gross character rendering the contract impossible of performance, unless he has given the employer by covenant a right to dismiss him for misconduct. An apprentice may be compelled to complete his apprenticeship, but if he fails to observe his part of the contract he cannot be sued for breach of the covenants. The parent or guardian, however, if he has bound himself as a party to the agreement, will be liable to be sued if the agreement is broken by the apprentice. A contract of apprenticeship may be dissolved by the mutual consent of all parties, and it may be determined by the permanent illness or death of the apprentice, or by the death of the employer. If the employer dies, the apprentice is not bound to serve the executors and the executors are not liable to the apprentice, unless the agreement expressly provides otherwise. The bankruptcy of the employer is a complete discharge of the indenture of apprenticeship upon notice in writing to that effect being given to the trustee, who may pay a reasonable sum to or for the use of the apprentice, or may on the application of the apprentice, transfer his indenture to another person. Disputes between employer and apprentice, in cases where no premium has been paid, or where the premium has not exceeded £25, are dealt with by courts of summary jurisdiction. Apprentices are afforded the protection given by the Factory and Workshop Acts and by the Workmen's Compensation Acts, and if they receive regular payments from their employers are insurable under the National Health Insurance and Unemployment Insurance Acts. Under the Trade Board Acts minimum rates of wages for apprentices have been fixed in certain trades, and payment at less than these rates renders the employer liable to prosecution.

APPRENTICESHIP IN OTHER COUNTRIES

British Dominions — In the Commonwealth of Australia apprenticeship is regulated by laws which vary from State to State. The conditions of apprenticeship in Victoria are fixed by wages boards elected by employers and employees, while in New South Wales and South Australia they are normally regulated by industrial awards or agreements. In Queensland an apprenticeship executive advises the minister of labour on matters of apprenticeship; there are advisory group apprenticeship committees for each trade group; a register of apprentices is kept by the director of labour; and conditions of apprenticeship are laid down in awards of the Board of Trade and Arbitration. In Western Australia the conditions are subject to awards issued by the court of arbitration, and apprentices are registered. In New Zealand the employment of apprentices is regulated either by special orders of the court of arbitration or by apprenticeship committees appointed by the court, composed of equal numbers of employers and workers with other persons interested. In the Union of South Africa the conditions of apprenticeship are regulated by the minister of labour in consultation with similar apprenticeship committees in those trades which decide to adopt the provisions of the Apprenticeship Act of 1924. Ministers have power to fix the number of apprentices in a given shop, the qualifications for apprenticeship, the period of apprenticeship, the

wages payable in each year of apprenticeship, and to determine the training classes to be attended. In South Africa, as in New Zealand, and certain of the Australian States, all apprenticeship contracts must be registered. In the Dominion of Canada apprenticeship is not regulated by Federal law, but certain provinces have laws bearing on the subject. A substantial number of apprenticeship schemes are in force, but these are normally instituted by individual firms or by groups of firms. (W. H. L. W.)

United States of America. — In the United States of America apprenticeship as understood in Europe has largely decayed, and questions of apprenticeship in industries where it still exists are usually determined by the custom of the trade or in accordance with the views of individual employers. Several States have no laws on the subject, others have repealed their apprenticeship laws or omitted them in later codifications of their laws. In Wisconsin, however, a system of apprenticeship under State supervision was established in 1915 under a revised apprenticeship law, and there are statutory provisions covering conditions and wages, while in the District of Columbia the conditions under which apprentices may be employed are regulated by the Act of 1911.

Schools may be classified under four heads: public schools; trade schools maintained by trades unions; trade schools maintained by employers' associations, and trade schools maintained by individual large employers. All these classes of schools frequently work in close co-operation with members of trade unions and also of employers' associations. As a rule the student enters at 16 to 18 years of age and remains from two to four years, according to the thoroughness of the schools and the difficulty of the craft in which he is being trained. In the public schools the technical training is supplementary to the general course of elementary education given, whereas in the typical trade schools a certain amount of general subjects, such as English, mathematics, etc., is given, but these are made supplementary to the study of the craft and are usually based directly on craft problems. A large number of the trade schools maintained both by unions and employers, either individual or association, put the student at part time work in the shop after he has spent a year or so at the fundamentals of the craft. In such cases it is usual to allow him a certain wage for his work, part of which is paid to him directly and part of which accumulates as bonus to be paid to him in a lump sum when he has completed his training and become a full-fledged journeyman. (X.)

See P. H. Douglas, ***American Apprenticeship and Industrial Education*** (1921).

Some Other Countries. — In Austria apprenticeship is closely controlled by the Industrial Act of 1907. In 1926 a further section was added to the code which gives an apprentice the right to be retained by his employer for three months after he has completed his apprenticeship. Again, in Denmark the Apprenticeship Act of 1921 governs the conditions under which apprentices are employed, and provides, among other things, that the minister of the interior, in agreement with the minister of commerce and the employers' and workers' organizations in the trade concerned, may decide that a test should be passed in certain trades before the apprenticeship can be regarded as completed. In France the contracts of apprenticeship are governed by a law of 1910 incorporated in the Labour Act. Shortage of skilled workers after the war led to another law, passed in 1919, which provides for the compulsory attendance of apprentices at professional courses of study at public expense. The Trade Councils Act of 1925 set up a professional crganization for recruiting apprentices from children leaving elementary schools, providing for the guidance of the children into the least crowded occupations, and for controlling the drawing up of contracts of apprenticeship and ensuring the proper performance by both parties of their obligations. In the same year an apprenticeship tax was imposed for carrying this act into effect. The tax is levied on practically all industrial and commercial establishments, with the exception of those already employing apprentices or participating in apprenticeship schemes. In Italy apprenticeship is not normally regulated by law, but there is some provision for the attendance of apprentices at State schools for industrial training. In Switzerland apprenticeship contracts are governed by the Civil Act; the regulation of apprenticeship is undertaken by the Cantonal and not by the Federal authorities, at the head of which is a Government department, commonly the Education Department, assisted normally by central district or local commissions which are usually in the nature of joint committees composed of persons nominated by employers' and workers' associations. The general conditions of apprenticeship in Germany are regulated by the Industrial Code, but the Vocational Education bill which has been drafted by the Federal Ministry of Labour substantially modifies the present system of regulation. The bill, among other things, confers on various autonomous joint trade bodies the statutory right to issue, in consultation with the appropriate public departments, detailed regulations governing the whole field of apprentice employment.

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APPROACH, in military language the phase during which troops are moving forward from their assembly positions or concentration areas towards the enemy, and lasting until they deploy for battle. An alternative term is "approach march." With the smaller units, of course, in these days of long-range weapons, their own "approach" takes place on the battle-field, and only begins after the force of which they form part has deployed. In a broad sense, the "approach" covers all movements and manoeuvres before, and when out of, contact with the enemy. It is thus the province of strategy, just as the attack and the defence are the province of tactics. Under this definition a retreat which lures the enemy on to a chosen battlefield or gains time for a decisive blow elsewhere, is an "approach." The term may also, justly, cover measures by which the enemy's morale is undermined.

APPROPRIATION, the act of setting apart and applying to a particular use to the exclusion of all other. In ecclesiastical law, appropriation is the perpetual annexation of an ecclesiastical benefice to the use of some spiritual corporation, either aggregate or sole. In the law of debtor and creditor, appropriation of payments is the application of a particular payment for the purpose of paying a particular debt. When a creditor has two debts due to him from the same debtor on distinct accounts, the general law as to the appropriation of payments made by the debtor is that the debtor is entitled to apply the payments to such account as he thinks fit. In default of appropriation by the debtor the creditor is entitled to determine the application of the sums paid, and may appropriate them even to the discharge of debts barred by the Statute of Limitations. In default of appropriation by either debtor or creditor, the law implies an appropriation of the earlier payments to the earlier debts. In constitutional law, appropriation is the assignment of money for a special purpose.

APPROPRIATIONS IN AID. In the terminology of British Government finance, the money received by Government departments, in the course of their work, for certain fees, miscellaneous services, rents, etc. These receipts are in many cases not paid into the Exchequer, but "appropriated in aid" of the expenses of the departments which receive them, whence their name. When a Government department presents its estimate to the House of Commons, the appropriations in aid serve to diminish the sums demanded, and are accounted for in the figures given to Parliament.

APPROVED SOCIETIES. In pursuance of its policy of grouping the compulsorily insured population in voluntary institutions, the National Insurance Act of Great Britain, which became law in 1911, provides that any respectable thrift institution, or body of persons, may adapt itself or establish itself to carry out the work of health insurance. Under rule, such a body may be approved by the Ministry of Health and thus become an "approved society." The main conditions of approval are (1) that the society must not be carried on for monetary profit and (2) that it must be subject to the absolute control of its mem-

bers. Insured persons may choose to join any such approved society, but an approved society is given the right to reject any insured person applying for membership. Generally, the British friendly societies have become approved societies under the Act, and many trade unions and collecting societies have formed separate sections to avail themselves of the special provision enabling them to constitute such sections as approved societies (see NATIONAL INSURANCE: HEALTH).

APPURTENANCES, a legal term for what belongs to and goes with something else, the accessories or things usually conjoined with the substantive matter in question. By s. 6 of the Conveyancing and Law of Property Act, 1881 (now s. 62 of the Law of Property Act, 1925) a conveyance of land includes all visible and permanent things, easements, rights and advantages reputed to appertain to the land or at the time reputed to be appurtenant thereto or to be part or parcel thereof.

APRAKSIN, THEDOR MATVYEEVICH (1671–1728), Russian soldier who began life as one of the pages of Tsar Theodore III, after whose death he served the little tsar Peter in the same capacity. The playfellowship of the two lads resulted in a lifelong friendship. In his 21st year Apraksin was appointed governor of Archangel, then the most important commercially of all the Russian provinces, and built ships capable of weathering storms, to the great delight of the tsar. He won his colonelcy at the siege of Azov (1696). In 1700 he was appointed chief of the admiralty, in which post (1700 to 1706) his unusual technical ability was of great service. While Peter was combating Charles XII, Apraksin was constructing fleets, building fortresses and havens (Taganrog). In 1707 he was transferred to Moscow. In 1708 he was appointed commander-in-chief in Ingria, to defend the new capital against the Swedes, whom he utterly routed, besides capturing Viborg in Carelia. He held the chief command in the Black sea during the campaign of the Pruth (1711), and in 1713 materially assisted the conquest of Finland by operations from the side of the sea. In 1719–20 he personally conducted the descents upon Sweden, ravaging that country mercilessly, and thus extorting the peace of Nystad, whereby she surrendered the best part of her Baltic provinces to Russia. For these great services he was made a senator and admiral-general of the empire. His last expedition was to Reval in 1726, to cover the town from an anticipated attack by the British government, with whom the relations of Russia at the beginning of the reign of Catharine I were strained almost to breaking-point. Though frequently threatened with terrible penalties by Peter the Great for his incurable vice of peculation, Apraksin, nevertheless, contrived to save his head, though not his pocket, chiefly through the mediation of the good-natured empress, Catharine, who remained his friend to the last, and whom he assisted to place on the throne on the death of Peter. Apraksin was the most genial and kindhearted of all Peter's pupils. He is said never to have made an enemy. He died Nov. 10, 1728.

See R. Nisbet Bain, *The* Pupils of Peter the Great (London, 1897). (R. N. B.)

APRICOT, the fruit of Prunus armeniaca. Like the plum and the peach, the apricot is a stone fruit, cultivated generally throughout temperate regions and like those fruits it is used fresh for dessert, or preserved by canning and drying. In tree, fruit and flower characters, the apricot is somewhat intermediate between the plum and the peach. Trees are large and spreading and in this respect are more like the peach trees. The leaves are broad, heart shaped, dark green in colour, and held erect on the twigs. The flowers are white in full bloom, resembling those of the plum in colour, but are borne not in clusters but singly or doubly at a node on very short stems. The apricot is self-fruitful and sets fruit when its blossoms are self-pollinated. The pit is smooth, somewhat like that of the plum but broader, somewhat flatter, and more winged. The fruit is nearly smooth, round to oblong in some varieties, somewhat flattened, and in general more like the peach in shape, but with little to no pubescence when ripe. The flesh is typically an attractive yellow to yellowish orange. The kernels of some varieties are sweet.

The apricot was formerly considered a native of the Caucasus and Armenia, hence the species name armeniaca, but later studies suggest that China is its native home. The fruit is now cultivated in all of central and southeastern Asia and in parts of southern Europe and north Africa. It was, doubtless, among the fruits brought into southern California early in the 18th century by the mission fathers. The American Pomological society lists 11 varieties as grown in the United States in 1879. The apricot has been crossed with varieties of plum, particularly the Oriental plum. Some of the more promising of these crosses have been introduced under the group name, plumcot. No horticulturally satisfactory peach-apricot varieties have been reported. Apricots are propagated by budding on peach or apricot root stocks. The peach, plum, and apricot may be readily intergrafted. The apricot does well on peach stock, but the peach on apricot is not entirely satisfactory. The tree succeeds in a well drained, loamy soil, preferably light rather than heavy.

Production of this fruit in the United States is restricted to regions where climatic conditions are favourable. Most varieties will withstand winter cold as well as peaches, but the blossom buds, opening earlier than those of the peach, are frequently killed by late freezes. The trees are quite drought resistant and under favourable growing conditions are long-lived. Some trees have been found which are estimated to have lived 50 to 100 years or longer.

The commercial production of the apricot in the United States is confined largely to the Pacific coast and Intermountain states. The average total production of the commercial crop for the ten-year period 1932–41 was 236,420 tons. The average annual production for California alone for the same period was 223,800 tons with a farm value of $8,575,000. The bulk of the crop is marketed as dried fruit. In some years of large yields more than 70% of the crop has been dried. Approximately 58,605,000 pounds of dried and canned apricots from the western states were exported annually in the five-year period 1935–39. The United Kingdom is the largest user of the canned fruit.

Dried apricots have a high dietary food value, being an excellent source of iron and vitamin A. (F. P. C.)

APRIES, the name by which Herodotus (ii. 161), and Diodorus (i. 68) designate *Uehabrē*, Ὠαφρής (Pharaoh-Hophra), the fourth king (counting from Psammetichus I.) of the 26th Egyptian dynasty. He reigned from 589 to 570 B.C. (See EGYPT and AMASIS.)

APRIL, the second month of the ancient Roman and the fourth of the modern calendar, contains 30 days. The derivation of the name is uncertain. The traditional etymology from Lat. aperire, "to open," in allusion to its being the season when trees and flowers begin to "open," is supported by comparison with the modern Greek use of ἄνοιξις (opening) for spring. In Rome on the fourth day games (Ludi *Megalenses*) were celebrated in honour of Cybele; besides others, on the 21st—which was regarded as the birthday of Rome—the *Vinalia* urbana, when the wine of the previous autumn was first tasted; and on the 28th and four following days the riotous *Floralia*.

See Chambers's *Book* of Days; Grimm's Geschichte der deutschen *Sprache*, Cap. "Monate"; also APRIL-FOOLS' DAY.

APRIL-FOOLS' DAY or **ALL-FOOLS' DAY,** the name given to the 1st of April in allusion to the custom of playing practical jokes on friends on that day, or sending them on fools' errands. The origin of this custom has been much disputed; it is in some way a relic of those once universal festivities held at the vernal equinox, which, beginning on old New Year's Day, March 25, ended on April 1. In India, at the feast of Huli, the last day of which is March 31, the chief amusement is the befooling of people by sending them on fruitless and foolish errands. Though April 1 appears to have been anciently observed in Great Britain as a general festival, it was apparently not until the beginning of the 18th century that the making of April-fools was a common custom. In Scotland the custom was known as "hunting the gowk," *i.e.*, the cuckoo, and April-fools were "April-gowks," the cuckoo being there, as it is in most lands, a term of contempt. In France the person befooled is known as *poisson d'avril*.

A PRIORI AND A POSTERIORI. The literal meaning of these terms is prior and subsequent respectively; and the reference is usually to the relation of knowledge to experience. Generally speaking any knowledge or component of knowledge that is prior to experience of the facts in question is described as a *priori*, whereas any knowledge or cognitive constituent that is derived from experience of the facts concerned is said to be a posteriori. Both these terms have many different shades of meaning, the chief of which can be best appreciated by following their historical course.

The Aristotelian meaning of the terms was intimately connected with Aristotelian philosophy generally. According to this anything real is composed of a universal essence (or form) and matter. By nature the universal essence is prior to the matter. Hence any reasoning from the general nature (or essence) of things is argument from that which is by nature prior (*a*

priori), whereas any knowledge derived from experience of the materialized instances of that essence is obtained from that which is by nature subsequent *(a posteriori)*. The Aristotelian use of these terms has only survived in the much modified form according to which any knowledge derived from general principles, or from the general nature of the objects contemplated, is said to be *a priori,* whereas knowledge derived from observation is described as *a posteriori.* In this modified sense, a *priori* and *a posteriori* are almost equivalent to *deductive* and *inductive* respectively.

The Scholastic meaning of the terms, as used by Albert of Saxony in the 14th century, was restricted to the purely temporal distinction between them, and abstracted from the Aristotelian metaphysics of form and matter. As causes precede their effects, arguments from causes to effects were called a *priori,* those from effects to causes were called *a posteriori.*

The Rationalistic use of the terms was different again. Briefly whatever is derived from concepts, ideas, or reason as such is called *a priori;* whatever is learned from experience is called *a posteriori.* This usage was partly suggested already by Plato, and encouraged by Descartes and Herbert of Cherbury, but was brought into vogue mainly by Leibniz. Its chief importance consists in the fact that it paved the way for the new uses to which Kant put these terms.

The Transcendental use of the terms, as introduced by Kant, ignores the temporal distinction and emphasizes the *logical* difference between them. What Kant distinguishes by means of them is not two *kinds* of knowledge but two moments or *factors* in all knowledge. In all human knowledge, according to Kant, there is something which is not derived from experience, something in fact without which human experience would be impossible—this factor he calls the *a priori* element in knowledge. Such a *priori* elements are the forms of space and time, the categories of substance, cause, etc. These are inherent in the nature of the mind as such, and are not derived from experience. On the other hand there is in all knowledge a something, a manifold something, supplied by experience or through experience—this factor, this raw material as it were, is the a *posteriori* element which is transformed into an *orderly* experience with the help of the *a priori* forms and categories. The *a priori* elements, as conceived by Kant, though subjective in the sense that they are supplied by the percipient mind and not by the manifold of sensation (the external raw material of experience), are objective in the sense that they are not peculiar to any individual mind but are characteristic of, and valid for, all experience. Again, the *a priori* elements are not things of which the mind is explicitly conscious; as a rule they only manifest themselves in the way in which they shape experience.

The Evolutionary use of the terms, as we find it in Herbert Spencer, G. H. Lewes and others, attempts to mediate between the transcendental and the genetic interpretations of the factors in question. What seems a *priori* to the individual may nevertheless have been slowly acquired from experience in the long history of the human race. If so the difference between the *a priori* and the *a posteriori* is not absolute—what is *a posteriori* to one generation may become *a priori* for some future generation.

(A. Wo.)

APRON, originally "napron," but corrupted from "a napron" to "an apron" (O.Fr. *naperon,* dim. of *nape, nappe,* table-cloth). An article of dress worn to protect the front of the clothes. The apron is part of the ceremonial dress of Freemasons, and bishops and deans. The word is also used technically for the protecting ledge below the entrance to a dock, the strip of lead beneath a gutter, etc.

APRON STAGE, in theatre design, the portion of the stage projecting into the auditorium. In England, the Elizabethan platform stage developed during the Restoration period into the wide "apron" extending from the proscenium arch. The apron itself was level, whilst the stage behind it generally sloped slightly upwards. This form of stage was unknown on the continent of Europe in the 17th century, and was peculiar to the English theatre. Early in the 19th century, when the curtain came into use to mark the close of an act or of the play itself, the use of the apron was abandoned. It has been revived in the 20th century, but generally for the production of Elizabethan or Restoration plays, when a setting appropriate to the period has been desired.

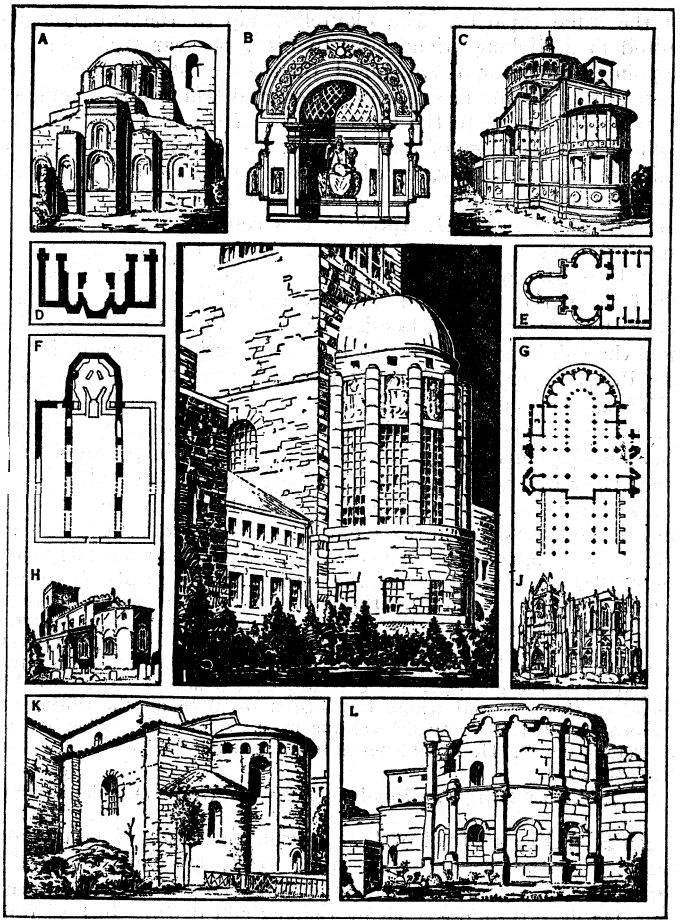
See Allardyce Nicoll, *The Development of the Theatre* (1927).

APSARAS, in Indian Vedic mythology, a water-sprite. In the *Rig-veda* the sea-apsarases flow to Soma (*q.v.*). Though they are consorts of the Gandharvas (*q.v.*), they also wed mortals. They are also wives of Krishna Vāsudeva.

See A. A. Macdonell. *Vedic Mythology,* and *E. W.* Hopkins, ***Epic Mythology*** (Strasbourg, 1895 and 1915).

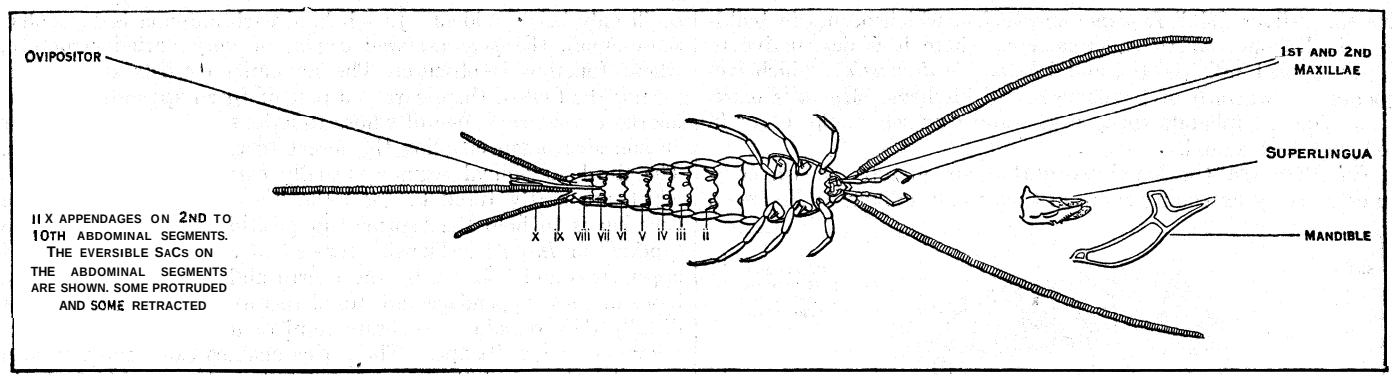
APSE, in architecture, primarily a semicircular recess covered by a half dome. Hence, through the use of such a form to terminate the choir in early churches the word is used, even when no vault is present, for any termination of a choir, a transept, an aisle or a chapel either circular or polygonal in plan.

In Roman work, where the apse first appears, it occurred chiefly as an enlarged niche (*q.v.*) to hold and give importance to the statue of a deity in a temple. From this original derivation the use of the form spread to other types of building, especially to the basilica as seen in the Imperial basilica in the palace of Domitian on the Palatine Hill *(see* illustration under *BASILICA).* The apse form thus used was, from the beginning, universally adopted by the early Christians as the climax of their churches. In the basil-



BY COURTESY OF SIR BANISTER FLETCHER* "HISTORY OF ARCHITECTURE ON THE COMPARATIVE METHOD" EIGHTH ED (1928), BATSFORD. ARCHAEOLOGICAL JOURNAL GARDNER "A GUIDE TO ENGLISH GOTHIC ARCHITECTURE" (CAMBRIDGE UNIVERSITY PRESS); WATTJES, "MODERN ARCHITECTURE" (KOSMOS); BENOIT, "ARCHITECTURE DE L'ORIENT" (RENOUARD)

A AND D. BYZANTINE. EXTERIOR AND PLAN OF THE TRIPLE APSE OF THE MONASTERY AT DAPHNE. GREECE; B. ROMAN. TEMPLE OF VENUS AND ROME. ROME; C AND E. ITALIAN RENAISSANCE. EXTERIOR AND PLAN OF THE THREE APSES OF STA MARIA DELLE GRAZIE, MILAN; F AND H. ENGLISH ROMANESQUE. WING CHURCH: G AND J. FRENCH GOTHIC. PLAN AND EXTERIOR OF CHOIR OF BEAUVAIS CATHEDRAL; I. MODERN FINNISH. LUTHERAN CHURCH, HELSINGFORS (LARS SONCK. ARCHITECT): K. ITALIAN LOMBARD ROMANESQUE. ABBEY CHURCH AT AGLIATE; L. SYRIAN BYZANTINE, CHURCH OF KALAT SIMAAN



AFTER G H. CARPENTER, IN "KNOWLEDGE," VOLUME 24

FIG. I.—THE VENTRAL VIEW OF A TYPICAL FEMALE THYSANURAN (MACHILIS MARITIMA)

icas of the time of Constantine, in the western part of the empire the apse always faced the west so that the rising sun might shine directly into the church. This was the orientation of the apse in old St. Peter's at Rome. During the 6th and 7th centuries, however, the usage in this matter gradually changed, so that churches in the west, like those in the east, had their apses toward the east and this has remained the custom ever since. The apse of the early Christian basilica was the place in which the clergy sat, the altar being situated between them and the rest of the church. This arrangement is still preserved in the apse of the cathedral at Torcello and in that of the church at Parenzo in Istria. In both cases there are semicircular benches of marble following the line of the apse and arranged in several stages, one above the other like the seats of an ancient theatre. In the centre, on the axis, was the bishop's throne, raised above the clergy benches and approached by a flight of steps. With the development of the choir as the place for the clergy seats, the old use of the apse naturally disappeared and the altar was pushed back into the apse until, in many Renaissance churches, it is against the back wall.

The apse was the place for the richest decoration in the church structure. It was sheathed with marble, frequently in elaborate patterns of light and dark, and the vault surface was covered with a glass mosaic in which some embodiment of the Godhead was the chief feature.

At the end of the 6th century, liturgical changes rendered necessary the addition of other apses besides the main choir apse. These were frequently placed at the end of the side aisles but occasionally, when there was a transept, at the ends of the transept (as in the basilica at Bethlehem and in many examples of Coptic churches).

By the time Romanesque design was developing in western Europe, apse chapels had also been added to the church plan. This at once gave a great opportunity for enriching exterior design, till then severely simple, and led eventually to the development of that complex and magnificent combination of main apse and apse chapels known as the chevet (*q.v.*). In Italy, however, where chapels were usually confined to other portions of the church, the apse remained simple in form and gained its richness from the use of wall arcading, cornices and buttresses.

The apse, because of its shape, enclosed on one side and open on the other, gives great dignity to any object, such as an altar or statue, placed in its centre. It is, therefore, an admirable form with which to terminate any vista or to end any large hall, and it is so used in much modern secular work. (T. F. H.)

APSE and **APSIDES,** in mechanics, either of the two points of an orbit which are nearest to and farthest from the centre of motion. They are called the lower or nearer, and the higher or more distant apsides respectively. The "line of apsides" is that which joins them. forming the major axis of the orbit.

APSIDIOLE, in architecture, a small apse, especially a minor apse attached to the exterior of the main apse of a church.

APSINES, of Gadara, a Greek rhetorician, (c. A.D. 190–250). He was the friend of Philostratus, the author of the *Lives of the Sophists,* who speaks of his accurate memory. Two rhetorical treatises by him are extant—a handbook of rhetoric largely taken from the *Rhetoric* of Longinus, and a smaller work on Propositions maintained figuratively.

Editions by Bake (1849); Spengel-Hammer in Rhetores Graeci ii. (1894); see also Hammer, De Apsine Rhetore (1876); Volkmann, Rhetorik der Griechen und Romer (1885).

APT, a town in France, in the department of Vaucluse, on the left bank of the Coulon, 41 mi. E. of Avignon by rail. Pop. (1936) 4,836. Apt was the chief town of the Vulgientes, destroyed by the Romans about 125 B.C. and restored by Julius Caesar, who named it Apta Iulia. Injured by the Lombards and the Saracens, its fortifications were rebuilt by the counts of Provence. The bishopric, founded in the 3rd century, was suppressed in 1790. The massive ancient walls have been replaced by boulevards; the streets are narrow and irregular. The church of Ste. Anne (once the cathedral) was begun about 1056 on the site of an older edifice, but was not completed until the 17th century. Roman remains have been found; the Pont Julien, spanning the Coulon, dates from the and or 3rd century. The chief manufactures are artistic pottery, cement, jam, and tiles; and there is a considerable trade in fruit, vegetables, silk, wool, grain, and cattle.

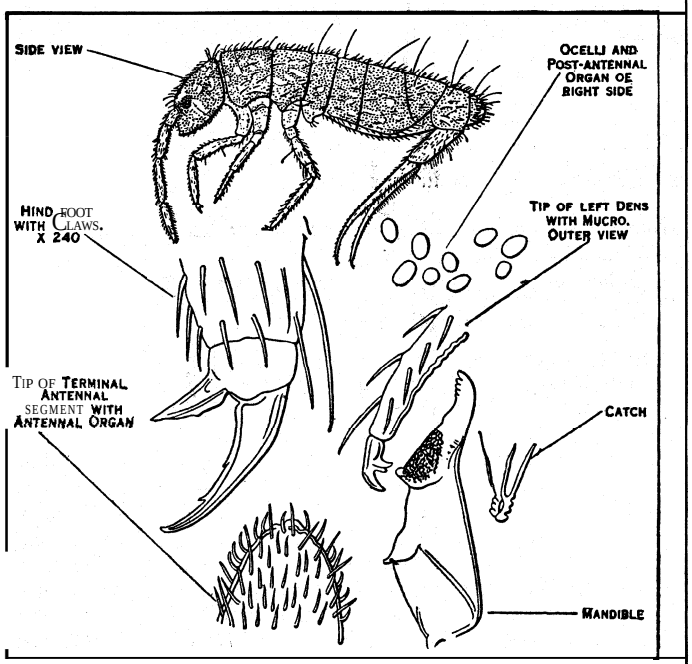
APTERA: see APTERYGOTA.

APTERYGOTA, the name given to the lower of the two subclasses into which the insects (*q.v.*) are divided and now used in preference to the older term Aptera, which has been discarded in modern zoological classification, The Apterygota are all wingless insects and there is every reason to believe that this wingless condition was inherited from primitive ancestors of the insects, long before the latter had acquired organs of flight. A second important feature is the fact that they undergo little or no metamorphosis and, unlike the higher insects (or Pterygota), they bear one or more pairs of abdominal appendages in addition to genitalia and cerci. Apterygota are universally distributed, but owing to their small size and concealed habits probably less than half the world's species have yet been discovered. Upwards of 1,200 species are known and these are classified into three well-defined orders:—(a) Thysanura, (b) Protura, and (c) Collembola.

The **Thysanura** (fig. 1) are popularly known as bristle-tails and include the most primitive of all insects. They are probably ancient survivals of a formerly more extensive group and persist to-day owing to their leading a concealed life in rotting wood, under stones, or in leaf-mould; a few also live in the nests of ants and termites. The mouth-parts are masticatory in function with well developed superlinguae, the antennae are many-jointed, and compound eyes may be present. The abdomen has 11 segments, the tenth usually carrying a pair of long bristle-like tail-feelers or cerci (fig. 1) and sometimes a median organ of the same character. It is to these feelers that the popular name is due. The abdomen also carries one to eight pairs of unjointed appendages, or styli, which are usually accompanied by protrusible sacs, possibly respiratory in function. They mainly breathe by means of tracheae and the spiracles vary in number from three pairs (*Campodea*) to 11 pairs (*Japyx*). Some of the species are clothed with scales like moths. Among the best known of the Thysanura

are the "silver fish," *Lepisma saccharina,* which occurs in buildings in Europe, North America, etc., where it is destructive to paper, book bindings, etc., and *Thermobia domestica,* which frequents the warmth of bakehouses and kitchens. *Machilis maritimus* (fig. 1) inhabits rocky coasts and *Campodea* spp. occur in soil and leaf-mould.

The Protura (or Myrientomata) are minute whitish creatures scarcely exceeding 2mm. in length and unlikely to be found



FROM CARPENTER. "STRUCTURE OF THE COLLEMBOLA" PROC. ROYAL DUBLIN SOC. XI

FIG. 2.—SHOWING THE STRUCTURE OF THE COLLEMBOLA. THE FIGURES ARE OF ISOTOMA HIBERNICA, EXCEPTING THE CATCH. WHICH REFERS TO ENTOMOBRYA ANOMALA

except by the expert collector, though they are not rare in certain types of moist soil, in peat, turf, or beneath bark. The order was first recognized by Silvestri in 1907 and only a small number of species have so far been described, but they have been found in Britain and other European countries, North America, and the Orient. Protura are elongate insects devoid of antennae and with piercing mouth-parts sunk into the head as in Collembola; superlinguae appear to be wanting. There are no eyes and the abdomen consists of 12 segments, the first three each bearing a pair of small footlike appendages. In the newly-hatched insect the abdomen is composed of nine segments, but during growth three more become added between the last two segments. This anamorphosis, or increase in the number of segments after emergence from the egg, is a feature shared with the Chilopoda and Diplopoda and is unique among insects. On account of this peculiarity some authorities, including Comstock and Berlese, maintain that these organisms form a separate class of their own—the Myrientomata. The balance of their characters, however, lends support to the view that they are a true, but somewhat anomalous, order of insects.

The Collembola (fig. 2) are popularly known as springtails. They are small insects rarely exceeding 5mm. in length and they occur in almost all situations, especially in decaying vegetable matter, under bark, on herbage, etc.; a few occur on the surface of fresh water and several inhabit the sea coast. The order is found in all regions from the poles to the tropics; a very wide distribution, extending over several continents and to remote islands, is also enjoyed by some of the genera and even by certain individual species. Collembola vary greatly in coloration, some being blue-black, others banded or white or even red, while those bearing scales have a metallic lustre. The mouth-parts are sunk into the head and are either biting or partly suctorial in function, and superlinguae are present. The antennae are never more than six-jointed and compound eyes are absent, simple eyes or lateral ocelli only being evident. Just behind each antenna is a peculiar sense-organ, the *post-antennal organ,* of very varied structure, whose function is obscure. The abdomen consists of six segments; the first of these carries a pair of fused appendages forming the *ventral tube,* one of whose functions appears to be that of an adhesive organ enabling the insect to climb smooth surfaces. The third abdominal segment usually carries small appendages which are partly fused to form the "catch" or *hamula,* whose function is to hold the "spring" in position when at rest. The "spring" or *furcula* is likewise formed of a pair of partly fused appendages and is borne by the fourth abdominal segment. The bases of these appendages are fused to form the *manubrium,* but distally they remain as separate rami or *dentes,* each bearing a *mucro* or claw at its apex. The spring enables Collembola to leap several inches, and the name springtail is due to this fact; in some genera, however, the spring is wanting or vestigial. Most Collembola have no tracheal system and breathe through the general body-surface; in the globular forms represented by *Sminthurus* and its close allies, tracheae are present and there is a single pair of spiracles placed on the anterior region of the prothorax, close to the head. Among well-known species of Collembola, the dark blue *Anurida maritima* is found on the Atlantic coasts of Europe and North America, where it is daily submerged by the tide. The minute purple-black *Bourletiella hortensis* is destructive to mangolds, and the green *Sminthurus viridis* is injurious to seedling clover in England as well as attacking lucerne in Australia.

Owing to their fragile structure but few Apterygota have been found preserved as fossils in the rocks. A number of Thysanura and Collembola occur, however, in Baltic amber of Oligocene date and a Lepismid is known from the Miocene of Florissant.

The embryonic development of several genera of Apterygota has been studied but the special features revealed in this subclass are better dealt with by comparison with other insects than here *(see* INSECTS).

BIBLIOGRAPHY.—The literature on Apterygota is technical, very scattered, and often difficult of access. Sir J. Lubbock's "Monograph of the Collembola and Thysanura," *Ray Society* (1873), is now out of date; for a useful recent handbook *see* C. Houlbert, "Thysanoures, Dermaptères et Orthoptères" in the *Encyclopédie Scientifique* (1924), which deals with the chief British and European species and has a good bibliography. V. Willem, "Recherches sur les Collemboles et Thysanoures," *Mem. Cour. Acad. Roy. Belg.* lviii. (1900) and W. Axelson, "Die Apterygotenfauna Finlands" in *Acta Soc. Scient. Fennicae,* xxsvii. and xl. (1907, 1912), are indispensable to the student. For the North American species J. E. Guthrie, *Collembola of Minnesota* (1903), and numerous papers by J. W. Folsom should be consulted. For the Protura the standard treatise is that of A. Berlese, "Monographia dei Myrientomata," *Redia,* vi. (1909). (A. D. I.)

APTERYX, the generic name of the kiwis *(q.v.)* of New Zealand, referring to the extremely reduced condition of the wings.

APUANIA, a town of Tuscany, Italy, capital of the province of Apuania, and located about 16 mi. S.E. of Spezia. It is composed of the communes of Massa, Carrara and Montignoso, which were merged in Dec. 1938, and renamed Apuania. Population of the three communes in the 1936 census was 103,682.

Since both Massa and Carrara were old cities, there are many mediaeval and Renaissance buildings in Apuania. The old Carrara cathedral (1272–1385) is a fine Gothic church dating from the period of Pisan supremacy. All the principal buildings of this part of Apuania are constructed of the local marble, for which Carrara was famous. Some of the quarries were worked in Roman times *(see* LUNA), but were abandoned after the downfall of the western empire, until the growth of Pisan art in the 12th and 13th centuries created a demand for the marble.

In the part which was formerly Massa is the Palazzo Ducale, erected in the 16th century by the Cybo-Malaspina family, who also built the old castle above the town.

The quarrying of marble is still important in the area.

APULEIUS, LUCIUS, Platonic philosopher and rhetorician, was born at Madaura, in Numidia, about A.D. 125. He was educated at Carthage and Athens, and then travelled in the east, principally in order to obtain initiation into religious mysteries. After practising as an advocate in Rome, he returned to Africa

and at Oea (Tripoli) met a rich widow, Aemilia Pudentilla, whom he later married. Her family disapproved and accused Apuleius of having won her affections by magic arts. His defense (*Apologia* or De Magia) before the proconsul. Claudius Maximus, is our chief authority for his biography. The remainder of his life was devoted to literature and philosophy.

The work on which the fame of Apuleius chiefly rests is the *Metamorphoses* or Golden Ass (the latter title seems not to be the author's own, but to have been bestowed in compliment), which was founded on a narrative in the Metamorphoses of Lucius of Patrae, a work extant in the time of Photius. From Photius's account (impugned, however, by Wieland and Courier), this book would seem to have been a collection of marvellous stories, related in perfect good faith. This particular narrative attracted the attention of Apuleius's contemporary, Lucian, who proceeded to work it up, adhering, as Photius seems to indicate, closely to the original, but giving it a comic and satiric turn. Apuleius followed Lucian's version, making it, however, the groundwork of an elaborate romance, and altering the *dénouement* to suit the religious revival of which he was an apostle.

The adventures of the young hero in the form of an ass are much the same in both romances, but in Apuleius he is restored to human shape by the aid of Isis, and finally becomes her priest. The book illustrates the contemporary reaction against a period of scepticism, and the influx of Oriental and Egyptian ideas into the old theology. It has also a well-marked literary aim, defined by Kretzschmann as the emulation of the Greek sophists, and the transplantation of their tours de force into the Latin language. The dignified, the ludicrous, the voluptuous, the horrible, succeed each other with bewildering rapidity; fancy and feeling are everywhere apparent, but not less so affectation and meretricious ornament. The Latinity has a strong African colouring, and is replete with obsolete words. The Golden *Ass* is invaluable as an illustration of ancient manners, and is full of entertainment. Don Quixote's adventure with the wine-skins, and Gil Blas's captivity among the robbers are borrowed from Apuleius, and several of the humorous episodes reappear in Boccaccio.

Of Apuleius's other writings, the Florida (probably meaning simply "anthology"), is a collection of excerpts from his declamations, ingenious but highly affected. The little tract *On the God of Socrates* expounds the Platonic doctrine of beneficent daemons, an intermediate class between gods and men. Two books on Plato (De *Platone* et *eius Dogmate*) treat of his life and his physical and ethical philosophy; a third, on logic, is considered spurious. The De Mundo is an adaptation of the Περὶ κόσμου wrongly attributed to Aristotle. Apuleius asserts that he also composed many poems and several works on natural history.

The place of Apuleius in literature is accidentally a more important one than his genius strictly entitles him to hold. He is the only extant example in Latin literature of an accomplished sophist in the best sense. The loss of other ancient romances has secured him a peculiar influence on modern fiction.

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APULIA (Italian *Puglia*), a part of Italy once inhabited by the Apuli, a Samnite tribe (see SAMNITES) settled round Mt. Garganus on the east coast. They mingled with Iapygians who had come from Illyria, so the name Apulia reached to the border of ancient Calabria. Almost the only monument of Samnite speech from the district is the famous Tabula *Bantina* from Bantia, on the Lucanian border, one of the latest and most important monuments of Oscan, with some southern peculiarities. (See OSCAN.) Dating between 118 and 90 B.C., it shows that Latin had not even then spread over the district. (See LUCANIA.) Far older are coins from Ausculum and Teate (later known as Teanum Apulum), the earliest being 4th century B.C. Roman or Latin colonies were few, Luceria and Brundisium being the chief. The Romans developed the migration of flocks and the practice still continues; sheep-tracks (tratturi), 350 ft. wide, leading from the Abruzzi into the plain of Apulia, date at least from Roman times. Large-scale sheep farming was, however, detrimental to the towns, and risings occurred until the Social War. Teate was at first the chief town, then Luceria, a military post, then, under the empire, Canusium. Once winter grazing for a million sheep, the plain now supports half that number, mainly because of the spread of cultivation.

The old road system consisted of the Via Appia (see APPIA, VIA), the Via Traiana, and the coast road, more or less parallel east-southeast. The first, east from Beneventum, entered Apulia at Pons Aufidi, and ran to Venusia, Tarentum, and Brundisium. The second, northeast from Beneventum, turned east at Aecae, and ran through Herdoniae, Canusium, Butuntum, Barium and Gnathia to Brundisium. A short cut from Butuntum to Gnathia through Caelia, ran inland. The third parallel line ran north of the Via Traiana, entering Apulia near Larinum, and thence, keeping in the plain south of Mons Garganus, rejoined the coast at Sipontum (branch at Aecae through Luceria and Arpi to the Via Traiana). It then passed through Barduli (where it was joined by a road from Canusium by way of Cannae) to Barium, where it joined the Via Traiana. From Barium a road probably ran through Caelia, south-southeast to the Via Appia, some 25 mi. N.W. of Tarentum.

Barium was an important harbour, though less so than Brundisium, and Tarentum, which, however, belonged to Roman Calabria. Apulia with Calabria, formed the second region of Augustus. Hannibalic and later wars, Strabo says, destroyed the prosperity of the country; in imperial times we hear little or nothing of it. Both were governed by a corrector from Constantine onwards, but in 668 the Lombards conquered Calabria and Apulia, and then the former name was transferred to Bruttium, the meaning of the latter being extended to include Calabria also. In the 9th century the greater part of this territory was recovered by the Byzantine emperors, whose governor was called Κατα-πανός, a name which, under the corrupt form Capitanata, belonged to the province of Foggia till 1861. It was conquered by the Normans under William Bras-de-fer, who became count of Apulia: it was raised to a dukedom with Calabria by Robert Guiscard in 1059, and united to the Sicilian monarchy in 1127. Fine Romanesque cathedrals were constructed under the Normans and the Hohenstaufen. It became part of the kingdom of the two Sicilies in 1734, and was united with Italy in 1861.

Modern Apulia comprises the five provinces of Foggia, Bari, Brindisi, Taranto and Lecce (the last three roughly the ancient Calabria), and is often known as Le Puglie; it stretches from Monte Gargano to the southeastern extremity of Italy, with an area of 7,440 sq.mi. and a pop. (1936) of 2,637,022 (1,589,064 in 1881; 1,964,180 in 1901), bounded on the north and east by the Adriatic, southeast by the Gulf of Taranto, south by Basilicata, and west by Campania and the Abruzzi. Foggia province has mountains but is mainly a great plain, the Tavoliere (chessboard) di Puglia, with coastal lagoons. Bari province, east-southeast of Foggia and divided from it by the Ofanto (Aufidus), the only considerable river of Apulia, is hilly. with coastal towns. The lack of villages is especially noticeable.

Besides sheep, horses, cattle and swine are bred. A great modern aqueduct spreads the waters of the Sele, and cultivation is

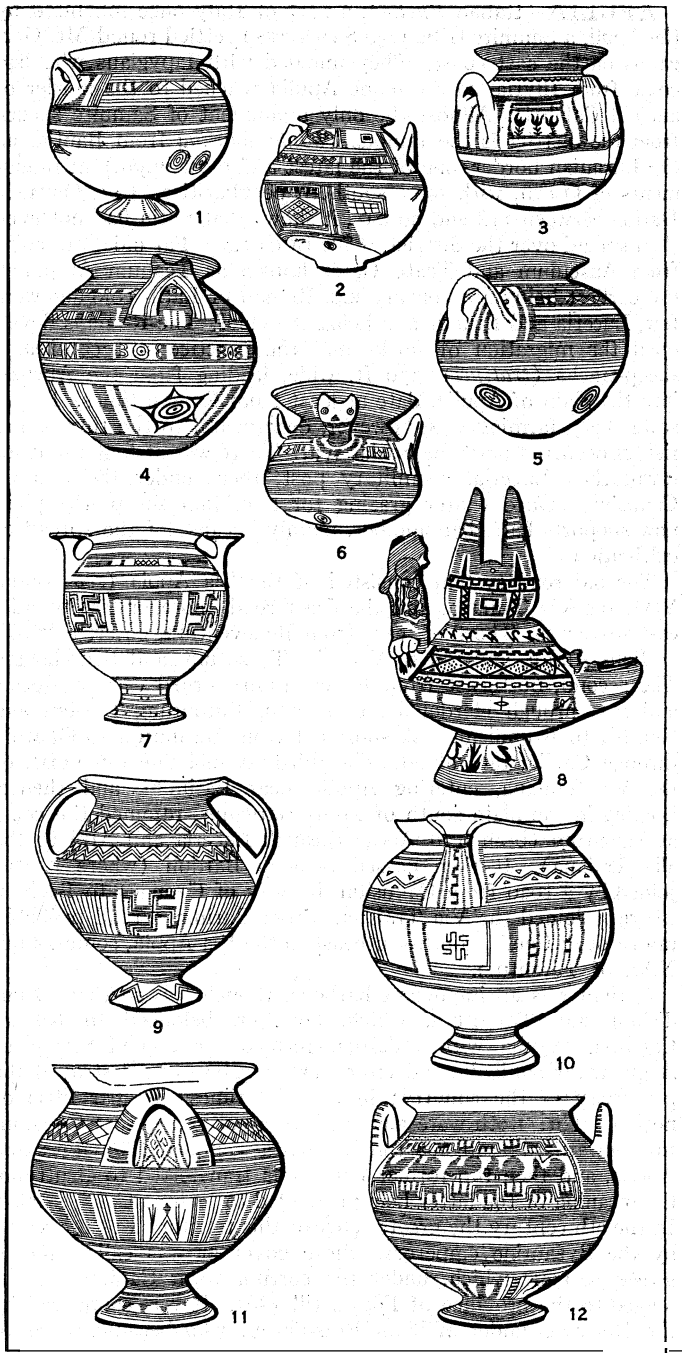

FIG. 1.—DAUNIAN AND PEUCETIAN GEOMETRIC POTTERY. THE PEUCETIAN WARE IS SIMPLE AND HARMONIOUS IN CONTRAST TO THE FANTASTIC RITUALISTIC DAUNIAN STYLE

1-8. Early Daunian Ware (600-450 B.C.). 1. Typical shape known in Picenum as early as 600 B.C. 2, 4 and 5, examples of round bottomed footless craters with side handles and plate-like rim; 3 and 5, products of Canosa; the thumbless human hand of 3 (see handle on right) was probably a talisman; 6, a characteristic double-storied jar, the handle representing a cat's head; 8, a ritual vase

9–12. Peucetian Ware (650–450 B.C.). 7, 9 and 10, the swastika sign will be noted on these specimens, which are of black and white pottery; 12, vase painted in red and black

active in Bari, where grain, wine, olives, almonds, lemons, oranges, tobacco, etc. abound; much olive oil is exported. The salt works of Margherita di Savoia produce large quantities of salt, and nitre is extracted near Molfetta. Chemical industries that draw their raw materials from these products are also developing rapidly. Seafishing is also an important industry.

The main railway from Bologna to Brindisi passes all through Apulia by way of Foggia, the main railway centre of Apulia, and Bari, with several branches; a steam tramway runs from Barletta to Bari via Andria.

The most important harbours of Apulia are Bari, Brindisi, Taranto; then follow Barletta, Molfetta and Gallipoli.

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Apulian Geometric Pottery.— The archaeology of ancient Apulia has been exceedingly obscure until the last few years, and even now its obscurity is only illumined by flashes thrown on certain parts. The legitimate iron age sequel to the Neolithic and bronze age culture of Matera and Molfetta has not yet been discovered, and the pre-history of Daunia, Peucetia and Messapia begins to take shape as a coherent whole only with the 7th century. Even then our knowledge is almost confined to the pottery, but this offers a rich field for study.

The subject of the painted pottery has been put on a scientific basis by the intensive studies of Maximilian Mayer, who has identified and distinguished the products of the several provincial schools. and has established a scheme of dating which, with some slight rectifications and adjustments, due principally to Gervasio, may be considered as final. The division of schools corresponds very closely to the old pre-Roman distribution of the region into three sections. Of these the most northern is Daunia, extending from the promontory of Gargano to the most southern point in the course of the Aufidus; next to which is Peucetia, which for purposes of this classification may be said to begin at Bari and end at Egnazia. South of a line drawn from Egnazia to Taranto, the whole heel of Italy, with Lecce as its centre, is Messapia. Each of these regions has its own peculiar and well marked style in pottery. The chronology of all three is not precisely concurrent; actually the Daunian school is dated from about 600 to 450 B.C. and the Peucetian from 650 to 500 B.C. while the Messapian only begins at 500 B.C. and lasts for two centuries. Wholly distinct is a much later Daunian school confined to Canosa, which belongs to the fourth and third centuries and may be called late-Canosan.

This chronology excludes any connection with the Mycenaean. Actually no single example of Mycenaean ware has ever been discovered between the Alps and the Gulf of Taranto. But at two places in Apulia, Mattinata on the promontory of Gorgano and the Borgo Nuovo at Taranto geometric pottery of the very early iron age has been found. These two isolated discoveries, however, have yet to be explained; they stand apart from all other Apulian products and their proper connections have not been ascertained The pottery of Mattinata and of the Borgo Nuovo is apparently a foreign importation and its date is several centuries earlier than that of the regular Apulian schools now to be described.

Canosa and Ruvo have yielded the greatest quantity of early Daunian pottery, and were perhaps the principal, though not the only, centres for its production. It is found over the whole of Daunia from ito onto-in the south to Lucera and Teanum in the north, occasionally in Picenum, and even in Istria. In Campania also the site of Suessula has yielded several vases, produced apparently under Daunian influence.

There are four principal forms. The first is a round-bottomed footless crater with side handles and a plate-like rim (see fig. 1., nos. 3, 4, 5); the second is a similar crater on a pedestal. This latter (see no. 1) is the shape known in Picenum, where its occurrence at Novilara puts its date at least as early as 600 B.C. From the round-bottomed crater is evolved the most peculiar and characteristic product of Canosa, viz., the double-storied jar (no. 6). The plate-like rim has been developed into a deep bowl, which becomes more and more exaggerated during the 5th century until eventually it takes up nearly half the height of the entire jar. Strange fanciful additions are then made in the way of plastic ornament. To the ordinary ring handles are added a third and even a fourth, of increasingly fantastic kind. They may take the shape of an animal's face, most like a cat or an owl, or be formed like a thumbless human hand, which had probably some talismanic value. The fourth principal shape of pot is that which

is known in Greece as an *askos,* derived originally from an ordinary goatskin, and known at an early date over much of Sicily and Italy, but perhaps introduced by the Greeks.

Rarer, but extremely characteristic of the Daunians, are elaborate grotesque ritual vases (no. 8). Opposite to the spout is a female figure in ceremonial dress with a fillet on her brow, long plaits of hair hanging down on her shoulders, and circular discs covering her ears. Instead of human figures, other examples have strange creatures with birds'-heads upon necks like serpents. The wild sheep on the mountains which appear on the base and the upper zone of no. 8 are an unusual experiment in zoomorphism. Apart from an occasional drawing of this kind, always quite schematic, the decoration of all Daunian vases is purely geometric. Squares, lozenges and triangles are the usual motives, arranged in panels of varying length and separated by vertical lines. Most of the decoration is placed on the upper half of the vase. In the school of Ruvo the fashion was to place a hanging trapezoidal figure on the lower half, but Canosa preferred horizontal bands or concentric circles on this otherwise empty field. Almost all the Daunian pottery was made by hand, but in a few of the finest craters from Ruvo the wheel seems to have been used. The decorative designs were painted in two alternating colours, red and dark violet, generally but not always laid on a background of whitish slip.

Entirely different from the Daunian pottery, both in spirit and in choice of shape and subject, is the Peucetian. Fantastic ritual-vases are unknown in Peucetia; craters, bowls and jugs are the only forms permitted, and these are decorated in a style which is both simple and harmonious. There are two main classes of Peucetian ware, the one painted in red and black (see no. 12), contemporary with imported Corinthian vases and considerably influenced by them, the other in plain black and white with a more restricted range of motives (see 7, 9, 10, 11). There are four principal motives in the black and white, two of which, the swastika and the comb, overshadow the others. Swastikas began to appear at just the same period on pottery in the north of Italy, and are probably an imported conception from the Danube or the Balkans. The other chief motives are the festoon, and the zigzag. Cross-hatched lozenges are common to all these geometric schools but the Maltese cross, though only occasional, is peculiar to the Peucetians. This black and white ware goes back to 650 B.C. and has a range of about 150 years from that point downwards.

The sources of inspiration for the black and white class have been unsuccessfully sought in various places; and it seems fair to regard this ware as in the main an indigenous product. Daunians and Peucetians, dissimilar enough in all other respects, had each inherited a certain repertoire of geometric tradition which was widely current over the Mediterranean, but each converted it into a new style which expressed the particular temperament of an inventive and artistic race.

With the red and black ware. the permeating Corinthian influence is readily identified, and vases of this kind have been found actually associated in the same graves with Corinthian. Here also credit must be given to the Peucetian potters for their ability in adopting new motives and transmuting them without slavish copying.

The Messapian school shows far less originality than the other two. When it appears for the first time in the 5th century, the Messapian is already a mixed style, to a great extent Hellenized. Some traces of an earlier geometric tradition still survive, though overlaid and almost stifled by the foreign innovations. In the early 5th century clepsydra, lozenge and band, the old elements of the Italian geometric, are still in existence. But the uncontaminated geometric is very rare in Messapia; the native potter can hardly resist adding his zone of Greek ivy-leaves, a maeander, a rosette, or even a bird. The chief centres of manufacture for such ware (nos. 1–9 of fig. 2) were at Rugge, near Lecce, and at Egnazia, each originally a Rhodian colony. The strongest Greek influence came therefore from Rhodian sources, though others may have had some share. The hall-mark by which all Messapian pottery, except a little of the very earliest, can be detected, is

FIG. 2.— MESSAPIAN AND LATE-CANOSAN GEOMETRIC POTTERY

1–9. Messapian Ware (500–300 B.C.). The round disks at the tops and bottoms of the handles are peculiar to this school. Hence such forms have been nicknamed "torzelle." Beside these and simple bowls the only shapes in general employ were: 4 and 9, craters with handles, and 5 and 6, jug-like forms

10–15. Canosan Ware (300–200 B.C.). These are typical of the Renaissance period of Apulian art. The ornamental designs were no longer solely geometric, but show motives common on Greek pottery

the round disc about the size of a large coin at the top and bottom of each handle. This peculiarity has caused the nickname of "torzelle" to be given to such forms as nos. 1, 2, 3, 7, 8 (fig. 2). Besides these the only shapes generally employed are the crater with column or handles like 4 and 9, the jug like 5 and 6, and a simple kind of bowl.

Carefully to be distinguished from these three schools is the late-Canosan, which has nothing in common with the earlier Daunian school that also flourished at Canosa, except the shape of the vase as in nos. 10, 11, 13 (fig. 2). This survived simply because it was used for certain rituals which had not changed, but all the details of its decoration are different. The date of all the late-Canosan

pottery is 3rd and 4th century. The evidence of the tombs shows that Canosa became the centre of a brilliant Apulian renaissance in the 4th century, and during the third she was an important factor in the art-history of the Hellenistic world, becoming especially famous for large rococo works in polychrome terra-cotta, huge vases with centaurs and Cupids springing from the sides, surmounted very often by a Niobe, a Hermes, or some other statuette. At Naples there is a large collection of these, and of magnificent vases painted with scenes from Greek mythology and history. Documentary evidence proves that this collection, including the famous Darius vase and all the splendid examples from Canosa now at Munich, came from the same tombs as the humbler askoi twin-situlae and "sphagia," figured as nos. 11–15 in figure 2. If the decoration of these is examined it will be seen that the whole spirit of the late-Canosan is entirely changed from that of the earlier Daunian school. In place of the lozenge, band and triangle, the primitive motives of the geometric repertoire, there are maeanders, frets, vine-leaves and egg patterns, all designs appearing on the contemporary Greek pottery. The domination of Greek fashion is complete. But the irrepressible individuality of the Daunian, even at this late stage, breaks out in another place, finding its opportunity no longer in this minor pottery, but in the large statuettes, often of quite notable beauty, and in all the fanciful accessories of the large plastic compositions.

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APURÉ, a river of western Venezuela, formed by the confluence of the Sarare and Uribante at 6° 45′ N. and 71° W., and flowing eastward across the Venezuelan llanos to a junction with the Orinoco at about 7" 40' N. and 66° 45' W. Its drainage area includes the slopes of both the Colombian and Venezuelan Andes. It has a sluggish course across the llanos for about 300m., and is navigable throughout its length. Its principal tributaries are the Caparro, Portuguesa and Guarico on the north, and the Caucagua on the south. Its lateral channels on the south mingle with those of the Arauca for many miles–forming an extensive district subject to annual inundations.

APURIMAC, an interior highland department of southern Perú. Area, 8,187 sq.mi.; population (1940) 280,213. The department was created in 1873 and comprises five provinces. Its physical features and productions are very similar to those of Ayacucho (*q.v.*), with the exception that sugar cane is cultivated with noteworthy success in the low valley of the province of Abancay. The capital, Abancay, 83 mi. S.W. of Cusco, which is only a village in size but is rich in historical associations, and Andahuaylas, in the northwest part of the department, are its principal towns.

APURIMAC, a river of central Perú, rising in the Laguna de Villafra in the western Cordilleras, seven miles from Caylloma, a village in the department of Arequipa, and less than 100 mi. from the Pacific coast. It flows first northeasterly, then northwesterly past Cusco to the mouth of the Perené tributary, thence east and north to its junction with the Ucayali at 10° 41′ S., and 73° 34′ W. It is known as the Apurimac only down to the mouth of the Mantaro tributary, 11° 45' S. and 1,325ft. above sea-level. Thence to the mouth of the Perené (984ft.) it is known as the Ené, and from that point to its junction with the Ucayali (859ft.) as the Tambo.

APYREXIA, in pathology, the normal interval or period of intermission in a fever.

'AQABA, GULF OF, the Sinus Aelaniticus of antiquity, the eastern of the two northern arms of the Red sea. Varying in width from 12 to 17m. it is 100m. long, penetrating into Arabia Petraea towards the north-north-east from 28° to 29° 32' north. The entrance is narrowed and made difficult by Tirān and other islands, while navigation is precarious owing to numerous coral-reefs and the sudden squalls which sweep down from the mountains on either side, many of which rise abruptly from the shore to 2,000 feet. It is a southward continuation of the Jordan-'Araba rift valley and raised beaches on the coast indicate a considerable fall in the sea-level. Dhahab on the western shore 33m. from the entrance is the only sheltered port in the gulf, near the head of which is Jazira Fir'ūn (mediaeval Isle de Graye), a rocky islet with ruins of a castle built by Baldwin I. (c. 1115). At the head of the gulf on the east side is 'Aqaba village with charming palm-groves, an excellent water supply and a mediaeval castle to protect pilgrims en route from Egypt to Mecca. It is the site of the biblical Elath (Eloth), one of the ports whence Solomon's fleet sailed to Ophir. The Romans called it Aelana, a military post with paved road up the valley of Wadi 'Itm to Ma'an and Petra. In the 10th century an Arab geographer described it (Haila or Ailat), as a great port of Palestine and the emporium of the Hejaz. Suffering at the hands of Saladin (12th century) it fell into decay until 1841 when Turkey recognized it as belonging with Sinai peninsula to Egypt owing to its regular use by Egyptian pilgrims. These later adopted the sea-route and in 1892 Turkey resumed possession of 'Aqaba. In 1906 the Turks occupied the neighbouring post of Taba, supposed to be the ancient port of Ezion-Geber. Great Britain intervened on behalf of Egypt and the Turks withdrew and agreed to the demarcation of a line joining the head of the Gulf of 'Aqaba to Rāfi'a on the Mediterranean as the Turko-Egyptian frontier. In 1917, during the World War, Col. Lawrence and the Hejaz army captured 'Aqaba by a brilliant *coup-de-main* from the land side whence no attack was anticipated by the garrison. From then till 1925 'Aqaba was administered together with Ma'ān, Petra and Shaubak as part of the Hejaz kingdom. King Husain took refuge there in Oct. 1924, after his abdication of the Hejaz throne in consequence of the Wahhabi invasion of his country. In July 1925, a Wahhabi attack being anticipated, Great Britain, as mandatory for Palestine, ejected King Husain (who retired to Cyprus) and occupied the 'Aqaba-Ma'ān province which has since been administered as part of Trans-Jordan. Ibn Sa'ud, as king of the Hejaz, maintains an attitude of protest against what he considers an act of usurpation, and the Hejaz–Trans-Jordan frontier remains undemarcated, though the de *facto* administrative frontier runs from south of 'Aqaba to Mudawwara on the Hejaz Railway.

'AQĪBA or **AKIBA BEN JOSEPH** (c. 50–132), Jewish Palestinian rabbi, of the circle known as *tanna* (*q.v.*). He became the chief teacher in the rabbinical school of Jaffa, where, it is said, he had 24,000 scholars. Whatever their number, it seems certain that among them was the celebrated Rabbi Meir, and that through him and others 'Aqiba exerted a great influence on the development of the doctrines embodied in the Mishnah. He sided with Bar Cocheba in the last Jewish revolt against Rome, recognized him as the Messiah, and acted as his sword-bearer. Being taken prisoner by the Romans under Julius Severus, he was flayed alive with circumstances of great cruelty, and met his fate, according to tradition, with marvellous steadfastness and composure. He is said by some to have been 120 years old at the time of his death. He is one of the ten Jewish martyrs whose names occur in a penitential prayer still used in the synagogue service. 'Aqiba was among the first to systematize the Jewish tradition, and he paved the way for the compilation of the Mishnah. From his school emanated the Greek translation of the Scriptures by Aquila.

AQUAE, a name given by the Romans to sites where mineral springs issued from the earth (Lat. for "waters."). Over roo can be identified, some declaring by their modern names their ancient use: Aix-les-Bains in Savoy (Aquae Sabaudicae), Aix-en-Provence (Aquae Sextiae), Aix-la-Chapelle or Aachen (Aquae *Grani*), etc. Only two occur in Britain: Aquae Sulis—less correctly Aquae Solis—at Bath (*q.v.*), in Somerset, which was famous, and Buxton (called Aquae simply).

AQUAE ALBULAE, springs, W. of Tibur, Latium, Italy, the water of which is bluish, strongly impregnated with sulphur and carbonate of lime, and rises at a temperature of about 75° Fahrenheit. Remains of a Roman thermal establishment exist near the principal spring, the so-called Lago della Regina. The baths are still frequented.

AQUAE CUTILIAE, a mineral spring in Italy, near modern Cittaducale, 9m. E. of Rieti. The lake near it, supposed by classical writers to be the centre of Italy, was renowned for floating islands

formed from partial petrification of plants by mineral substances in the water. Remains of baths may be seen; they were apparently resorted to by Vespasian and Titus who both died there.

AQUAE SEXTPAE, BATTLE OF: *see* AIX.

AQUA FORTIS, an early name for nitric acid (*q.v.*).

AQUAMARINE, a transparent variety of beryl (*q.v.*), having a delicate blue or bluish-green colour, suggestive of the tint of sea-water. It occurs at most localities which yield ordinary beryl, some of the finest coming from Russia.

AQUA REGIA, a mixture of one volume of concentrated nitric acid and three volumes of concentrated hydrochloric acid. It was originally given the name which it still retains, by the alchemists because of its power to dissolve gold—the king of metals.

When aqua regia dissolves gold, the metal is converted into auric chloride, $AuCl_3$, which combines with more hydrogen chloride to form aurichloric acid (chloroauric acid), $HAuCl_4$, which crystallizes from solution as $HAuCl_4$, $4H_2O$. Aqua regia also dissolves platinum, and on concentrating the solution with excess of hydrochloric acid, deliquescent crystals of platinichloric or chloroplatinic acid, $H_2PtCl_6,6H_2O$, are obtained. Evaporation of the aqua regia solution leads to the isolation of an intermediate nitrosoplatinic chloride, $PtCl_4,2NOCl$ or $(NO)_2PtCl_6$. Palladium is also readily dissolved by aqua regia, but the other four metals of the platinum group (iridium, osmium, rhodium and ruthenium) are less readily attacked by this solvent. (*See* PLATINUM METALS.)

In qualitative analysis aqua regia is also a useful solvent for certain of the less soluble sulphides: it attacks arsenious and mercuric sulphides with the production of the chlorides of arsenic, $AsCl_3$, and mercury, $HgCl_2$. It also dissolves the sulphides of cobalt and nickel, forming the corresponding chlorides, $CoCl_2$ and $NiCl_2$. The solvent action is due to an interaction between nitric and hydrochloric acids whereby chlorine is produced: $HNO_3+3HCl=Cl_2+NOCl+2H_2O$. On warming aqua regia the two gases (chlorine and nitrosyl chloride) are evolved, and if passed through concentrated sulphuric acid, chlorine escapes and nitrosyl chloride is absorbed as nitrosyl sulphate:

$$NOCl+SO_2(OH)_2=SO_2(OH)\cdot O\cdot NO.$$

When the solution of nitrosyl sulphate is dropped on to sodium chloride, pure nitrosyl chloride is generated as an orange-yellow gas with pungent suffocating odour, easily condensed in a freezing mixture to a red liquid, boiling at 5·6°C and solidifying at −60°C to a lemon-yellow solid. This gas has no action on gold although it attacks mercury. (G. T. M.)

AQUARELLE, the French term for water-colour, used in reference both to the technique and the resultant painting: *see* WATER-COLOUR PAINTING.

AQUARII, a name given to the Christians who substituted water for wine in the Eucharist. They were not a sect, for the practice was widely in vogue at an early time, even among the orthodox. (*See* EUCHARIST.)

AQUARIUM (plural *aquavia),* a name given to a receptacle or institution in which living aquatic animals and plants are kept. The term may be applied to a show-place exhibiting aquatic specimens with the object of entertaining or instructing the public, or it may be used to describe such a domestic toy as a bowl containing goldfish. Certain aquaria are purely scientific institutions designed for the study of physiological and biological problems. Of these the best known are those at Plymouth, England, and Naples, Italy, where, apart from numerous small tanks in laboratories for the use of research workers, there is in each case a public aquarium attached, in which the exhibits are at the disposal of the students for the purpose of observation and experiment. At the Marine Biological Station at Plymouth, which receives grants from the Government and the Fishmongers' Company, a number of biologists are definitely retained for the purpose of studying the habits and life histories of the marketable inhabitants of the ocean.

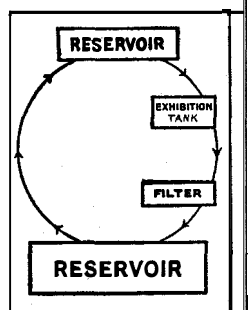


DIAGRAM ILLUSTRATING THE SYSTEM OF WATER CIRCULATION IN AN INLAND AQUARIUM

In the case of large aquaria situated near the shore, the water which can be continually replenished, is pumped from the sea in to reservoirs usually situated in the basements of the institutions After being allowed to settle, it is pumped direct into the tanks containing the specimens. Where, however, the aquaria are located inland, special care must be taken to keep the water pure and clear and to prevent the overflow from the tanks running to waste.

The most up-to-date inland aquarium is that of the Zoological Society of London in Regent's Park, which was opened in 1924. In the case of this institution, which, whilst encouraging the scientific study of aquatic life, caters for the entertainment of the public, the sea-water was brought from the Bay of Biscay. Both the fresh-and salt-water in the aquarium are prevented from becoming stagnant by a system of continual circulation, being pumped from the underground reservoirs, having in the case of the fresh-water a 60,000 gallon capacity, and in the case of the salt-water a 125,000 gallon capacity, to other reservoirs situated in the mountains of the Mappin Terraces, about 30 ft. above the exhibition tanks. From the high level reservoirs the water falls by gravity into the show tanks, the overflows passing through a series of sand filters before returning to the main storage reservoirs in the cellars of the building. The efficient oxygenation of the water is obtained by passing compressed air directly into the show tanks, and by discharging the water feeding these tanks with great force through a nozzle with a narrow aperture, the resulting bubbles producing the effect of a smoke cloud. The purity of the sea-water is also ensured by a discreet choice of the metals used in the manufacture of the piping and in the construction of the tanks. Should, for instance, copper or zinc come into contact with the sea-water of an aquarium the exhibits die speedily of metallic poisoning. The piping in the Society's aquarium is formed of chemically pure lead, or of iron lined with glass enamel. The exhibition tanks, the three largest of which hold 5,000 gallons, are constructed of slate or concrete, and are decorated with rocks. The thickness of the glass used for the fronts of the large tanks is $1\frac{1}{4}$ in. Aquatic animals are easily killed by sudden changes in temperature. The Zoological Society's aquarium has elaborate heating and refrigerating systems which keep the tanks in the temperate fresh-water and marine aquaria at a temperature of about 60°F. throughout the year. The majority of the tropical aquaria are kept at a uniform temperature of 75° to 80°F.

In an aquarium where it is not possible to replace the water continually, artificial aids must be sought to remove pollution, which, owing to the excess in number of fish per unit volume compared with the sea or river, cannot be coped with by natural means. In the Regent's park aquarium, before the water is cleaned by being passed through a series of filters, most rejected food, excrement, etc., which is easily detected on the sandy floors of the tanks, is removed daily by means of a suction pipe. Filtration is further responsible for the removal of suspended organic matter and phosphates. Aeration oxidizes ammonia and organic matter in solution. Storage in the dark kills the noxious bacteria.

Fish have been kept in captivity for hundreds of years. The ancient Romans for instance spared no expense in building huge ponds and reservoirs which they stocked with rare and expensive specimens, whilst the hobby of keeping ornamental fish in tanks has been in vogue with the Chinese since very early times. The public aquarium, however, is a comparatively modern innovation, the first to be established being the small one opened in 1853 in the Zoological Society's gardenain Regent's park. Although owing to its faulty construction it had but a short life as a fresh-water and marine aquarium, the building is still in existence and is now being used for the exhibition of wading and diving birds. The best equipped aquaria at the present day, apart from the one in Regent's park, are those at Amsterdam, Antwerp, Berlin, Brighton, Naples, New York, Honolulu, Madras and San Francisco. The Shedd Aquarium in Chicago, completed in 1931, is one of the largest and most fully equipped in the world. Its cost, including stocking, exceeded $3,500,000.

The guiding principles to be observed in the management of a large aquarium apply with equal force to the miniature home

aquarium. Anyone wishing to maintain a small aquarium stocked with suitable marine specimens should, apart from aerating the water, circulate and filter it. This may be effected by means of a syphon pipe emptying the water from a small high level tank into the exhibition tank likewise fitted with a syphon, which slowly empties the water into a low level tank after filtering through a flower pot filled with sand. When the lower tank is full the water it contains is emptied into the high level tank which should be of equal capacity. On the size of the syphon pipes depends the rate of the flow of the water, which can be controlled to last 10 or more hours according to the requirements of the specimens. In the event of the aquarist experiencing difficulty in obtaining water in sufficient quantity from the coast, there should be no difficulty in his manufacturing his sea-water at home. The fallowing formula has been tested in the Marine Biological Association's laboratories, and found to give satisfactory results:—Common salt, 45½ oz.; potassium chloride, 1¼ oz.; calcium chloride (dry), 2 oz.; magnesium chloride (crystals), 8¾ oz.; magnesium sulphate (crystals), 11½ oz.; bicarbonate of soda, ⅕ oz.

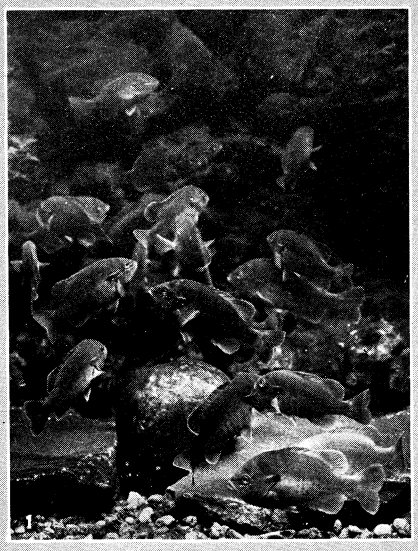
The above should be mixed with 10 gal. of soft water to which should be added, after mixing, ⅕ oz. of potassium nitrate, 10 grains of sodium phosphate, 5 grains of chloride of iron and ½ gal. of natural sea-water. The reason for adding a small quantity of natural sea-water is that sea-water contains a certain mysterious ingredient which has up to the present defied analysis, but may be considered analogous to what is known as vitamins in food. Its entire absence would result in the specimens in the aquarium developing disease in a comparatively short period.

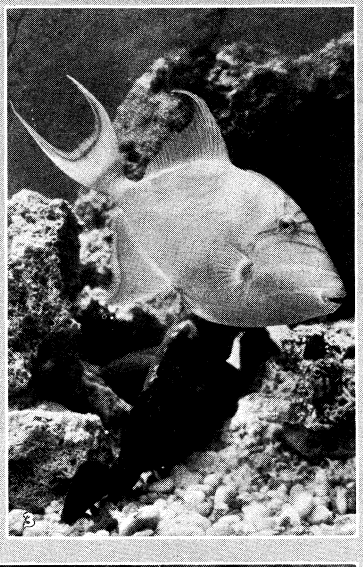
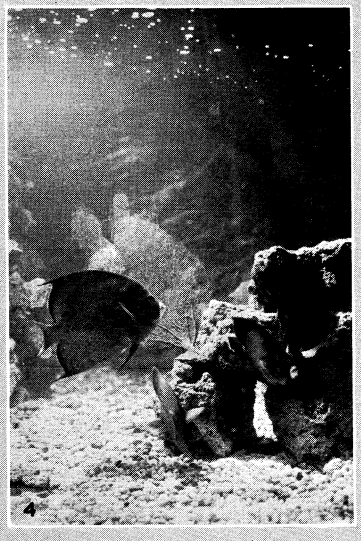
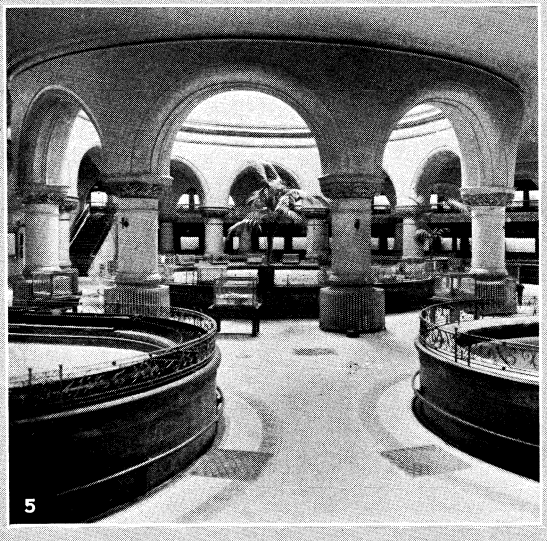
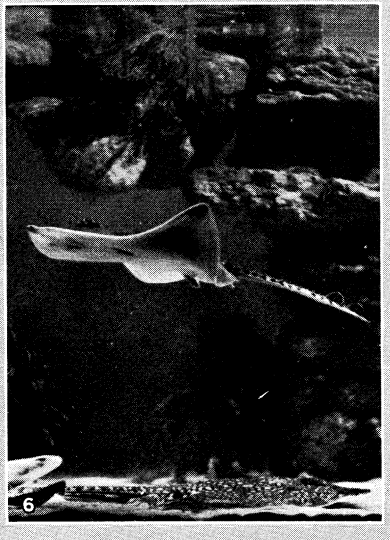
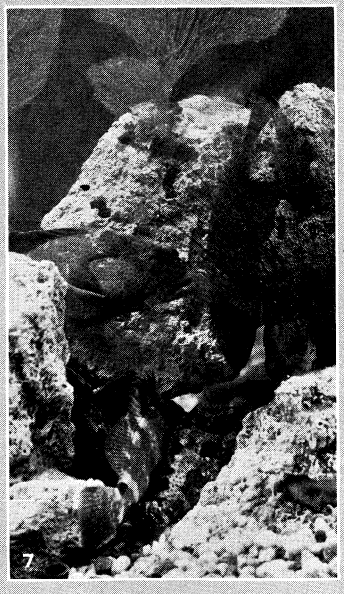
An aquarium tank should present the greatest possible surface of water to the air in proportion to its size and depth. The popular goldfish bowl is to be condemned as admitting too little air for the well-being of its inhabitants. Square, metal-framed, slate bottom, glass-sided aquaria are best. With regard to size, the aquarist wishing to keep such comparatively hardy fish as goldfish, carp, tench, orfe, perch, etc., should allow one gallon of water to every inch of fish. Delicate forms such as trout require double that amount of water.

In setting up a small private aquarium, which should be so placed that. it receives not more than one hour of direct sunlight a day, the floor should be covered with about 2in. of well-washed gravel or sand before filling with water and planting. Plants are necessary for keeping the balanced fresh-water aquarium in a healthy condition, as they not only oxygenate the water but absorb the carbon dioxide given off by the fishes. The following plants are specially suitable for the aquarium:—Eel Grass (*Valisneria spiralis*), Arrowhead (*Sagittaria natans*), Swamp Grass (*Ludwigia palustris*), Fanwort (Cabomba caroliniana), Ditchmoss (Anacharis canadensis), Water Milfoil (*Myriophyllum verticillatum*) and Stonewort (*Nitella gracilis*). The small aquarium should have a light glass cover to keep out the dust and prevent the fishes from jumping out. If the aquarium receives daily attention the water need be changed only very rarely. Special care should be taken to ensure that any new water added is of the same temperature as the old. Fish should be transported from their native elements to the aquarium in receptacles that are broader than deep. In the case of trout which require much aeration a grid of perforated galvanized iron should be fixed in the travelling tank about 3in. from the bottom, forming a false bottom on which the fish can lie without the risk of clouding the water by the disturbance of excretory and other noxious products. On arrival at their destination the fish should not be immediately transferred to the aquarium, but the water in the carriers should be slowly replaced by the water of the exhibition tank. In the aquarium fresh-water fish are victims to various ailments. The most common is a very virulent and highly contagious fungoid disease, popularly known as salmon disease. This, which often results from sudden changes in the temperature of the water, is due to bacteria (*Saprolegnia* ferox) and first shows itself in the form of a whitish film which coats the outside of the fish. At a later stage it attacks the gills and causes the victim to die df asphyxiation. The victim may often be cured if treated in the early stages of the disease. The best remedy is to introduce common rock salt, or preferably sea-water, into the aquarium, a suitable quantity of salt being one oz. to each gallon of water. If sea-water is used, one part should be introduced for four parts of fresh-water. As the fish recovers, the strength of the solution should be very gradually reduced. It is important not to overfeed, and fish confined in small aquaria should always be on the alert for a meal. One meal a day suffices, care being taken not to introduce more food than can be devoured by the inhabitants in the course of an hour. With regard to the question of variety of foods, the majority of large fish should be supplied with bullocks', sheep's or horses' heart, liver, earthworms, prawns and shrimps. Small fish will flourish on a diet consisting of the crustacea *Gammarus* and Daphnia, enchytrae worms, the larvae of the common gnat, hard-boiled yolk of egg and fresh ants' eggs. Goldfish and other members of the carp family may be given biscuit and should also be provided with a small quantity of lettuce or other green food. Newly-born fish after the absorption of their yolk sac feed on infusoria which can easily be produced in a day or two by an infusion of vegetable matter. (E. G. Bo.)

The United States.—The principal public aquaria of the United States are at Boston, Chicago, Detroit, Honolulu, New Orleans, New York city, Philadelphia, San Francisco and Washington. The aquarium in New York is maintained by the city, its management being in the hands of the New York Zoological Society which provides all exhibits from its private funds. The Boston and Detroit aquaria are municipal institutions controlled by park departments. The aquarium in San Francisco, built with private funds and controlled by the California Academy of Sciences, is maintained by the city. The aquarium in New Orleans was privately built, is in a public park and is managed by a zoological society. The smaller aquarium in Washington is maintained by the Bureau of Fisheries in a Government building. It was long the custom of the national Bureau of Fisheries to operate excellent temporary aquaria at industrial expositions and these were highly successful. A few of the aquarium buildings were architecturally beautiful. At the world fairs of Chicago, Atlanta, St. Louis, Buffalo, Omaha, Charleston, Nashville and other cities the aquarium attracted more visitors than any other single exhibit. The larger permanent aquaria usually attract the attention of the people more than do zoological gardens or museums of natural history or art. The collections consist of living marine and fresh water animals. It is the character of the exhibits which determines the cost of maintenance. An aquarium with exhibition tanks requiring nothing more complicated than mere connections with a city water system, can obviously be operated at less expense than one requiring pumps for the circulation of sea water. It would be possible for any inland city not too remote from suitable collecting waters to maintain exhibits of fresh water fishes and amphibians at small cost as compared with marine forms requiring stored sea water. The flow of fresh water being automatic, the equipment for operation can be reduced to very simple terms.

For marine exhibits, the equipment and maintenance are far more costly. The piping, if for permanent use with salt water, is specially constructed of vulcanized rubber, lead or other non-rusting material, with valves and other fittings to match. An underground reservoir for the storage of sea water is necessary, together with rust-proof pumps of bronze for its circulation. Filters are required to clear the water flowing back to the reservoir. For pumps which must run night and day there is necessarily an increase in the number of employés, some of whom, such as mechanicians, require special compensation. For tropical forms of life water-heating equipment is required to insure their safety in winter. For northern forms of life cold water is equally necessary in summer. A large aquarium in the latitude of New York, for instance, requires a complicated equipment if its aquatic exhibits include both northern and tropical fresh-water and marine forms. The construction of a reservoir for pure sea water is imperative, even if the aquarium be located on the sea shore. Experience has shown that the water supply must be maintained in uniformly good condition, unaffected by storms, changes in salinity, winter and summer temperatures, and the im-



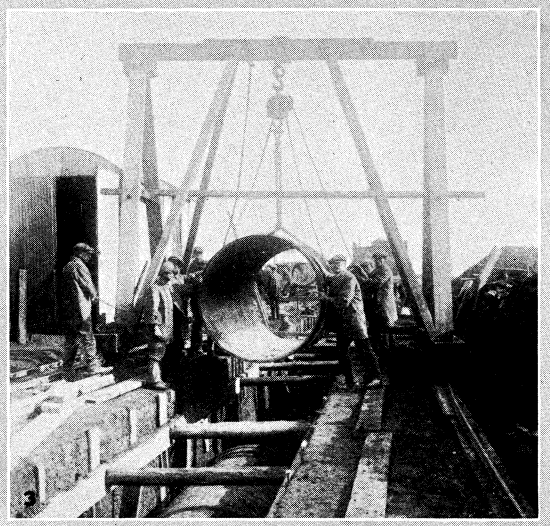






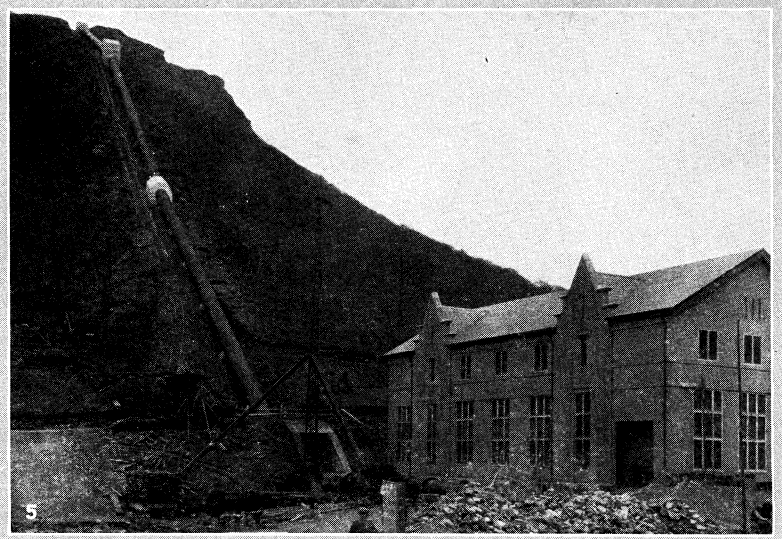

BY COURTESY OF (1, 3, 4, 5, 7 8) THE NEW YORK ZOOLOGICAL SOCIETY, (2) MARINE STUDIOS, (6, 10) THE TIMES COPR , LONDON, (9) NEVILLE KINGSTON

FISHES FROM MANY WATERS IN AMERICAN AND BRITISH AQUARIA

1. Red breasted sunfish. 2. Aerial view of Marine Studios, Marineland, near St. Augustine, Fla.; all specimens are placed together in two large outdoor tanks. 3. Trigger fish. 4. Blue angel fish. 5. Interior view of New York city aquarium, razed in 1941. 6. Skate fish. 7. Rock hind. 8. Sea horses. 9. Angel fish. 10. Angel fish of the Amazon

AQUEDUCTS





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AQUEDUCT PIPES IN MANY PARTS OF THE WORLD

1. Riveted steel penstocks twelve feet, four inches in diameter which deliver water from Hetch-Hetchy reservoir, California, through a power plant at Moccasin Creek, to San Francisco. The distance covered by the pipes between the reservoir and San Francisco is 158 miles
2. Duplicate riveted steel pipes, six feet in diameter, with a total weight of 78,000 tons, used by the Tansa aqueduct, at Bombay
3. Welded steel, cement lined pipes, five feet in diameter, used in the construction of the additional pipe line of the Elan aqueduct, at Birmingham, England
4. Set of seven wooden stave pipes, nine and a half feet in diameter, serving the Humber Arm hydro-electric station in Newfoundland
5. Welded steel, high pressure pipe line, six feet in diameter, serving Maentwrog power station, Wales

purities of harbours. Unfavourable variations in the water supply cannot be avoided where water is pumped directly from the sea. The prime requisite for aquatic animals in captivity is a plentiful supply of their natural element, to which everything else is subordinate. The water supply must be pure and abundant, both for marine and for fresh water exhibits. The fresh water supply of most cities is good enough for aquarium purposes as it comes from the pipes, but during long continued rains or necessary alterations of the system the water may become murky and remain so for weeks. Suitable filters are therefore necessary to insure the clearness of water desirable for exhibition purposes. Filters for fresh water are installed to receive the water before it is delivered to exhibition tanks. In the case of permanently stored sea water, filters are also necessary, but they are installed so as to receive the drainage of the exhibition tanks and return the water to the reservoir clear and free from the impurities created by the feeding of animals. City waters that are treated with chlorine are not suitable for aquarium purposes.

All equipment tending to facilitate the distribution of stored water and to preserve its purity is desirable, because its vitiation, even in small degree, may result in serious losses of animal life. Lack of food can be long endured by aquatic animals but the impairment of their natural element is immediately fatal, whether from actual fouling or mere lack of oxygen. They may long survive overcrowding if the supply of water is abundant. The collecting of aquatic animals, with the exception of mammals, involves their transportation in weighty tanks of their natural element, which moreover must be kept pure in transit. Aquatic animals must reach their destination not merely alive, but able to endure the conditions of captivity, which are always more or less unfavourable to wild creatures.

The exhibits of a public aquarium are popularly supposed to consist chiefly of fishes, aquatic reptiles and some of the more conspicuous invertebrates, but this conception is a narrow one. The name aquarium admits of a much more comprehensive interpretation. The collections of an ideally equipped establishment for the exhibition of living aquatic forms might properly include representatives of the entire aquatic fauna and flora, so far at least as the forms selected are capable of living in shallow water.

See C. H Townsend, ***The Public Aquarium, Its Construction, Equipment and Management*** (1928); ***C. W.*** Coates, *Tropical* ***Fishes for a Private Aquarium*** **(1933)**; ***W.*** T. Innes, Exotic ***Aquarium Fishes*** (1935). (C. H. To.)

AQUARIUS (the Water-bearer or Cup-bearer), in astronomy, the eleventh sign of the zodiac, situated between Capricornus and Pisces. Its symbol is ♒ representing part of a stream of water, probably in allusion to the fact that when the sun is in this part of the heavens (January, February), the weather is rainy. The constellation, though large, has no striking features, the brightest stars being of the third magnitude.

AQUATINT, a variety of etching (*q.v.*) in which effects are obtained by the action of acid through a porous ground of sand or some powdered resinous substance (Lat. aqua, water, and *tincta,* dyed). The plate is first covered with a ground over which the resinous powder or sand is evenly dusted by some mechanical process, the portions of the plate which are to appear white when printed being covered with stopping-out varnish. The plate is then covered with the mordant which bites into the interstices between the minute particles and produces a granulated surface. The process is repeated and the different tones obtained by the varied depths to which the different portions of the plate are bitten. In theory therefore aquatint is not capable of producing even graduations of tint, but may be compared in effect to a contour map where each particular elevation is indicated by a flat tint ending abruptly. In skilful hands, however, the series of bitings can be so manipulated as to make these contours almost invisible; the process can be used in conjunction with etching, drypoint, mezzotint and crayon.

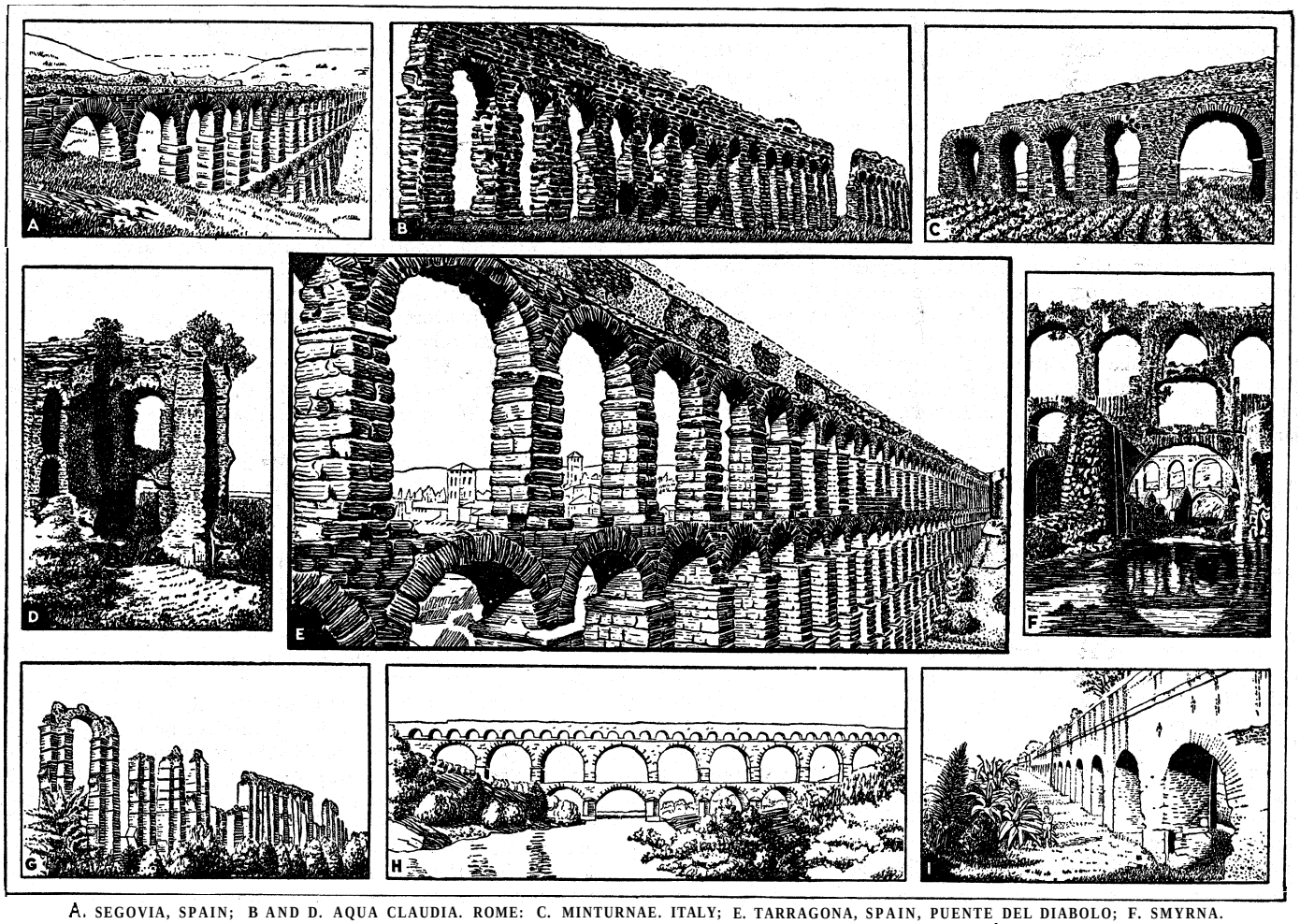
The invention of aquatint is generally credited to Jean Baptiste Le Prince (1734–81), but there seems little doubt that some form of it was known and used almost 100 years earlier. A certain Jan van de Velde seems to have combined aquatint with roulette work in some of his portraits about 1658. In the hands of F. Janinet, P. L. Debucourt and other French artists of the end of the 18th century the process was brought to a technical perfection which has never been surpassed. It was used by them, with extraordinary skill and success, as a vehicle for printing in colour. In England in the last quarter of the 18th century and the first half of the 19th century the method was used by such artists as Paul Sandby, Thomas Malton, the Daniells, R. Pollard, J. C. Stadler for reproducing water-colour drawings. English aquatints were not printed in colours, but were usually coloured by hand. The process during the latter part of the 19th century fell into disuse but was revived and successfully employed by Sir Frank Short, Theodore Roussel, Oliver Hall, W. Lee Hankey, W. P. Robins and others. (*See* ETCHING.) (A. E. P.)

AQUAVIVA, CLAUDIO (1542–1615), fifth general of the Society of Jesus, the youngest son of the duke d'Atri, was born at Naples. He joined the Jesuits at Rome in 1567, and his administrative gifts marked him out for the highest posts. He was soon nominated provincial of Naples and then of Rome; and during this office he offered to join the Jesuit mission to England that set out under Robert Parsons (q.v.) in the spring of 1580. The following year, being then only 37 years old, he was elected by a large majority general of the society in succession to Mercurian, to the great surprise of Gregory XIII.; but the extraordinary political ability he displayed and the vast increase that came to the society during his long generalate abundantly justified the votes of the electors. He, together with Lainez, may be regarded as the real founder of the society as it is known to history. A born ruler, he secured all authority in his own hands, and insisted that those wha prided themselves on their obedience should act up to the profession. He successfully quelled a revolt among the Spanish Jesuits, which was supported by Philip II., and he made use in this matter of Parsons. A more difficult task was the management of Sixtus V., who was hostile to the society. By consummate tact and boldness Aquaviva succeeded in playing the king against the pope, and Sixtus against Philip. For prudential reasons, he silenced Mariana, whose doctrine on tyrannicide had produced deep indignation in France; and he also appears to have discountenanced the action of the French Jesuits in favour of the League, and was thus able to secure solid advantages when Henry IV. overcame the confederacy.

To him is due the Jesuit system of education in the book *Ratio atque institutio studiorum* (Rome, 1586). But the Dominicans denounced it to the Inquisition and it was condemned both in Spain and in Rome, on account of some opinions concerning the Thomist doctrines of the divine physical premotion in secondary causes and predestination. The incriminated chapters were withdrawn in the edition of 1591. In the fierce disputes that arose between the Jesuit theologians and the Dominicans on the subject of grace, Aquaviva managed, under Clement VIII. and Paul V., to save his party from a condemnation that at one time seemed probable. He died at Rome, Jan. 31 1615, leaving the society numbering 13,000 members in 550 houses and 15 provinces. The subsequent influence exercised by the Jesuits, in their golden age was due largely to the far-seeing policy of Aquaviva, who was undoubtedly the greatest general that has governed the society.

AQUEDUCTS. In the broad sense of the word, an aqueduct is an artificial channel for the conveyance of water. In a more restricted sense it is often understood to mean a bridge formed in a series of arches or spans for the conveyance of water across a valley. In the usual acceptance of the word in modern engineering an aqueduct is a primary channel or conduit for the conveyance of water from a source to the principal point of distribution or use, subsidiary distribution conduits being not generally classed as aqueducts.

Ancient Aqueducts. — There are records of the use of aqueducts for irrigation, extending back to very remote times in Babylonia, Assyria and Egypt, where the benefits of the practice of that art were no doubt taught by the annual overflow of the Nile. Extensive systems of canals in conjunction with storage reservoirs were in existence in the time of Rameses II. in the 14th century B.C.



A. SEGOVIA, SPAIN; B AND D. AQUA CLAUDIA. ROME: C. MINTURNAE. ITALY; E. TARRAGONA, SPAIN, PUENTE DEL DIABOLO; F. SMYRNA. ASIA MINOR. GRAND AQUEDUCT; G. MERIDA, SPAIN, AQUEDUCT "DE LOS MILAGROS"; H. PONT DU GARD, NÎMES, FRANCE; I. SEVILLE, SPAIN. CAÑOS DE CARMONA

Traces of remarkable aqueducts carried out by the Phoenicians have been found in Syria and in Cyprus, including tunnelling through rock and the construction of syphons across valleys for the conveyance of water to temples.

Jerusalem has from very early times been supplied by a series of conduits, the earliest of which probably date back to the times of the kings of Judah. The principal reservoir is formed by the Pools of Solomon from which two conduits delivered water to the city. The lower of the two, which is still complete, is about 20 miles long, and crosses the valley of Hinnom on arches.

In Europe the earliest aqueducts were made by the Greeks. Lake Copais in Boeotia was drained by a tunnel driven from 16 shafts, the deepest of which was 150ft. Eupalinus, a celebrated hydraulic engineer, carried out a water supply for Megara about 625 B.C. and later drove a tunnel 8ft. by 8ft. in section and 4,200ft. long through a hill to convey a water supply to Samos. Conduits involving less difficult work brought in water from Hymettus and Pentelicus to Athens. The Hadrian Aqueduct was constructed A.D. 134–40 to augment the supply to that town. It consists of over 15 miles of tunnel lined with brick and masonry arranged to tap underground water-bearing strata by means of subsidiary galleries, wells and drains. After long years of disuse and disrepair this aqueduct has again been made good and brought into service to supply about 2,500,000 gallons per day.

Roman Aqueducts. — In the year 312 B.C., Appius Claudius Caecus, the constructor of the Via Appia, brought in a supply of water from springs situated to the east of Rome. His aqueduct, known as the Appia, was built of squared masonry and formed a covered conduit or tunnel for practically the whole length of about 10·6 miles.

The second aqueduct, known as the Anio Vetus, was constructed 40 years later to convey water from a source on the river Anio in the Apennines. It was a work of some magnitude, having a length of about 41 miles, formed mainly a covered conduit, and was carried out by contract, the price being the spoils obtained from the defeat of Pyrrhus. The waterway was of rectangular form with pointed roof and had a height of 8ft. 1½in. and width of 3ft. 7in.

In 145 B.C. Marcius the praetor constructed the first high level aqueduct to convey water of fine quality from various springs including those near mile 38 on the Via Sublacensis where it emerged from caves into a pool of deep green hue. His aqueduct, known as the Marcia, had varying cross-sections, the internal dimensions at the upper end being about 8ft. 2in. high by 5ft. 9in. wide. Its length of about 58.4 miles included half a mile raised above ground on masonry walling, and about 63 miles on masonry arches mainly at the city end.

The construction of the fourth aqueduct, a comparatively small and short one, known as the Tepula, followed 18 years later in 127 B.C. Large use was made of concrete in its construction and for part of the way it was built on top of Marcia.

After an interval of 94 years Agrippa in 33 B.C. tapped another source near the 12th milestone on the Via Latina by the construction of the fifth aqueduct called the Julia which joined the Tepula and ran on top of it. Its waterway had a rectangular section about 4ft. 7in. high by 2ft. 4in. wide. Its total length was about 14·6 miles of which fully 6 miles were on arches. Near the Porta Tiburtina the aqueducts Marcia, Tepula and Julia were formed one above another on the same line of arches.

In 20 B.C., the sixth aqueduct, called the Virgo, about 13 miles long, was completed by Agrippa to convey water of excellent quality to Rome from a group of springs on the estate of Lucullus. The waterway was about 6ft. 7in. high by 1ft. 7in. wide and fully one mile was raised above ground on walling and arches.

The Alsietina was the seventh important aqueduct and was constructed by Augustus to bring in a low level supply of rather unpalatable water from the small lake Alsietina situated about 20 miles north-west of Rome. Its length was 21 miles, of which one-third of a mile only was on arches.

In A.D. 36 Caligula initiated the construction of two additional aqueducts known as Claudia (the eighth) and Anio Novus (the ninth) respectively, to cope with the increasing demands of the public services and private luxury. The former was completed by Claudius in A.D. 50, and conveyed water from some fine springs near milestone 38 on the Via Sublacensis. Its waterway was about 6ft. 7in. high by 3ft. 3in. wide and the whole length of about 44 miles; nine miles were carried on arches generally of 20ft. span with piers 8ft. thick in elevation.

The Anio Novus was completed in A.D. 86 and drew its water from the river Anio, at a point near the 42nd milestone on the Via Sublacensis. The waterway was variable, one section being about 8ft. oin. high by 3ft. 3in. wide. The whole length was about 55.6 miles and the last seven miles were formed on the top of Claudia on walling and arches having a maximum height of 109ft. It was constructed principally of concrete with brickwork facing. Some 36 years later the route of this aqueduct was shortened by driving a tunnel about 3 miles long under Mount Affliano.

Towards the close of the first century A.D. the aqueducts, now nine in number, came under the care of Sextus Julius Frontinus, who had record plans prepared showing the valleys and rivers crossed, the raised and arched portions, and the places on the hillsides where particular care was required in maintenance. He states in his work *De Aqueductibus Urbis Romae* that he thereby reaped the advantage of having the works in which he was concerned directly before him. That he appreciated the practical importance of his charge may be judged from his observation, "Will anybody compare the idle Pyramids, or those other useless though much renowned structures of the Greeks with these many indispensable aqueducts?" He found a number of practices in vogue which were inimical to public service. The aqueducts were surreptitiously bled en *route* by proprietors of adjacent lands. At the city the water was measured into distributing tanks by a few bronze meter orifices of large capacity and distributed out again by a large number of small orifices to the various purchasers. The watermen by making the inlet orifices larger than the nominal diameter and the outlet orifices smaller, were enabled to balance the quantities received and distributed while having a considerable actual surplus which they sold on their own account. Many of the citizens also were not averse to receiving water by illegal tapping of the State lead mains supplying the public institutions and fountains.

Based on his experience of the upkeep of the vast system of water supply conduits under his charge, developed by a succession of builders during a period of 400 years, he formed the opinion that the workmanship in the old aqueducts was better than in the new. The work of maintenance was heaviest on the above-ground portions of the aqueducts, particularly the arches and much less on the underground portions which were immune from the effects of heat and frost, but which on the other hand were liable to damage from penetration by the roots of trees. Major works of repair were usually undertaken on one aqueduct at a time, with the flow cut off, but were sometimes carried out without interruption of supply by erecting supports from the ground and by-passing the water in a lead trough.

The water supply system was further extended after the time of Frontinus by the construction of the Aqua Trajana in A.D. 109 which conveyed water from the springs near Lake Bracciano, 20 miles north-westwards from Rome and the Alexandrina in A.D. 226 which tapped some springs near the Via Praenestina about 14 miles from Rome.

Frontinus gives quantities of water delivered by the various aqueducts in "quinaria" but the equivalent discharge in modern measure is difficult to arrive at. A determination by Claudia di Fenigio is, one quinaria=0·48 litre per sec. which is equal to 9,400 imperial gallons per day. On this basis the total water delivered by the aqueducts in the time of Frontinus was about 130,000,000 gallons per day of which 92,000,000 gallons were used within the city.

The water supply per head in Rome was about twice as great as in Glasgow (in 1928), but allowing for the unavoidable loss from Rome's free flowing conduits, the utilizable supply to the two cities would be more nearly on a par.

What has been the fate of those great works? The Virgo and the Trajana were restored to use in 1570 and 1611 respectively. The ugly Acqua Felice, constructed by Sixtus V. in 1585 takes the place of the Alexandrina, though on a somewhat different line. The excellent waters from the springs which fed the old Marcia are once again being conveyed to Rome by a new aqueduct 33 miles long, known as the Pia Marcia, constructed in 1870. The upper half is formed as a rectangular masonry conduit with arched roof having a capacity of 27,000,000 gallons per day, while the lower half is a pressure conduit formed of a number of lines of 24in. cast iron pipe.

The most impressive remains are the stretches of arches which still stand, indicating in monumental fashion the vast extent of the ancient structures provided for the conveyance of the high level supply across the last broad depression of the campagna to the city of Rome.

Roman Aqueducts Outside Italy.—The following examples are specially noteworthy: (1) The Pont du Gard at Nimes, France, which is still standing, and for boldness and gracefulness of design is unrivalled. It was built by Agrippa possibly in A.D. 18. It has three tiers of arches in its height of 160ft., the lowest tier having six arches of 60ft. to 75ft. span, the middle tier 11 arches of 75ft. span, and the upper tier 35 small arches over which the waterway was constructed. (2) The aqueduct bridge at Segovia in Spain about 2,700ft. long and 102ft. high formed with 109 masonry arches in two tiers. The aqueduct, of which this splendid bridge forms part, is still in use.

Mediaeval Aqueducts.—The water supply to the cathedral city of Spoleto in central Italy is conveyed by a 7th century aqueduct about 700ft. long and 270ft. high. It is noteworthy for its light and graceful proportions and for the use of pointed arches, there being ten of about 66ft. span.

Several fine examples of arched construction exist on the conduit system of Constantinople, the most noteworthy being the aqueduct of Justinian which constitutes one of the most imposing monuments of its period. It is 720ft. long, 108ft. high and has two tiers of pointed arches with 55ft. spans in the lower story and 40ft. spans in the upper. The piers are buttressed and lightened by having small arches pierced through them at different heights.

MODERN CONSTRUCTION

In the ancient aqueducts, with few exceptions, the conveyance of the water was accomplished by forming the aqueduct as a free flowing channel, usually built of masonry, with a continuous slight fall in the direction of the delivery point. If it were necessary to cross a valley the channel was continued on its pre-determined level and gradient on a built masonry construction either of continuous walling or of piers and arches until the other side was reached when it again followed the contour of the ground. The advancement of engineering science has obviated the necessity for the use on a large scale of such constructions in modern aqueducts, where the water can be conveyed when required in large closed pipes flowing full under pressure, and arranged within limits to follow the depressions and elevations of the surface of the ground.

There are, therefore, two distinct methods of flow which may be used according to the circumstances. In the one case the water flows with a free surface in a channel having a regular gentle slope, corresponding to the case of natural flow in a river, in the other case the water completely fills the closed conduit in which it is confined and exerts pressure on the whole of the interior surface tending to burst the walls.

Free Flowing Conduit.—The principal types of construction used for free-flowing conduits are the following: (a) Open canal

formed in the earth, with or without an impervious Lining; (b) covered conduit built of brickwork, masonry or concrete; (c) tunnel, unlined or with a smooth lining of brickwork, masonry or concrete.

Free-flowing conduits take many shapes in cross-section such as rectangular, horse-shoe and circular. In the case of open canals the most usual form has a straight flat floor and sloping sides.

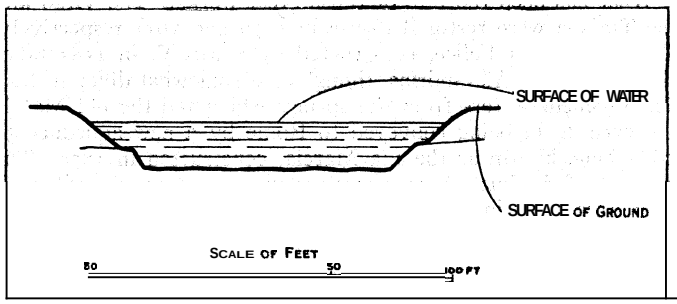


FIG. 1.— TYPICAL CROSS SECTION OF THE UNLINED HUMBER-ARM POWER CANAL FOR CONVEYANCE OF 5.000 CU. FT, OF WATER PER SECOND. TO HUMBER-ARM HYDRO-ELECTRIC STATION. NEWFOUNDLAND

Open Canals.--Open canals in Britain are not in favour for conveying domestic water supplies on account of their liability to contamination and interference. They are principally used on a large scale for conveying water to low head water power stations and for the irrigation of large cultivable areas in dry countries. When unlined the gradient must be fixed so that the velocity does not become great enough to cause erosion of the bed or banks, say from $2\frac{1}{2}$ to 5ft. per second according to the firmness and cohesion of the material. Considerable loss of water from leakage may be expected with unlined canals. In lined canals velocities up to 10ft. per second or more are possible.

An unlined canal at the Humber-Arm Hydro-Electric Works, Newfoundland, to convey a minimum water flow of 5,000 cusecs, has a bed width of 100ft. and water depth of 21ft. as shown in fig, 1. The gradient is 1 in 7,450 and the maximum velocity about 3ft. per second.

A concrete-lined (fig. 2) canal for conveying water to the low head power station at Beaumont-Monteux on the Basse-Isère, France, is 105ft. wide on the bottom with 15ft. maximum depth of water, side slopes of 1 to 1 and cement concrete lining 12in. thick on floor and sides, finished with a surface rendering of cement mortar $1\frac{1}{4}$in. thick. The lining is laid in sections with a

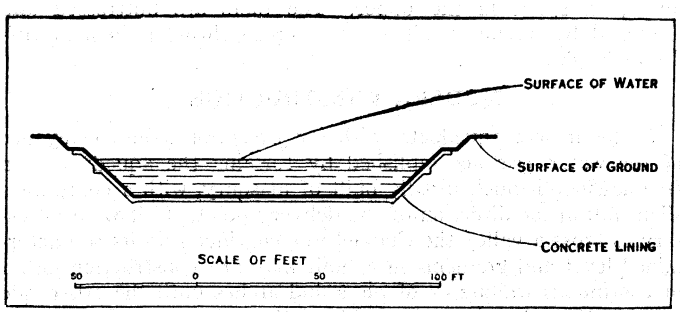


FIG. 2.— CROSS-SECTION OF BEAUMONT-MONTEUX POWER CANAL WITH SMOOTH CONCRETE LINING. FOR CONVEYANCE OF 10.000 CU. FT. OF WATER PER SECOND. TO POWER STATION ON THE BASSE-ISERE AT BEAUMONT-MONTEUX, FRANCE

transverse expansion joint every 23ft. The maximum flow is 10,000 cusecs and velocity $6\frac{1}{2}$ft. per second. The fall is 1 in 6,400.

Covered Conduits.—Built aqueducts for the conveyance of domestic water supplies in Britain are almost invariably roofed and covered over with earth. Numerous examples have been constructed in masonry and brickwork, but concrete is now generally preferred. Such conduits in suitable circumstances are more economical than pipes where the quantity of water is large, but are only applicable where a route can be located on the ground having the desired fall along a contour gradient tending in the direction of the point of delivery. Figs. 3 and 4 show typical cross-sections of the conduit for supply of 75,000,000 gallons per day from the Elan Valley to Birmingham and the Catskill conduit for water supply to New York respectively. The latter is one of the largest aqueducts ever constructed for conveyance of domestic water supply.

Tunnels.—Continued improvements in mechanical drilling, in the power and reliability of explosives, and in the methods of handling and transporting the excavations, have contributed to a decided increase in the speed and relative economy of tunnel construction during the first three decades of the 20th century. The result is that tunnelling is used in aqueduct-construction to a much larger extent than formerly. It may be the only way for conveying water from one valley to another through a ridge which cannot be circumvented, and in other cases it may be chosen in preference to covered conduit on account of shortening of the route, greater security, lessened maintenance cost, and obviation of surface damage. In very sound unfissured rock, lining of masonry, brickwork or concrete mav be dispensed with. but it is very seldom that lining of the 'invert is omitted; where reliability of service under determinate hydraulic conditions is essential, a smooth lining on the whole of the wetted surface should be provided.

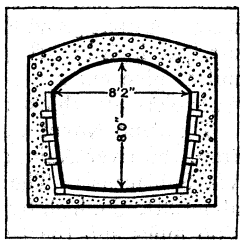


FIG. 3.—ELAN AQUEDUCT, BIRMINGHAM WATER SUPPLY
Cross-section of covered concrete conduit, with internal brick lining, for conveyance of 75,000,000 imperial gallons of water per day (140 cu. ft. per second)

The new Loch Katrine aqueduct of the city of Glasgow has about 19 miles of lined tunnel of horseshoe shape with a height of 9ft. and width at springing of roof arch of 10ft. It has a fall of $11\frac{1}{2}$in. per mile and a capacity of 76,000,000 gallons per day. Tunnelling on a very large scale has been used in America in aqueducts supplying certain of the large cities such as New York, San Francisco, and Los Angeles. A long concrete-lined tunnel on the Catskill aqueduct for New York has a capacity of 500 million U.S. gallons per day with a horseshoe shaped cross-section having a width of 13ft. 4in., a height of 17ft., and an effective waterway of 165 sq.ft. The gradient is ·37 per 1,000.

Pressure Conduits.— Conduits which are required to flow full under pressure are subject to strict limitations in the matter of shape and material of construction. The material must be capable

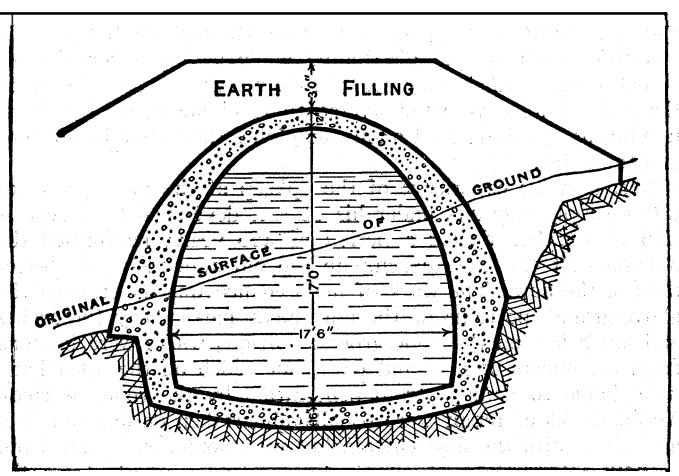


FIG. 4.— CATSKILL AQUEDUCT, NEW YORK CITY WATER SUPPLY
Typical cross-section of large, free-flowing, covered, concrete conduit for conveyance of 500 million U.S. gallons of water per day (770 cu. ft. per second)

of resisting high tensile stresses and Is most effective when disposed in circular form. The most usual types of construction are: (a) Cast Iron Pipes, (b) Steel Pipes, (c) Wood Stave Pipes, (d) Reinforced concrete pipes or conduit, (e) Tunnel.

Cart *Iron* Pipes.—Cast iron pipes came into use about the beginning of the 19th century as an alternative to lead and wooden pipe, for the distribution of water in towns. With rapid development of the iron-founders' craft it became available for aqueducts and has been so used in sizes up to 54-in. diameter and over.

TABLE No. I. *Particulars of aqueducts for certain large towns in Great Britain*

Town	Scheme	Capacity of aqueduct Imp. gals. per day (000,000s omitted)	Length of aqueduct in miles: Tunnel	Cut and cover	Pressure pipes	Total length	Particulars of tunnels and built conduits	Particulars of pressure pipes
Glasgow	Loch Katrine Aqueduct No. 2	76	19¼	1¼	3	23½	Lined horseshoe tunnels 10ft. wide, 9ft. high. Fall ·18 per 1,000.	Two lines cast iron 48in. diam. Fall 1·0 per 1,000.
Birmingham	Elan Valley	75	13	23½	36½	73	Lined horseshoe sections from 7ft. 6in. wide by 8ft. high to 8ft. 2in. by 8ft. 6in. Falls ·25 to ·33 per 1,000.	*Six lines cast iron 41in. to 42in. diam. steel for pressures over 400 ft. Fall ·57 per 1,000.
Manchester	Thirlmere	50	14	37	45	96	Lined rectangular sections with arched roof, normally 7ft. 1in. by 7ft. 0in. Fall ·31 per 1,000.	†Three lines cast iron 48 in. diam. for part of length and 5 lines cast iron 36in. to 40in. diam. for remainder.
Liverpool	Vyrnwy	40	4	nil	64½	683	Unlined tunnel 7ft. diam Fall ·39 per 1,000.	Three lines cast iron pipes 39in. to 42in. diam. Fall ·85 to 1·3 per 1,000.

*The particulars give the installation originally contemplated. Steel pipes 60in. diameter have been used on sections of the third line of pressure pipes.

†The particulars relate to the installation originally contemplated. In the fourth line of pipes, welded steel, reinforced concrete and cast iron 54in. diam. have been used on separate sections.

Cast iron pipes are usually made in lengths of 9 to 13ft. with end joint of spigot and socket form made watertight with lead. Pipes with flanged ends to bolt together are also used. Pressure conduits of cast iron pipe may follow any irregular profile imposed by the route chosen, ascending here and descending there, and crossing summits and hollows provided always that none of the summits rise above the "hydraulic gradient" which for a pipe of uniform diameter is the straight line joining the inlet and outlet ends on the longitudinal profile. Should air collect at any of the summits the flow will be interfered with. Air valves are therefore installed on top of the pipe at such places and automatically discharge the air as it collects without allowing water to escape. Sluice valves fixed on scour branches at the bottom of the pipe are required at the lowest points of the pipe for the periodical discharge of any sediment which may collect there and restrict the flow. Should a burst occur on a large pipe great damage and loss of water may occur before the water can be cut off. Automatic valves for stopping the flow when a burst occurs are desirable at the upper end of an important pipe and also at the principal summits in the case of a long pipe, and commonly take the form of a circular disc valve on a horizontal axis which passes through glands in the walls of the pipe and is connected to hydraulic operating gear in a chamber formed over the pipe. The operating gear is set in motion by a valve connected to and controlled by a small paddle within the pipe. The flow of water in the pipe imposes pressure on the paddle, which becomes greater with increase of velocity, and matters are so adjusted that a definite increase of velocity above the normal will move the paddle, thereby setting the operating gear in motion and closing the main valve.

In Britain pipes are secure from the effects of frost if laid with a cover of 2ft. 6in. of earth, whereas in more severe climates greater cover up to 5 or 6ft. as a maximum may be necessary. Where the foundation is unsatisfactory or where exceptional loads have to be resisted or special forces dealt with as in changing direction at a bend, the pipe should be reinforced by bedding it on, or surrounding it with concrete. In normal circumstances cast iron pipe has long life and is generally more liable

TABLE No. II. Particulars of aqueducts for certain large towns in the United States

Town	Location of aqueduct	Capacity (millions of gallons per day)	Length of aqueduct in miles: Tunnel	Cut and cover	Pressure pipes	Total length (miles)	Particulars of tunnels and conduits	Particulars of pressure pipes
Los Angeles	Owens River Sierra Nevada Mountains	280	42·90	166·46	14·05	223·41	Tunnels driven through rock and soil. Lined with concrete. Horseshoe arch construction with steel reinforcing. World record for rock tunnel driving established at 1061·6ft. per month. Concrete lined and unlined conduits. Conduits covered through Mojave desert.	Concrete pipe used on heads up to 75 feet. Steel piping used above 75 feet. Largest steel section weighed 26 tons and was erected by use of incline railways and special hoists. Inverted siphons lined with cement used on valleys and canyons, part on surface and part buried.
San Francisco	"Hetch Hetchy" Sierra Nevada	400	84·90	None	70·90	155·80	Tunnels driven through rock and soil. Reinforced arch construction. Lined with concrete. No open canals or conduits in the entire system.	Riveted steel piping used throughout with submarine piping on the rivers, Siphons on short valleys lined with cement and laid on surface.
New York†	Catskill Mountains Supply	600	14·00	55·00	23·00	92·00	Tunnels driven through rock and soil. Arch construction with no reinforcing. Conduits lined with concrete and grounded with cement.	Riveted steel piping used for 6m., sunk below surface. Pressure tunnels of heavily reinforced concrete for 17 miles. Submarine piping used under rivers.

†Not including Shandaken Tunnel.

to deterioration inside than outside, so that some loss of capacity takes place with lapse of time.

Steel Pipes.—The advantages of steel are its lightness, reliability, watertightness, and security from cracking, and not least the fact that it can be used in much larger sizes than cast iron. Experience also shows that well coated steel pipes when buried in normal soil will endure for many years. Riveted pipe is suitable for moderate heads, a good example of such construction being the new pipe line from Lake Tansa for the Bombay water supply. The pipe has diameters from 57in. to 72in. and is formed of rings 7ft. 4in. long alternately in and out, each made from a single plate $\frac{3}{8}$in. thick, with the longitudinal joints double riveted and the circumferential joints single riveted. The pipes are uncovered and laid direct on the graded surface of the ground.

On the Catskill aqueduct of New York there are many miles of large riveted pressure pipe from 7ft. 4in. to 11ft. 3in. diameter. The pipes are made in ring courses of $7\frac{1}{2}$ft. alternately in and out with one or two plates to the circle according to the size. The thickness varies from $\frac{7}{16}$in. to $\frac{9}{16}$in. and the longitudinal joints are lapped for the thinner plates and butted and double strapped for the thicker. The pipes are surrounded with a casing of concrete having a minimum thickness of 6in. placed in position after the pipe had been tested and made watertight and while it was full of water under pressure. They were afterwards furnished with a smooth interior protective lining of cement mortar having a thickness of 2in.

In Britain and elsewhere there has been considerable development in the use of smooth welded steel pipes which have definite advantages over riveted pipes in that the weight is less for the same strength, the capacity is greater for the same size and installation in the field involves less work from the fewer number of joints required. Such pipes are formed of mild steel plates, heated and bent to circular form by means of large bending rolls and having the longitudinal joints lap welded by heating with water gas. The pipes are commonly made in lengths of 20 to 30ft. and one or two plates are required to form the circle according as the diameter is under 3ft. or between 3ft. and 6ft. Still larger pipes may be made with three plates to the circle. The steel used requires to be of extra mild ductile and weldable quality such that when allowance of about 90% efficiency for the welded joint is made a working tensile stress of about 5 tons per square inch is appropriate. Joints of welded pipes for water supply aqueducts are commonly formed with spigots and sockets, either close fitting. for riveting. or with an annular gap for filling with lead.

Considerable effort has been directed towards the application to metal pipes of a smooth interior lining of substantial thickness which will adhere permanently and prevent rusting, pitting and incrustation. Experience is being accumulated with two such linings, having portland cement and bitumen respectively as the basic material, which are applied by a process of centrifugal spinning. Protection of exterior surfaces of steel pipes is usually effected by a coating of bituminous material which may be reinforced by one or more wrappings of bitumen-impregnated hessian.

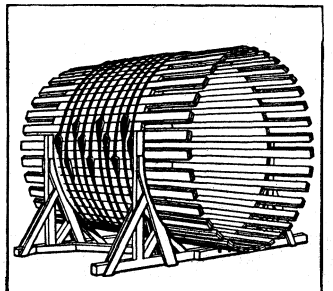


FIG. 5.—VIEW OF SPECIMEN LENGTH OF WOOD STAVE PIPE, SHOWING ELEMENTS OF CONSTRUCTION
The machined wood staves are bound with mild steel hoops

Wood Stave Pipes.—Wood stave pipes formed in the manner shown in fig. 5, with machined staves bound at close intervals with mild steel hoops, are economical for low heads in districts where suitable timber is abundant and cheap. At the Humber-Arm works, Newfoundland, there are seven lines of such pipe, 9ft. 6in. diameter, used for a maximum head of 167ft.

A wood stave pipe 16ft. diameter and 1,318ft. long to carry 3,000 cusecs was constructed in 1925 to serve the Hydro-Electric Plant No. 2 of the California-Oregon Power Co.

Reinforced Concrete Pressure Conduits.—Closely spaced hoops of steel, along with a system of longitudinal bars are contained in a cylindrical concrete shell and serve to prevent bursting and fracture. The chief advantages of this method arise from small cost of maintenance, security against collapse, and frequently saving in first cost as compared with other methods. For moderate diameters and pressures, pipes may be precast in lengths up to 12ft., transported to the site and connected together with joints of the "collar," "lockjoint," or other special type. On the Spavinaw aqueduct for the water supply to Tulsa, Oklahoma, there are 53 miles of reinforced concrete pressure conduit. Large conduits require to be manufactured in situ. Fig. 6 shows a cross-section of the huge conduit 19.7ft. diameter of the Drac-Romanche Hydro-Electric Development, near Grenoble, France, designed to carry 2,800 cusecs with a fall of 1 in 1,500 under a maximum head of 50ft.

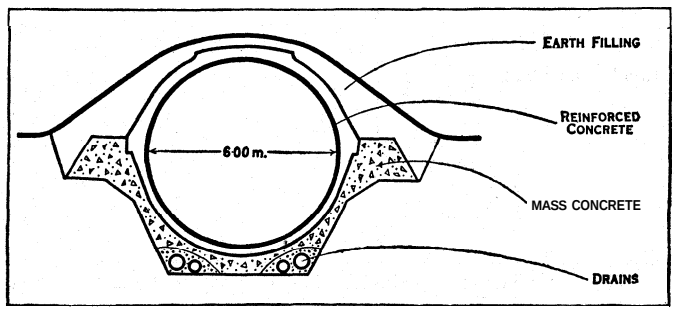


FIG. 6.— DRAC-ROMANCHE PRESSURE CONDUIT AT GRENOBLE, FRANCE
Cross-section of huge, reinforced concrete pressure conduit, 19.7 ft. in diameter, for conveyance of 2,800 ou. ft. of water per second, under a pressure of 50 feet

Pressure *Tunnels*.—Low pressure tunnels are largely used in mountainous districts to convey water from a reservoir or intake to the head chamber of a hydro-electric station. In hard, sound unfissured rock, such tunnels may be unlined, but a smooth lining of rich concrete in conjunction with sealing of fissured places by the injection of cement through drill holes is generally desirable.

Specially interesting examples of pressure tunnels exist on the Catskill aqueduct of New York. A concrete-lined pressure tunnel, about 4 miles long, is formed in shale deep down below the valley of the Wallkill river, thus obviating construction with pipes on the surface. It is 14ft. 6in. in diameter with a capacity of 500 million U.S. gallons per day and connects with free flowing conduit at each end by means of vertical shafts. Many miles of similar tunnel have been formed in rock at a depth of 500ft. below the streets of New York.

Aqueducts for City Water Supply.—The increasing distances from the place of use at which additional supplies have to be sought are well exemplified in the case of most of the larger towns of Britain, London being a notable exception. Glasgow, when its supply from the nearby Gorbals Water Works no longer sufficed, reached out into the Highlands 30 miles away and by tunnelling on a bold scale was enabled to obtain an abundant and pure supply from Loch Katrine. Birmingham had to go to the Elan Valley in the mountains of mid-Wales, a distance of 73 miles. Manchester went to Lake Thirlmere in Cumberland, a distance of 96 miles, to supplement the original supply obtained from Longendale, 18 miles east of the city. Liverpool has gone to the River Vyrnwy in North Wales, a distance of 683 miles. (J. WI.)

Some of the aqueducts for the supply of cities in the United States of America are colossal in comparison with the largest in Britain. Los Angeles obtains its water supply from the headwaters of the Owens River. The work was carried out in five years at a cost of about $23,000,000; later construction was begun on a 242-mile aqueduct, at an estimated cost of $220,000,000, to supply an additional 1,500 sec.-ft. of water to 13 cities in Southern California from the Colorado river. The Hetch Hetchy aqueduct, designed to carry 400,000,000 gallons per day from the Sierra Nevada to San Francisco, began delivering water in 1934.

New York city began work in 1937 on a $273,000,000 aqueduct to increase its water supply by 50%. The new project will

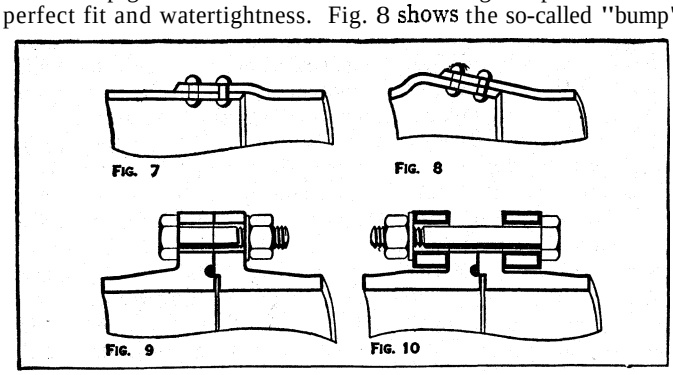
bring water from the Delaware river by a tunnel to the existing Croton and Kensico reservoirs. The Catskill aqueduct is capable of delivering 500 million gallons per day to New York city. (X.)

Modern Italy again furnishes one of the most remarkable water supply systems of the world in the Apulian aqueduct which conveys water from the moist western slopes of the Apennines to an area of 8,000 square miles of semi-arid territory in the south-eastern corner of the country. The intake is at the perennial Caposile springs so that, as in the case of the aqueducts of ancient Rome, a storage reservoir is not required. The main conduit, which has a capacity of about 110 million imperial gallons per day is carried through the ridge of the Apennines in a tunnel 9½ miles long and extends westwards and southwards for a distance of 152 miles, terminating at Taranto. Altogether some 67 miles of the conduit were formed in tunnel, a typical cross section having a horseshoe shape 8ft. gin. wide by gft. 5in. high. Water is delivered to a population of three millions in 266 communities by a system of 841 miles of main and branch pipes and 550 miles of distribution pipes.

Of surpassing interest in some respects is the aqueduct constructed in 1903 for supplying the gold mining centres of Coolgardie and Kalgoorlie in Western Australia with water. The source is near the western coast and the point of delivery is some 1,300ft. higher in the arid heart of the country 350 miles away. The aqueduct is formed as pressure pipe of the locking bar type, 30in. diameter with steel plate ¼in. thick. The water is forced up stage by stage by means of a series of eight pumping stations with balancing tanks at each station.

High Pressure Hydro-electric Pipes.--Of special importance are the aqueducts required to deliver water to hydro-electric stations utilizing high falls of from 400ft. to 5,000ft. or more. For such cases the fall is concentrated at the power station in as short a distance as possible. Welded steel pipe is almost exclusively used, either in single pipe lengths of 20 to 30ft. or in multiple lengths formed by welding two or three single pipes together. The joints are a vital part of the pipe line and the trend of development is to make them strong and rigid and to avoid the use of bolted, packed and expansion joints wherever possible. Pipes formed with close fitting spigot and socket ends joined together by single, double or treble riveting according to the pressure represent good power line practice for medium and large sizes.

Two forms of riveted joint are shown in figs. 7 and 8. Fig. 7 shows a spigot and socket form made to slight taper to ensure perfect fit and watertightness. Fig. 8 shows the so-called "bump"



ILLUSTRATING TYPES OF JOINT FOR HIGH PRESSURE PIPE LINES
Figs. 7 and 8. Forms of riveted joint, used for large welded pressure pipes. Figs. 9 and 10. Pressure pipes connected by bolting through fixed, and loose, flanges respectively

joint, with coned and swelled ends, connected by riveting. For the smaller sizes of pipe, flanged and bolted joints of various types are used, generally with a packing ring to ensure watertightness. Typical forms of two classes of flanged joint are shown in figs. 9 and 10. Where great strength is required, welded pipe, with weldless steel bands shrunk on at intervals, has been used.

Two contrasting methods of installation are in use, which may be designated the Swiss and the French method respectively. In the Swiss method a heavy concrete anchorage surrounding the pipe is provided at every bend, horizontal or vertical, the pipe* line being thus divided into a series of straight lengths, each of which is provided with an expansion joint near its upper end. The anchorages are designed to resist the maximum forces transmitted by the section of pipe-line attached thereto. In the French method main anchorages are provided at top and bottom only, there are no expansion joints, subsidiary intermediate anchorages are provided to hold the pipe in position and take care of the stresses produced by local variations of temperature and generally bends and elbows are left free to spring somewhat under extremes of temperature.

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AQUEOUS HUMOUR, the clear watery fluid which fills the front part of the eyeball. It is enclosed by the cornea in front and the lens, suspensory ligament and ciliary body behind. The iris divides this small space into an anterior and a posterior chamber. The fluid is secreted in the latter chamber by the ciliary gland and circulates through the pupil to be absorbed slowly in the anterior chamber into the circular canal of Schlemm. When this absorption is interfered with, the pressure of the accumulating fluid increases, giving rise to the condition called glaucoma. Injuries of the cornea may cause escape of the aqueous humour but if infection does not supervene the wound usually closes and the fluid reaccumulates.

AQUIFOLIACEAE, a family of trees and shrubs, the best known members of which are the holly (*q.v.*) and the Paraguayan tea, both of the genus *Ilex.* This genus contains in excess of 450 recognized species.

See T. Loesener, Monographia Aquifoliacearum. Nova Acta Academiae Caesareae Leopoldino-Carolinae Naturae Curiosum vol. 78, pp. i-viii, 1–570, tables 1–5 (1901); vol. 89, pp. 1–313 (1908).

AQUILA (Ἀκύλας), (1) a Jew from Rome, who with his wife Prisca or Priscilla had settled in Corinth, where Paul stayed with them (Acts xviii. 2, 3). They became Christians and fellow-workers with Paul, to whom they seem to have shown their devotion in some special way (Rom. xvi. 3, 4). (2) A native of Pontus, celebrated for a very literal and accurate translation of the Old Testament into Greek. Epiphanius (*De* Pond. *et Mens.,* c. 15) preserves a tradition that he was a kinsman of the Emperor Hadrian, who employed him in rebuilding Jerusalem (Aelia Capitolina [*q.v.*]), and that he was converted to Christianity, but, on being reproved for practising pagan astrology, apostatized to Judaism. He is said also to have been a disciple of Rabbi 'Aqiba (d. A.D. 132), and seems to be referred to in Jewish writings as עקילס. Aquila's version is said to have been used in place of the Septuagint in the synagogues. The Christians generally disliked it, alleging that it rendered the Messianic passages incorrectly, but Jerome and Origen speak in its praise. Origen incorporated it in his *Hexapla.*

It was thought that no other copy of Aquila's version was extant, but in 1897 fragments of two codices were brought to the Cambridge University library. These have been published—the fragments containing I. Kings 7–17; II. Kings xxiii. 12–27 by F. C. Burkitt in 1897, those containing parts of Psalms xc. ciii. by C. Taylor in 1899. *See* F. C. Burkitt's article in the *Jewish Encyclopedia.*

AQUILA, Abruzzi, Italy, capital of a province, seat of an archbishop, 2,360 ft. above sea-level, 50 mi. N.E. of Rome, 145 mi. by rail; until 1937 known as Aquila degli Abruzzi. Pop. (1936) 20,573 (town), 54,722 (commune). It is on a hill in the valley of the Aterno, surrounded by mountains with the Gran Sasso d'Italia on the northeast. The railway from Terni to Sulmona runs through it and there is a branch line to Capitignano, 20 mi. to the northwest. A summer resort, it is cold and windy in winter. The highest part has the massive citadel (1535) of the Spanish viceroy Don Pedro de Toledo. The church of S. Bernardino di Siena (*q.v.*) containing his tomb (1454–72) has a fine

Renaissance façade by Nicolò Filotesio (commonly called Cola d'Amatrice). The church of S. Maria di Collemaggio, just outside the town, has a fine, simple Romanesque façade (1283–88) in red and white marble. S. Giusta, S. Silvestro, etc., have similar facades. Outside the town is a fountain with 99 jets along three walls, constructed in 1272. Conrad, son of Emperor Frederick II, founded Aquila about 1250, as a bulwark against the papacy. Destroyed by Manfred in 1259, it was rebuilt by Charles I of Anjou and its walls completed in 1316. It maintained itself as an almost independent republic until the Spaniards, masters of the kingdom of Naples from 1503, subdued it in 1521. It was seriously damaged by an earthquake in 1703, and twice sacked by the French in 1799.

See L. Serra, *Aquila Monumentale* (Aquila, 1912), well illustrated.

AQUILA, in astronomy, the "eagle," sometimes named the "vulture," a constellation of the northern hemisphere, traversed by a bright part of the Milky Way, which is here divided into two branches. The stars, β, α, γ (*See* ALTAIR), form a conspicuous group reminding us slightly of Orion's belt. Several Novae have appeared in this constellation; in particular Nova Aquilae III, discovered on June 8, 1918, attained a brightness only slightly inferior to Sirius.

AQUILEIA (med. *Aglar,* Slovene *Voglej),* a former city of the Roman empire and mediaeval western patriarchate, at the head of the Adriatic, 6 mi. inland, and 22 mi. W.N.W. of Trieste; it is now a village. Pop. (1936) 1,116 (town), 9,495 (commune).

Aquileia was founded by the Romans 181 B.C. to prevent the irruptions of barbarians along the narrow strip between the Alps and the Adriatic. Here the Postumian Way terminated; beyond, the roads branched out to Illyria, Pannonia and Noricum. Its situation soon made it a commercial and military centre of the first importance. It was connected by canal to the sea at Grado, which was joined by a causeway to the mainland, and here part of the Roman fleet was stationed. Its trade increased rapidly after Pannonia and Illyria became part of the Roman Empire. It was the capital of the province of Venetia, and the only city in Italy, beside Rome, which had the right of striking coins. Ausonius ranks it as the fourth Italian town, after Rome, Milan and Capua. Under Hadrian it had between 300,000 and 500,000 inhabitants.

In A.D. 452 it was taken by the Huns, after a three months' siege, and razed to the ground. The surviving inhabitants fled for safety to the neighbouring lagoons. The only importance left Aquileia was as an ecclesiastical centre. Aquileia had been the seat of a very old bishopric. Tradition ascribes its foundation to St. Mark, and its early incumbents included SS. Hermagoras, Hilarius and Valerian. In the jth and 6th centuries its diocese included all of north-east Italy, with Illyria, Noricum and Rhaetia, and it was thus the chief ecclesiastical power among the eastern Germanic tribes. Its bishop Macedonius (535–556) refused to acknowledge the conclusions of the 5th Oecumenical Council (553) and seceded from Rome at the head of the bishops of north Italy, Venetia and Istria, assuming in 557 the title of Patriarch, which had been accorded to him by the barbarians. Soon after, Italy was overrun by the Lombards, and the patriarch fled to Grado, six miles away. The Metropolitan Candidian of Aquileia (in Grado) made submission to the pope in 606, but his Lombard suffragan did not follow him and there were for long rival patriarchs of both Aquileia and Grado. But Poppo of Aquileia sacked Grado in 1024 and carried off its treasures to Aquileia, where he built the present cathedral (consecrated 1037). The Emperor Conrad supported him in the resultant war with Venice, granted him the fief of Istria, with the right to strike coins, and forced Pope John XX. to recognize him as metropolitan of all Italy, after Rome. From this time onward, the city was overshadowed by Venice, which finally deprived Aquileia of all territories bestowed on it by the Empire (1420). In 1438 the city itself was destroyed by an earthquake; the next patriarch acquiesced in the loss of his old power in return for an annual payment of 5,000 Venetian ducats (1445). Henceforward the patriarch resided at Udine, of which city he was to all intents bishop, and Venice claimed the sole right of appointing the incumbents. This right was disputed by the rulers of Austria, some of whose recently-acquired territories lay within the see of Aquileia. At last Pope Benedict XIV. was chosen as arbiter, and in 1748–49 abolished the patriarchate (then represented by its 109th incumbent, Daniel Delfino) altogether.

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(C. A. M.)

AQUINAS, THOMAS (THOMAS OF AQUINO) (1225?–1274), the prince of scholastic philosophers, known as *Doctor Angelicus,* was born at the castle of Roccasecca, near Aquino in the province of Naples. Having received his elementary education at the abbey of Monte Cassino, in 1239 he went to study the seven liberal arts at the University of Naples. There, five years later, he entered the Order of St. Dominic, against the wishes of his family. From 1245–48 he studied in Paris under Albert the Great, and when Albert returned to Cologne in 1248 Thomas went with him. In 1252 he was again in Paris, where, in 1256, after composing the commentaries on the Bible and on the Sentences, he received the degree of Licentiate in Theology, and shortly afterwards that of Master in Theology. For the next few years he was engaged in teaching and defending the rights of his Order against William of St. Amour, the spokesman of the University of Paris. From 1259–68 he taught at the Pontifical Curia in Rome, and again in Paris from 1268–72, where he began his opposition to Siger of Brabant and the Latin Averroists, and to the Franciscan supporters of Augustinianism. In 1272 he was recalled to his native country, to teach at Naples. Like his friend, St. Bonaventure, he was summoned by Gregory X. to the General Council of Lyons (1274), which proposed to reconcile the differences between the Greek and Latin Churches, but while on his way to Lyons he died on March 7, 1274.

In spite of the condemnations of many of his doctrines by Stephen Tempier, bishop of Paris, and by Kilwardly, the Dominican archbishop of Canterbury, Thomas was canonized in 1323 by Pope John XXII., and in 1567 his festival was ranked by Pius V. with those of the four great Latin fathers — Ambrose, Augustine, Jerome and Gregory. No theologian, save Augustine, has had an equal influence on the theological thought of the Western Church, a fact strongly emphasized by Leo XIII. (*q.v.*) in his *Encyclical* of Aug. 4, 1879, which directed that the teachings of St. Thomas should be taken as the basis of theology. At least three further justifications for bestowing this honour upon the *doctor angelicus* could be suggested. Firstly, St. Thomas was a many-sided nature, as keenly interested in politics or mysticism as in metaphysics or theology. Secondly, he was the ideal scholar, persuading instead of denouncing his opponents, critical within reason, sober in judgment and proving all things while holding fast to that which is good. Thirdly, he was the producer of a most astounding synthesis of past philosophical thought *(see* SCHOLASTICISM).

All the many writings of St. Thomas are preparatory to his great work, the *Summa Theologica.* He began in 1254 with his *Commentary on the Sentences* of Peter the Lombard, a work in which the influence of Albert the Great and of the Augustinianism that he was to desert later, is very evident. Then came his deliverances upon speculative theological problems in some of his early *Quaestiones disputatae* and the *Quaestiones quodlibetales,* and his commentaries upon certain of the Scriptures. About the same time he was producing commentaries on Boethius, on the *De divinis nominibus* of pseudo-Dionysius, on the *Liber de Causis,* and on the following works of Aristotle: the *Physics, Metaphysics, De Anima, De Sensu, De Memom'a, Ethics, Politics, Posterior Analytics, Mefeors, Pem' Hermeneias, De Caelo* and the *De Generatione.* Most of the important doctrines of all these works and the later *Opuscula,* are set forth in a simplified manner in the two great *Summae,* the *Summa contra Gentiles,* and the *Summa Theologica.*

In the *Summa contra Gentiles* (1259–64), the chief work of the middle ages on natural theology, St. Thomas attempts to meet the views and objections of non-Christians by clearly distinguishing the spheres of natural reason and faith. Reason and faith, he thinks, are both concerned with the same object, but in different ways; the former starts from sense-data, and attains to a knowl-

edge of the existence, the unity, the goodness, the intelligence and the will of God; the latter rests on revelation and authority, and attains to a knowledge of God as a purely spiritual Being, *e.g.*, a Being with a Trinity of Persons. Each requires to take into account the knowledge arrived at by the other, and, on account of the difference in their methods, there need be no fear of contamination; they cannot be confused and they should not be isolated. Of the two, faith is the more important, because it bestows on man a knowledge which he could not ordinarily possess, and thus it is said to transcend reason. True reason and faith can never be contradictory, for they both come from the one source of all truth, God, the Absolute One.

After 1265, St. Thomas began his Summa Theologica, which he intended to be the sum of all known learning. It is divided into three parts, which may be said to treat of God, Man and the God-Man. The first and the second parts are wholly the work of the angelic doctor; but of the third only the first 90 questions are his; the rest of it was finished in accordance with his designs by Reginald of Piperno. Part I., after a short introduction upon the nature of theology, proceeds to treat of the existence of God, of His nature and attributes, of the Trinity, of the Creation, of problems pertaining to the angels and to man, and lastly, of the divine government of the world. Part II. includes the Prima *Secundae* and the Secunda Secundae, the former embracing general morality as founded on the ethics of Aristotle and including man's end, his will, the *passiones* of his soul, virtue in general, sin, the old law and the new law of grace — the latter dealing with special morality, including the theological and cardinal virtues which raise numerous practical issues, and the contemplative life (see ETHICS). In the third part of the Summa, St. Thomas discusses the Person, office and work of Christ, and had begun to discuss the sacraments when death ended his labours; additions to complete the scheme are appended as a *Supplementum* Terfiae *Partis.*

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AQUINUM, ancient city of the Volsci, Italy, 7½m. N.W. of Cassino. Pop. (1936) 1,697 (town), 3,447 (commune). Birthplace of Juvenal and of the Emperor Pescennius Niger; S. Thomas Aquinas was born in Roccasecca castle, 5m. to the north. It retains portions of walls, so-called temples, basilica and amphitheatre as well as the gateway (Porta S. Lorenzo) by which the Via Latina entered it. The 11th century Romanesque basilica, S. Maria Libera, now roofless, has Roman inscriptions built into it and near by, south of the town, is a triumphal. arch with composite capitals. (See E. Grossi, *Aquinum* [Rome, 1907].)

AQUITAINE, the name of an ancient province in France, the extent of which has varied considerably from time to time. About the time of Julius Caesar the name Aquitania was given to that part of Gaul lying between the Pyrenees and the Garonne, and its inhabitants were a race, or races, distinct from the Celts. In keeping with the Roman policy of denationalization, the term Aquitania was extended, and under Augustus it included the whole of Gaul south and west of the Loire and the Aliier, and thus ceased to possess ethnographical importance. In the 3rd century A.D. this larger Aquitania was divided into three parts: Aquitania Prima, the eastern part of the district between the Loire and the Garonne; Aquitania Secunda, the western part of the same district; and Aquitania Tertia, or Novempopulana, the region between the Garonne and the Pyrenees, or the original Aquitania. The seats of government were respectively Bourges, Bordeaux, and Eauze; the province contained 26 cities, and was in the diocese of Vienne. Like the rest of Gaul, Aquitania absorbed a large measure of Roman civilization, and this continued to distinguish the district down to a late period. In the 5th century the Visigoths established themselves in Aquitania Secunda, and also in parts of Aquitania Prima and Novempopulana, but after the defeat of their king, Alaric II., by the Franks under Clovis in 507, Aquitaine passed under the nominal rule of the Merovingian kings and was frequently partitioned among them.

The first line of dukes began about 660 with one Felix, who, like his successor, Lupus, probably owed allegiance to the Frankish kings, and whose seat of government was Toulouse. About the end of the 7th century an adventurer named Odo, or Eudes, made himself master of this region. Attacked by the Saracens, he inflicted on them a crushing defeat, but when they reappeared he was obliged to invoke the aid of Charles Martel, who, as the price of his support, claimed and received the homage of his ally. Odo was succeeded by his son Hunald, who, after carrying on a war against the Franks under Pippin the Short, retired to a convent, leaving both the kingdom and the conflict to Waifer, or Guaifer. For some years Waifer strenuously carried on an unequal struggle with the Franks, but he was assassinated in 768, and with him perished the national independence, although not the national individuality, of the Aquitanians. In 781 Charlemagne bestowed Aquitaine upon his son, Louis, and the province is referred to during the Carolingian period as a kingdom. When Louis succeeded Charlemagne as emperor in 814, he granted Aquitaine to his son Pippin, on whose death in 838 the Aquitanians chose his son Pippin II. (d. 865) as their king. The emperor Louis I., however, opposed this arrangement and gave the kingdom to his youngest son Charles, afterwards the emperor Charles the Bald. Now followed a time of confusion and conflict, which resulted eventually in the success of Charles, although from 84j to 852 Pippin was in possession of the kingdom. In 852 Pippin was imprisoned by Charles the Bald, who soon afterwards gave to the Aquitanians his own son Charles as their king. On the death of the younger Charles in 866, his brother Louis the Stammerer succeeded to the kingdom, and when, in *877,* Louis became king of the Franks, Aquitaine was united to the Frankish crown.

A new period now begins in the history of Aquitaine. By a treaty made in 845 between Charles the Bald and Pippin II. the province had been diminished by the loss of Poitou, Saintonge and Angoumois, which had been given to Rainulf I., count of Poitiers. Somewhat earlier than this date the title of duke of the Aquitanians had been revived, and this was now borne by Rainulf, although it was also claimed by the counts of Toulouse. The new duchy of Aquitaine, comprising the three districts already mentioned, remained in the hands of Rainulf's successors until 893, when Count Rainulf II. was poisoned by order of King Charles III. Charles then bestowed the duchy upon William the Pious, count of Auvergne, the founder of the abbey of Cluny, who was succeeded in 918 by his nephew, Count William II., who died in 926. A succession of dukes followed, one of whom, William IV., fought against Hugh Capet, king of France, and another of whom, William V., called the Great, was able considerably to strengthen and extend his authority. William's duchy almost reached the limits of the Roman Aquitania Prima and Se-

cunda, but did not stretch south of the Garonne, a district which was in the possession of the Gascons. William died in 1030, and the names of William VI. (d. 1038), Odo or Eudes (d. 1039), who joined Gascony to his duchy, William VII. and William VIII. bring us down to William IX. (d. 1127), who succeeded in 1087, and became famous as a crusader and a troubadour. William X. (d. 1137) married his daughter Eleanor to Louis VII., king of France, and Aquitaine went as her dowry. When Eleanor was divorced from Louis and was married, in 1152, to Henry II. of England, the duchy passed to her new husband, who, having suppressed a revolt there, gave it to his son Richard. When Richard died, in 1199, it reverted to Eleanor, and on her death five years later, was united to the English crown and henceforward followed the fortunes of the English possessions in France. Aquitaine, as it came to the English kings, stretched, as of old, from the Loire to the Pyrenees, but its extent was curtailed on the south-east by the wide lands of the counts of Toulouse. The name Guienne, a corruption of Aquitaine, seems to have come into use about the 10th century, and the subsequent history of Aquitaine is merged in that of Gascony (*q.v.*) and Guienne (*q.v.*).

See E. Mabille, *Le Royaume d'Aquitaine et ses marches sous les Carlovingiens* (1870); A. Longnon, *Gkographie de la Gaule au VIe. siècle* (1876); E. Desjardins, *Gkographie historique et administrative de la Gaule romaine* (1876, 1893); A. Luchaire, *Les Origines linguistiques de l'Aquitaine* (1877); A. Perroud, *Les Origines du premier duché d' Aquitaine* (1881).

ARA, a constellation of the southern hemisphere (ara, an altar). (See COXSTELLATION.)

ARABESQUE, a word meaning simply "Arabian," but technically used for a certain form of decorative design in flowing lines intertwined; hence comes the more metaphorical use of this word, whether in nature or in morals, indicating a fantastic or complicated interweaving of lines against a background. In decorative design the term is historically a misnomer. It is applied to the grotesque decoration derived from Roman remains of the early time of the empire, not to any style derived from Arabian or Moorish work. Arabesque is a term pretty well restricted to varieties of cinquecento decoration, which have nothing in common with any Arabian examples in their details, but are a development derived from Greek and Roman grotesque designs, such as we find them in the remains of ancient palaces at Rome, and in ancient houses at Pompeii. These were reproduced by Raphael and his pupils in the decoration of some of the corridors of the Loggie of the Vatican at Rome: grotesque is thus a better name for these decorations than arabesque. Pliny and Vitruvius give us no name for the extragavant decorative wall-painting in vogue in their time, to which the early Italian revivers of it seem to have given the designation of grotesque, because it was first discovered in the arched or underground chambers *(grotte)* of Roman ruins—as in the golden house of Nero, or the baths of Titus. What really took place in the Italian revival was in some measure a supplanting of the arabesque for the classical grotesque, still retaining the original Arabian designation, while the genuine Arabian art, the Saracenic, was distinguished as moresque or Moorish. So it is now the original arabesque that is called by its specific names of Saracenic, Moorish and alhambresque, while the term arabesque is applied exclusively to the style developed from the debased classical grotesque of the Roman empire.

There is still much of the genuine Saracenic element in Renaissance arabesques, especially in that selected for book-borders and for silver-work, the details of which consist largely of the conventional Saracenic foliations. But the arabesque developed in the Italian cinquecento work repudiated all the original Arabian elements and devices, and limited itself to the manipulating of the classical elements, of which the most prominent feature is ever the floriated or foliated scroll; and it is in this cinquecento decoration, whether in sculpture or in painting, that *arabesque* has been perfected.

In the Saracenic, as the elder sister of the two styles, which was ingeniously developed by the Byzantine Greek artists for their Arabian masters in the early times of Mohammedan conquest, every natural object was proscribed; the artists were, therefore, reduced to making symmetrical designs from forms which should have no positive meaning; yet the Byzantine Greeks, who were Christians, managed to work even their own ecclesiastical symbols, in a disguised manner, into their tracery and diapers; as the lily, for instance. The cross was not so introduced; this, of course, was inadmissible; but neither was the crescent ever introduced into any of this early work in Damascus or Cairo.

The Alhambra diapers and original Majolica (Majorca) ware afford admirable specimens of genuine Saracenic or Moorish decoration. A conventional floriage is common in these diapers; tracery also is a great feature in this work, in geometrical combinations, whether rectilinear or curvilinear; and the designs are rich in colour. These curves, angles or interlacings constitute the prominent elements of an Arabian ornamental design, combining also Arabic inscriptions. The Alhambra displays almost endless specimens of this peculiar work, all in relief, highly coloured, and profusely enriched with gold. The mosque of Tulun, in Cairo, A.D. 876, the known work of a Greek, affords the completest example of this art in its early time; and Sicily contains many remains of this same exquisite Saracenic decoration.

Such is the genuine arabesque of the Arabs, but a very different style of design is implied by the arabesque of the cinquecento, a purely classical ornamentation. This owes its origin to the excavation and recovery of ancient monuments, and was developed chiefly by the sculptors of the north, and the painters of central Italy; by the Lombardi of Venice, by Agostino Busti of Milan, by Bramante of Urbino, by Raphael, by Giulio Romano, and others of nearly equal merit. Very beautiful examples in sculpture of this cinquecento arabesque are found in the churches of Venice, Verona and Brescia; in painting, the most complete specimens are those of the Vatican Loggie, and the Villa Madama at Rome and the ducal palaces at Mantua. The Vatican arabesques, chiefly executed for Raphael by Giulio Romano, Gian Francesco Penni, and Giovanni da Udine, though beautiful as works of painting, are often very extravagant in their composition, ludicrous and sometimes aesthetically offensive; as are also many of the decorations of Pompeii. The main features of these designs are balanced scrolls in panels; or standards variously composed, but symmetrically scrolled on either side, and on the tendrils of these scrolls are suspended or placed birds and animals, human figures and chimeras, of any or all kinds, or indeed any objects that may take the fancy of the artist. The most perfect specimens of cinquecento arabesque are certainly found in sculpture. As specimens of exquisite work may be mentioned the Martinengo tomb, in the church of the Padri Riformati at Brescia, and the façade of the church of Santa Maria dei Miracoli there, by the Lombardi; and many of the carvings of the Chbteau de Gaillon, France.

See R. *N.* Wornum, *Analysis of Ornament* (1874); *A.* Riegl, *Stilfragen* (1893); *J.* Evans, *Pattern, a Study of Ornament* (1931). *(R.N.* W.)

(See BYZANTINE ARCHITECTURE, MOHAMMEDAN ARCHITECTURE, RENAISSANCE ARCHITECTURE: see also GROTESQUE.)

ARABGIR or **ARABKIR,** a town of Turkey in Asia in the Malatia vilayet, situated near the confluence of the eastern and western Euphrates, but some miles from the right bank of the combined streams. Pop. about 30.000. It is connected with Sivas by a *chaussée,* prolonged to the Euphrates. The inhabitants are employed in the manufacture of silk and cotton goods, or in the production of fruit. The present town was built at a comparatively recent date; but about 2m. north-east is the old town, now called Eski-Shehr, given (c. 1021) to Senekherim of Armenia by the emperor Basil II.

ARABIA, a peninsula at the south-west extremity of Asia lying between 12° and 32° N. and 35° and 60° E., bounded west by the Red Sea, south by the Gulf of Aden and the Indian Ocean, east by the Gulf of Oman and the Persian Gulf, and north by 'Iraq and the mandated territory of Trans-Jordan The northern boundary starts in the east at a point near Fao at the head of the Persian Gulf and follows the 'Iraq–Kuwait boundary to Riqa'i, whence it runs (as laid down in detail in the Treaty of Muhammara, 1921) in a north-west direction to Jebal Anaza (intersection of 32° N. and 39° E.), whence the line is as described in the Treaty of Hadda (1925) to the intersection of 29° 35′ N. and 38° E. From this point

westward the boundary (undefined) runs through Mudawwara station on the Hejaz railway to a point immediately south of Aqaba and thence along the eastern shore of the gulf of that name. The Sinai peninsula, Palestine, Trans-Jordan, Syria and 'Iraq, though of predominantly Arab population, are thus excluded from Arabia, whose formerly uncertain land frontiers have at last acquired a certain amount of precision. In shape the peninsula forms a rough trapezium of a total area of about 1,000,000 sq.m. Its greatest length is 1,400m. from Aqaba to Aden, whence the distance to Ras Al Hadd is 1,250m. The other two sides are roughly 900m. to Fao and 750m. thence to Aqaba.

GEOGRAPHY AND EXPLORATION

General Features. — In general terms Arabia may be described as a plateau sloping gently eastward from a mountain range running along the whole length of its west side within an average of 10 or 15m. of the Red Sea littoral, from which it rises steeply to an average height of 5,000ft. The coastal plain rarely exceeds 30m. in width. The greatest height of the range is at the southern end where it rises to 9,000 or 10,000ft., and the plateau-slope is further divided into subsidiary slopes trending respectively north-east and south-east from a central watershed. At the south-east extremity the uniform character of the peninsula is disturbed by the lofty excrescence of the Jebal Akhdar range of Oman, 9,000 to 10,000ft. Outside Yemen, Oman and numerous scattered valleys in the western range Arabia is a country remarkable for its aridity and barrenness. The monsoon-rains that visit Abyssinia bring but little precipitation to Arabia and that only to the region of high mountains in the south-west. Elsewhere the country is true desert with numerous but widely scattered oases in the dry beds of torrents which on rare occasions each year come down in spate. There are no rivers and no forests and, so far as is known, only three groups of permanent pools (Hasa, Kharj and Aflaj) scarcely worthy to be called lakes. The peninsula falls naturally into three main divisions: a central core of hard desert with numerous valleys and oases supporting a considerable settled population; an almost complete circle of sand waste surrounding the above with bulges of enormous area to north and south; and an outer circle round the latter of steppe or mountain, in part bare and arid and in part more or less thickly populated and cultivated. The first is Nejd; the second comprises the northern Nefud, the Dahna and the Rub' Al Khali; and the last the Syrian Hamad, Midian, Hejaz, Asir, Yemen, Hadhramaut, Oman and Hasa. The highlands of Asir and Yemen with part of Hadhramaut constitute the *Arabia Felix* of old time imagination, enjoying a temperate climate, a reasonable rainfall and good soil. The same remarks apply to Oman, whose Batina coast, irrigated by the streams of Jebal Akhdar, is as productive as any other part of the peninsula. Outside these areas the desert predominates, dotted with oases, many of them of great fertility such as Medina, the Qasim and Hasa, to name but three. The Rub' Al Khali is empty and only visited by the Bedouins.

EXPLORATION

An account of the progress of exploration of Arabia up to the year 1904 has been given in detail by the late Dr. D. G. Hogarth in his *Penetration of Arabia.* Since then, and particularly during the World War, considerable additions have been made to European knowledge of the peninsula, though no professional survey work has been carried out in any part of the country excepting the Aden Protectorate and, to a less extent, on the northern fringe of Hejaz during the war. The coastline has been laid down with reasonable accuracy by the marine surveys of the Indian Government and the Admiralty, but the mapping of the interior is entirely based on the itineraries of explorers supported to an increasing extent by their astronomical and other observations. Maps of the greater part of the country on the international scale 1:1,000,000 have been published, and the general character of the peninsula is well enough known. Vast gaps, however, still remain-to be filled in in our detailed knowledge of Arabia, which in the Rub' Al Khali contains what is probably the largest and most important totally unexplored area in the two hemispheres. excluding the Polar regions.

Carsten Niebuhr.—Arabian exploration in the modern sense may be said to have begun with Carsten Niebuhr's expedition under the auspices of the Danish Government in 1761–64. After a year in Egypt and Sinai the party reached Jedda at the end of 1762 and after a short stay sailed to Luhaiya, a port on the coast of Yemen, the exploration of which was the main object of the mission. The party travelled *via* Bait al Fakih and Zabid to Mocha, then the great port of the coffee-trade, and thence up into the highlands which they reached at Udain in the coffee country. As they ascended eastwards to higher altitudes coffee gave way to wheat and barley and Jibla was reached amid mountains 10,000ft. high. Travelling south to Taizz, they returned to the Tihama (coastal plain) and reached Mocha *via* Hais and Zabid. Von Haven, the mission's archaeologist, having died, Taizz was revisited in June 1763, whence the party travelled to Sana, the capital of Yemen and the headquarters of its ruling Zaidi Imam, via Jibla and Yarim, where Forskal the botanist died, and Dhamar, a Zaidi university frequented by 500 students. Four days' march over a stony plateau dominated by bare sterile mountains brought the mission to Sana where it was cordially received by Mahdi 'Abbas, the Imam. Niebuhr describes the city as it was in his time in terms which substantially represent its main features at the present day, though recent Italian penetration may be expected to produce considerable changes in the near future. It had an encircling wall flanked with towers, a citadel at the foot of Jebal Nuqum which rises 1,000ft. above the plain and the fortress and palace of the Imams (now replaced by a Turkish hospital). The Jews' quarter and the suburb of Bir Al Azab with its scattered houses and gardens were prominent features of the city, a few miles to the north of which is the large village of Raudha in a fertile irrigated plain which Niebuhr likened to Damascus. Having spent ten days at Sana the mission returned to Mocha travelling along part of the present main road to Hodeida as far as the rich coffee district of Jebal Haraz and thence south. At Mocha they embarked for India and next year the death of his three remaining companions left Niebuhr the sole survivor. He then visited Oman at the south-eastern extremity of Arabia and various points on the shores of the Persian Gulf and, travelling via Basra, Syria and Palestine, reached Denmark in 1764 after an absence of four years. The results of Niebuhr's mission, published in 1772, gave the world its first comprehensive description not only of Yemen but of all Arabia. At the same time the localities actually visited were described with such fullness and accuracy of detail that little or nothing was left for later travellers to discover.

J. Halevy. — The next great name in the record of the exploration of south-west Arabia is J. HalCvy who went to the Yemen more than a century later. It was Halévy who in 1869 carried out the first exploration of Marib and its rock-cut inscriptions. Travelling south-east from Sana he reached Madid (5,000 inhabitants) and, after crossing a plateau, Mijzar at the foot of Jebal Yam on the borders of Jauf, whence he made his most important discoveries of Sabaean inscriptions. He explored Ma'in (ancient capital of Minaeans), Kamna (ancient Caminacum) and Khirbat Al Baidha (Pliny's Nesca), where the Romans under Aelius Gallus defeated the Sabaean army in 24 B.C. Passing northwards by Khabb and skirting the Great South Desert he reached the fertile district of Najran, where he spent several weeks with a colony of Jews at Makhlaf. Some miles to the east he discovered the ruins of Ptolemy's Nagra at Madinat Al Ma'hud and in June, 1870, he reached Marib, where he explored the ruins of Madinat Al Nahas (so named from its inscriptions engraved on brass plates). Two hours to the east he found the famous dam constructed by the Himyarites across the Wadi Shibwan, on which depended the water supply of their capital.

E. Glaser.—The next visitor to Marib was the Austrian archaeologist, E. Glaser (1855–1908), who under Turkish protection visited the spot in 1889 after an initial failure due to the hostility of the Hashid and Bakil tribes north-east of Sana, who turned him back from Khamr. He was able however to reconnoitre the plateau between the wadis Kharid and Hirran formerly covered with Himyarite settlements, and to trace these wadis to their junction at Al'Ish and thence to Jauf. On his second journey he reached

and spent 30 days at Marib collecting a large number of inscriptions. He was unable to penetrate further eastward and left the problem of the Jauf drainage and its connection with the Hadhramaut valley unsolved.

Wellsted, von Wrede, L. Hirsch, **J. T.** Bent,—Meanwhile in 1835 the first attempt had been made by Lieuts. J. R. Wellsted and C. Cruttenden of the "Palinurus," employed on the marine survey of the Arabian coast, to penetrate into the interior of the Hadhramaut. Among the ruins of Naqb Al Hajr and at Husn Ghurab near Mokalla they found Himyaritic inscriptions, the first record of ancient Arabian civilization in this province. They were unable to follow up their discoveries and it fell to Adolph von Wrede in 1843 to reach wadi Duwan, one of the main southern tributaries of the Hadhramaut valley. He reached the edge of the Great South Desert but was forced to return to Mokalla owing to the detection of his disguise as a pilgrim to the shrine of the prophet Hud. He had established the existence of the populous ,and fertile district of the main Hadhramaut valley reported to Wellsted and his failure to enter it was made good in 1893 by L. Hirsch travelling from Mokalla under the protection of the Qa'aiti Sultan, ruler of the whole province except Saihun and Tarim which belonged to the Kathiri dynasty. Reaching wadi Duwan, where he found ruins and inscriptions near Hajrain, he proceeded north-east to Hauta in the main valley and thence to Shibam. With a Kathiri escort he passed on through Saihun to Tarim, the former capital, whence after a short stay the hostility of the inhabitants compelled him to a hasty retreat via Shibam and wadis Ibn 'Ali and 'Adim to Mokalla, whence a few months later J. Theodore Bent and his wife with Imam Sharif, a surveyor lent by the Indian Government, travelled by the same track upwards, visiting many ruinous sites with Himyaritic remains and inscriptions and making a very valuable survey of the country. The hostility of the local Saiyids militated against adequate examination of the remains and much was left for future travellers. Oman, the south-eastern buttress of the Great South Desert, offers perhaps conditions more favourable for exploration than any other part of Arabia. Here as in Hadhramaut Wellsted was the pioneer of exploration as Niebuhr did not go inland from Muscat. In 1810 a British Indian expedition to the Pirate coast provided various opportunities of visiting the interior, but it was not till 1835 that Wellsted carried out the first proper exploration of the country. Landing at Sur near Ras Al Hadd he travelled south through Bani Bu'Ali country to the edge of the desert and thence north-west up wadi Baidha, a fertile, well-watered country running up to the southern fringe of Jebal Akhdhar. He was made welcome by the inhabitants, visiting 'Ibra, Samad and Nazwa, but the presence of Wahhabi outposts and raiding-parties prevented him exploring to the west and he returned to India after an excursion along the Batina coast to Sohar.

Miles.—His work was continued in 1876 by Col. S. B. Miles, who travelled from Sohar across the dividing range into the Dhahira, whose principal settlement, Buraima, he was the first to visit. In this district he found an industrious agricultural population with numerous settlements and he ascertained that the unexplored tract extending thence 250m. west to Qatar is a gravelly steppe shelving down to the salt marshes along the Persian Gulf.

The lure of the forbidden Mecca and Medina has made the Hejaz the best known province of Arabia. Its first European visitor was perhaps L. de Varthema, an Italian, who appears to have reached it by travelling from Damascus via wadi Sirhan early in the 16th century. Joseph Pitts, of Devon, was another early visitor and others are known to have reached Mecca in the disguise or semblance of pilgrims, but it was not till the beginning of the 19th century that the Hejaz was visited for the first time by an European explorer with a definite scientific object. This was the Spaniard, Badia y Leblich, who, under the name of 'Ali Bey and claiming to be the last representative of the 'Abbasid Califs, arrived at Jedda in 1807 and performed the pilgrimage to Mecca. Besides giving to the world the first accurate description of the holy city and the Hajj ceremonies, he was the first to fix the position of Mecca by astronomical observations and to describe its surroundings.

J. L. **Burckhardt.**—But the real pioneer of exploration in the Hejaz was J. L. Burckhardt, who had already won a reputation as the discoverer of Petra, and whose experience of Arabian travel and knowledge of Arab life enabled him to pass as a Muslim. He landed at Jedda in 1814, when the Wahhabi occupation of the Hejaz had been terminated and the troops of Mohammed 'Ali were preparing for an advance into Nejd. Having first visited Taif, he spent three months in Mecca performing the rites incumbent on a pilgrim. In Jan. 1815, he travelled to Medina by the western or coast route and, in spite of failing health, recorded all that he saw and experienced with the same accuracy that had marked his work at Mecca. He was forced however to curtail his wanderings and returned via Yanbu' to Cairo, where he died two years later. With Niebuhr, Burton and Doughty he must be reckoned among the greatest of Arabian explorers.

Richard Burton.—His successor in the Hejaz—sed longo *intervallo*—was perhaps one of the greatest explorers of the 19th century, and his work in Arabia, though confined to the Hejaz, has never been surpassed in its intensity, its accuracy and its comprehensiveness. Richard Burton, travelling as an Afghan pilgrim, reached Yanbu' after a long and arduous voyage from Suez in a sanbuk (native sailing-boat) with a crowd of pilgrims in 1854. Thence he visited Medina, where he amplified Burckhardt's description while confirming its accuracy. He then proceeded to Mecca by the eastern route, not traversed by any other explorer, running south-east from Medina and then south across the Harra lava-field, always keeping to the high plateau of the Nejd-Hejaz borderland. Lack of time and tribal unrest in the interior balked his scheme of travelling across the Great South Desert and it was not till 1877 that he was able to make further contributions to Arabian geography, being deputed by Khedive Ismail of Egypt to exainine the reported gold deposits of Midian (northern Hejaz). He found traces of ancient workings in several places and made many archaeological discoveries of value, while carrying out a valuable topographical survey of the country from Aqaba southward to wadi Hamdh, whose importance he was the first to recognize. His survey extended from the coast to the Hisma plain beyond the mountain barrier of Midian.

Snouck **Hurgronje.**—Two decades later the Hejaz and its holy cities were visited by another explorer worthy to be ranked among the greatest of the explorers of Arabia, Snouck Hurgronje, a Dutchman. The work of Snouck Hurgronje, published in German only, did not bring him the fame that his predecessors achieved, but this was in part due to the fact that for the most part he covered ground already well known. Nevertheless for fullness and accuracy his sojourn in the Hejaz marked a definite stage in the exploration of the country. The overthrow of the Wahhabi power by Ibrahim Pasha in 1818 marks the beginning of European penetration of the deserts of central Arabia. A number of European officers accompanied the Egyptian army but left no record of their experiences and observations, but it was to that expedition that the first visit of a British traveller to Nejd was directly due.

G. F. **Sadlier.**—The Indian Government, concerned to put down piracy in the Persian Gulf and desirous of obtaining a first hand report on the Arabian situation, deputed Capt. G. F. Sadlier to visit Ibrahim Pasha as de *facto* ruler of the Wahhabi country. Arriving at Hufuf he learned that Ibrahim had already left Dar'iya, but hoping to find him before he left Nejd, he followed up the Egyptian army's line of march to Rass in Qasim, where he heard that the pasha had gone on to Medina. Unable to obtain escort or safe-conduct back to the coast, Sadlier unwillingly accompanied the army to Medina where he met Ibrahim and was courteously received. Unable however to achieve any result from his interview he continued his journey to Yanbu', thus being the first European to cross the Arabian peninsula from sea to sea. He returned via Jedda to India and, though the political results of his mission were nil, the value of his journey was immense from the geographical standpoint and for the first time it became possible to locate some of the principal places in Arabia in something like their proper relative positions. It also showed that a considerable body of troops could cross the deserts of Nejd even in July and August. Sadlier's fame as an explorer appears to have been achieved with

considerable reluctance on his part if not positively in spite of his efforts to avoid it. The trail that had been blazed by Sadlier had left the province of Jebal Shammar untouched.

G. A. Wallin.—That province was the objective of the next journey into Arabia, made by G. A. Wallin in 1845 on behalf of Mohammed Ali, who desired information on the new situation in northern Nejd brought about by the rising power of Abdullah Ibn Rashid. Crossing the Damascus-Mecca route at Ma'an he travelled via wadi Sirhan to Jauf and thence, some months later, across the Nafud to Hail, already a flourishing town and capital of the Shammar principality embracing all northern Nejd from Qasim to the Syrian border. Enjoying every opportunity of observing the character of the country and its inhabitants as well as the hospitality and patriarchal justice of its chief, he returned to Egypt via Medina and Mecca. In 1848 he revisited Hail, travelling via Mowaila, Tabuk and Taima, and passed out of Arabia on the eastern side at Rarbala.

Carlo Guarmani.—Wallin's visit to Jauf was repeated in 1851 by an Italian Levantine, Carlo Guarmani, who in 1864 set out on a more ambitious expedition to buy stallions for the French emperor. Travelling through the Ruwala country he reached Taima without incident and was the first European to visit Khaibar, then under Ibn Rashid's rule, whence he proceeded to the Qasim. Abdullah, the son of Faisal Ibn Saud, was there on a raiding-expedition and sent him a prisoner to Anaiza, where Zamil, the Amir, befriended him and enabled him to proceed to Hail. He was well received there by the new ruler, Talal, and in due course returned with his successful purchases of horseflesh across the Nafud to Syria. The geographical results achieved by him were remarkable and to him belongs the credit of making the scientific cartography of central Arabia possible. His travels occasioned some scepticism but there is no reasonable doubt as to his general veracity, supported by compass bearings which have not been shaken by subsequent work in the same field.

W. G. Palgrave.—The same can scarcely be said of another and more famous traveller of the same period, W. G. Palgrave, who claimed to have visited Jauf, Hail, Buraida, Riyadh, Kharj, Aflaj and the Hasa during the years 1862–63 in company with one Barakat, a Syrian Christian priest who afterwards became a bishop. Palgrave published a remarkable narrative which has taken its place as a classic of Arabian travel. His intimate knowledge of Syria and the Arabic language and his unchallengeable knowledge of the history and politics of Arabia enabled him to paint a picture of Arab life of the greatest interest and charm, but the geographical value of his work is practically nil. This fact, emphasized by the fantastic nature of his geographical descriptions of the country, laid him open to a vigorous challenge by G. P. Badger, who, for want of full and accurate knowledge, failed however to establish his case. Yet it is strange that Doughty, visiting the country only 15 years later, should apparently have found no trace of him. Be that as it may, Palgrave's reputation survived until well into the 20th century, when it was subjected to a vigorous attack in detail by Philby, who had covered all the ground which he claimed to have traversed except Jebal Shammar. Palgrave was ably defended by Dr. D. G. Hogarth and again in 1924 by Cheesman, who had visited the Hasa and thought that, for all his inaccuracies, he must have been an eye-witness of the scenes described.

Pelly.—Col. Lewis Pelly, Political Resident in the Persian Gulf, headed a mission to the Wahhabi capital in 1865 and accomplished some work of great geographical value, visiting Sadus, where a column was seen in *situ* supposed to date from pre-Islamic days and now destroyed by Wahhabi fanaticism, and other places in the Sudair province. He established the basis of a British entente with Faisal Ibn Saud which has endured to our own times.

Doughty.—Charles Doughty, the next Englishman to visit northern Arabia, covered little new ground but saw more of the desert life and described it more faithfully and more artistically than any other explorer before or since. Travelling down from Damascus in 1875 with the Hajj caravan he stopped at Al Hajr to explore the rock-cut tombs of Madain Salih, drawings of which together with copies of the inscriptions thereon he sent to Renan in Paris before launching out on his wanderings in Arabia. Travelling with the Fuqara Bedouins he wandered all over the Nejd-Hejaz borderland, visiting Taima where he discovered the famous inscribed stone afterwards acquired by Huber for the Louvre. The following year he travelled to Hail and back to Khaibar where the negro governor and inhabitants ill-treated him and threatened his life. Returning to Hail in the absence of Mohammed Ibn Rashid, its great Amir, he was expelled thence and also later from Buraida, but eventually found the hospitable protection of Zamil at Anaiza, whence after many perils and an arduous journey with a butter-caravan bound for Mecca he reached the Hejaz and, narrowly escaping with his life from a mad Sharif, visited Taif and reached the coast at Jedda. A dozen years later he published his epic account of his experiences under the title of Arabia Deserta, which fell completely flat, but he lived to hear it acclaimed on all sides as a masterpiece just before and during and after the World War. As Khalil he is still remembered at Hail and Anaiza and many of his Arabian contemporaries still alive heard with regret of his death in Jan. 1926, full of years and honour.

The Blunts.—Three years later Mr. Wilfred and Lady Anne Blunt made their expedition to Jebal Shammar in company with a young sheikh of Palmyra, who was anxious to visit Nejd to seek a bride among his own folk. They travelled via Kaf and wadi Sirhan to Jauf, where the matrimonial object of the journey was successfully achieved, and thence across the Nafud to Hail, where they were hospitably entertained for a month by the Amir. Thence they accompanied the Persian pilgrim caravan returning to Karbala and Baghdad, taking with them the nucleus of what was to become the famous Crabbet Park stud of Arab horses. Their descriptions of the Nafud threw much new light on the whole problem of Arabian horse breeding and other matters in connection with native pastoral life.

Huber and **Euting.**—In 1883 the French traveller, C. Huber, accompanied by the archaeologist, J. Euting, travelled from Damascus to Hail by the same route as the Blunts. Euting's narrative of the journey, supplemented by the accounts of the Blunts and Doughty, furnishes as complete a picture as could be wished for of the social and political life of Jebal Shammar and of the general nature of the country. Huber's journal contains a vast array of topographical and archaeological material of the greatest scientific value and his notes are still the best available data (supplemented by those of A. Musil) for the mapping of northern Arabia. Besides copying many inscriptions between Hail and Taima he secured the famous Taima stone which ranks with the Moabitic stone of Diban amongst the most valuable of Semitic inscriptions. From Hail Huber followed Doughty's track to Anaiza and thence travelled to Jedda. A month later, in July, 1884, at the inception of another journey he was murdered by his guides at Rabigh. His body was buried in the cemetery at Jedda under a monument provided by the French Government in recognition of his service to science.

E. Nolde.—Mohammed Ibn Rashid still ruled at Hail when the next European visitor, Baron E. Nolde, reached it in 1893. The Amir's victory over the Wahhabi forces at Mulaida had now brought the whole of Nejd under his rule. Nolde crossed the Nefud to Haiyaniya and, finding the Amir absent from Hail, journeyed to his camp in the neighbourhood of Shaqra. He gives, however, little or no description of his route thither or of his return journey north by the Persian pilgrim route already covered by Huber in 1881. Thus, though he broke much new ground, his work, containing much of interest regarding the climate and animal life-especially the horses and camels—of central Arabia, is devoid of topographical value. He was the last of the 19th century pioneers of Arabian exploration who prepared the ground for the more detailed work awaiting the travellers of the first quarter of the 20th century. At the dawn of the latter the northern half of the Arabian peninsula above the line Mecca-Hufuf had been covered with a network of routes which made it unlikely that any important geographical feature had been overlooked. Below that line, except at Najran and Jauf, no European had penetrated 100m. in a direct line from the coast, and the whole of southern Nejd and Asir and the Great South Desert were virgin territory.

Exploration in the 20th Century.—The desert north of lat. 30 N. is now well known and the number of those who have contributed to this result is legion. Chief among the causes of our improved knowledge of this area are the activities of the British armies of Generals Allenby and Maude during the World War, the work of the Royal Air Force and the Nairn and other motor-transport companies since the war; and the projected scheme of a railway and oil pipe-line connecting 'Iraq and Palestine. Amid such a plethora of material it is impossible to single out the work of individuals, but no one man has contributed more to a correct idea of the topography of northern Arabia than Aloïs Musil, the results of whose many pre-war journeys are now being published in 7 volumes—two already issued on Northern Hejaz and Arabia Deserta with a case of maps. His work is a monument of skill and patience. Among others may be mentioned Lt. Col. G. E. Leachman who first drew attention to wadi Kharr and the route from 'Iraq to Syria via Jauf in 1910 and 1912 and was the first to travel from Jebal Shammar to Suq Al Shuyukh; Miss Gertrude Bell, who travelled from Damascus round the west fringe of the Nefud to Hail and thence to Najaf via Lauqa and who was one of the few women who can lay just claim to the title of explorer, having used instruments along the whole of her route; W. H. I. Shakespeare, who in 1914 crossed the peninsula from Kuwait to Suez via Sudair, Riyadh, Washm, Qasim, Hail and Jauf; Douglas Carruthers, who visited Taima in 1909; and Major A. L. Holt, who carried out much preliminary survey work for the railway above mentioned and, with Philby, travelled from Amman via Wadi Sirhan and Jauf to Karbala.

Central Arabia.—It is in Nejd and particularly in its southern parts that the most striking results have been achieved in the elucidation of the country's topography. Leachman came down from 'Iraq through Qasim and Washm to Riyadh and passed out of Arabia via the Hasa in 1912, his geographical results being disappointing owing to the speed of his marching often at night. In the same year Barclay Raunkiaer, a Dane, travelled from Kuwait to Qasim and returned via the Hasa, meeting with much hostility at Buraida. Shakespeare during a number of years carried out extensive journeys in the hinterland of Kuwait, ending up with the great journey across the peninsula already mentioned in 1914 and cementing the British entente with the Wahhabi ruler, Ibn Saud (*q.v.*), to whom he returned on the outbreak of the World War as British Representative. He was killed in Jan., 1915, at Jarrab in a battle between Ibn Saud and Ibn Rashid. Though he covered little ground that was absolutely new few travellers have added more than he to our knowledge of the topography of central Arabia. Major H. R. P. Dickson in 1921 did some excellent (still unpublished) mapping in the Hasa, whose topography was comprehensively studied in 1923–24 by Major R. E. Cheesman, who in addition gained well-deserved laurels by making the first visit of an European to the mysterious oasis of Jabrin on the edge of the Great South Desert, clearing up during his journey all the problems connected with this tract and confirming the existence of the Sahaba channel. Jabrin itself was found to be a dilapidated oasis and Major Cheesman heard of ruins named Magainma far out in the heart of the desert. The latest and completest explorations of the Great Central Desert were those of two Englishmen, Bertram Thomas in 1931–32, and H. St. John Philby in 1932–33.

In 1917–18 Philby had crossed the peninsula from sea to sea, a feat previously accomplished by only one other European, Capt. Sadlier in 1819, Philby's route being by way of Hufuf, Riyadh and Taif. In the Hufuf oasis the rainfall of a large area emerges at the surface and makes for great fertility. Beyond Riyadh he followed the great central pilgrim route to Mecca, a pioneer effort. Subsequently he explored southern Nejd, going 300m. southward from Riyadh to Dam and back, making valuable contributions to the map of this area. The oases of Nejd were found to comprise, usually, a nucleus town with scattered hamlets, with not more than a few square miles of cultivated land in each case, and populations not exceeding 10,000 save at Riyadh. That city has a great Wahhabi mosque and a palace of the Emirs and its population was from 12,000 to 15,000. In Aflaj and Kharj he discovered ruins spread over a wide area, suggesting burial mounds of an early era.

In both districts, the peculiar system of irrigation from natural reservoirs or deep well pits by means of subterranean channels, or *karez,* was unexpectedly found to prevail. At Umm al Jabal, just south of Laila, is a lake ¾m. by ¼m., possibly the largest sheet of permanent water in Arabia, and also a number of reservoirs of unusual size, one measuring 500 by 600 yards. In the Makran depression, south of Badia (lat. 22° N.), are other perennial pools of water surrounded by woods of well-grown trees. The oasis of Dam, locally known as "the wadi," consists of some 20 separate settlements with a total population of 9,000, mostly of negro origin or of the Dawasir tribe. It was found that the Nejd oases are not tropical paradises, that there is no chain of oases linking Nejd with either Asir or Yemen; and that there is no region of fertility between southern Nejd and Oman, nor any settled spot between it and either Oman or Hadhramaut.

Hejaz.—The determination in 1917 of the exact position of Maan and the observation of the longitude of a few stations to the south facilitated the adjustment of the inaccurately known alinement of the Hejaz railway. A tract 300m. long between Wajh and Rabigh and a smaller area south of Aqaba were explored during the World War, while a Turkish staff-map of the country within a 30m. radius of Medina added further useful data. A great part of the Hejaz can now therefore be mapped with fair accuracy. A. J. Wavell visited Mecca and Medina in the disguise of a Zanzibari pilgrim in 1908–09 and has left an admirable account of those cities and the pilgrimage ceremonies.

Asir and Yemen.—During the World War much information was collected by British officers about the tribes and localities of Asir, which, however, except for Sabiya and points along the coast, still remains totally unexplored, though the position of Ibha, its capital, is known. In Yemen on the other hand great progress has been made towards the acquisition of accurate knowledge of the country and the influx of Italians in recent years will certainly result in the solution of all its geographical and scientific problems in due course. Of pre-war visitors A. J. Wavell, who visited Sana in 1911 and gave the best description of the city since Manzoni (1884), stands out. A. J. Beneyton, a French engineer, did much survey work in 1909 in connection with a projected railway from Hodeida to Sana and Amran, much unexplored territory being mapped. And in 1912 G. Wyman Bury travelled from Hodeida to Sana and has thrown much light both on the topography and on the economic conditions of Yemen. Col. H. F. Jacob of the Aden residency made several journeys into Yemen before and since the war, publishing his results under the title *Kings* of Arabia in 1923. Three years later Sir Gilbert Clayton conducted a British political mission to the Imam Yahya at Sana and its failure to achieve any result led to the despatch of an Italian mission under Commendatore Gasparini in the same year, resulting in an Italo-Yemeni treaty of friendship.

Aden Protectorate.—In 1902–04 an Anglo-Turkish commission demarcated the boundary between the Protectorate and Yemen, which runs from a point opposite Perim north-eastwards to Qa'taba. This afforded full opportunity for the study of the topography of the region and in 1911 Bury penetrated the Kaur watershed north of the Yafa'i country, reached Yashbum (pop. 4,000) the capital of the Upper Aulaqi, where cotton and indigo are cultivated, and got as far as Baihan, 110m. inland from Shaqra and not distant from Marib.

The Red Sea Coast.—The naval patrol during the World War explored the intricate coast-line between Aqaba and Aden, exposing the numerous channels through the triple coral-reef which had hitherto limited navigation in these waters.

Oman and **Hadhramaut.**—Among the first and most notable explorers of the Oman province in the 20th century was Col. P. Z. Cox (later Sir Percy Cox, and Chief Political Officer of the Mesopotamian force and High Commissioner for 'Iraq), who added considerably to our knowledge in the course of several journeys while serving as Political Agent at Muscat. More recently a thorough geological investigation of part of the country has been made by an expedition organized by the Anglo-Persian Oil Company. Mr. B. S. Thomas and Capt. G. Eccles have also acquired much new and interesting information. In Hadhramaut

the only recent traveller of importance is Capt. W. H. Lee-Warner who covered some new ground and compiled a valuable report of conditions in the country. He reached wadi Duwan by a previously untraversed route (wadi Himam) and went on to Shibam.

TOPOGRAPHICAL DETAILS

Syrian Desert.—The Syrian desert or *Hamad* occupies the whole of northern Arabia above lat. 30° N. extending from the confines of Palestifie on the west to the edge of the Mesopotamia delta. For the most part this tract belongs politically to Palestine, Syria and 'Iraq, though it is a definite geographical unit clearly to be classified with Arabia rather than with its borderlands. On the west a tract of dark-coloured flint-desert separates the slopes of the Moab and Edom mountain-chain from the depression of wadi Sirhan and the volcanic ridges forming the southern continuation of Jebal Druz. From this upland an unbroken gravel plain slopes gently eastward to 'Iraq, scored by the channels of numerous wadis, of which the chief is wadi Hauran. The depression of wadi Sirhan runs south-eastward from the permanent spring-pools of Azraq at the edge of the Druz country through the "salt-villages" of Kaf, Ithra, etc., where a certain amount of palm-cultivation is carried on and salt-pans are largely exploited for the Syrian market, to the great oasis-depression of Jauf-Sakaka with the two towns of those names. Wadi Sirhan with its nearly uniform altitude of about 1,850ft. above sea-level appears to have been originally an inland sea. Brackish water is found in it at many points a few feet only below the surface. The town of Jauf has extensive rich palm-groves and a population of some 3,000 souls, while that of Sakaka (a collection of villages scattered among flourishing palm-groves rather than a town) is somewhat larger. Jauf is the original settlement of Daumat Al Jandal and its chief feature is the fine mediaeval castle of Marid. A short distance south of Jauf begins the Great Nafud, a vast expanse of billowy red sand-desert which with the Dahna, extending southward from its eastern extremity, the great south desert or Rub' Al Khali occupying the greater part of southern Arabia, and a series of lesser sand-strips on the west, forms the most characteristic feature of the peninsula—an almost continuous circle of sand enclosing the central core of Nejd.

The Northern **Nafud.**—The northern Nafud extends some 400m. from west to east and has an average width of 200 miles. Almost waterless throughout its whole extent, it is rich in pasture in any season of normal winter rainfall and during the spring season is the regular resort of the Bedouins and their herds of camels. The formation of sand-dunes is here exemplified on a large scale and longitudinal dunes of astonishing length are of frequent occurrence with valleys between them which it takes three or four hours to cross on a camel (about 10 to 12 miles). The most striking feature of this dune area is however the Falj pits of horse-shoe formation, studied in considerable detail by Blunt and Huber. Their floor is generally of hard soil bare of sand and their enclosing walls are of pure sand piled up to a considerable height at a steep angle of as much as 50°. The largest of these pits, which are of uniform appearance but vary greatly in size, was estimated by Huber at 1¼m. across and 99ft. deep. They appear to run in strings from east to west corresponding with their individual direction, the convex face of the *Falj* being towards the west, *i.e.*, the direction of the prevailing wind, and the cusps to leeward. In the south of this tract Huber found the pits turned towards the south, the prevailing wind being from that direction. These dunes, though subject to slight changes, appear to be practically permanent features. The general altitude of the Nafud is almost 3,000ft. above sea-level. Excrescences of rock are of frequent occurrence.

The **Dahna.**—Unlike the Nafud, the Dahna has an average width of only about 30m. and a length from north to south of some 400 miles. It consists of seven longitudinal bands of sand of varying width separated by shallow sandy valleys seldom more than a mile across. In the northern half of the Dahna sand-peaks of 200 or 300ft. in height and of pure red-sand without any sign of vegetation rise out of the longitudinal sand-ridges in groups or long lines, as many as 30 being visible together in some parts. Further south these peaks disappear as also to some extent the longitudinal arrangement of the ridges, the whole width of the barrier being a confused mass of low dunes and hollows without symmetry. South of the Riyadh-Hasa road the Dahna is unknown to Europeans, but the whole tract is, like the northern Nafud, covered with rich desert pasture in the winter and spring, when it is visited by the Bedouins. So far as is known the tract is entirely waterless.

The Rub' **Al Khali.**—The southern sand-desert or Rub' Al Khali is wholly unexplored and may contain considerable tracts of hard gravel or limestone desert in its vast inhospitable expanse. For the most part, however, it is probably a tract of sand-dunes generally similar to the northern Nafud and the Dahna. Its fringes have been viewed from afar at several points and it is reputed to contain the ruins of settlements of ancient times. The Al Murra and other tribes breed the famous *Umaniya* camel in its vast spaces, somewhere in whose recesses lies an area of salt-marshes or briny pools, of which the camels but not the human denizens of the desert drink. The latter subsist on camel's milk during their extended periods of sojourn with their flocks in this area, their permanent bases of operations being Jabrin, the southern districts of Nejd and the fringes of Oman, Hadhramaut and Yemen.

The western part of Nejd is separated from the Hejaz by various sand-strips, none of which have the importance of those already described and the most important of which is probably the Arq Al Subai lying athwart the main route between Riyadh and Mecca. A tract of firm desert parts its northern extremity from the southern extremities of the northern Nafud and provides the only unprotected entrance to Nejd.

Nejd.—Inside the sand-barrier above described lies the central province of Nejd, the fountain-head, as it were, of the Arab race. It is traversed by three main wadi-systems from west to east: wadi Rima in the northern part rising in the Khaibar Harra and traversing the Qasim district, where its continuity is broken by the sand-masses of that area and the Dahna, beyond which it resumes its course under the name of Al Batin to the neighbourhood of Zubair; wadi Sirra, which rises in the highlands of western Nejd and, breaking through the longitudinal barrier of the Jebal Tuwaiq plateau under the name of Sha'ib Birk, eventually joins wadi Hanifa at Yamama and, again changing its name to Al Sahba, cuts through the Dahna and eventually reaches the Persian Gulf near Al Qatar; and wadi Dawasir in the south which unites the three Asir and Yemen wadis of Ranya, Bisha and Tathlith at Al Hajla and, passing through the Dawasir and Sulaiyil settlements, loses itself south-eastward in the Rub' Al Khali. All three of these wadis carry floods on occasion, but wadi Rima more regularly than the others. Wadi Dawasir, which flows but seldom, experienced a flood of great magnitude in 1917. The floods of wadi Sirra are very local, though its affluent, wadi Hanifa flows almost every year and often more than once in a year.

The general slope of Nejd is from west to east in conformity with that of the peninsula as a whole. As already stated two of its chief "rivers" rise outside the province in the main mountain-range of the west. The third rises in a confused tract of mountains within the western frontier of the province, which are of granite and kindred formation and appear to be an offshoot of the main western range though separated from it by a wide interval. These mountains (Hadhb Dawasir, Damkh, the Ardh range, etc.) form an irregular mass scattered over the face of a vast sandy desert and rising at many points to an elevation of 5,000 or 6,000ft. above sea-level. They offer no impediment to progress, as the various ridges and massifs are separated by wide gaps through which run the main pilgrim-route from east to west and other caravan-tracks. Farther north lies the better known group of granite mountains collectively with the district dependent on them called Jebal Shammar. This group is also an offshoot of the main western range, merging westward in a plateau which extends continuously from the Khaibar Harra. It consists of two parallel ranges, Jebal Aja 10om. long from south-west to north-

east and rising to 4,600ft. above sea-level, and Jebal Salma, less high and to the east. The town of Hail, formerly the capital of the Ibn Rashid dynasty, and many flourishing villages with extensive palm and other cultivation depend on the floods of the wadis emanating from the twin ranges. The rest of the Jebal Shammar district is pastoral in character and the headquarters of the Shammar, one of the leading tribes of Arabia. Hail contains a population of some 15,000 souls. South of Jebal Shammar and separated from it by a steppe-desert lies the district of Qasim astride Wadi Rima—a district of sand-dunes with numerous oases scattered about its hollows. Most important of these are the vast oasis and town of Anaiza (15,000 inhabitants) and the important town of Buraida (20,000 inhabitants) with its extensive palm-groves. Continuing southward we come at the tail of Wadi Hanifa to the district of Kharj with its old capital of Yamama now choked with drifted sand and its modern capital of Dilam (5,000 inhabitants). Its chief feature is a series of unfathomed spring-fed pools still used for the irrigation of a considerable area through narrow channels cunningly constructed in the limestone rock and formerly a source of the great prosperity which gained for the district its now lost reputation of being the granary of Nejd. Here ancient ruins betoken the presence at one time of a race, perhaps the Persians, more skilled in irrigation and agriculture than the Arab inhabitants of to-day. Still further south in the heart of Tuwaiq is the Fara valley district with the two important settlements of Hauta and Hariq with 15,000 inhabitants between them: and the province of Aflaj partly in Tuwaiq and partly to the eastward of it, where is the largest surface of open water in all Arabia—the lake of Umm Al Jebal, which with half a dozen other spring-fed reservoirs formed the basis of an elaborate system of irrigation in former times and still serves, though to a reduced extent, the same purpose. Laila with 8,000 inhabitants is the capital of the district—a large and flourishing oasis like its neighbour, Saih. Other notable settlements here are Raudha and Badia with Ghail on its perennial stream in the hill tract.

El Hasa.—The eastern and western flanks of the great encircling sand-barrier are bordered by wide expanses of steppe-desert running north and south. That of the east sloping gently towards the Persian Gulf, from which it is parted by a sand-strip of an average width of 25m., comprises the Dibdiba and Summan of gravel and limestone respectively and contains one of the most prosperous districts of Arabia, El Hasa, famous for its many hot and cold spring-fed reservoirs, its irrigation channels, its rich vegetation—the *Khalas* date of its palm-groves is among the best dates in the world—and its two great towns of Hufuf (30,000 inhabitants) and Mubarraz (20,000). At some distance to southward lies the important but unprosperous oasis of Jabrin at the edge of the Great Desert, while 50m. east lies the rich and populous sea-port and oasis of Katif. South of the latter is Ukair, the ancient Gerra. Other settlements along the Gulf coast, are Kuwait furthest north, Jubail, Qatar and the Trucial coast ports.

Hejaz and Yemen. — The outer crust of Arabia on the north, west and south is formed by an almost continuous barrier of lofty mountains beginning in the north with the coastal granite range of Midian and the inner volcanic masses known as *Harra* (the most important of these are Harrat Uwairidh, Harra Khaibar and Harra Nawasif) forming a southern excrescence of the volcanic system of Jebal Druz. The mountain range is continued southward by limestone massifs increasing in height through the Taif hills and the uplands of Asir to the lofty mountains of Yemen. Turning eastward the range runs at a considerably lower elevation through the Hadhramaut district and peters out in the southern sands of the Great Desert. The highest point in the Harra tracts is probably Jebel Anz of 7,000ft. The peaks of Midian rise to even greater heights, while those of Yemen often exceed 10,000ft. Down to the southern border of the Hejaz (*q.v.*) this mountain system is the scene of rich though intermittent cultivation, containing the city and large oasis of Medina, the oases of Yanbu Al Nakhl and Taif and the city of Mecca (70,000 inhabitants). The highlands of Asir (*q.v.*) and Yemen (*q.v.*) are even more richly and continuously cultivated (coffee being an important item), while the valleys of Hadhramaut are rich in palms and tobacco. The mountain-range is supposedly rich in mineral deposits, gold having been worked formerly in Midian, where and further south in Asir (and the adjacent Farsan islands) there are indications of oil. Rock salt abounds in various localities. Sana (15,000 inhabitantsj is the capital of Yemen, and Abha (5,000) that of Asir. On the east and partly on the south the outer crust of the peninsula is formed by sand-ridges, but in the south-east the continuity of these is interrupted by the great mountain-mass of Oman (*q.v.*), rising to 10,000ft. above sea-level, with its capital at Muscat on the coast of the Gulf of Oman. This, like Yemen, is a tract of great fertility, its mountain valleys and oases on the sea coast maintaining a population of about a million. The range of Jebal Akhdar, the central feature of the district, plunges down abruptly on both sides to the sea and the Great Desert respectively.

Geology. — The geological structure of Arabia is very similar to that of Egypt. The oldest rocks consist of granite and schist with intrusive dykes, and on this foundation lie sedimentary deposits beginning with the Nubian sandstone of Petra, which outcrops at Jauf and runs along the Hejaz railway southward and is overlain by Cretaceous strata to the east. Later deposits are found in Wadi Sirhan and in the desert fringing 'Iraq. Jurassic formations have been found on the surface in the range of Jebal Tuwaiq, and the eastern desert belongs mainly to later epochs. The granite outcrops in Nejd at Jebal Shammar and in the western highlands. Over the Kubian sandstone and the older granite great sheets of lava have been poured and these. protecting the softer beds beneath from denudation, stand up as the high plateaux and hills called *Harra.* Volcanic cones are numerous and an eruption was recorded near Medina as recently as A.D. 1256. In southern Arabia the crystalline floor appears along the coast and in Oman, the geology of which has reckntly been studied by an expedition of the Anglo-Persian Oil Company. At Marbat Nubian sandstone overlies the granite, and marls showing Cenomanian fossils are in evidence, being overlaid by Cretaceous limestones with isolated patches of overlying Alveolina limestones. The greater part of southern Arabia seems, however, to be formed of Alveolina and nummulitic limestones of Tertiary age. An extinct volcano occurs at Aden and volcanic rocks are found near the Straits of Bab Al Mandab. Throughout Arabia the folding of the sedimentary beds is of the gentlest, but faults of considerable magnitude occur here and there. The Gulf of Aqaba is a case in point and the Red Sea itself is a great trough bounded by faults along each side. The occurrence of hot springs in Hasa and the deep spring-fed reservoirs of Kharj and Aflaj deserve careful further study in connection with the geological structure of the peninsula.

Climate.--Owing to its low latitude and general aridity Arabia must be classed among the hot regions of the earth, but is not comparable in the matter of high temperatures with such tracts as the Sind desert and Mesopotamia. The mean maximum summer temperature of Nejd probably seldom exceeds 112°, while frosts are not uncommon in the northern part of the province, where a temperature of 18° was registered (by Nolde) at Hail in Feb. 1893. The central desert tracts indeed may be said to enjoy a healthy climate at all times of the year owing to the dryness of the atmosphere which produces a feeling of great invigoration when the wind is from the north—the famous *Nasim* or zephyr of Nejd. With a south wind at whatever season of the year the climate tends to be relaxing. The same effects are experienced with the wind in the north and south respectively all along the coastal fringe, where an excessive humidity, coupled with maximum summer temperatures of over 90° on the Red Sea coast and over 100° in the Persian Gulf, has given the whole country an unsavoury reputation scarcely warranted by the facts. The high plateau and mountain-range of western Arabia and the massif of Oman enjoy a delightful climate without extremes of temperature at all times, though the Midian district experiences considerable falls of snow and low temperatures with chill winds from the east in winter. Except in Yemen, which lies within the monsoon-

belt and receives considerable precipitation in the later summer months (16in. were recorded from June to Sept. in 1902 at Dhala, 4,800ft., on the Aden Protectorate frontier), and Oman, which has a good rainfall and occasional snow, Arabia is a country of scanty and irregular rainfall. The average annual fall at Aden is only about 4in. and that of the Red Sea coast is scarcely more, precipitation, when it occurs, being of a torrential character and concentrated in only a few hours or days of the winter. In the centre and east of the peninsula the rainfall also occurs during the winter, though occasionally in the central and west-central districts there is a small fall in Aug. or Sept. Great areas of Arabia, especially in the west and south, experience long periods of drought, but on the whole the country gets enough rain to make the desert blossom in the spring and to foster the oasis cultivation of its valleys. The mountain districts of Hejaz are generally well favoured in this respect and Taif enjoys the distinction of being at the extreme limit of the monsoon area northwards,

In northern Arabia the prevailing winds alternate between east and west, the latter bringing the rain from the Mediterranean across the Palestine hills. Elsewhere north and south are the prevailing directions of the wind which alternates between those points in periodical bursts—the south wind being the harbinger of rain in the winter and of heat in the summer. Yemen receives the moisture of heavy mists sweeping up from the plains during the rainless season and elsewhere dew, in parts exceedingly heavy, plays the life-giving rôle of rain in more favoured countries.

Fauna.—The wild animals of Arabia are for the most part of the desert-loving type, the commonest of all being gazelles akin to the Persian gazelle. These roam the desert spaces in considerable numbers, though the advent of the high-velocity rifle has made them less numerous than formerly. Of the larger antelopes so common on the African side of the Red Sea only one is found in Arabia—the *Oryx beatrix* or wild cow of the Arabs, which is found in the northern Nafud and in the Rub' Al Khali. The Wal, a species of ibex, is found in the mountains of Yemen, Hejaz and Oman. Hares and foxes are common as also the Jarbu and a species of coney called Wabar. Monkeys of several species occur in Hejaz and Yemen, while wolves, hyenas and panthers are not uncommon. The wild cat is also found in the mountain districts. Of birds the greatest is the ostrich, not uncommon in the desert round Jauf and found also on the fringes of the Rub' Al Khali. Sand-grouse and Sisi are very plentiful in most parts of the peninsula, as also are doves and pigeons, but duck and snipe are by no means common visitors. Quail are found everywhere in small numbers and the bustard is fairly common in all desert-tracts. Much light has recently been thrown on the wild fauna of eastern Arabia by Major R. E. Cheesman, while that of Oman was intensively studied at the beginning of the century by Sir Percy Cox. Wyman Bury has studied the birds of Yemen, but much still remains to be done for the elucidation of the fauna of Arabia as a whole. This particularly applies in the realm of insects of which comparatively little is known, though Arabia would appear to be the meeting place of species characteristic of the three continents at the junction of which it lies. Many insects new to science have been found of recent years. Scorpions, centipedes, millipedes, spiders and ants are very common. Locusts frequently appear in great swarms, doing much damage to crops and providing the Bedouins with a welcome addition to their larder. Bee-keeping is a flourishing industry among the hill-folk of Hejaz, Yemen and Hadhramaut, the honey having a great local reputation though it has a peculiar taste. The domestic fauna of Arabia comprises camels, horses, sheep, goats, donkeys and, to a less extent, cows. Of these the most useful is the camel which is the sole stock-in-trade of the great Bedouin tribes. The Arabian camel has a single hump and is in general more aristocratic than his like in neighbouring countries. The best of the Arabian breeds, which differ from each other in appearance as widely as a race-horse from a cart-horse, is the Umaniya bred by the Al Murra tribe of the Rub' Al Khali. This, like most of the better Arabian breeds, is renowned for its endurance of long periods without water and long marches at a high average speed. But it is not suited to the carrying of great burdens; 300 lb. is a heavy load for an Arabian camel to carry over long distances or day after day, and eight miles an hour would seem to be as great a speed as it can maintain for any length of time continuously. In Jan. 1928, a large number of Bedouin entrants for a race between Jedda and Mecca failed to cover the distance of about 50m. in less than 69 hours. In the summer good camels will do without water for three or even four days' marching an average of 25m. a day, but in the spring pastures they will abstain from water for as long as a month at a time. Horse-breeding has of recent years suffered a set-back in Arabia partly owing to the introduction of the modern rifle, which has made them of less account in Bedouin warfare, and partly owing to the decline of the Bombay horse-market, once a good and regular customer of Arabia. Horse-breeding is still, nevertheless, a favourite hobby of the Arabian princes and Ibn Saud maintains a large stud in the Kharj district as the Ibn Rashid dynasty used to do at Hail. The best stud in Arabia at the present day is probably, however, that of Ibn Jiluwi, governor of Hasa. From it came "Romany," a horse of classic *Nejdi* type, which has recently made history in Egypt. The greater number of horses now marketed as Arabs in Egypt and India hail from Upper Mesopotamia and Trans-Jordan, where the partially settled or nomadic tribes still breed from an original *Nejdi* stock under more favourable conditions of pasture than obtain in its original home. Anaiza in the Qasim is still to some extent a clearing-house for horses destined for export to India via Kuwait.

Large white asses of excellent quality are bred in many places, the best being those of Hasa. This stock was formerly much exported to Mecca, where they are still bred and were much used for riding purposes until the recent advent of the motor-car. The gipsy tribe of Suluba breeds a hardy type of white ass capable of great feats of endurance in the matter of thirst and probably originally derived from the Hasa stock. Asses and camels are much used for well-traction throughout the country and cows also to a limited extent. The latter are small in stature and not numerous. The sheep and goats of Arabia are of excellent quality as regards the milk and meat they provide but inferior as regards their wool. The *Saman*, or clarified butter made from their milk, and their skins and fleeces are an important article of export capable of much development, while the goat's hair provides the material for the black booths of the Bedouins. Camel's hair is used for the weaving of the mantles worn by the better class Arabs.

Flora.—The flora of Arabia has been investigated by P. Forskal of Niebuhr's mission, P. E. Botta, G. Schweinfurth and A. Deflers. Their results and those of more casual collectors have been published in volumes 7 and 8 of the *Records* of *the Botanical Survey of India* by E. Biatter, to which the reader is referred for a compendious view of the matter. The most thoroughly investigated part of the peninsula in this respect is the mountain region of the south-west, but it may be said in general terms that the Arabian type has African rather than southern Asian affinities. Various species of fig, tamarind, carob and several kinds of cactiform *Euphorbia* occur in the higher regions, as also the juniper of which there are forests in Yemen, Asir and Midian. *Adenium obesum* with its bulb-like stems and red flowers occurs in Yemen. Some fine aloes are found and all over Arabia the *Zizyphus Jujuba* is common, often growing to large trees. The tamarisk or *Ithil* occurs everywhere in sandy tracts and is often planted (as in Qasim) in hedges to protect villages and cultivation from the encroachment of drift-sand. The date-palm flourishes everywhere, producing fruit of great excellence in many parts. Vines, peach, apricot, pomegranate and fig occur in most oases; quince and apple in the highlands only; and banana in favoured valleys of low altitude. Of cereals wheat and barley and the common millets, *Dhurra* and *Dukn*, occur commonly, while lucerne is a favourite fodder-crop. The water-melons of Manfuha enjoy a high reputation and both these and musk-melons are cultivated in the Hejaz and elsewhere. Radishes, pumpkins, cucumbers, onions and leeks grow freely. Roses grow at Taif and other highland localities, where *Itr* or attar of roses is extracted on a small scale. Thyme. jasmine, lavender and other aromatic plants are of frequent occurrence. Coffee is said to have been introduced from Abyssinia

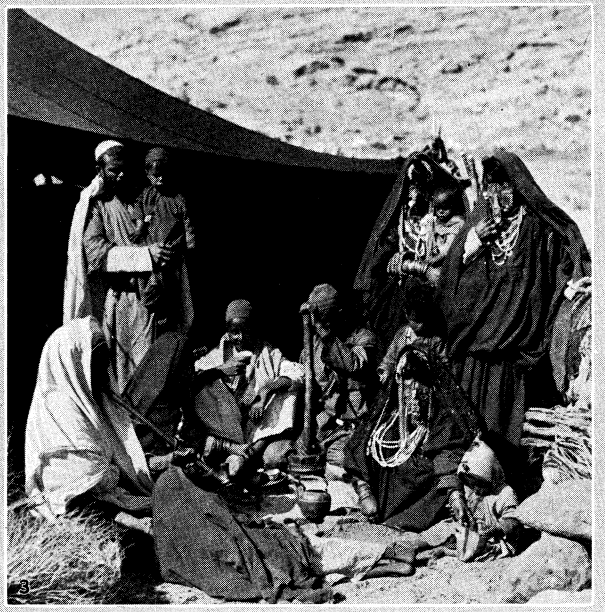
in the 6th century A.D. and thrives on the seaward slopes of Yemen and Asir between 4,000 and 7,000 ft. Jebal Haraz is an important centre of its cultivation, it being planted here and elsewhere in terraces and protected from the sun by fringes of tamarind and fig. The plants are raised from seedlings, transplanted when six weeks old in rows 4 to 6ft. apart. They are watered from irrigation channels twice a month and bear fruit in two to four years. The berries are dried in the sun and sent down to Hodeida and Aden, whence they are exported in considerable quantities. The husks are used for making a beverage called *Qishr* in Yemen and southern Nejd. Another plant universally used as a stimulant in south-west Arabia is Kat (*Catha* edulis), which grows best around Taizz. It is a small bush grown from cuttings and stripped of its leaves after three years, except for a few buds which develop next year into young shoots sold in bunches as Kat Mubarak. The Kat Malhani or shoots of the succeeding year command a higher price. The bushes are then left for another three years and the same process repeated. The leaves are chewed and have a highly stimulating effect. Tobacco is grown on a considerable scale in Hadhramaut, the chief source of the *hummi* leaf smoked in the nargilas of the western coast. Gum-bearing acacias flourish in the desert, as also many other varieties of acacia, but there is little trade in gum. Myrrh is extracted at Suda, 60m. north-north-east of Sana by cupping the trunks and the balsam of Mecca is collected in the same way. The plants of the Nefud areas and the hard desert are legion.

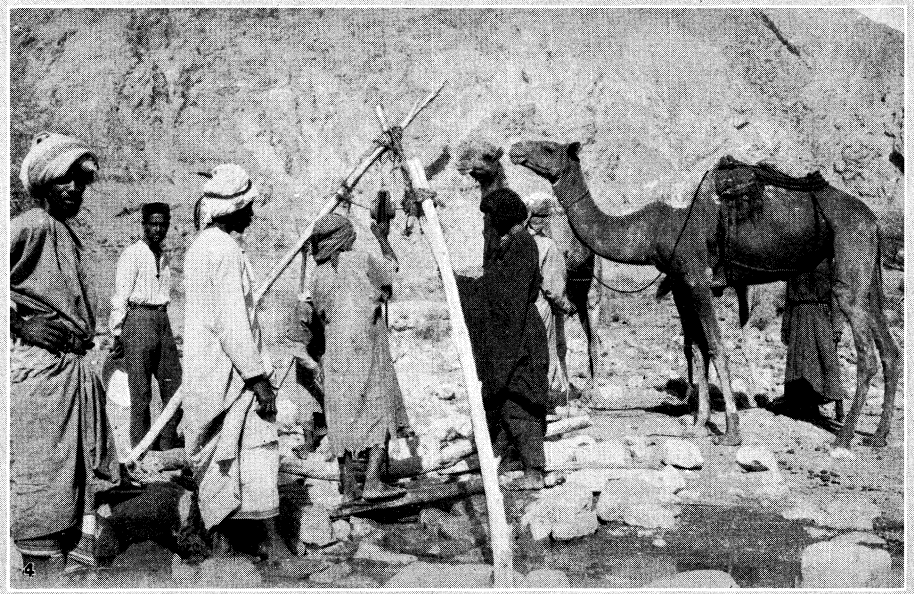
Population.— The population of Arabia may be roughly estimated at 7,000,000, distributed as follows:—

Yemen and Asir	3,000,000
Hejaz	1,000,000
Oman and' Hadhramaut	1,000,000
Nejd, Hasa and the desert	2,000,000

According to an Arab proverb Yemen is the cradle and 'Iraq the grave of the Arab race, and this saying probably represents fairly accurately the facts of the peopling of the peninsula. Who the original denizens of the desert were and whence they came cannot even be conjectured, but there seems to be little doubt that the large Anaza tribe of northern Arabia came originally from the Yemen and their progress across the desert in a north-east direction can be traced in detail in the colonies of Anaza origin scattered over the face of the peninsula. The same is true of other tribal elements and the history of pastoral Arabia must ever have been the same, the displacement of one tribe by a stronger or larger treading on its heels. Cross and reverse currents of population have also doubtless played their part and Arab tradition insists that the Arab race is derived from two stocks—the pure Arabs of Qahtan, a descendant of Shem, with their original home in the highlands of south and west Arabia; and the Must'araba or naturalized Arabs descended from Ishmael. Both stocks are presumably of Semitic origin, while another important element of the Arabian population, found at the present day in every stage of assimilation to the aboriginal population, doubtless came from Africa across the Red Sea. As far north as Khaibar and the villages of Jebal Shammar and throughout the country south thereof to wadi Dawasir a negro element is found in the settlements side by side with settlers of Bedouin origin. This element has mixed freely with the Arabs producing in the process a large and homogeneous group of mixed origin known as Bani Khadhir. Another extraneous element in the population is represented by the curious gipsy tribe of Suluba, who claim a Christian origin and are despised by the Arabs as an inferior race. They are great hunters and enjoy a practical monopoly of various crafts in the service of the great tribes to whom they pay a tolerance fee. These Suluba are found mainly in east Arabia, whereas in the west their functions are performed by the remnants of a Jewish element which was once numerous, occupying Medina (Yathrib) in pre-Muslim times, but is now confined to a few localities in Yemen. The Jewish population of Sana numbers several thousands and there is also a small colony in Najran. These Jews possibly represent an unconverted remnant of one of the Must'araba reverse currents already referred to. Alternative traditions date this Jewish immigration to the reign of Solomon and to the capture of Jerusalem by Nebuchadrezzar. The pilgrimage prescribed by the Prophet has given Mecca, Medina and Jedda a cosmopolitan character, while the seaports of the Arabian coast have drawn their populations from the neighbouring countries—Indians, Persians and Baluchis at Muscat and the Gulf ports; Indians and others at Makalla and the Red Sea ports. Of the Arab population the Bedouin tribes are of pure descent with some negro infiltration, and these tribes take precedence among each other under a broad distinction between those that raise camels and horses (the aristocracy) and those that breed sheep and goats (the helots). Most of the princely houses of Arabia derive from the Anaza tribe, to which belongs Ibn Saud, the king of Hejaz and Nejd. But an important element of the aristocracy in the west comprises various groups of claimants to direct descent from the Prophet. Of these the most prominent section is the Ashraf of the Hejaz, who ruled in Mecca until the Egyptian invasion of 1814, and, after a century of comparative suppression under the Turks, recovered their dominant position by the revolt of King Husain in 1916. Their return to power was however short-lived as they were ousted in 1925 by the Wahhabi conquest of their country. The Imams of Sana claim descent from the Prophet and rule the Yemen in virtue of that fact. In that province and Hadhramaut many villages are exclusively occupied by a religious hierarchy of Saiyids and inland Oman is ruled by an Imam, who is in constant opposition to the temporal dynasty of the coast. In Asir the administration is also in religious hands, its rulers being the Idrisi family under a Wahhabi protectorate. During the last decade and a half the revived Wahhabi movement has coloured the texture of Bedouin society and the patriarchal system of tribal administration, with its democratic rule, its blood feuds and its *lex* talionis, is gradually giving way before the divine majesty of the Shar law of Islam. Zkhwan colonies have sprung up at numerous points like mushrooms and the ancient pastime of raid and counter-raid is discouraged by the new doctrine of universal brotherhood in the faith. Arabia is changing rapidly into the semblance of an organized state.

Communications.— In no respect is Arabia changing more rapidly than in the matter of its communications. At the beginning of the 20th century there were no railways in the whole country. During its first decade Medina was linked by the Hejaz railway via Maan (800km.) with Damascus and a survey made for an extension to Mecca, which has not yet materialized. About the same time a railway-survey was made of the country between Hodeida and Sana, though progress with the scheme was rendered impossible by the Turco-Italian War of 1913. During and since the World War a railway has been constructed between Aden and Lahaj and beyond, but the southern section of the Hejaz railway from Maan to Medina, seriously damaged by the operations of Lawrence and deprived of practically all its rolling stock in the interests of Syria and Palestine since the war, has only been in fitful operation during the last ten years. The Hejaz saw its first aeroplanes during the war and has maintained a number of them as part of its armament since then, though the foreign personnel employed by the Sharifian *régime* have disappeared and the machines have been relegated to a maintenance basis. The Imam of Yemen has recently received one or more of these machines as a present from the Italian Government, while early in the year 1928 squadrons of the Royal Air Force were posted at Aden where the military command is henceforth to be exercised by an Air officer. Finally, and also early in 1928, the Royal Air Force in 'Iraq conducted punitive operations against the *Ikhwan* raiders of the north-eastern frontier. The exploration of the Rub' Al Khali by air has also been frequently mooted of recent years but in general terms it may be said that air communications are still a thing of the future so far as Arabia is concerned. The same remark applies to wireless telegraphy, though there are wireless stations at a number of places in Hejaz (Jedda, Medina, etc.) and a station (1927) at Sana. A telegraph and telephone line connects Jedda with Mecca and is to be extended to Taif, while Jedda communicates with the outer world by a cable to Port Sudan, the joint property now of the Hejaz and Sudan Governments and maintained by the Eastern Telegraph

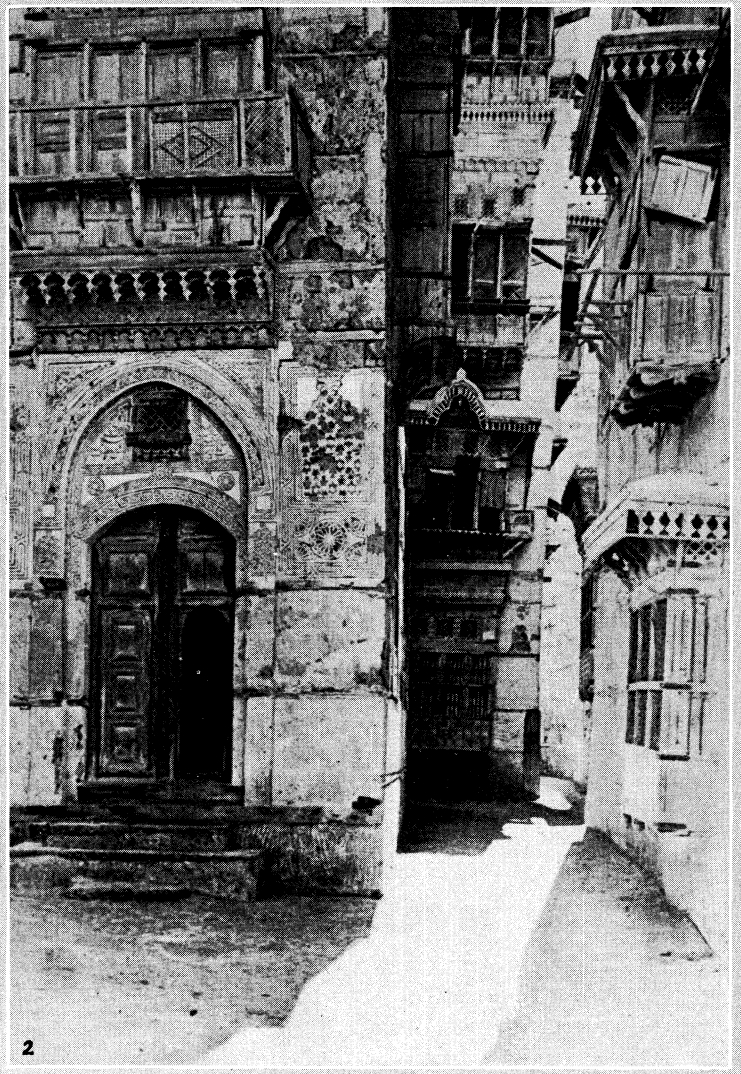


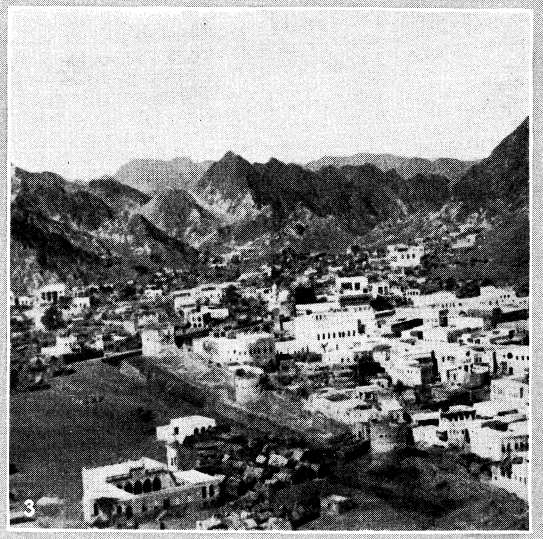


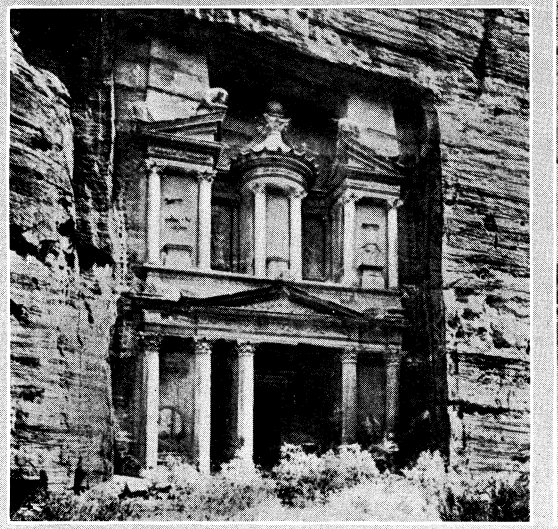
PHOTOGRAPHS, (1, 2, 3) UNDERWOOD AND UNDERWOOD, (4, 5) BY COURTESY OF MR. C. W. SWITZER

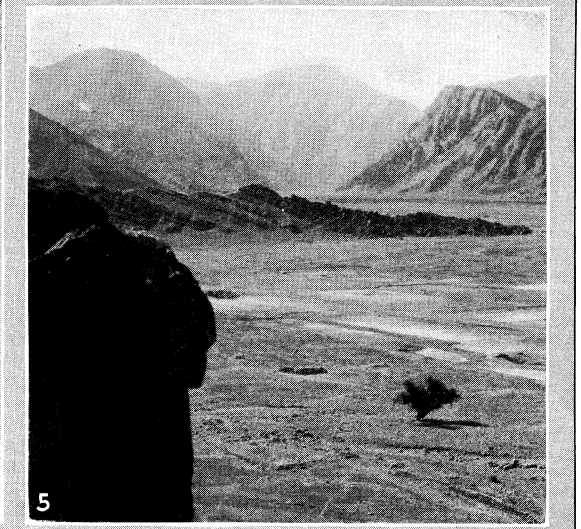
ARAB LIFE IN TOWN AND DESERT

1. An Arab village of reed mats on the lower Euphrates, in Mesopotamia
2. Citizens of Baghdad eating in the open air at the bread and cheese bazaar
3. Scene in front of a Bedouin tent in the desert
4. A well in Southern Arabia
5. Desert foothills near the Baraimi Oasis, Arabia









PHOTOGRAPHS, (1, 2, 4) INTERNATIONAL NEWSREEL, (3, 5) BY COURTESY OF MR. C. W. SWITZER

VARIED SCENES IN ARABIA

1. Arabs, camels and merchandise in front of the gate leading into the city of Jidda, in the province of Hejaz, Saudi Arabia
2. A narrow street in Jidda showing doors and windows in which the Moorish style predominates
3. General view of Muscat, the capital of Oman, on the southeast coast of Arabia
4. "Al Khazna" ("El Khazneh," "El Hazne"), the treasure house of the Pharaohs in Petra, Syria, sometimes called "the city of ruins"
5. Among the granite and limestone mountains of Oman, a nominally independent kingdom in southeastern Arabia, in part irrigated and fertile, in part arid desert

Company. In another direction astonishing progress has been made of recent years. Motor cars first came to the Hejaz during the World War but were sternly discouraged thereafter by King Husain except for limited personal and official use. Nejd and Hasa saw motor cars for the first time in 1919 or 1920. With the establishment of the Wahhabi régime in the Hejaz, however, motor transport was allowed in connection with the 1926 and subsequent pilgrimages, with the result that the number of cars in the country has increased from four to over 600 in two years. The journey between Jedda, Mecca and Medina is now regularly performed by car, while the road between Medina and Yanbu has recently been opened. Ibn Saud and his large camp following have also in two successive years performed the journey between Hejaz and Riyadh in the royal fleet of cars, from 25 to 30 vehicles. Motor transport is thus definitely established in Arabia.

At the end of 1927 the construction of a metalled road between Jedda and Mecca was begun but there are no other metalled roads in the whole country. Of the old caravan-routes one of the most important, that from Damascus to Medina, has been killed by the Hejaz railway, as the adoption of the sea route killed the pilgrim track along the coast from Aqaba to Yanbu and Mecca. Camel transport still holds its own, however, on the Hejaz pilgrim tracks and for goods, while it still enjoys the monopoly of the main north to south and east to west routes across the peninsula, as well as on all the feeder-routes.

There is regular steamship communication between Suez and Port Sudan and the Arabian ports of the Red Sea down to Aden, while in the pilgrim season Jedda receives numerous ships direct from Java, Singapore and India. Mokalla is in similar commercial communication with Bombay and Karachi, whence there are also regular sailings to the Persian Gulf ports. In addition to the above a great part of the Arabian coasting traffic is carried on by native sailing-boats.

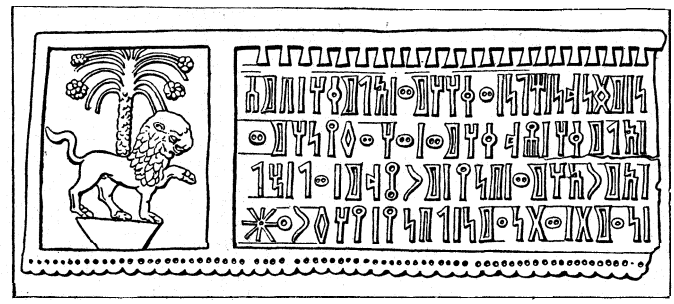
Commerce.— For want of exact statistics in most of the ports concerned with the export and import trade of Arabia it is difficult to estimate the annual value of goods entering and leaving Arabia. The chief articles of export are coffee (from Aden, Hodeida and Mocha), hides, wool, *saman* (clarified butter), sheep (mainly from Wajh to Suez) and dates (from Hasa). Specie, mainly brought in by the pilgrims visiting the country, is exported in large quantities to make good the deficit between the small volume of exports and the heavy imports of the ordinary necessaries of life—piece-goods, rice, flour, sugar and tea. Of recent years motor cars and machinery of all kinds have formed a rapidly increasing part of the import trade of the country.

(H. ST. J. B. P.)

HISTORY

Arabia is a land of Semites, and is supposed by some scholars to have been the original home of the Semitic peoples. The dispersion of the early Arabian Semites is easy to imagine. The migration into Babylonia was simple, as there are no natural boundaries between it and north-east Arabia. That of the Aramaeans at an early period was likewise free from any natural hindrance. The connection with Palestine has always been close; and the Abyssinian settlement is probably as late as the beginning of the Christian era. Of these migrations, however, history knows nothing. Arabian literature has its own version of prehistoric times, but it is entirely legendary. In the 19th century the discovery and translation of numerous early Arabian inscriptions revealed the existence of a great civilization in Arabia for at least 1,000 years before the Christian era and stimulated the study of the materials in the Assyrian inscriptions, the Old Testament, and classical writings. All scholars are agreed that the inscriptions reach as far back as the 9th century B.C. and prove the existence of at least four civilized kingdoms during these centuries. These are the kingdoms of Ma'in (Minaean), of Saba (Sabaean), of Hadhramaut (Hadramut) and of Katabania (Katabanu). Of the two latter little is known.

Saba and Ma'in.—As to the Sabaean kingdom there is fair agreement among scholars. The inscriptions go back to 800 B.C. or earlier. A queen of this people (the "Queen of Sheba") is said (I. Kings x.) to have visited Solomon about 950 B.C. There is, however, no mention of such a queen in the inscriptions. The Sabaean rule is generally divided into periods indicated by the titles given to their rulers. In the first of these (between the 9th and the 6th century) ruled the Makarib, who seem to have been priest-kings. Their first capital was at Sirwah. The second period begins about 550 B.C. The rulers are known as "kings of Saba."



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EARLY HIMYARITIC SCRIPT ON A BRONZE TABLET IN BAS RELIEF

The inscription is a dedication to the god Almakah, who was a Sabaean deity. The script used is developed from the so-called Phoenician of about the 8th century B.C.

Their capital was Ma'rib. Their sway lasted until about 115 B.C., when they were succeeded by the Himyarites. During this period they were engaged in constant strife with the neighbouring kingdoms of Hadramut and Katabanu. The great prosperity of south-west Arabia at this time was due in large measure to the fact that the trade from India with Egypt came there by sea and then went by land up the west coast, but this trade was lost when the Ptolemies established an overland route from India to Alexandria. The connection of Saba with the north, where the Nabataeans (*q.v.*) had existed from about 200 B.C., was now broken. The decay that followed caused a number of Sabaeans to migrate to other parts of Arabia.

The Minaean kingdom extended over the south Arabian Jauf, its chief cities being Karnau, Ma'in and Yathil. Some 25 kings are known from the inscriptions, and their history must cover several centuries. As inscriptions in the Minaean language are found in al-'Ula in north Arabia, it is probable that they had colonies in that district. With regard to their date opinion is much divided; some scholars maintaining that their kingdom existed prior to that of Saba, others that none of the inscriptions is earlier than about 800 B.C. and that the Minaean kingdom existed side by side with the Sabaean. It is curious that the Sabaean inscriptions contain no mention of the Minaeans, though this may be due to the fact that very few of the inscriptions are historical in content.

About 115 B.C. the power over south Arabia passed from the Sabaeans to the Himyarites, a people from the extreme south-west of Arabia; and about this time the kingdom of Katabanu came to an end. The title taken by the ne rulers was "king of Saba and Raidan." In this period the Romans made their one attempt at direct interference in the affairs of Arabia. But the expedition under Aelius Gallus was betrayed by its guides and lost in the desert. During the latter part of this time the Abyssinians, who had earlier migrated from Arabia to the opposite coast of Africa. began to flow back to the south of Arabia, and in the 4th century they became strong enough to overturn the Himyarite kings and establish a dynasty of their own. The Himyarites were, however, still active, and having accepted Judaism founded a Jewish Sabaean kingdom. The struggle between them and the Abyssinians now became one of Judaism against Christianity, and apparently for this reason Christian Abyssinia was supported from Byzantium in its attempts to regain power. These attempts were crowned with success in 525, but in 575 the Persians, who had been called in by the opponents of Christianity, succeeded in taking over the rule and in appointing governors over Yemen. (*See* further ETHIOPIA: *The Axumite Kingdom.*)

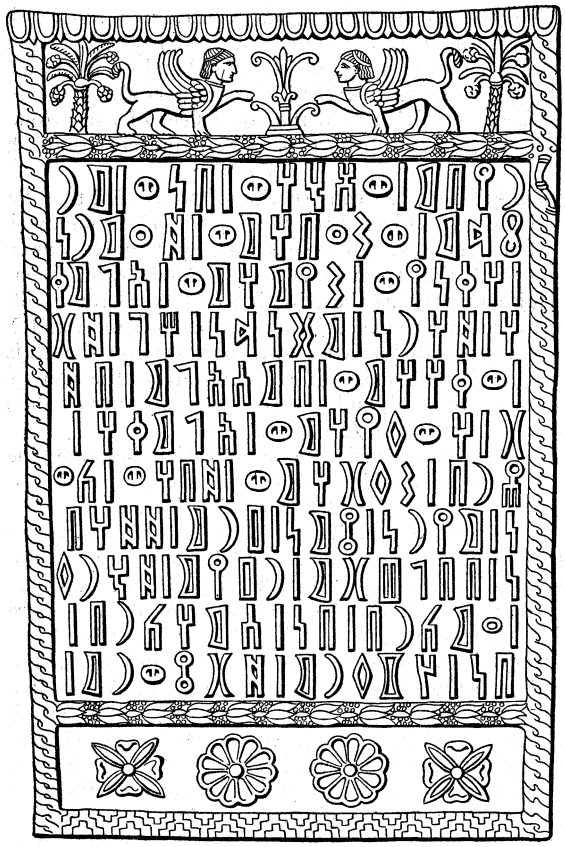
Hira, Ghassan and Kinds.-The kingdom of Hira (Hira) was established in the fertile boundary land between the Euphrates

and the Arabian desert. The chief town was Hira a few miles south of the site of the later town of Kufa. The inhabitants of this land are said in Ṭabari's history to have been of three classes: —(1) The Tanukh (Tnuhs), who lived in tents and were Arabs from the Tehama and Nejd, who had united in Bahrein to form a new tribe, and migrated from there to Hira about the beginning or middle of the 3rd century A.D. The Arabian historians relate their conflict with Zenobia. (2) The 'Ibad or 'Ibadites, who dwelt in the town of Hira in houses and so led a settled life. These were Christians, whose ecclesiastical language was Syriac, and language of intercourse Arabic. A Christian bishop of Hira is known to have attended a synod in 410. In the 5th century they became Nestorians. (3) Refugees of various tribes, who came into the land but did not belong to the Tanukh or the 'Ibad. There is no trustworthy information as to the earlier chiefs of this people. The dynasty of the Lakhmids, famed in Arabian history and literature, arose towards the end of the 3rd century and lasted until about 602. Although so many of their subjects were Christian, the Lakhmids remained heathen until Nu'mān, the last of the dynasty. The kingdom of Hira always stood in a relation of dependence on Persia. At the height of its power it was able to render valuable aid to its suzerain. Much of its time was spent in wars with Rome and Ghassan. Its revenues were derived from the neighbouring Bedouins as well as its own subjects. About 602 the Lakhmid dynasty fell, and the Persian Chosroes II. appointed as governor an Arab of the tribe of Ṭāi.

In the beginning of the 6th century A.D. a dynasty known as the Jafnids enter into the history alike of the Roman and Persian empires. They ruled over the tribe of Ghassan in the extreme north-west of Arabia, east of the Jordan, from near Petra in the south to the neighbourhood of Rosafa in the north-east. Of their origin little is known except that they came from the south. A part of the same tribe inhabited Yathrib (Medina) at the time of Mohammed. The first certain prince of the Jafnid house was Harith ibn Jabala, who, according to the chronicle of John Malalas, conquered Mondhir of Hira in 528. In the following year, according to Procopius, Justinian perceived the value of the Ghassanids as an outpost of the Roman empire, and as opponents of the Persian dependants of Hira, and recognized Harith as king of the Arabs and patrician of the Roman empire. He was thus constantly engaged in battles against Hira. In 541 he fought under Belisarius in Mesopotamia. After his death friendly relations with the West continued until about 583. The Ghassanid kingdom split into sections each with its own prince. Some passed under the sway of Persia, others preserved their freedom at the expense of their neighbours. At this point their history ceases to be mentioned in the western chronicles.

In the last decade of the 5th century a new power arose in central Arabia, the tribe of Kinda under the sway of the family of Aqil ul Murar, who came from the south. They seem to have stood in much the same relation to the rulers of Yemen, as the people of Hira to the Persians and the Ghassanids to Rome. Abraha in his invasion of the Hejaz was accompanied by chiefs of Kinda. Details of their history are not known, but they seem to have gained power at one time even over the Lakhmids of Hira; and to have ruled over Bahrein as well as Yemama until the battle of Shi'b ul Jabala, when they lost this province to Hira. The poet Amru'ul Qais was a member of the princely family of Kinda.

The Coming of Mohammed. — Apart from the powers mentioned above, Arabia in the 6th century was in a state of political chaos. Bahrein, inhabited chiefly by the Bani 'Abd Qais and the Bani Bakr, was largely subject to Persian influence near its coast, nnd a Persian governor, Sebocht, resided in Hajar, its chief town. In Oman the Arabs, who were chiefly engaged in fishing and seafaring, were Azdites mixed with Persians. The ruling dynasty of Julanda in their capital Suhar lasted on till the 'Abbasid period. On the west coast of Arabia the influence of the kingdom of Yemen was felt in varying degree according to the strength of the rulers of that land. Apart from this influence the Hejaz was simply a collection of cities each with its own government, while outside the cities the various tribes governed themselves and fought continual battles with one another. Thus at the time of Mohammed's advent the country was peopled by various tribes, some more or less settled under the government of south Arabia, Kinda, Hira and Ghassan, these in turn depending on Abyssinia, Persia and Rome (*i.e.*, Byzantium); others as in the Hejaz were ruled in smaller communities by members of leading families, while in various parts of the peninsula were wandering Arabs still maintaining the traditions of old family and tribal rule. To these may be



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EARLY HIMYARITIC SCRIPT ON A BRONZE TABLET
This tablet, 19¾ in. by 10¾ inches, is characteristic in its representation of animals and plants. The top border depicts two sphinxes, backed by palm trees and facing each other from opposite sides of the conventional sacred tree

added a certain number of Jewish tribes and families deriving their origin partly from migrations from Palestine, partly from converts among the Arabs themselves. Mohammed appealed at once to religion and patriotism; the external conquests of the Arabs were the natural outcome of his ideas, but his own work was the unification of Arabia. It began with the formation of a party of men —the *Muhajirun* (Refugees or Emigrants) and the Ansar (Helpers or Defenders) — who accepted Mohammed as their religious leader. As the necessity of overcoming his enemies became urgent, this party became military. A few successes in battle attracted to him men who were willing to accept his religion as a condition of membership of his party, which soon began to assume a national form. The capture of Mecca (630) was not only an evidence of his growing power, which induced Arabs throughout the peninsula to join him, but gave him a valuable centre of pilgrimage. At his death in 632 Mohammed left Arabia practically unified.

Early Caliphs. — Abu Bekr (632–634), the first of his successors, was a man of simple life and profound faith. He understood the intention of Mohammed as to foreign nations, and as soon as he assumed office he sent out the army already chosen to advance against the Romans in the north. The successful reduction of the rebels in Arabia enabled him in his first year to send his great general Khālid with his Arab warriors first against Persians, then against Romans. Under the second caliph Omar (634–644) the

Persians were defeated at Kadesiya (Kadessia), 'Iraq was completely subdued, and the new cities of Kufa and Basra were founded (635). In the same year Damascus fell into the hands of the Arabs. In 636 Jerusalem fell and received a visit from the caliph. Three years later the fateful step was taken of appointing Moawiya (Mu'awiyya) governor of Syria. In 640 'Amr-ibn-el-Ass invaded Egypt, and the following year took Alexandria and founded Fostat (which later became Cairo). The victory at Nehavend in 641 over the Persians, the flight of the last Sassanid king and the capture of Rei or Rai in 643 meant the entire subjugation of Persia and crowned the conquests of Omar's caliphate. The reign of the third caliph Othman (644–656) was marked by the beginning of the internal strife which was to ruin Arabia; but the foreign conquests continued. In the north the Muslim arms reached Armenia and Asia Minor; on the west they were successful as far as Carthage on the north coast of Africa. After the murder of Othman, 'Ali (656–661) became caliph, but Moawiya, governor of Syria, soon rebelled on the pretext of avenging the death of Othman. After the battle of Siffin (657) 'Ali was deposed (658), and the Omayyad dynasty was established with its capital at Damascus.

During these early years the Arabs had not only made conquests by land, but had found an outlet for their energy at sea. In 640 Omar sent a fleet of boats across the Red Sea to protect the Muslims on the Abyssinian coast. The boats were wrecked. But Othman allowed a fleet from Africa to help in the conquests of the Levant and Asia Minor, and in 649 he sanctioned the establishment of a maritime service, on condition that it should be voluntary. Abu Qais, appointed admiral, showed its usefulness by the capture of Cyprus. In 652 Abu Sarh with a fleet from Egypt defeated the Byzantine fleet near Alexandria.

The first task of Abu Bekr had been to reduce the rebels who threatened to destroy the unity of Arabia even before it was fully established. At the end of the first year of his caliphate he saw Arabia united under Islam. The new national feeling demanded that all Arabs should be free men, so the caliph ordained that all Arab slaves should be freed on easy terms. The solidarity of Arabia survived the first foreign conquests. It was not intended that Arabs should settle in the conquered lands except as armies of occupation. Thus it was at first forbidden that Arabs should buy or possess land in these countries. Kufa was to be only a military camp, as was Fostat in Egypt. The taxes with the booty from conquests were to be sent to Arabia for distribution among the Muslims. Many of those who went forth acquired property and rank in the new lands. Kufa attracted chiefly men of south Arabia, Basra those of the north. Both became great cities, each with a population of 150,000 to 200,000 Arabians. Yet so long as the caliphs lived in Medina, the capital of Arabia was the capital of the expanding Arabian empire. To it was brought a large share of the booty. The caliphs were chosen there, and there the rules for the administration were framed. Thence went out the governors to their provinces. Omar was the great organizer of Arabian affairs. He compiled the Koran, instituted the civil list, regulated the military organization. He, too, desired that Mohammed's wish should be carried out and that Arabia should be purely Muslim. To this end he expelled the Christians from Nejran and the Jews from Khaibar. The secondary position that Arabia was beginning to assume in the Arabian empire is clearly marked during the caliphate of Othman. In his appointments to governorships and other offices, as well as in his distribution of spoil, Othman showed a marked preference for members of his own tribe the Koreish (Quraish) and his own family the Bani Omayya (Umayya). The other Arab tribes became increasingly jealous of the Koreish, while among the Koreish themselves the Hāshimite family came to hate the Omayyad, which now had much power, although it had been among the last to accept Islam and never was very strict in its religious duties. But the quarrels which led to the murder of Othman were fomented not so much in Arabia as in Kufa and Basra and Fostat. In Kufa a number of the Koreish had settled, and their arrogance became insupportable. The result was the murder of the caliph. Syria alone remained loyal to the house of Omayya. Arabia itself counted for little, though it was involved in the struggle which followed the election of 'Ali. Ayesha, Talha and Zobair, who were strong in Mecca, succeeded in obtaining possession of Basra, but were defeated in 656 at the battle of the Camel (see ALI). In the south of Arabia 'Ali succeeded in establishing his own governor in Yemen, though the government treasure was carried off to Mecca. But the centre of strife was not to be Arabia. When 'Ali left Medina to secure Basra, he abandoned it as the capital of the Arabian empire. With the success of Moawiya Damascus became the capital of the caliphate (658) and Arabia a mere province, though always of importance because of its possession of the two sacred cities, Mecca and Medina. The final blow to any political pretensions of Medina was dealt by the caliph when he had his son Yazid declared his successor, thus taking away any claim on the part of the citizens of Medina to elect to the caliphate.

The Omayyads and 'Abbasids.—The early years of the Omayyads were years of constant strife in Arabia. The Kharijites who had opposed 'Ali on the ground that he had no right to allow the appeal to arbitration, were defeated at Nahrawan or Nahrwan (658), but those who escaped became fierce propagandists against the Koreish, some claiming that the caliph should be chosen by the Faithful from any tribe of the Arabs, some that there should be no caliph at all, that God alone was their ruler and that the government should be carried on by a council. They broke up into many sects, and were long a disturbing political force in Arabia as elsewhere. On the death of 'Ali his house was represented by his two sons Ḥasan and Hosain (Ḥusain), Ḥasan soon made peace with Moawiya. On the accession of Yazid, Ḥosain refused homage and raised an army, but was slain at Kerbela (680). 'Abdallah ibn Zobair immediately stepped forward in Mecca as the avenger of 'Ali's family and the champion of religion. The two sacred cities supported him. Medina was besieged and sacked by the troops of Yazid (682) and Mecca was besieged the following year. The siege was raised in the third month on the news of the death of Yazid, but not before the Ka'ba had been destroyed. 'Abdallah remained in Mecca, recognized as caliph in Arabia, and soon after in Egypt and even a part of Syria. He defeated the troops of Merwan I., but could not win the support of the Khārijites. In 691 Abdalmalik ('Abdul-hlalik) determined to crush his rival and sent his general Ḥajjāj against Mecca. The siege was begun in March 692, and in October the city was taken and 'Abdallah slain. Abdalmalik was now supreme in Arabia and throughout the Muslim world. During the remaining years of the Omayyad dynasty (*i.e.*, until 750) little is heard of Arabia in history. The conquests of Islam in Spain on the one side and India on the other had little or no effect on it. It was merely a province.

The accession of Abul 'Abbas and the transference of the capital of the caliphate from Damascus to Kufa, then Anbar and soon after (in 760) to Baghdad meant still further degradation to Arabia and Arabs. From the beginning the 'Abbasids depended for help on Persians and Turks, and the chief offices of State were frequently filled with foreigners. In one thing only the Arabs conquered to the end; that was in their language. The study of Arabic was taken up by lexicographers, grammarians and poets with a zeal rarely shown elsewhere. The old Arabian war spirit was dying. Although the Arabians, as a rule, were in favour of the Omayyad family, they could not affect the succession of the 'Abbasids. They returned more and more to their old inter-tribal disputes.

The Carmathians.—Towards the close of the 9th century Arabia was disturbed by the rise of a new movement which during the next hundred years dominated the peninsula. In 880 Yemen was listening to the propaganda of the new sect of the Carmathians (*q.v.*) or followers of Hamdan Qarmat. Four years later these had become a public force. In 900 'Abu Sa'id al-Jannabi, who had been sent to Bahrein by Hamdan, had secured a large part of this province and had won the city of Kaṭif (Ketif) which contained many Jews and Persians. The Arabs who lived more inland were mostly Bedouin who found the obligations of Islam irksome, and do not seem to have made a very vigorous opposition to the Carmathians who took Hajar the capital of Bahrein in 903. From this they made successful attacks on Yemāma (Yamama), and attempts on Oman. In 906 the court at Baghdad learned that these

sectaries had gained almost all Yemen and were threatening Mecca and Medina. Abu Sa'id was assassinated (913) in his palace at Lahsa, which in 926 was fortified and became the Carmathian capital of Bahrein. His son Sa'id was deposed and succeeded by his brother Abu Ṭahir. His success was constant and the caliphate was brought very low by him. In Arabia he subjugated Oman, and swooping down on the west in 929 he horrified the Muslim world by capturing Mecca and carrying off the sacred black stone to Bahrein. In 939, however, the stone was restored and pilgrimages to the holy cities were allowed to pass unmolested on payment of a tax. So long as Abu Ṭahir lived the Carmathians controlled Arabia. After his death, however, they quarrelled with the Fatimite rulers of Egypt (969) and began to lose their influence. In 985 they were completely defeated in 'Iraq, and soon after lost control of the pilgrimages. Oman recovered its independence. Three years later Kaṭīf, at that time their chief city, was besieged and taken by a Bedouin sheikh, and subsequently their political power in Arabia came to an end. It was significant that their power fell into the hands of Bedouins. Arabia was now completely disorganized. Mohammed's attempt to unify it had failed. The country was once more split up into small governments, more or less independent, and groups of wandering tribes carrying on their petty feuds. Of their history during the next few centuries little is known, except in the case of the Hejaz. Here the presence of the sacred cities led writers to record their annals. The two cities were governed by Arabian nobles (*sherifs*), often at feud with one another, recognizing formally the overlordship of the caliph at Baghdad or the caliph of Egypt. Thus in 966 'Alyite took Possession of the Government of Mecca and recognized the Egyptian caliph as his master. About a century later (1075–94) the 'Abbasid caliph was again recognized as spiritual head owing to the success in arms of his protector the Seljuk Malik-Shah. With the fall of the Baghdad caliphate all attempts at control from that quarter came to an end. After the visit of the Sultan Bibars (1269) Mecca was governed by an amir dependent on Egypt. Outside the two cities anarchy prevailed and the pilgrimage was frequently unsafe owing to marauding Bedouins. In 1517 the Osmanli Turkish sultan Selim conquered Egypt, and, having been accorded the right of succession to the caliphate, was solemnly presented by the sherif of Mecca with the keys of the city and recognized as the spiritual head of Islam and ruler of the Hejāz. At the same time Yemen, which since the 9th century had been in the power of a number of small dynasties ruling in Zubed, San'ā, Sa'dā and Aden, passed into the hands of the Turk. Little more than a century later (1630), a Yemen noble, Khasim, succeeded in expelling the Turk and establishing *a* native imamate, which lasted until 1871.

For the history of Yemen during this period see H. C. Kay, *Omarah's History of Yaman* (1892), and S. Lane-Poole, The *Mahommedan* Dynasties, pp. 87–103 (1894).

Since the separation from the caliphate (before A.D. 1000) Oman had remained independent. For more than a century it was governed by five elected imāms, who were chosen from the tribe of al-Azd and generally lived at Nizwa. After them the Bani Nebhan gained the upper hand and established a succession of kings (maliks) who governed from 1154 to 1406. During this time the country was twice invaded by Persians. The "kings of Hormuz" claimed authority over the coast land until the beginning of the 16th century. In 1435 the people rose against the tyranny of the Bani Nebhan and restored the imamate of the tribe al-Azd. In 1508 the Portuguese under Albuquerque seized most of the east coast of Oman. In 1624 a new dynasty arose in the interior, when Nasir ibn Murshid of the Yariba (Ya'aruba) tribe (originally from Yemen) was elected imām and established his capital at Rustak. He was able to subdue the petty princes of the country, and the Portuguese were compelled to give up several towns and pay tribute for their residence at Muscat. About 1651 the Portuguese were finally expelled from this city, and about 1698 from the Omanite settlements on the east coast of Africa.

For the history of Oman from 661 to 1856 see G. P. Badger, *History* of *the* Imams *and* Seyyids of *Oman* by *Salil-ibn-Razik* (1871). (G. W. T.)

WAHHĀBI MOVEMENT

Modern Arabian history begins with the Wahhābi movement of the middle of the 18th century. Arabia was at the time parcelled out in a number of principalities or baronies, independent of each other and ever striving for existence and mastery. Of the central and eastern States those of the 'Arair house in Hasā, of Ibn Mu'ammar at 'Ayaina and of Ibn Da'ās at Manfiiha appear to have been the principal when the originator of the Wahhābi puritan revival, Muhammad Ibn 'Abdul Wahhāb, returned about 1750 to 'Ayaina, where he had been born at about the beginning of the 18th century, He had during a long period of absence studied at Basra and Damascus and visited Mecca for the pilgrimage, returning convinced of the backsliding of his fellows from the pure principles of the Muslim faith and determined to preach reform on puritanical lines, involving an uncompromising return to the practice and precepts of the Prophet. Rejected by the prince of 'Ayaina as a mischief-making busybody he sought and found hospitality at the court of the petty but ambitious baron of Dar'iya, Muhammad Ibn Sa'iid, who found himself hemmed in between the two fires of 'Ayaina and Manfūha. Within a few years Muhammad Ibn Sa'ūd, who died in 1765, had gathered a considerable army of fanatical Bedouins round his standard and effectually established his own supremacy throughout central and eastern Arabia. His son, 'Abd-ul-'aziz, extended his power far beyond the limits of Nejd and his attacks on the pilgrim caravans from 1780 onwards compelled the attention of the Ottoman sultan. In 1798 a Turkish force invaded Hasā but was compelled to withdraw, the Wahhiibis retaliating in 1801 by the capture and sack of the Shia' holy city of Karbala and capturing Mecca the following year. On both occasions they destroyed tombs and other objects of veneration and carried away all relics and treasure of value. In Oct. 1802, 'Abd-ul-'azīz fbn Sa'iid was murdered in the mosque at Dar'iya by a Shia' fanatic in revenge for the desecration of Karbala. Sa'iid, who had for many years commanded his father's armies in the field, celebrated his accession to the throne by the capture of Medina in 1804. The Wahhābi empire, which reached the confines of Oman and Yemen in the south, was now at its zenith and seemed destined to embrace the whole Arab race. The Ottoman sultan was, however, now roused to a sense of the dangerous situation which had arisen in Arabia, and at the same time the discipline accepted by the Bedouin tribes as the condition of their victorious and profitable progress through the length and breadth of Arabia began to be irksome in the circumstances of peace. Turkey was fully occupied with affairs in Egypt and, accordingly, the sultan deputed to Muhammad 'Alī, the viceroy of Egypt, the task of crushing the Wahhiibis. Sa'iid had set out on a campaign against Baghdad in 1811 when Tussiin, the pasha's son and only 16 years of age, landed with 10,000 men on the Hejāz coast. The Wahhābi ruler, turning west to meet the new danger, defeated Tussiin, but Mecca and Medina were occupied by the Egyptian forces in 1812. In 1813 Muhammad 'Ali himself took charge of the operations but without success, and in 1814 Tussiin suffered a defeat near Tāïf. The same year Sa'iid died and his son, 'Abdulltih attempted to negotiate, but the Egyptian pasha advanced in 1815 to Rass which was captured. Peace was then arranged and the Egyptians retired from Nejd, whereupon 'Abdulliih refused to carry out some of the conditions imposed on him. In 1816 the struggle was renewed, Ibrāhīm Pasha replacing his brother Tussiin in the Egyptian command. Having secured by presents the allegiance of the Harb and Mutair tribes he defeated 'Abdulliih at Wiya and advanced into Nejd. The four-months siege of Rass failed but Ibrāhīm, leaving it aside, captured 'Anaiza after a bombardment and occupied Buraida. The 'Ataiba and Bani Khālid having now joined his cause he captured Shaqra in Jan. 1818 after a regular siege and, sacking Huraimala on the way, began the siege of Dar'iya on April 14. On Sept. g the capital surrendered and 'Abdulltih was ignominiously beheaded at Constantinople. Dar'iya was razed to the ground and Egyptian garrisons were posted in several of the Nejd towns. The Wahhābi empire had collapsed incontinently and the Arabs recognized their inability to stand before disciplined troops, but the Egyptians found equal difficulty in retaining their hold on the turbulent interior.

In 1824 'Abdullāh's son, Turki, headed a rising and re-established the Wahhiibi State with his capital at Riyādh. Accepting the nominal suzerainty of Egypt and paying tribute, he consolidated his power on solid foundations till 1834 when he was murdered by his cousin, Mishārī. In 1836 his son and successor Feisul, refused tribute and an Egyptian force was sent to depose him. He was led away captive to Cairo, Khālid, of a collateral branch of the family, being installed in his place as amir. The Egyptian garrisons were, however, gradually withdrawn to support Muhammad 'Ali and Ibriihim in their conflict with Turkey for Syria. In 1842 Feisul, having escaped from prison, reappeared in Arabia and was universally accepted as ruler. The last remnants of the Egyptian troops were ejected and the Wahhābi State was once more independent of all foreign control. Oman, Yemen and Hejāz remained outside the pale and Bahrein, with British support, refused to return to the Wahhibi fold, but elsewhere Feisul re-established his writ within the old limits. The rest of his reign until his death in 1867 was spent in the consolidation of his central Arabian dominions, in strenuous efforts to keep the peace between his two eldest sons, 'Abdullāh and Sa'iid, and in constant watchfulness to ward off the challenge of a rival power which had arisen in the north during his Egyptian exile.

Owing to a feud between his family and the Ibn 'Ali, the premier house of the Shammar tribe, 'Abdullāh Ibn Rashīd, had migrated to Riyādh in 1830. Four years later he had rendered signal service to Feisul by helping him to recover Riyādh from the usurpation of his father's murderer. As a reward he was granted the governorship of Hāïl and by skilful and sympathetic administration of the Bedouins had by the time of Feisul's return from exile consolidated his position as a ruler independent in all but name. In 1843 he died and was succeeded by his son, Talāl, who, with the loyal assistance of his uncle, 'Ubaid, carried on the work of his father, fortified his capital and extended his jurisdiction to Khaibar, Taima and Jauf. "At the same time in spite of occasional alarums and excursions he maintained a proper attitude towards Feisul, while flirting alternately with the Turks and Egyptians. His death by his own hand in 1868 was the beginning of a long series of tragedies in the house of Rashīd. Leaving no children he was succeeded by his brother Mit'ab, who was soon after murdered by his nephews, the elder of whom, Bandar, became amir. Muhammad, the third son of 'Abdulliih, realizing, thanks to Hamūd, the son of 'Ubaid, that his life mas in danger, saved himself by slaying Bandar and seizing the Citadel. He then perpetrated a general massacre of the members of his family and thus, with blood on his hands, began a reign destined to be both long and distinguished in the annals of Arabia.

Muhammad Ibn Rashid.—Securely established in north and west Arabia Muhammad in 1872 found a suitable occasion for interference in the affairs of the south. 'Abdullāh, the son of Feisul, had after a reign of five years been ejected by his brother, Sa'ūd, and appealed to Muhammad who succeeded in ousting the usurper. In 1874, however, 'Abdullāh, once more deposed, found an asylum at Hāïl whence he appealed for assistance to Midhat Pasha, the Turkish governor at Baghdad. The latter, in spite of British protests, occupied Hasā in 1875 and established a new province under the title of Nejd with 'Abdullāh as its governor, thus reasserting the Turkish claim to suzerainty over central Arabia abandoned three decades earlier by the Egyptians. Nejd itself was, however, not occupied and 'Abdullāh was left to prosecute his quarrel with Sa'ūd, now ruler of Riyādh, as best he could. Turkey was too busy with the Russian war to attend to Arabian affairs though a few years later her attempt to occupy Bahrein was frustrated by a British gun-boat. Central Arabia reverted to a state of anarchy centring round the constant struggles of the two Wahhābi brothers for supremacy, while the astute ruler of Hāïl manoeuvred to establish his own power throughout the whole of Nejd. This menace from the north resulted in a loose coalition of the southern provinces under Zāmil, the famous amir of 'Anaiza, who protected Doughty in 1877. A long period of desultory skirmishing without result found the rival armies drawn up in line of battle for the final test at Mulaida in 1891. With Muhammad were his own Shammar and the Harb, while the Mutair and 'Ataiba followed the standard of the Wahhābi allies. Zāmil was in an impregnable position based on the sand-hills opposite Qara 'a while the enemy sought in vain all day to tempt him to open combat in the plain. Towards sunset his patience gave way and Ibn Rashīd's superior cavalry soon had the allies at their mercy. Zāmil and his eldest son were killed as also two of the Ibn Sa'ūd family. 'Anaiza and Buraida opened their gates to the victorious Muhammad, to whom Riyidh and its dependent provinces soon made their submission. For the six years of life which remained to him his writ ran unquestioned from Jauf to Wadi Dawāsir. The Wahhābi dynasty ceased to exercise any shred of authority in Arabia and the exiled remnants of the Ibn Sa'ūd family found scattered refuges at Kuwait and Bahrein and other localities on the Persian Gulf. To all appearances the Wahhābi power was finally at an end and the strong and stable Government of Muhammad Ibn Rashīd gained the praise and approbation of all who saw it. But fate was busy with other designs and only three years after his death in 1897 the house of Ibn Sa'iid was back in the saddle and only a quarter-century later Muhammad's own dynasty had ceased to exist. The wheel of fortune had come full circle.

'Abd-ul-'aziz **II. Ibn Sa'ūd.**—Muhammad, leaving no sons, was succeeded by his brother Mit'ab's son, 'Abd-ul-'aziz, who possessed none of the political acumen of his uncle and soon estranged the sympathies of the Wahhābi provinces. Meanwhile the growing power of Shaikh Mubārak of Kuwait was becoming a serious factor in the Arabian situation, and a still more serious factor, as events were to prove, was the young prince 'Abd-ul-'aziz Ibn Sa'ūd (*q.v.*), living in exile at Kuwait with his father, 'Abd-ul-rahmiin, the youngest of Feisul's four sons. The political training received by young 'Abd-ul-'aziz at the hands of Mubārak was destined to be a large factor in the history of the country during the first quarter of the 20th century, the first decade of which was a period of war and rumours of war in Arabia.

An unsuccessful attempt by 'Abd-ul-rahmān in 1900 to reassert Wahhābi claims in Arabia was followed next year by a bold and successful *coup-de-main* on the part of 'Abd-ul-'aziz, then a lad of 20. The attention of Hāïl, encouraged by Turkey, was concentrated on a quarrel with Mubārak against whom an expedition under Ahmad Faizi Pasha was equipped at Basra in 1901. Mubārak appealed to Great Britain and the Turkish design was duly frustrated. Kuwait was not formally placed under British protection, but it was officially announced by the Government on May 5, 1903, "that the establishment of a naval base or fortified port in the Persian Gulf by any other power would be regarded as a very grave menace to British interests which would certainly be resisted with all the means at its disposal." Meanwhile 'Abd-ul-'aziz Ibn Sa'ūd, having launched out into the desert with a mere handful of followers, succeeded in entering Riyādh by night and slaying the Rashidite governor. Having thus assumed the Amirate of the capital he busied himself during the next few years in recovering the outlying provinces of the south and Washm and Sudair on the north. Simultaneously Mubārak in alliance with Sa'diin Pasha of the 'Irāq Muntafik threatened Ibn Rashīd from the east and with their assistance Ibn Sa'iid in 1904 recovered the province of Qasim, inflicting two defeats on the Shammar forces. The Porte now came to the assistance of its protégé by sending out columns of troops from Medina and Basra, the latter again under Ahmad Faizi Pasha. The Qasim was occupied without difficulty but in 1904 an important battle took place between the Wahhābis under Ibn Sa'ūd himself, who was wounded, and the combined Turco-Shammar force at Bukairiya. No decisive result was achieved, but the Wahhābi claim to the victory is at least justified by the fact that the Turks withdrew their forces finally from central Arabian soil and the Qasim remained under the dominion of Ibn Sa'iid. This position was definitely crystallized in 1906 by the defeat and death in battle of 'Abd-ul-'aziz Ibn Rashīd at Raudhat al Muhanna. Since then the Shammar forces have never seriously threatened the Wahhābi dominions. From 1906 to 1908 a period of anarchy followed at Hāïl under a succession of short-lived amirs of the 'Ubaid branch until in the latter year Sa'ūd, the son of 'Abd-ul-'aziz, definitely emerged triumphant and remained on the throne until 1920, when he was assassinated. Apart from intermittent

struggles for suzerainty over Jauf and a somewhat desultory alliance with the Turks during the World War, the history of Hāïl since 1908 is that of a petty State eclipsed by the growing greatness of the rival Wahhābi State of the south, with which it became finally merged by the capture of Hāïl by Ibn Sa'iid in August 1921, and the removal of the surviving members of the Ibn Rashīd dynasty — including the last two reigning amirs, 'Abdullāh Ibn Mit'ab and Muhammad Ibn Talāl — to Riyādh. Jabal Shammar, for 87 years an independent State and during part of Muhammad's reign the capital of a central Arabian empire, thus ceased to exist except as a province of the Wahhābi power, in which status it has remained ever since.

The victory of Raudhat al Muhanna left Ibn Sa'iid in undisputed mastery of central and southern Nejd and free to concentrate on the consolidation of his State on firm foundations. The history of Arabia had taught him two lessons by which he was quick to profit with results visible in the Arabia of to-day. The first was that the centrifugal tribal organization of the mainly nomad population could be welded together under a suitable stimulus, such as religious revival, for the prosecution of a common cause whether defensive or offensive, but could not be held together in cold blood for purposes of peaceful development. The second was that a single great tribe could achieve great conquests under a leader of capacity, but could not administer its conquests except under the urge of a religious stimulus. The plan he formulated was nothing less than to break down the Bedouin constitution of his subjects under the stimulus of a new religious revival and to perpetuate that break-down for the purposes of administration under peace conditions by the creation of agricultural colonies wherever possible. Thus the Bedouins, tending to settle on the land in non-tribal groups based on agriculture rather than pasture, acquired a stake therein which could easily be used to advantage against their nomad brethren. "Back to the Koran and on to the land" became as it were the motto of the new *Ikhwān* movement, an ultra-puritan revival of the original Wahhābi movement, which Ibn Sa'iid incepted and financed at the desert wells of 'Artāwiya in 1912 — now a large walled city with nearly 10,000 inhabitants. The first adherents to the new movement were the Mutair under Faisal al Duwish, their leading sheikh, and since then over 50 *Ikhwān* settlements have come into existence in all parts of the country with a permanent population of not less than 50,000 souls — the nucleus of the standing army of the Wahhābi State. For five years the essential character and immense possibilities of this movement were not appreciated outside the limits of Nejd itself. Consciousness of it then began to dawn slowly on the world, which declined to take it seriously. And to-day its achievements are universally recognized and admitted. Ghatghat and 'Artāwīya are names to conjure with in all the border-lands, as many explorers have found to their advantage.

Having organized the nucleus of this movement, and warned by recent developments of the revival of Turkish interest in the direction of Nejd — the proposal to utilize Kuwait as the terminus of the Baghdad railway and the mission of Saiyid Tālib Pasha of Basra to Hasā were not the least of such indications — Ibn Sa'iid decided to strike a blow in vindication of his independence. Early in 1914 he descended suddenly on Hasā with a small force and captured Hufiif by a night-attack almost without resistance on the part of the Turkish garrison, which took refuge in the fort-like precincts of the Ibrāhīm Pasha mosque but surrendered next day. The Turkish troops were escorted to the coast, and with the garrisons of Qatif and 'Uqair, which likewise surrendered, were allowed to depart in peace by sea. And, before the Turks could avenge the loss of their eastern province, they were involved in the World War, as the result of which they ceased to exercise dominion in any part of Arabia.

The World War. — The co-operation of Ibn Sa'iid was sought by Great Britain at an early stage of the World War, Captain W. H. I. Shakespear of the Indian political department being deputed to get into touch with him. Ibn Sa'iid immediately began hostilities against Jabal Shammar which had declared for Turkey, and a battle was fought at Jarrāb in Jan. 1915, without decisive result. Unfortunately Shakespear was killed in this encounter and the British authorities abandoned the idea of further active co-operation with Ibn Sa'iid, with whom, however, a treaty of friendship was concluded at 'Uqair in Dec. 1915 by Sir Percy Cox. But for the purposes of the war the centre of Arabian gravity was now transferred to Hejāz (*q.v.*), where Sharif Husain Ibn 'Alī, amir of Mecca, raised the standard of revolt against the Turks in June 1916. His unauthorized assumption of the title of "King of the Arab Countries" was not viewed with favour by Ibn Sa'iid and created between the two rulers an ever-growing coolness which was only prevented from culminating in open hostilities during the war by the constant efforts of the British Government. This estrangement was exacerbated by a dispute over the village of Khurma on the Hejāz-Nejd border at the end of 1917, when the Philby mission visited Ibn Sa'iid on behalf of the British Government to re-focus his attention on an attack on Ibn Rashīd. In 1918 the Khurma affair developed in a series of crises and the village folk under their Sheikh, Khālid Ibn Luwai, were called upon to defend themselves against three attacks by the Sharifian forces. Meanwhile Ibn Sa'iid was engaged in an expedition which led him to the walls of Hāïl but achieved no solid result, and the World War ended leaving him still within his pre-war frontiers with a potential *casus belli* in Khurma in the west. In 1919 King Husain appealed for British intervention on this issue and in March Lord Curzon, deciding in his favour, authorized him to occupy Khurma and warned Ibn Sa'iid to relinquish it on pain of incurring the displeasure of the British Government and of losing his subsidy of £60,000 a year. In May the Hejāz forces under 'Abdullāh, the king's second son, camped at Turaba, 80m. from Khurma, and were attacked during the night by the Wahhābi army. 'Abdullāh's force was annihilated, though he himself escaped with a small following, and Tāïf was evacuated by its inhabitants for fear of a Wahhābi attack. But Ibn Sa'iid, content with the annexation of Turaba, withdrew to Riyādh and turned his attention to other fields of expansion. The upland districts of 'Asir with its capital, Ibha, were the first to fall to his sword in 1920. The following year Hāïl capitulated and the Wahhābi armies occupied Khaibar and Taima. In 1922 Jauf fell and the whole of inner Arabia was under Ibn Sa'iid's control, his outposts reaching to the confines of Oman and Yaman. The struggle with Hejāz was still to come and the British Government, having placed its nominees, the Sharifs Feisal and 'Abdullāh, on the thrones of Trans-Jordan and 'Irāq, endeavoured to compose the differences between the rival parties by convening a conference at Kuwait during the winter of 1923–24. The definite failure of this gathering to arrive at any arrangement by April resulted in its dissolution and in Sept. 1924, the capture and sack of Tāïf by the Wahhābi vanguard ushered in the final campaign against Hejāz. Mecca was occupied in October and Ibn Sa'iid made his formal entry into the holy city on Dec. 5. The siege of Jidda was immediately begun and somewhat later that of Medina. The fall of both cities in Dec. 1925 left Ibn Sa'iid master of Hejāz of which he was proclaimed king on Jan. 8, 1926. During the siege of Jidda Sir Gilbert Clayton visited Ibn Sa'iid in Wadi Fatima to negotiate the treaties of Bahra and Hadda, by which the boundaries of Nejd and Trans-Jordan were fixed and various questions between 'Irāq and Nejd settled. In May 1927 a further treaty was negotiated at Jidda by Sir Gilbert Clayton with Ibn Sa'iid in his dual character of king of Hejāz and Nejd and its dependencies, Nejd having been proclaimed a kingdom in Feb. 1927, when Ibn Sa'iid returned to Riyādh for his first visit since the beginning of the Hejāz campaign. By subsidiary treaties in 1921 and 1922 (negotiated at Muhammara and 'Uqair) various outstanding questions between Ibn Sa'iid on one side and 'Irāq and Kuwait on the other had been regulated, including the frontiers between Nejd and the two States mentioned. Late in 1927, however, the building of a police outpost by the 'Irāq Government at Busaiya in the neighbourhood of the frontier — by a protocol attached to the 'Uqair treaty the building of fortifications on desert wells near the frontier was forbidden — caused renewed trouble. In Sept. 1932 the kingdom of Hejaz and Nejd with its dependencies became known as the kingdom of Saudi Arabia; and in 1934 Asir was incorporated in this kingdom.

EUROPEAN INFLUENCE

Oman.—European influence, which has never penetrated far inland, was not felt in any part of Arabia until the 16th century after the discovery of the Cape route. In 1506 the Portuguese under Albuquerque seized Hormuz and occupied Maskat and the coast of Oman (*q.v.*) until 1650. The Persian occupation which succeeded the Portuguese lasted 100 years till 1759 when the Ghaffāri dyndsty, which has lasted ever since, was established by Ahmad Ibn Sa'id. In 1798 his son entered into treaty relations with the East India Company with the object of excluding the French from Oman, and the next ruler, Sa'id (1804–56) still further strengthened the British connection. For a while early in the 19th century Oman became subject to the Wahhābi empire but regained its independence in 1818. Meanwhile a British-Indian expedition had in 1810 destroyed the strongholds of the Jawāsimi pirates on the coast. Sa'id subsequently equipped a fleet and took possession of Socotra and even Zanzibar, as well as the Persian coast north of Hormuz to Gwadar on the east. On his death in 1856 his dominions were divided between his sons, Majid receiving Zanzibar while Thuwaini with British support established himself in Oman, whose independence was recognized in 1862 by Great Britain and France. Turki succeeded Thuwaini on his assassination in 1866 and, on his death in 1888, the British Government installed and subsidized Feisul on the condition that he should cede no part of his territory to any other Power. Great Britain has followed a similar policy of exclusive influence in a series of agreements with the petty States of the Trucial coast, the southern coast and the shores of the Persian Gulf up to Kuwait. Oman figures prominently in connection with the arms traffic question, in which French subjects were actively interested, early in the 20th century, while German and Russian interests were active at the same time in efforts to secure coaling-stations in the gulf. The World War helped to stereotype the de *jacto* position of Great Britain as warden of the south and east coasts of Arabia and of the adjacent seas, and this position finds expression in the various treaties or understandings in force between Great Britain on the one hand and the rulers of Kuwait, Bahrain, the Trucial States, Oman and Mukalla. Late in 1927 the Persian Government challenged this position in respect of Bahrain (*q.v.*) in a somewhat naïve protest to the League of Nations. For all practical purposes the "British lake" policy holds the field in the Persian Gulf to-day and the only section of its Arabian coast which is effectively independent is the Hasā shore of Ibn Sa'iid's dominions. Recently there has been talk of laying the route of the Cairo-Karachi air-mail along this coast, but no decision has yet materialized.

Yemen.—As in the Persian Gulf, so in the Red Sea the Portuguese were the first to show a European flag. In 1516 they failed in an attempt on Jidda, while the occupation of Yemen soon after by the Turks frustrated their designs in this direction. For a long period thereafter the Arabian coast of the Red Sea figured but little in international circles, but the opening of the overland route to India brought it into prominence. The Hejāz and Yemen were at this time held by Muhammad 'Ali as Viceroy of Egypt, though they reverted to direct Turkish rule about 1845. Meanwhile in 1839, after some years of trouble, the British had occupied Aden, which has remained in their possession ever since. In 1857 the island of Perim was similarly occupied. In 1872 the conquest of Yemen placed the whole of the Red Sea littoral (Midian was ceded to the Turks by 'Abbās Hilmi in 1892) under Turkish rule and during the period 1902–05 a joint Anglo-Turkish commission laid down the boundary between Turkish territory and that part of the mainland opposite Aden claimed as a British protectorate. The line runs from Shaikh Sa'id opposite Perim to a point in Wādī Bana 12m. N.E. of Qa'taba, and continues thence (undefined) in a north-easterly direction into the Great Desert. During 1892–93 Turkey was engaged in the suppression of a serious revolt in the Yemen headed by the Imām with his headquarters at Sa'da; but Ahmad Faizi Pasha's eventual success was followed by a period of general unrest and in 1904 another rebellion took place and, as a result, San'ā was cut off from communication with the coast. In 1905 the commander, 'Ali Ridha Pasha, surrendered and Ahmad Faizi Pasha was sent out from Constantinople with a large force to restore the situation, San'ā being recovered and the rebellion crushed. In 1911 'Asir staged a revolt against the Turks under Saiyid Muhammed al Idrisi who with Italian assistance succeeded in asserting his virtual independence in the Tihāma. In 1915 he allied himself with Great Britain but contributed little to the common cause, while the Imām of Yemen remained faithful to his Turkish allegiance, and early in the war some anxiety was caused to the authorities at Aden by the development of a Turkish menace to the Protectorate. From 1918, the Turks having surrendered all their Arabian interests, the Imām Yahya continued to rule independently from San'a, but Hudaida was occupied in 1920 by the Idrisi, relying on his treaty with Great Britain, after the failure of a British mission under Col. H. F. Jacob in late 1919 to get into touch with the Imām—it was forcibly detained at Bājil by the Quhra tribesmen. Subsequently the Imām established his authority at Hudaida and, Ibn Sa'ūd having occupied upland 'Asir, the Idrisi was left with only a small area in the Tihāma and was forced by circumstances in 1926—Saiyid Muhammad had been succeeded by his son, 'Ali, and the latter had been expelled by his uncle, Hasan, the present governor—to place himself under the Protectorate of Ibn Sa'ūd. Disputes relating to the Yemen-Asir and Yemen-Nejd frontier led in 1934 to hostilities between the Imām Yahya and king Ibn Sa'iid, in which the Yemen was defeated but received generous terms.

Hejāz.—In Hejāz European interests have long been represented by the consuls and agents of various Powers at Jidda and in 1916 the British authorities organized and supported the revolt of Sharif Husain against the Turks. Jidda and Wajh were captured with British naval assistance and the land operations of the Arabs against the Hejāz railway were actively supported by the Arab bureau of Cairo which was charged with the operation in this theatre. The capture of 'Aqaba by Lawrence in 1917 practically completed the defeat of the Turks in Hejāz, though they held out at Medina till Jan. 1919. The whole country was then left to King Husain to administer as an independent kingdom and, though he gave the British Government much trouble and many anxious moments by his reckless rule, no attempt was made to interfere with the local administration. Lawrence in 1921 failed to negotiate a treaty with Husain and in 1924 British intervention to adjust his difficulties with Ibn Sa'iid again failed at the Conference of Kuwait. During the Wahhābi invasion which followed Great Britain and the other Powers declared their neutrality and Husain, having abdicated the throne in 1924, retired to 'Aqaba, which, with Ma'ān, the British Government made an unsuccessful attempt in negotiation with King 'Ali to detach from the Hejāz in favour of Trans-Jordan. In July 1925, however, a favourable opportunity of achieving this object presented itself and, King Husain having been deported to Cyprus, the British Government annexed the territory in question down to the Haql-Mudawwara line. Ibn Sa'iid has steadily declined to recognize this annexation as being inconsistent with the declared neutrality of Great Britain during the war with Husain, and this area remains almost the only corner of Arabia where the relations of the Arabs and Europe have not been satisfactorily adjusted. A similar problem exists on the Aden Protectorate border where the Imām is in occupation of a small area south of the Anglo-Turkish boundary of 1905 *See* also IBN SA'UD (H. ST. J. B. P.)

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ARCHAEOLOGY

Arabia lay between the still more ancient civilizations of Egypt and Mesopotamia, and mas exploited by its two neighbours from early days. Egyptian commercial enterprise in the Red Sea was fully developed before the V. Dynasty (c. 2743 B.C.) and brought gold and incense from East Africa and Arabia; whilst about 2600 B.C. Gudea of Lagash procured diorite and timber from Me-luḫ-ḫa, which seems then to have denoted a district in south Arabia, though the name was afterwards extended to East Africa. The evidence for this early penetration of Arabia has to be gathered from Egyptian, Sumerian and Akkadian records; no direct evidence is known to exist in Arabia itself. Mesopotamian influence passed down the Persian Gulf and, across south Arabia, where it evolved a local culture of which traces remain. At a later date the trade route from India to the Persian Gulf was extended along south Arabia and so to Egypt and Europe; many articles found in Arabia are connected with this trade route.

In south-west Arabia, the cultural centre, there were two great kingdoms, Minaea and Saba' but it is a matter of controversy whether they were contemporary or followed one another. About A.D. 244 they were replaced by Himyar. In 522 the Abyssinians conquered south Arabia, but towards the end of the 6th century the Persian empire spread down and absorbed all south Arabia. In 622 Mohammed established Islam as a secular power, and ancient conditions came to an end.

Inscriptions. — The first archaeological material obtained from Arabia was a very faulty copy of five inscriptions made by U. J. Seetzen in 1811. Scientific work dates from J. Halévy, who procured over 600 inscriptions in 1869. From time to time others were found, until E. Glaser, in three expeditions, in 1882–88, obtained 1,032 more, and on these our knowledge of pre-Islamic Arabia is mainly based. In them the two languages, Minaean and Sabaean, are clearly distinguished; a third variety, the Kattabanian, is only a dialect of Minaean. All are loosely classed as Himyaritic. The languages are Semitic, closely related to Akkadian (Babylonian-Assyrian) and to the Ethiopic of Abyssinia, which was colonized from Arabia about the 2nd century B.C., suggesting a culture drift, Mesopotamia–Arabia–East Africa. The modern dialects of Mahra (south Arabia) and Sokotra contain elements akin to these ancient languages.

The script used is developed from the so-called Phoenician of about the 8th century B.C. onwards, and is the direct parent of that still used in Abyssinia. Some inscriptions are adorned with figures of animals and plants, and these show very clearly the influence of late Assyrian art (cf. Brit. Mus. 48455, 48456).

Buildings. — The oldest temples and fortresses in Arabia are due to Graeco-Roman influence and occur mostly in the north. At Marib, the Sabaean capital, are ruins covering an area of about 500 metres in diameter, amongst them marble columns without capitals. Other such remains are scattered over south-west Arabia, but as yet have not been examined adequately, and it is impossible to say to what period they belong. West of Marib are the remains of the dam which figures so prominently in Arabic tradition. These show a very solid construction with several sluices. It was destroyed by a flood and restored about A.D. 447–450 by the Abyssinian governor, Abraha; the inscription recording this has been copied by E. Glaser (*Zwei Inschr. über d. Dammbruch von Marib,* in *M.V.G.* 1897); south-west of this is a building constructed of large blocks of hewn stone. At Aden are rock-hewn reservoirs (cleared in 1856); it is doubtful whether these are of the Minaean-Sabaean age or date from the Persian occupation.

In the 6th and 7th centuries Christianity spread over parts of Arabia, its centre being Nejran (north-north-east of Marib). The mosque at San'a was once a church, and Christian symbols occur in various parts. Possibly some of the ancient wells lined with masonry near Medain Salih were the handiwork of monks who brought Byzantine methods of engineering to Arabia and are celebrated in Arabic poetry as well-makers. Within the territory of the ancient Nabataean kingdom, suppressed by Trajan in A.D. 106, are found rock-hewn temples and sepulchres in the later Greek style, and similar monuments are reported by Doughty as far south as Medain Ṣaliḥ.

Coins, Sculptures, **etc.**—These finds connect with the ancient trade routes. Greek and Roman coins have been found, sometimes surcharged with Himyaritic letters, as well as native imitations of these types, *e.g.,* obverse, head of Athena, reverse owl, olive spray, crescent, letters often blundered. Later coins, head of Athena replaced by beardless male with curly hair copied from Ptolemaic coins (?), head of Arab king or god encircled by wreath (Seleucid?). Sculptures, including bronzes, of later Greek workmanship (cf. Brit. Museum, 43311), a very few possibly Egyptian or Assyrian.

Prehistoric Remains. — The prehistoric remains in Arabia are its least known antiquities. In 1926 Flight-Lieut. Maitland observed and photographed circles, forts or cattle-pens, on the Jebel Druze east of the Dead Sea (*Antiquity,* 1927, 197), and Doughty reports similar relics some 100m. farther south. Dolmens are scattered over areas east of Jordan, but no information is available as to how far they extend down into Arabia.

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(D. L. O'L.)

Antiquities. — Much spade-work remains to be done before a complete picture of life in ancient Arabia can be pieced together. Systematic exploration of its antiquities has never been possible and our knowledge of the subject depends entirely on the reports and collections of explorers often not properly equipped for the task. In 1876 Doughty studied, sketched and copied the Nabataean rock-tombs and inscriptions at Madain Salih, which have since been studied by Peres Jaussen, Sevignac and others. Other Nabataean rock-tombs with inscriptions were studied in 1877 by Burton during his examination of the ancient gold-workings of Midian. Roman ruins have been found in or near the border of northern Hejaz. At Taima, Huber in 1883 secured the famous Semitic inscription now in the Louvre, and Doughty

recorded the existence of "flagstones set edge-wise" and "round heaps, perhaps barrows" during his wanderings between Khaibar and Hail. The monoliths mentioned by Palgrave at Uyun south of the latter place were not recorded by Huber or Leachman who visited the place later and must be held under suspicion pending verification. At Sadus in Nejd, Pelly found an ancient "Christian" column since destroyed by the Wahhabis. In wadi Sirhan are Roman and early Arab remains—basalt masonry with inscriptions. Near Taif, Doughty found a "prehistoric" sketch of a colossal human being and he and others have recorded the existence at Taif itself of two large shapeless stone idols worshipped by the ancients under the names of Lat and Uzza and broken up by the Wahhabis in 1925. The third idol of this group, Manat, possibly a prehistoric monolith, is said to exist somewhere south of Taif. The meteoric black stone of Mecca was doubtless an object of prehistoric veneration and superstition, and the well of Zamzam is certainly of great antiquity. "Eve's tomb" at Jedda did not apparently exist at the time of Varthema's visit (16th century) and has recently (1927) been demolished by the Wahhabi régime. On the other side of Arabia the puzzle of the exact locality of the ancient seaport of Gerra would seem to have been solved by the discovery by Cheesman of ruins at Ukair, whose name unquestionably preserves the ancient appellation of the city. In the provinces of Kharj and Aflaj, Philby found ruins in connection with the irrigation systems of these parts. They are perhaps comparable to the *tumuli* of Bahrein, examined and attributed to the Phoenicians by Bent, Prideaux and others. In Oman, B. W. Thomas has recently discovered ruins which may prove to be of importance. These and the reported buried cities of the Rub' Al Khali deserve investigation.

The parts of Arabia most exhaustively studied from the archaeological point of view are Yemen and Hadhramaut where considerable remains of the Sabaean and Minaean civilizations have been found. The ruins of Marib, the old Sabaean capital have been visited by Arnaud, Halévy, Glaser and others, who collected a number of inscriptions in the language of Minaea and Saba on bronze and limestone. Arnaud studied in detail the famous dam, on which the irrigation of the district depended and which are comparable to the well-known tank system of Aden. These are unquestionably of great antiquity and were repaired in the 5th and 6th centuries A.D. according to two long inscriptions published by Glaser. Another dam 150 yards long with three tanks above it was seen by W. B. Harris at Hirran in Yemen. The inscriptions above mentioned are in letters apparently derived from the Phoenician. Many of them are of votive character and those of a historical bearing are undated and therefore the subject of controversy. The range of possible dates seems to be from 800 B.C to the 6th century A.D. Among the remains (some in *situ* and others built into walls) are altars and statue-bases, the later stones being ornamented with designs of leaves, flowers, ox-heads, men and women. Some have designs of a sacred tree similar to those of Babylonia. Grave-stones and stelae as well as bronze castings of various animals also occur.

The Vienna Museum possesses a small number of seals of bronze, copper, silver and stone with Sabaean inscriptions and gems of later date with various figures and even Arabic inscriptions. Coins imitated from Greek models but with Sabaean inscriptions have been brought to Europe from Aden, Sana and Marib. (H. ST. J. B. P)

Ethnology.— As Arabia forms a single unit ethnologically with Asia Minor these two political areas are treated together under ASIA MINOR: Ethnology.

ARABIAN ART: see MOHAMMEDAN ART.

ARABIAN NIGHTS' ENTERTAINMENT: see THOUSAND AND ONE NIGHTS.

ARABIAN PHILOSOPHY. What is known as "Arabian" philosophy owed to Arabia little more than its name and its language. It was a system of Greek thought, expressed in a Semitic tongue, and modified by Oriental influences, called into existence amongst the Muslim people by the patronage of their more liberal princes, and kept alive by the intrepidity and zeal of a small band of thinkers, who stood suspected and disliked in the eyes of their nation. Their chief claim to the notice of the historian of philosophy comes from their warm reception of Greek philosophy when it had been banished from its original soil, and whilst western Europe was still too rude and ignorant to be its home (9th to 12th century).

Origin.— In the course of that exile the traces of Semitic or Mohammedan influence gradually faded away, and the last of the line of Saracen thinkers was a truer exponent of the one philosophy which they all professed to teach than the first. The whole movement is little more than a chapter in the history of Aristotelianism. That system of thought, after passing through the minds of those who saw it in the hazy light of an orientalized Platonism, and finding many laborious but narrow-purposed cultivators in the monastic schools of heretical Syria, was then brought into contact with the ideas and mental habits of Islam. But those in whom the two currents converged did not belong to the pure Arab race. Of the so-called Arabian philosophers of the East, al-Fārābī, Ibn-Sīnā and al-Ghazālī were natives of Khorasan, Bokhara and the outlying provinces of north-eastern Persia; whilst al-Kindi, the earliest of them, sprang from Basra, on the Persian Gulf, on the debatable ground between the Semite and the Aryan. In Spain, again, where Ibn-Bājja, Ibn-Tufail and Ibn Rushd rivalled or exceeded the fame of the Eastern schools, the Arabians of pure blood were few, and the Moorish ruling class was deeply intersected by Jewish colonies, and even by the natives of Christian Spain. Thus, alike at Baghdad and at Cordova, Arabian philosophy represents the temporary victory of exotic ideas and of subject races over the theological one-sidedness of Islam, and the illiterate simplicity of the early Saracens.

Islam had, it is true, a philosophy of its own among its theologians (see ISLAM). It was with them that the Muslim theology—the science of the word (*Kalām*)—first came into existence. Its professors, the *Mutākallimūn* (known in Hebrew as *Medabberim,* and as *Loquentes* in the Latin versions), may be compared with the scholastic doctors of the Catholic Church. Driven in the first instance to speculation in theology by the needs of their natural reason, they came, in after days, when Greek philosophy had been naturalized in the Caliphate, to adapt its methods and doctrines to the support of their views. They employed a quasi-philosophical method, by which, according to Maimonides, they first reflected how things ought to be in order to support, or at least not contradict, their opinions, and then, when their minds were made up with regard to this imaginary system, declared that the world was not otherwise constituted. The dogmas of creation and providence, of divine omnipotence, chiefly exercised them; and they sought to assert for God an immediate action in the making and the keeping of the world. Space they looked upon as pervaded by atoms possessing no quality or extension, and time was similarly divided into innumerable instants. Each change in the constitution of the atoms is a direct act of the Almighty. When the fire burns, or the water moistens, these terms merely express the habitual connection which our senses perceive between one thing and another. It is not the man that throws a stone who is its real mover: the supreme agent has for the moment created motion. If a living being die, it is because God has created the attribute of death; and the body remains dead, only because that attribute is unceasingly created. Thus, on the one hand, the object called the cause is denied to have any efficient power to produce the so-called effect; and, on the other hand, the regularities or laws of nature are explained to be direct interferences by the Deity. The supposed uniformity and necessity of causation is only an effect of custom, and may be at any moment rescinded. In this way, by a theory which, according to Averroes (*q.v.*), involves the negation of science, the Muslim theologians believed that they had exalted God beyond the limits of the metaphysical and scientific conceptions of law, form and matter; whilst they at the same time stood aloof from the vulgar doctrines, attributing a causality to things. Thus they deemed they had left a clear ground for the possibility of miracles.

But at least one point was common to the theological and the philosophical doctrine. Carrying out, it may be, the principles of the Neo-Platonists, they kept the sanctuary of the Deity

securely guarded, and interposed between Him and His creatures a spiritual order of potent principles, from the Intelligence, which is the first-born image of the great unity, to the Soul and Nature, which come later in the spiritual rank. Of God the philosophers said we could not tell what He is, but only what He *is not*. The highest point, beyond which strictly philosophical enquirers did not penetrate, was the active intellect, — a sort of soul of the world in Aristotelian garb — the principle which inspires and regulates the development of humanity, and in which lies the goal of perfection for the human spirit. In theological language the active intellect is described as an angel. The inspirations which the prophet receives by angelic messengers are compared with the irradiation of intellectual light, which the philosopher wins by contemplation of truth and increasing purity of life. But while the theologian incessantly postulated the agency of that God whose nature he deemed beyond the pale of science, the philosopher, following a purely human and natural aim, directed his efforts to the gradual elevation of his part of reason from its unformed state, and to its final union with the controlling intellect which moves and draws to itself the spirits of those who prepare themselves for its influences. The philosophers in their way, like the mystics of Persia (the Sufites) in another, tended towards a theory of the communion of man with the spiritual world, which may be considered a protest against the practical and almost prosaic definiteness of the creed of Mohammed.

Arabian philosophy, at the outset of its career in the 9th century, was able without difficulty to take possession of those resources for speculative thought which the Latins had barely achieved at the close of the 12th century by the slow process of rediscovering the Aristotelian logic from the commentaries and verses of Boëthius. What the Latins painfully accomplished, owing to their fragmentary and unintelligent acquaintance with ancient philosophy, was already done for the Arabians by the scholars of Syria. In the early centuries of the Christian era, both within and without the ranks of the Church, the Platonic tone and method were paramount throughout the East. Their influence was felt in the creeds which formulated the orthodox dogmas in regard to the Trinity and the Incarnation. But in its later days the Neoplatonist school came more and more to find in Aristotle the best exponent and interpreter of the philosopher whom they thought divine. It was in this spirit that Porphyry, Themistius and Joannes Philoponus composed their commentaries on the treatises of the Peripatetic system which, modified often unconsciously by the dominant ideas of its expositors, became in the 6th and 7th centuries the philosophy of the Eastern Church. But the instrument which, in the hands of John of Damascus (Damascenus), was made subservient to theological interests, became in the hands of others a dissolvent of the doctrines which had been reduced to shape under the prevalence of the elder Platonism. Peripatetic studies became the source of heresies; and conversely, the heretical sects prosecuted the study of Aristotle with peculiar zeal. The church of the Nestorians, and that of the Monophysites, in their several schools and monasteries, carried on from the 5th to the 8th century the study of the earlier part of the *Organon,* with almost the same means, purposes and results as were found among the Latin schoolmen of the earlier centuries. Up to the time when the religious zeal of the emperor Zeno put a stop to the Nestorian school at Edessa, this "Athens of Syria" was active in translating and popularizing the Aristotelian logic. Their banishment from Edessa in 489 drove the Nestorian scholars to Persia, where the Sassanid rulers gave them a welcome; and there they continued their labours on the *Organon.* A new seminary of logic and theology sprang up at Nisibis, not far from the old locality; and at Gandisapora (or Nishapur), in the east of Persia, there arose a medical school, whence Greek medicine, and in its company Greek science and philosophy, ere long spread over the lands of Iran. Meanwhile the Monophysites had followed in the steps of the Nestorians, multiplying Syriac versions of the logical and medical science of the Greeks. Their school at Resaina is known from the name of Sergius, one of the first of these translators, in the days of Justinian; and from their monasteries at Kinnesrin (Chalcis) issued numerous versions of the introductory treatises of the Aristotelian logic. To the *Isagoge* of Porphyry, the *Categories* and the *Hermeneutica* of Aristotle, the labours of these Syrian schoolmen were confined. These they expounded, translated, epitomized and made the basis of their compilations, and the few who were bold enough to attempt the *Analytics* seem to have left their task unaccomplished.

The energy of the Monophysites, however, began to sink with the rise of the Muslim empire; and when philosophy revived amongst them in the 13th century, in the person of Gregorius Bar-Hebraeus (Abulfaragius) (1226–1286), the revival was due to the example and influence of the Arabian thinkers. It was otherwise with the Nestorians. Gaining by means of their professional skill as physicians a high rank in the society of the Muslim world, the Nestorian scholars soon made Baghdad familiar with the knowledge of Greek philosophy and science which they possessed. But the narrow limits of the Syrian studies, which added to a scanty knowledge of Aristotle some acquaintance with his Syrian commentators, were soon passed by the curiosity and zeal of the students in the Caliphate. During the 8th and 9th centuries, rough but generally faithful versions of Aristotle's principal works were made into Syriac, and then from the Syriac into Arabic. The names of some of these translators, such as Johannitius (Hunain ibn-Ishāq), were heard even in the Latin schools. By the labours of Hunain and his family the great body of Greek science, medical, astronomical and mathematical, became accessible to the Arab-speaking races. But for the next three centuries fresh versions, both of the philosopher and of his commentators, continued to succeed each other.

To the Arabians Aristotle represented and summed up Greek philosophy, even as Galen became to them the code of Greek medicine. They adopted the doctrine and system which the progress of human affairs had made the intellectual food of their Syrian guides. From first to last Arabian philosophers made no claim to originality; their aim was merely to propagate the truth of Peripateticism as it had been delivered to them. It was with them that the deification of Aristotle began; and from them the belief that in him human intelligence had reached its limit passed to the later schoolmen *(see* SCHOLASTICISM). The progress amongst the Arabians on this side lies in a closer adherence to their text, a nearer approach to the bare exegesis of their author. and an increasing emancipation from control by the tenets of the popular religion.

Under the Caliphate. — Secular philosophy found its first entrance amongst the Saracens in the days of the early caliphs of the Abbasid dynasty, whose ways and thoughts had been moulded by their residence in Persia amid the influences of an older creed, and of ideas which had in the last resort sprung from the Greeks. The seat of empire had been transferred to Baghdad, on the highway of Oriental commerce; and the distant Khorasan became the favourite province of the caliph. Then was inaugurated the period of Persian supremacy, during which Islam was laid open to the full current of alien ideas and culture. The incitement came, however, not from the people, but from the prince: it was in the light of court favour that the colleges of Baghdad and Nishapur first came to attract students from every quarter, from the valleys of Andalusia as well as the upland plains of Transoxiana. Mansiir, the second of the Abbasids, encouraged the appropriation of Greek science; but it was al-Ma'mūn, the son of Hariin al-Rashid, who deserves in the Mohammedan empire the same position of royal founder and benefactor which is held by Charlemagne in the history of the Latin schools. In his reign (813–833) Aristotle was first translated into Arabic. Orthodox Muslims, however, distrusted the course on which their chief had entered, and his philosophical proclivities became one ground for doubting his final salvation.

In the eastern provinces the chief names of Arabian philosophy are those known to the Latin schoolmen as Alkindius, Alfarabius, Avicenna and Algazel, or under forms resembling these. The first of these, Alkindius *(see* KINDI), flourished at the court of Baghdad in the first half of the 9th century. His claims to notice at the present day rest upon a few works on medicine, theology, music and natural science. With him begins that encyclopaedic

character — the simultaneous cultivation of the whole field of investigation which is reflected from Aristotle on the Arabian school. In him too is found the union of Platonism and Aristotelianism expressed in Neoplatonic terms. Towards the close of the 10th century the presentation of an entire scheme of knowledge, beginning with logic and mathematics, and ascending through the various departments of physical enquiry to the region of religious doctrine, was accomplished by a society which had its chief seat at Basra, the native town of al-Kindi. This society — the Brothers of Purity or Sincerity (Ikhwān us Safā'i) — divided into four orders, wrought in the interests of religion no less than of science; and though its attempt to compile an encyclopaedia of existing knowledge may have been premature, it yet contributed to spread abroad a desire for further information. The proposed reconciliation between science and faith was not accomplished, because the compromise could please neither party. The 51 treatises of which this encyclopaedia consists are interspersed with apologues in true Oriental style,' and the idea of goodness, of moral perfection, is as prominent an end in every discourse as it was in the alleged dream of al-Ma'mūn. The materials of the work come chiefly from Aristotle, but they are conceived in a Platonizing spirit, which places as the bond of all things a universal soul of the world with its partial or fragmentary souls. Contemporary with this semi-religious and semi-philosophical society lived Alfarabius (see FARĀBĪ), who died in 950. His paraphrases of Aristotle formed the basis on which Avicenna constructed his system, and his logical treatises produced a permanent effect on the logic of the Latin scholars. He gave the tone and direction to nearly all subsequent speculations among the Arabians. His order and enumeration of the principles of being, his doctrine of the double aspect of intellect, and of the perfect beatitude which consists in the aggregation of noble minds when they are delivered from the separating barriers of individual bodies, present at least in germ the characteristic theory of Averroes. But al-Farābī was not always consistent in his views; a certain sobriety checked his speculative flights, and although holding that the true perfection of man is reached in this life by the elevation of the intellectual nature, he came towards the close to think the separate existence of intellect no better than a delusion.

Avicenna.—Unquestionably the most illustrious name amongst the Oriental Muslims was Avicenna (980–1037) (*q.v.*). His rank in the mediaeval world as a philosopher was far beneath his fame as a physician. Still, the logic of Albertus Magnus and succeeding doctors was largely indebted to him for its formulae. In logic Avicenna starts by distinguishing between the isolated concept and the judgment or assertion; from which two primitive elements of knowledge there is artificially generated a complete and scientific knowledge by the two processes of definition and syllogism. But the chief interest for the history of logic belongs to his doctrine in so far as it bears upon the nature and function of abstract ideas. The question had been suggested alike to East and West by Porphyry, and the Arabians were the first to approach the full statement of the problem. Farābī had pointed out that the universal and individual are not distinguished from each other as understanding from the senses, but that both universal and individual are in one respect intellectual, just as in another connection they play a part in perception. He had distinguished the universal essence in its abstract nature, from the universal considered in relation to a number of singulars. These suggestions formed the basis of Avicenna's doctrine. The essences or forms — the *intelligibilia* which constitute the world of real knowledge — may be looked at in themselves (metaphysically), or as embodied in the things of sense (physically), or as expressing the processes of thought (logically). The first of these three points of view deals with the form or idea as self-contained in the principles of its own being, apart from those connections and distinctions which it receives in real (physical) science, and through the act of intellect. Secondly, the form may be looked at as the similarity evolved by a process of comparison, as the work of mental reflection, and in .that way as essentially expressing a relation. When thus considered as the common features derived by examination from singular instances, it becomes a universal or common term strictly so called. It is intellect which first makes the abstract idea a true universal. In the third place, the form or essence may be looked upon as embodied in outward things, and thus it is the type more or less represented by the members of a natural kind. It is the designation of these outward things which forms the "first intention" of names; and it is only at a later stage, when thought comes to observe its own modes, that names, looked upon as predicables and universals, are taken in their "second intention." Logic deals with such second intentions. It does not consider the forms before their embodiment in things, *i.e.*, as eternal ideas — nor as immersed in the matter of the phenomenal world — but as they exist in and for the intellect which has examined and compared. Logic does not come in contact with things, except as they are subject to modification by intellectual forms. In other words, universality, individuality and speciality are all equally modes of our comprehension or notions; their meaning consists in their setting forth the relations attaching to any object of our conception. In the mind, *e.g.*, one form may be placed in reference to a multitude of things, and as thus related will be universal. The form animal, *e.g.*, is an abstract intelligible or metaphysical idea. When an act of thought employs it as a schema to unify several species, it acquires its logical aspect of generality; and the various living beings qualified to have the name animal applied to them constitute the natural class or kind. Avicenna's view of the universal may be compared with that of Abélard, who calls it "that whose nature it is to be predicated of several," as if the generality became explicit only in the act of predication, in the proposition, and not in the abstract, unrelated form or essence. The three modes of the universal before things, in things, and after things, spring from Arabian influence, but depart somewhat from his standpoint.

The place of Avicenna amongst Muslim philosophers is seen in the fact that Shahrastānī takes him as the type of all, and that Ghazālī's attack against philosophy is in reality almost entirely directed against Avicenna. His system is in the main a codification of Aristotle modified by fundamental views of Neoplatonist origin, and it tends to be a compromise with theology. In order, for example, to maintain the necessity of creation, he taught that all things except God were admissible or possible in their own nature, but that certain of them were rendered necessary by the act of the creative first agent — in other words, that the possible could be transformed into the necessary. Avicenna's theory of the process of knowledge is an interesting part of his doctrine. Man has a rational soul, one face of which is turned towards the body, and, by the help of the higher aspect, acts as practical understanding; the other face lies open to the reception and acquisition of the intelligible forms, and its aim is to become a reasonable world, reproducing the forms of the universe and their intelligible order. In man there is only the susceptibility to reason, which is sustained and helped by the light of the active intellect. Man may prepare himself for this influx by removing the obstacles which prevent the union of the intellect with the human vessel destined for its reception. The stages of this process to the acquisition of mind are generally enumerated by Avicenna as four; in this part he follows not Aristotle, but the Greek commentator. The first stage is that of the hylic or material intellect, a state of mere potentiality, like that of a child for writing, before he has ever put pen to paper. The second stage is called in habitu; it is compared to the case of a child that has learned the elements of writing, when the bare possibility is on the way to be developed, and is seen to be real. In this period of half-trained reason it appears as happy conjecture, not yet transformed into art or science proper. When the power of writing has been actualized, we have a parallel to the *intellectus* in *actu* — the way of science and demonstration is entered. And when writing has been made a permanent accomplishment, or lasting property of the subject, to be taken up at will, it corresponds to the intellectus *adeptus* — the complete mastery of science. The whole process may be compared to the gradual illumination of a body naturally capable of receiving light. There are, however, grades of susceptibility to the active intellect; *i.e.*, in theological language, to communication with God and His angels. Sometimes the receptivity is so vigorous

in its affinity, that without teaching it rises at one step to the vision of truth, by a certain "holy force" above ordinary measure. (In this way philosophy tried to account for the phenomenon of prophecy, one of the ruling ideas of Islam.) But the active intellect is not merely influential on human souls. It is the universal giver of forms in the world.

In several points Avicenna endeavoured to give a rationalistic account of theological dogmas, particularly of prophetic rule, of miracles, divine providence and immortality. The permanence of individual souls he supports by arguments borrowed from those of Plato. The existence of a prophet is shown to be a corollary from a belief in God as a moral governor, and the phenomena of miracles are required to evidence the genuineness of the prophetic mission. Thus Avicenna, like his predecessors, tried to harmonize the abstract forms of philosophy with the religious faith of his nation. But his arguments are generally vitiated by the fallacy of assuming what they profess to prove. His failure is made obvious by the attack of Ghazālī on the tendencies and results of philosophic speculation.

Ghazālī.—To GhazLli (*q.v.*) it seemed that the study of secular philosophy had resulted in a general indifference to religion, and that the scepticism which concealed itself under a pretence of piety was destroying the life and purity of the nation. With these views he carried into the fields of philosophy the aims and spirit of the Muslim theologian. His restless life was the reflex of a mental history disturbed by prolonged agitation. Revolting, in the height of his success, against the current creed, he began to examine the foundations of knowledge. The senses are contradicted by one another, and disproved by reason. Reason, indeed, professes to furnish us with necessary truths; but what assurance have we that the verdicts of reason may not be reversed by some higher authority? GhazLli then interrogated all the sects in succession to learn their criterion of truth. He first applied to the theological schoolmen, who grounded their religion on reason; but their aim was only to preserve the faith from heresy. He turned to the philosophers, and examined the accepted Aristotelianism in a treatise which has come down to us—The *Destruction* of *the Philosophers.* He assails them on 20 points of their mixed physical and metaphysical peripateticism, from the statement of which, in spite of his pretended scepticism, we can deduce some very positive metaphysical opinions of his own. He claims to have shown that the dogmas of the eternity of matter and the permanence of the world are false; that their description of the Deity as the demiurgos is unspiritual; that they fail to prove the existence, the unity, the simplicity, the incorporeality or the knowledge (both of species and accidents) of God; that their ascription of souls to the celestial spheres is unproved; that their theory of causation, which attributes effects to the very natures of the causes, is false, for that all actions and events are to be ascribed to the Deity; and, finally, that they cannot establish the spirituality of the soul, nor prove its mortality. These criticisms disclose nothing like a sceptical state of mind, but rather a reversion from the metaphysical to the theological stage of thought. He denies the intrinsic tendencies, or souls, by which the Aristotelians explained the motion of the spheres, because he ascribes their motion to God. The sceptic would have denied both. G. H. Lewes censures Renan for asserting of Ghazālī's theory of causation—"*Hume n'a rien dit plus.*" It is true that Ghazālī maintains that the natural law according to which effects proceed inevitably from their causes is only custom, and that there is no *necessary* connection between them. But while Hume absolutely denies the necessity, GhazLli merely removes it one stage farther back, and plants it in the mind of the Deity. This, of course, is not metaphysics, but theology. Having, as he believed, refuted the opinions of the philosophers, he next investigated the pretensions of the Allegorists, who derived their doctrines from an imam. These Arabian ultramontanes had no word for the doubter. They could not, he says, even understand the problems they sought to resolve by the assumption of infallibility, and he turned again, in his despair, to the instructors of his youth—the Sūfīs. In their mystical intuition of the laws of life, and absorption in the immanent Deity, he at last found peace. This shows the true character of the treatise which, alike in mediaeval and modern times, has been quoted as containing an exposition of his opinions. The work called *Tlze Tendencies* of *the Philosophers,* translated in 1506, with the title *Logica et Philosophia Algazelis Arabis,* contains neither the logic nor the philosophy of Ghazālī. It is a mere abstract or statement of the Peripatetic systems, and was made preliminary to that *Destruction* of which we have already spoken.

This indictment against liberal thought from the standpoint of the theological school was afterwards answered in Spain by Averroes; but in Baghdad it heralded the extinction of the light of philosophy. Moderate and compliant with the popular religion as Alfarabius and Avicenna had always been, as compared with their Spanish successor, they had equally failed to conciliate the popular spirit, and were classed in the same category with the heretic or the member of an immoral sect. The 12th century exhibits the decay of liberal intellectual activity in the Caliphate, and the gradual ascendancy of Turkish races animated with all the intolerance of semi-barbarian proselytes to the Mohammedan faith. Philosophy, which had only sprung up when the purely Arabian influences ceased to predominate, came to an end when the sceptre of the Muslim world passed away from the dynasty of Persia. Even in 1150 Baghdad had seen a library of philosophical books burned by command of the caliph Mostanjid; and in 1192 the same place might have witnessed a strange scene, in which the books of a physician were first publicly cursed, and then committed to the flames, while their owner was incarcerated. Thus, while the Latin Church showed a marvellous receptivity for ethnic philosophy, and assimilated doctrines which it had at an earlier date declared impious, in Islam the theological system entrenched itself towards the end of the 12th century in the narrow orthodoxy of the Asharites, and reduced the votaries of Greek philosophy to silence.

In Spain.—The same phenomena were repeated in Spain under the Mohammedan rulers of Andalusia and Morocco, with this difference, that the time of philosophical development was shorter, and the heights to which Spanish thinkers soared were greater. The reign of al-Hakam the Second (961–976) inaugurated in Andalusia those scientific and philosophical studies which were simultaneously prosecuted by the Society of Basra. From Cairo, Baghdad, Damascus and Alexandria, books both old and new were procured at any price for the library of the prince; 27 free schools were opened in Cordova for the education of the poor; and intelligent knowledge was perhaps more widely diffused in Mohammedan Spain than in any other part of Europe at that day. The mosques of the city were filled with crowds who listened to lectures on science and literature, law and religion. But the future glory thus promised was long postponed. The usurping successor of Hakam found it a politic step to request the most notable doctors of the sacred law to examine the royal library; and every book treating of philosophy, astronomy and other forbidden topics was condemned to the flames. But the spirit of research, fostered by the fusion of races and the social and intellectual competition thus engendered, was not crushed by these proceedings; and for the next century and more the higher minds of Spain found in Damascus and Baghdad the intellectual aliment which they desired. At last, towards the close of the 11th century, the long-pent spiritual energies of Mohammedan Spain burst forth in a brief series of illustrious men. Whilst the native Spaniards were narrowing the limits of the Moorish kingdoms, and whilst the generally fanatical dynasty of the Almohades might have been expected to repress speculation, the century preceding the close of Mohammedan sway saw philosophy cultivated by Avempace, Abubacer and Averroes. Even amongst the Almohades there were princes, such as Yusiif (who began his reign in 1163) and Yaqūb Almansūr (who succeeded in 1184), who welcomed the philosopher at their courts and treated him as an intellectual compeer. But about 1195 the old distrust of philosophy revived; the philosophers were banished in disgrace; works on philosophical topics were ordered to be confiscated and burned; and the son of Almansiir condemned a certain Ibn-Habīb to death for the crime of philosophizing.

Avempace.—Arabian speculation in Spain was heralded by Avicebron or Ibn Gabirol (*q.v.*), a Jewish philosopher (1021–58). About a generation later the rank of Muslim thinkers was introduced by Abii-Bakr Muhammad ibn Yahya, surnamed Ibn-Bājja, and known to the Latin world as Avempace. He was born at Saragossa, and died comparatively young at Fez in 1138. Besides commenting on various physical treatises of Aristotle he wrote some philosophical essays, notably one on the *Republic* or *Régime* of *the Solitary*, understanding by that the organized system of rules, by obedience to which the individual may rise from the mere life of the senses to the perception of pure intelligible principles and may participate in the divine thought which sustains the world. These rules for the individual are but the image or reflex of the political organization of the perfect or ideal state; and the man who strives to lead this life is called the *solitary*, not because he withdraws from society, but because, while in it, he guides himself by reference to a higher state, an ideal society. Avempace does not develop at any length this curious Platonic idea of the perfect state. His object is to discover the highest end of human life, and with this view he classifies the various activities of the human soul, rejects such as are material or animal, and then analyses the various spiritual forms to which the activities may be directed. He points out the graduated scale of such forms, through which the soul may rise, and shows that none are final or complete in themselves, except the pure intelligible forms, the ideas of ideas. These the intellect can grasp, and in so doing it becomes what he calls *intellectus acquisitus*, and is in a measure divine. This self-consciousness of pure reason is the highest object of human activity, and is to be attained by the speculative method. The intellect has in itself power to know ultimate truth and intelligence, and does not require a mystical illumination as Ghazālī taught. Avempace's principles, it is clear, lead directly to the Averroistic doctrine of the unity of intellect, but the obscurity and incompleteness of the *Régime* do not permit us to judge how far he anticipated the later thinker. (See Munk, *Mélanges de phil. juive et arabe*, pp. 383–410.)

The same theme was developed by Ibn-Tufail (*q.v.*) in his philosophical romance, called *Hayy ibn-Yakdhān* (the Living, Son of the Waking One), best known by Pococke's Latin version, as the *Philosophus Autodidactus*. It describes the process by which an isolated truth-seeker detaches himself from his lower passions, and raises himself above the material earth and the orbs of heaven to the forms which are the source of their movement, until he arrives at a union with the supreme intellect. The experiences of the religious mystic are paralleled with the ecstatic vision in which the philosophical hermit sees a world of pure intelligences, where birth and decease are unknown. It was this theory which Averroes (1126–98), the last and most famous of the thinkers of Muslim Spain, made use of in his doctrine of the unity of intellect.

Averroes.—For Aristotle the reverence of Averroes was unbounded, and to expound him was his chosen task. The uncritical receptivity of his age, the defects of the Arabic versions, the emphatic theism of his creed, and the rationalizing mysticism of some Oriental thought, may have sometimes led him astray, and given prominence to the less obvious features of Aristotelianism. But in his conception of the relation between philosophy and religion, Averroes had a light which the Latins were without. The science, falsely so called, of the several theological schools, their groundless distinctions and sophistical demonstrations, he regarded as the great source of heresy and scepticism. The allegorical interpretations and metaphysics which had been imported into religion had taken men's minds away from the plain sense of the Koran. God had declared a truth meet for all men, which needed no intellectual superiority to understand, in a tongue which each human soul could apprehend. Accordingly, the expositors of religious metaphysics, Ghazālī included, are the enemies of true religion, because they make it a mere matter of syllogism. Averroes maintains that a return must be made to the words and teaching of the prophet; that science must not expend itself in dogmatizing on the metaphysical consequences of fragments of doctrine for popular acceptance, but must proceed to reflect upon and examine the existing things of the world. Averroes, at the same time, condemns the attempts of those who tried to give demonstrative science where the mind was not capable of more than rhetoric; they harm religion by their mere negations, destroying an old sensuous creed, but cannot build up a higher and intellectual faith.

In this spirit Averroes does not allow the fancied needs of theological reasoning to interfere with his study of Aristotle, whom he simply interprets as a truth-seeker. The points by which he told on Europe were all implicit in Aristotle, but Averroes set in relief what the original had left obscure, and emphasized things which the Christian theologian passed by or misconceived. Thus Averroes had a double effect. He was the great interpreter of Aristotle to the later Schoolmen. On the other hand, he came to represent those aspects of Peripateticism most alien to the spirit of Christendom; and the deeply religious Muslim gave his name to the anti-sacerdotal party, to the materialists, sceptics and atheists, who defied or undermined the dominant beliefs of the church.

On three points Averroes, like other Muslim thinkers, came specially into relation, real or supposed, with the religious creed, viz., the creation of the world, the divine knowledge of particular things, and the future of the human soul.

The real grandeur of Averroes is seen in his resolute prosecution of the standpoint of science in matters of this world, and in his recognition that religion is not a branch of knowledge to be reduced to propositions and systems of dogma, but a personal and inward power, an individual truth which stands distinct from, but not contradictory to, the universalities of scientific law. In his science he followed the Greeks, and to the Schoolmen he and his compatriots rightly seemed philosophers of the ancient world. He maintained alike the claim of demonstrative science with its generalities for the few who could live in that ethereal world, and the claim of religion for all—the common life of each soul as an individual and personal consciousness. But theology, or the mixture of the two, he regarded as a source of evil to both—fostering the vain belief in a hostility of philosophers to religion, and meanwhile corrupting religion by a pseudo-science.

The latent nominalism of Aristotle only came gradually to be emphasized through the prominence which Christianity gave to the individual life, and, apart from passing notices, as in Abélard, first found clear enunciation in the school of Duns Scotus. The Arabians, on the contrary, emphasized the idealist aspect which had been adopted and promoted by the Neoplatonist commentators. Hehce, to Averroes the eternity of the world finds its true expression in the eternity of God. The ceaseless movement of growth and change, which presents matter in form after form as a continual search after a finality which in time and movement is not and cannot be reached, represents only the aspect the world shows to the physicist and to the senses. In the eye of reason the full fruition of this desired finality is already and always attained; the actualization, invisible to the senses, is achieved now and ever, and is thus beyond the element of time. This transcendent or abstract being *is* that which the world of nature is always *seeking*. He is thought or intellect, the actuality, of which movement is but the fragmentary attainment in successive instants of time. Such a mind is not in the theological sense a creator, yet the onward movement is not the same as what some modern thinkers seem to mean by development. For the perfect and absolute, the consummation of movement is not generated at any point in the process; it is an ideal end, which guides the operations of nature, and does not wait upon them for its achievement. God is the unchanging essence of the movement, and therefore its eternal cause.

A special application of this relation between the prior perfect, and the imperfect, which it influences, is found in the doctrine of the connection of the abstract (transcendent) intellect with man. This transcendent mind is sometimes connected with the moon, according to the theory of Aristotle, who assigned an imperishable matter to the sphere beyond the sublunary, and in general looked upon the celestial orbs as living and intelligent. Such an intellect, named active or productive, as being the author

of the development of reason in man, is the permanent, eternal thought, which is the truth of the cosmic and physical movement. It is in man that the physical or sensible passes most evidently into the metaphysical and rational. Humanity is the chosen vessel in which the light of the intellect is revealed; and so long as mankind lasts there must always be some individuals destined to receive this light. What seems from the material point of view to be the acquisition of learning, study and a moral life, is from the higher point of view the manifestation of the transcendent intellect in the individual. The preparation of the heart and faculties gives rise to a series of grades between the original predisposition and the full acquisition of actual intellect. These grades in the main resemble those given by Avicenna. But beyond these, Averroes claims as the highest bliss of the soul a union in this life with the actual intellect. The intellect, therefore, is one and continuous in all individuals, who differ only in the degree which their illumination has attained. Such was the Averroist doctrine of the unity of intellect — the eternal and universal nature of true intellectual life. By his interpreters it was transformed into a theory of one soul common to all mankind, and when thus corrupted conflicted not unreasonably with the doctrines of a future life, common to Islam and Christendom.

Opponents of **Averroism.**—Averroes, rejected by his Muslim countrymen, found a hearing among the Jews, to whom Maimonides had shown the free paths of Greek speculation. In the cities of Languedoc and Provence, to which they had been driven by Spanish fanaticism, the Jews no longer used the learned Arabic, and translations of the works of Averroes became necessary. His writings became the text-book of Levi ben Gerson at Perpignan, and of Moses of Narbonne. Meanwhile, before 1250, Averroes became accessible to the Latin Schoolmen by means of versions, accredited by the names of Michael Scot and others. William of Auvergne is the first Schoolman who criticizes the doctrines of Averroes, not, however, by name. Albertus Magnus and St. Thomas devote special treatises to an examination of the Averroist theory of the unity of intellect, which they labour to confute in order to establish the orthodoxy of Aristotle. But as early as Aegidius Romanus (1247–1316), Averroes had been stamped as the patron of indifference to theological dogmas, and credited with the emancipation which was equally due to wider experience and the lessons of the Crusades. There had never been an absence of protest against the hierarchical doctrine. Berengar of Tours (11th century) had struggled in that interest, and with Abélard, in the 12th century, the revolt against authority in belief grew loud. The dialogue between a Christian, a Jew and a philosopher suggested a comparative estimate of religions, and placed the natural religion of the moral law above all positive revelations. Nihilists and naturalists, who deified logic and science at the expense of faith, were not unknown at Paris in the days of John of Salisbury. In such a critical generation the words of Averroism found willing ears, and pupils who outran their teacher. Paris became the centre of a sceptical society, which the decrees of bishops and councils, and the enthusiasm of the orthodox doctors and knights-errant of Catholicism, were powerless to extinguish. At Oxford Averroes told more as the great commentator. In the days of Roger Bacon he had become an authority. Baton, placing him beside Aristotle and Avicenna, recommends the study of Arabic as the only way of getting the knowledge which bad versions made almost hopeless. In Duns Scotus, Averroes and Aristotle are the unequalled masters of the science of proof; and he pronounces distinctly the separation between Catholic and philosophical truth, which became the watchword of Averroism. By the 14th century Averroism was the common leaven of philosophy; John Baconthorpe is the chief of Averroists, and Walter Burley has similar tendencies.

Meanwhile Averroism had come to be regarded by the great Dominican school as the arch-enemy of the truth. When the Emperor Frederick II. consulted a Muslim free-thinker on the mysteries of the faith, when the phrase or legend of the "Three Impostors" presented in its most offensive form the scientific survey of the three laws of Moses, Christ and Mohammed, and when the characteristic doctrines of Averroes were misunderstood, it soon followed that his name became the badge of the scoffer and the sceptic. What had begun with the subtle disputes of the universities of Paris, went on to the materialist teachers in the medical schools and the sceptical men of the world in the cities of northern Italy. The patricians of Venice and the lecturers of Padua made Averroism synonymous with doubt and criticism in theology, and with sarcasm against the hierarchy. Petrarch refuses to believe that any good thing can come out of Arabia, and speaks of Averroes as a mad dog barking against the Church. In works of contemporary art Averroes is at one time the comrade of Mohammed and Antichrist; at another he lies with Arius and Sabellius, vanquished by the lance of St. Thomas.

The School of **Padua.**—It was in the universities of north Italy that Averroism finally settled, and there for three centuries it continued as a stronghold of Scholasticism to resist the efforts of revived antiquity and of advancing science. Padua became the seat of Averroist Aristotelianism; and, when Padua was conquered by Venice in 1405, the printers of the republic spread abroad the teaching of the professors in the university. As early as 1300, at Padua, Petrus Aponensis, a notable expositor of medical theories, had betrayed a heterodoxy in faith; and John of Jandun, one of the pamphleteers on the side of Louis of Bavaria, was a keen follower of Averroes, whom he styles a "perfect and most glorious physicist." Urbanus of Bologna, Paul of Venice (d. 1428), and Cajetanus de Thienis (1387–1465), established by their lectures and their discussions the authority of Averroes; and a long list of manuscripts rests in the libraries of Lombardy to witness the diligence of these writers and their successors. Even a lady of Venice, Cassandra Fedele, in 1480, gained her laurels in defence of Averroist theses.

With Pietro Pomponazzi (*q.v.*) in 1495, a brilliant epoch began for the school of Padua. Questions of permanent and present interest took the place of outworn scholastic problems. The disputants ranged themselves under the rival commentators, Alexander and Averroes; and the immortality of the soul became the battle-ground of the two parties. Pomponazzi defended the Alexandrist doctrine of the utter mortality of the soul, whilst Agostino Nifo (*q.v.*), the Averroist, was entrusted by Leo X. with the task of defending the Catholic doctrine. The parties seemed to have changed when Averroism thus took the side of the Church; but the change was probably due to compulsion. Nifo had edited the works of Averroes (1495–97); but his expressions gave offence to the dominant theologians, and he had to save himself by distinguishing his personal faith from his editorial capacity. Alessandro Achillini, the persistent philosophical adversary of Pomponazzi, both at Padua and subsequently at Bologna, attempted, along with other moderate but not brilliant Averroists, to accommodate their philosophical theory with the requirements of Catholicism. It was this comparatively mild Averroism, reduced to the merely explanatory activity of a commentator, which continued to be the official dogma at Padua during the 16th century. Its typical representative is Marc-Antonio Zimara (d. 1552), the author of a reconciliation between the tenets of Averroes and those of Aristotle.

Summary. — Meanwhile, in 1497, Aristotle was for the first time expounded in Greek at Padua. Plato had long been the favourite study at Florence; and Humanists, like Erasmus, Ludovicus Vives and Nizolius, enamoured of the popular philosophy of Cicero and Quintilian, poured out the vials of their contempt on scholastic barbarism with its "impious and thrice-accursed Averroes." The editors of Averroes complain that the popular taste had forsaken them for the Greek. Nevertheless, while Fallopius, Vesalius and Galileo were claiming attention to their discoveries, G. Zabarella, Francesco Piccolomini (1520–1604) and Cesare Cremonini (1550–1631) continued the traditions of Averroism, not without changes and additions. Cremonini, the last of them, died in 1631, after lecturing 12 years at Ferrara and 40 at Padua. The great educational value of Arabian philosophy for the later schoolmen consisted in its making them acquainted with an entire Aristotle. At the moment when it seemed as if everything had been made that could be made out of the frag-

ments of Aristotle, and the compilations of Capella, Cassiodorus and others, and when mysticism and scepticism seemed the only resources left for the mind, the horizon of knowledge was suddenly widened by the acquisition of a complete Aristotle. Thus the mistakes inevitable in the isolated study of an imperfect *Organon* could not henceforth be made. The real bearing of old questions, and the meaninglessness of many disputes, were seen in the new conception of Aristotelianism given by the Metaphysics and other treatises. The former Realism and Nominalism were lifted into a higher phase by the principle of the universalizing action of intellect—Zntellectus in *formis agit universalitatem.* The commentaries of the Arabians in this respect supplied nutriment more readily assimilated by the pupils than the pure text would have been.

Arabian philosophy, whilst it promoted the exegesis of Aristotle and increased his authority, was not less notable as the source of the separation between theology and philosophy. Speculation fell on irreligious paths. In many cases the heretical movement was due less to foreign example than to the indwelling tendencies of the dominant school of realism. But it is not less certain that the very considerable freedom of the Arabians from theological bias prepared the time when philosophy shook off its ecclesiastical vestments. In the hurry of first terror, the Church struck Aristotle with the anathema launched against innovations in philosophy. The provincial council of Paris in 1209, which condemned Amalricus and his followers, as well as David of Dinant's works, forbade the study of Aristotle's *Natural Philosophy* and the Commentaries. In 1215 the same prohibition was repeated, specifying the Metaphysics and Physics, and the Commentaries by the Spaniard Mauritius (*i.e.,* probably Averroes). Meanwhile Albertus Magnus and Thomas Aquinas, accepting the exegetical services of the Arabians, did their best to controvert the obnoxious doctrine of the Intellect, and to defend the orthodoxy of Aristotle against the unholy glosses of infidels. But it is doubtful whether even they kept as pure from the infection of illegitimate doctrine as they supposed. The tide meanwhile flowed in stronger and stronger. In 1270 Étienne Tempier, bishop of Paris, supported by an assembly of theologians, anathematized 13 propositions bearing the stamp of Arabian authorship; but in 1277 the same views and others more directly offensive to Christians and theologians had to be censured again. Raymond Lully, in a dialogue with an infidel thinker, broke a lance in support of the orthodox doctrine, and carried on a crusade against the Arabians in every university; and a disciple of Thomas Aquinas drew up a list (De *erroribus philosophorum*) of the several delusions and errors of each of the thinkers from Kindi to Averroes. Strong in their conviction of the truth of Aristotelianism, the Arabians carried out their logical results in the theological field, and made the distinction of necessary and possible, of form and matter, the basis of conclusions in the most momentous questions. They refused to accept the doctrine of creation because it conflicted with the explanation of forms as the necessary evolution of matter. They denied the particular providence of God, because knowledge in the divine sphere did not descend to singulars. They excluded the Deity from all direct action upon the world, and substituted for a cosmic principle the active intellect,—thus holding a form of Pantheism. But all did not go the same length in their divergence from the popular creed.

The half-legendary accounts which attribute the introduction of Arabian science to Gerbert, afterwards Pope Sylvester II., to Constantinus Africanus and to Adelard of Bath, if they have any value, refer mainly to medical science and mathematics. It was not till about the middle of the 12th century that under the patronage of Raymond, archbishop of Toledo, a society of translators, with the archdeacon Dominicus Gundisalvi at their head, produced Latin versions of the Commentaries of Avicenna and Ghazālī, of the *Fons* Vitae of Avicebron, and of several Aristotelian treatises. The working translators were converted Jews, the best-known among them being Joannes Avendeath. With this effort began the chief translating epoch for Arabic works. Avicenna's Canon of *Medicine* was first translated into Latin by Gerard of Cremona (d. 1187), to whom versions of other medical and astronomical works are due. The movement towards introducing Arabian science and philosophy into Europe, however, culminated under the patronage of the emperor Frederick II. (1212–50). Partly from superiority to the narrowness of his age, and partly in the interest of his struggle with the Papacy, this *Malleus* ecclesiae *Romanae* drew to his court those savants whose pursuits were discouraged by the Church, and especially students in the forbidden lore of the Arabians. He is said to have pensioned Jews for purposes of translation. One of the scholars to whom Frederick gave a welcome was Michael Scot, the first translator of Averroes. Scot had sojourned at Toledo about 1217, and had accomplished the versions of several astronomical and physical treatises, mainly, if we believe Roger Bacon, by the labours of a Jew named Andrew. But Bacon is apparently hypercritical in his estimate of the translators from the Arabic. Another protégé of Frederick was Hermann the German (Alemannus), who, between the years 1243 and 1256, translated amongst other things a paraphrase of al-Fārābī on the Rhetoric, and of Averroes on the Poetics and *Ethics* of Aristotle. Jewish scholars held an honourable place in transmitting the Arabian commentators to the schoolmen. It was amongst them, especially in Maimonides, that Aristotelianism found refuge after the light of philosophy was extinguished in Islam; and the Jewish family Ben-Tibbon were mainly instrumental in making Averroes known to southern France. (See JEWISH PHILOSOPHY.)

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(W. WAL.; *G.* W. T.)

ARABIAN SEA (anc. Mare Erythraeum), the north-west section of the Indian ocean, bounded east by India, north by Baluchistan and southern Persia, and west by Arabia and the "horn" of Africa. It has two important branches—the Gulf of Aden, connecting with the Red sea through the Strait of Bab-el-Mandeb; and the Gulf of Oman, leading to the Persian Gulf. The sea, long a centre of coastwise sailing, forms part of the chief highway between Europe and India. Its islands are few and insignificant, the chief being Socotra, off Somaliland, and the Laccadives. The coasts, save for the Indian shore between Bombay and Karachi, are steeply tilted and fall into deep water.

ARABIC ACID, also known as arabin and *gummic* acid. is the chief constituent of gum arabic. (See GUMS.) It can be obtained as an amorphous precipitate by treating with alcohol an aqueous solution of gum arabic in the presence of hydrochloric acid. It is soluble in water and insoluble in alcohol. Pure arabic acid, or λ-*arabinosic* acid, $C_{23}H_{38}O_{22}$, differs from the naturally occurring gum acid which is a compound of arabinosic acid with the sugar residues, arabinan and galactan.

ARABICI, a religious sect originating about the beginning of the 3rd century, mentioned by Augustine (De Haeres, c. lxxxiii.), and called also θνητοψυχῖται ("mortal-souled") by John of Damascus (De Haeres, c. xc.). Their distinctive doctrine was a form of Christian materialism, showing itself in the belief that the soul perished and was restored to life along with the body,

ARABIC LANGUAGE. In the 7th and 8th centuries, Arab conquests and the expansion of Islam spread the Arabic language into many countries outside Arabia, and in some form or other it is spoken (sometimes, along with other languages) in Mesopotamia, Syria, Palestine, Egypt, Malta, north Africa, and in certain districts further south; *e.g.,* in the Sudan. Nigeria, the western Sahara, and Zanzibar. Arabic was formerly spoken in Spain, which produced important contributions to Arabic literature, in the Balearic islands and Sicily (up to the end of the period

of Arab domination), in the island of Pantelleria, between Sicily and Tunis (up to the 18th century) and in Madagascar.

Even in Arabia itself the Arabic language exhibits dialectic differences, and such variations are still more marked in countries more remote from the land of its origin. But the written language has almost invariably conformed to that type which has been conveniently denominated as classical Arabic, characterized by an extraordinary richness of vocabulary and the logical, systematic character of its grammatical structure.

Alphabet. — The Arabic alphabet consists of 28 letters. (For pronunciation, see W. H. T. Gairdner, The Phonetics of Arabic, 192j.) To these may be added ' (hamza), the glottal stop. (For a discussion of the divergent theories on hamza, see C. Landberg, Glossaire *Datînois,* p. 1,744, sqq., 1923.)

Roots. — Most Arabic words (except those of foreign origin) can be traced back to a triliteral root; some words are considered to be derived from roots of two consonants only (*v.* Th. Noldeke, *Neue Beiträge zur semitischen Sprachwissenschaft,* pp. 109–178, 1910). By combining these consonants with certain other letters, the original idea associated with the root can be modified in such a manner that the three letters of the root (provided that one or more of them is neither hamza, wāw nor yā) can in most cases be clearly recognized; *e.g.,* from the root KTB "write," we have *KaTaBnā* "we wrote," *naKTuBu* "we will write," *KāTiB*^{un} "writing, a writer," *KiTāB*^{un} "a book," *maKTaB*^{un} "a place of writing, a school," *muKTiB*^{un} "a teacher of writing," *taKāTaBā* "they two corresponded with one another," *astaKTiBu* "I will ask (him) to write," *wa.KtaTaBa* "and he got his name written down (in the register)," *KuTTāB*^{un} '(scribes," *muKāTaBat*^{un} "correspondence," etc.

Verbs. — The Arabic verb has only two tenses: Perfect and Imperfect.

The Perfect tense of the Indicative of the Active of the simple verb, formed from the root QTL (meaning "kill"), is as follows:

	Sing.	Dual	Plural
3 m.	*qatala*	qatald	qatalli
f.	qatalat	*qatalatā*	*qatalna*
2 m.	*qatalta*	*qataltumā*	*qataltum*
f.	qatalti		*qataltunna*
1 m.f.	qataltu		*qatalnā*

In some verbs (generally intransitive) the vowel following the second radical is i, in others (always intransitive) u.

The Imperfect Indicative Active tense, from the same root, is:

	Sing.	Dual	Plural
3 m.	*yaqtulu*	*yaqtulāni*	*yaqtulūna*
f.	taqtulu	*taqtulāni*	yaqtulna
a m.	*taqtulu*	*taqtulāni*	taqtullina
.	*taqtulīna*		taqtulna
1 m.f.	*aqtulu*		*naqtulu*

If the vowel following the second radical in the Perfect is *i,* that of the Imperfect is generally a; if this vowel in the Perfect is *u,* that of the Imperfect is invariably u.

The Arabic verb has in the Active five moods, viz., the Indicative (both Perfect and Imperfect), the Subjunctive and Apocopated (Imperfect only), the Imperative (having a special form) and the Energetic (both Apocopated and Imperative).

The Perfect and Imperfect Passive differ from the corresponding tenses of the Active in that the first radical of the Perfect is always followed by *u* and the second radical by *i;* while in the Imperfect the prefixes take u and the second radical a. The Passive has the same moods as the Active, with the exception of the Imperative and the Energetic of the Imperative, the Apocopated being used instead.

The meaning of the simple verb may be modified in various ways by the addition of one or more letters to the root, and thus 14 derived conjugations may be formed. The commonest of these and of the changes of meaning they imply are as follows: — II, by doubling the medial consonant of the root the meaning is intensified (*e.g., KaSaRa* "he broke," *KaSSaRa* "he smashed"); or an intransitive verb becomes transitive (*e.g., FaRiḤa* "he was glad," *FaRRaḤa* "he gladdened"); or a transitive verb becomes doubly transitive (*e.g., ḤaMaLa* "he carried," *HaMMaLa* "he made to carry"). III adds *ā* after the first radical, with the idea of reciprocity or effort (*e.g., KaTaBa* "he wrote," *KāTaBa* "he corresponded with," *GhaLaBa* "he overcame," *GhāLaBa* "he tried to overcome"). IV prefixes hamza, with a causative meaning (*e.g., JaLaSa* "he sat," *'aJLaSa* "he made to sit"). V (ta+II, *e.g., taKaSSaRa* "it is smashed") and VI (ta+III, *e.g., taKāTaBā* "they are in correspondence with one another") and VII (n+I, *e.g.,* wa *nKaSaRa* "and it is broken") and VIII (*ta* inserted between the first and second radicals, *e.g., FaRaQa* "he divided," *wa FtaRaQa* "and it went asunder") commonly express a state or condition. IX doubles the third radical and is used chiefly of colours and defects (*e.g.,* wa *ṢFaRRa* "and it is yellow"). X (st + I, *e.g., GhaFaRa* "he pardoned," wa sta — Fara "and he asked for pardon") has a variety of meanings — asking for, reflexive, denominative, etc. Conjugations XI to XV are comparatively rare.

These forms of the simple verb undergo modifications if the second and third radicals are identical, or one of the radicals is hamza or W or Y.

Articles. — There are two articles: (1) definite *l* "the" (originally a demonstrative pronoun, '(this, that"); at the beginning of a sentence al, and always so written, except after the preposition *li* "for," and (2) indefinite *n* "a, an," affixed to the end of a noun, etc.; *e.g., li l* ntaliki "for the king"; *li malikin* "for a king."

Nouns. — There are two declensions of nouns in the singular: (1) triptote, *u* (nom.), *i* (gen.), a (acc.); (2) diptote, *u* (nom.), a (gen. and acc.); the latter never takes the indefinite article and conforms to (1) when determined by the definite article or by a following genitive. There are terminations for the dual and plural. But the idea of plurality is more often expressed by means of singular collective nouns, among which are the so-called "broken plurals," of which there are 29 varieties, each associated with some one or more forms of the singular noun.

Gender. — There are two genders only, masc. and fem. (For the theories on the origin of gender, *v.* A. J. Wensinck, Some aspects of gender in *the* Semitic *languages;* 1927.)

Numerals. — The cardinal numbers (with the exception of the first two, which are adjectives) are all substantives and are followed, from 3 to 10, by the genitive of the broken plural (where possible) and take the fem. form when the objects numbered are masc., and vice versa: — from 11 to 99, by the acc. sing.; 100 and 1,000 by the gen. sing.

Dialects. — It is not possible here to give an account of the dialectical peculiarities of the different local varieties of Arabic, but details may be found in regard to the more important of these in the grammars enumerated below: — Egypt: W. H. T. Gairdner, *Egyptian* colloquial Arabic (1926); J. S. Willmore, The spoken Arabic of Egypt (1905); D. C. Phillott and A. Powell, Manual of Egyptian Arabic (1926); Syria and Palestine: G. R. Driver, A grammar of the colloquial Arabic of Syria and Palestine (1925); H. H. Spoer and E. N. Haddad, *Manual* of Palestinian Arabic (1909); Mesopotamia: J. Van Ess, *The* Spoken Arabic of Mesopotamia (1917); A Socin, Der *arabische* Dialekt *von Mosul und Mardīn* (1904); Algeria: A. G. P. Martin, Mkthode *déductive* d'arabe *nord-africain* (1919); Morocco: M. Gaudefroy-Demombynes et L. Mercier, *Manuel d'arabe marocain* (1913); Nigeria: G. L. Lethem, *Colloquial* Arabic, Shuwa dialect of *Burnu,* Nigeria, and of the region of Lake Chad (1920); Tunis: J. Clermont, *L'arabe parlé tunisien* (1909); Sudan: A. Worsley, Sudanese *Grammar* (1925); S. Hillelson, *Sudan* Arabic, an English-Arabic *vocabulary* (1925); Malta: H. Stumme, *Maltesische* Studien (1904).

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ARABIC LITERATURE begins with the poems and proverbs of the northern Arabs of the 5th and 6th centuries after Christ. Of written literature, prior to the redaction of the Koran, nothing is known.

PRE-ISLAMIC POETRY

The origins of Arabian poetry can only be guessed at. Poets to whom the earliest pieces are attributed already exhibit a fully-

developed art. Their poems are couched in elaborate metres, of which 16 in all were recognized when the metrical system was eventually standardized in the 8th century by Khalīl ibn Aḥmad (*q.v.*). The historical development of these metres from a simple iambic measure has yet to be elucidated; some were possibly of recent introduction, due to foreign influences, in Khalil's time. In all the verse is divided into equally-balanced halves, and the same rhyme is retained at the end of each verse throughout the poem. The rule that every verse should form an organic whole gives a certain jerkiness to the poem, making it easy to displace lines and to extract choice passages for inclusion in anthologies. The poetic language was that of the desert Arabs, somewhat standardized and amplified by dialect variations. This language became, under the influence of the Koran, the standard language of all later Arabic literature, and its excessive richness led in time to the compilation of commentaries and lexicons.

In form and content the poems fall into two groups. On the one hand are the occasional poems, of from two to 20 lines, called out principally by the emotions of war or revenge. Praise of his own tribe and satire of its enemies were indeed the original functions of the primitive poet (*shā'ir, i.e.,* "kenner" or medicineman). An important place is taken by elegies, for which a number of poetesses, notably Khansā (*q.v.*), are specially famed. Distinct from these poems is the elaborate ode (*qaṣīda*) of from 60 to 100 lines. In this form there is a regular scheme, which is followed whatever the subject of the poem. In the opening verses (called the *nasīb*) the poet is supposed to be on a journey. He halts with his companions at a deserted camping-ground, whose mouldering traces recall the memory of an ancient passion, and tells of his love and the sorrow of parting. After this section he continues his journey and describes his camel or horse, comparing it to some wild animal of the desert. The natural descriptions or accounts of the chase introduced in this connection often form the most attractive part of the poem. His journey at last leads up to the occasion of the poem, which may be praise of his tribe or of his own gallantry, descriptions of camp or desert life (such as a storm), or most frequently panegyric of some patron in whose honour the poem has been composed, and from whom the poet expects a reward. It may well occasion surprise that a volume of poetry so uniform, so artistic within its limits, and of a metrical regularity rarely violated in spite of the complex metres, should have been produced by the poverty-stricken and predatory inhabitants of a barren country.

Transmission. — The oral transmission of these compositions over a period of from 150 to 250 years, or even longer, was carried out by a class of professional reciters (*rāwīs*), amongst whom many of the most famous poets were numbered. The powers of memory with which the reciters are credited are remarkable, but even on the most favourable view it must be allowed that the poems thus preserved were liable to suffer mutilations, omissions and transpositions. The divergences in the text of many ancient poems are very great, and frequently portions of different poems are found pieced together. Unfortunately several of the most famous rāwīs, especially two of those who first undertook the writing down of the early poems in the 8th century, Ḥammād ar-Riiwiya (*q.v.*) and Khalaf al-Aḥmar, are suspected of dealing in the most arbitrary manner with their material, and roundly declared to be clever forgers. On these and other grounds the authenticity of much so-called pre-Islamic poetry is open to serious question, and some scholars even reject the whole or all but a small portion outright."

Dīwāns.—The poems attributed to the early bards have come down to us in two kinds of collections. We have on the one hand many *dīwāns,* or collected poetical works, of individual poets, and in particular of all the principal bards, Amru'ul-Qais, Tarafa, Zuhair, Niibigha, 'Alqama, A'shā and Labīd (see under each separately, and below under *Mu'allaqāt*). In addition the *dīwāns* of several minor poets have been edited, Lyall's edition of 'Abid ibn Abraṣ (London, 1913) deserving special mention, and one tribal *dīwān,* that of the tribe Hudhail. Among the many poets of whom only a few pieces survive two robber-poets and outlaws, Ta'abbafa Sharrā and Shanfarā, are specially celebrated, and the poems attributed to them, whether genuine or not, breathe in magnificent language a courage and hardihood rarely if ever equalled in any literature. Along with the work of the desert poets some interesting relics have come down of a different class of poetry. The Christian 'Adi ibn Zaid, a townsman of Hira (*q.v.*), wrote wine-songs as well as graver verse. There were Jewish poets, of whom Samau'al ibn 'Ādiyā is the best-known. Controversy still rages over the religious poems attributed to Umayya ibn abi'ṣ-Ṣalṭ, which bear a remarkable resemblance to passages in the Koran, though Umayya rejected Mohammed's mission. Of the other poets conteniporary with the Prophet, the *dīwān* of Ḥassān ibn Thābit, Mohammed's "court-poet," is interesting from that circumstance, and a panegyric addressed to him by Ka'b ibn Zuhair (known from its opening words as *Bānat Su'ād*) is one of the most celebrated of Arabic qaṣīdas.

Anthologies. — The second category consists of collections or anthologies, of which three, the *Mu'allaqāt*, the *Ḥamāsa* and the *Mufaḍḍalīyāt,* are held in special favour.

Al-Mu'allaqāt is the title of a group of seven pre-Islamic odes. The name signifies "the suspended," the traditional explanation being that these poems were hung up by the Arabs in or on the Ka'ba at Mecca. But this legend must be entirely rejected, as a pure fabrication based on the name, which was taken in its literal sense. The selection of the seven poems is ascribed, with much probability, to Ḥammād ar-Rāwiya, in the 8th century A.D. His collection appears to have consisted of the same seven poems which are found in modern editions, composed respectively by Amru'ul-Qais, Tarafa, Zuhair, Labīd, 'Antara ibn Shaddād, 'Amr ibn Kulthiim, and Hiirith ibn Hilliza, to which later scholars appended three other poems, one each of Niibigha, A'shā, and 'Abid ibn Abraṣ. The lives of these ten poets were spread over a period of more than 100 years. The earliest was Amru'ul-Qais (*q.v.*), regarded by many as the most illustrious of Arabian poets. He was a scion of the royal house of the tribe Kinda, which lost its power in the year 529. 'Abid ibn Abraṣ was a contemporary of Amru'ul-Qais, and belonged to the enemies of Kinda, the Banii Asad. The Mu'allaqa of 'Amr hurls defiance at the king of Hira, 'Amr ibn Mundhir (554–568), who was afterwards slain by the poet. The same prince is addressed by Hiirith in his Mu'allaqa, and a few satirical verses directed against him by Tarafa have been preserved. The productive period of 'Antara, Zuhair and 'Alqama is probably to be placed in the end of the 6th century, which is certainly the date of Niibigha (*q.v.*). The poem of A'shā contains an allusion to the battle of Dhū Qār, in which a Persian force was defeated by the tribe Bakr between 604 and 610. Labīd (*q.v.*) is the only one of the ten who embraced Islam, though his *Mu'allaqa,* like almost all his other poetical works, belongs to the pagan period. The *Mu'allaqāt* represent almost every type of ancient Arabian poetry in its excellences and its weaknesses. In order rightly to appreciate them we must translate ourselves into the world of the Badawin and seek to realize the peculiar conditions of his life, together with the views and thoughts arising from these conditions. In the *Mu'allaqa* of Tarafa we are repelled by a long, anatomically exact description of his camel, but such a description had an extraordinary charm of its own in a society where every man was a perfect connoisseur on this subject. In the *Mu'allaqas* of 'Amr and Ḥārith we can read the haughty spirit of the powerful chieftains, boastfully celebrating the splendours of their tribe. The song of Zuhair contains the practical wisdom of a sober man of the world. The other poems are fairly typical examples of the customary qasida, and bring before us the various phases of Badawin life.

Al-Ḥamāsa is an anthology compiled by the poet Abū Tammām (*q.v.*) about 836 AD., from, it is said, the materials contained in the library of a citizen of Hamadhān. The collection is so called from the opening book, containing poems descriptive

[1] *See* Ahlwardt, *Bemerkungen über* die Aechtheit der *alten* Arabischen Gedichte (Greifswald 1872); Lyall, Introduction to the *Mufaḍḍalīyāt* (see below); Margoliouth in Journal of Royal Asiatic *Society,* July 1925, 417–449; and (in Arabic) Ṭāhā Husain, Fi'l-adab al-jāhilī (Cairo, 1927).

of constancy and valour in battle, patient endurance of calamity, steadfastness in seeking vengeance, manliness under reproach and temptation, all which qualities make up the attribute called by the Arabs *ḥamāsa*. It consists of ten books, containing in all 884 poems or fragments, divided as follow: (1) Gallantry (*Ḥamāsa*), 261 pieces; (2) Dirges, 169 pieces; (3) Manners, 54 pieces; (4) The Beauty and Love of Women (*Nasīb*), 139 pieces; (5) Satires, 80 pieces; (6) Hospitality and Panegyric, 143 pieces; (7) Miscellaneous Descriptions, 3 pieces; (8) Journeying and Drowsiness, 9 pieces; (9) Pleasantries, 38 pieces;, (10) Dispraise of Women, 18 pieces. The first two books together make up more than half the bulk of the work. The poems are for the most part fragments selected from longer pieces, though a number are probably entire. They are taken from the works of Arab poets of all periods down to that of Abii Tammām himself, but chiefly of the poets of the pre-Islamic time and of the 1st century of the Hijra (622–719). Many of the poems belong to the class of extempore or occasional utterances, as distinguished from qaṣīdas. While the latter abound with comparisons and long descriptions, in which the skill of the poet is exhibited with much art and ingenuity, the poems of the Hamisa are short, direct, and for the most part free from comparisons. It is due probably to the fact that Abii Tammām preferred this style of composition for his collection that he has chosen hardly anything from the works of the most famous poets. The fragments in the fourth book, however, are generally taken from the opening verses of qaṣīdas, or alternatively from the productions of the school of erotic poetry of the early Islamic period. The worth of the *Ḥamāsa* as a store-house of ancient legend, of faithful detail regarding the usages of the pagan time and early simplicity of the Arab race, can hardly be exaggerated. The high level of excellence which is found in its selections, both as to form and matter, is remarkable, and caused it to be said that Abii Tammām displayed higher qualities as a poet in his choice of extracts than in his own compositions. What strikes us chiefly is its exceeding truth and reality, its freedom from artificiality, the evident first-hand experience which the singers possessed of all which they sang. It has the true stamp of the heroic time, of its cruelty and wantonness as of its strength and beauty.

When "the *Ḥamāsa*" is spoken of, that of Abii Tammām, as the first and most famous of the name, is meant, but several collections of a similar kind, also called *Ḥamāsa,* exist, the best-known of which is the *Ḥamāsa* of Buhturi (*q.v.*).

The *Mufaḍḍalīyāt* is an anthology of poems named after Mufaddal ibn Ya'lā, of the tribe Dabba, who compiled it for the instruction of the future caliph Mahdi, between 762 and 784. It has recently been edited and translated by Lyall (Oxford, 1921). Mufaddal was a careful and trustworthy collector both of texts and traditions, and is praised by all authorities on Arabian history and literature as in this respect greatly the superior of Ḥammād and Khalaf. The collection, which in its present form contains 126 pieces of verse, long and short, is of the highest importance as a record of the thought and poetic art of Arabia in the time immediately preceding the rise of Islam. Almost all the poets represented belong to the days of "the Ignorance," and though a certain number of those born in paganism accepted Islam, their work bears few marks of the new faith. The ancient virtues — hospitality to the guest and the poor, profuse expenditure of wealth, valour in battle, faithfulness to the cause of the tribe — are the theme of praise; wine and games of chance, forbidden by Islam, are celebrated by poets who professed themselves converts; and if there is no mention of the old idolatry, there is also little spirituality in the outlook on life. The 126 pieces are distributed between 68 poets, and the work represents a gathering from the compositions of those who were called *muqillūn* "those of whom little has survived," in contrast to the famous poets whose works had been collected into *dīwāns*. At the same time many of them are extremely celebrated, and among the pieces selected by Mufaddal several reach a very high level of excellence. A remarkable feature of the work is the insertion of ten pieces by Muraqqish the Elder, a poet who is assigned to the end of the 5th century A.D. It is probable that the compiler set down all that he could gather of this ancient bard, and that his interest in him was chiefly due to his antiquity. The *Mufaḍḍalīyāt* differs from the *Ḥamāsa* in being a collection of complete odes, while the latter is an anthology of brilliant passages, selected for their interest or effectiveness. It is, of course, not the case that all the poems are complete; many are mere fragments, and even in the longest there are often gaps, but Mufaddal evidently set down all that he could collect of a poem, and did not, like Abii Tammām, pick out only the best portions. We are thus presented with a view of the literature of the age which is much more characteristic and comprehensive than that given in the *Ḥamāsa* and enables us to form a better judgment of the general level of poetic achievement.

In addition to these anthologies, numerous excerpts are contained in the works of later compilers, notably the Book *of* Poetry and Poets of Ibn Qutaiba (*q.v.*), the *'Iqd al-Farīd* of Ibn 'Abd Rabbihi (*q.v.*), and the greatest work of this kind, the *Kitāb al-Aghānī* ("Book of Songs") of Abu'l-Faraj (*q.v.*).

(C. J. L.; TH. N.; H. A. R. G.)

POST-ISLAMIC POETRY

Umayyad Period. — During the 1st century after Mohammed there was little change in the general character of Arabic poetry. The four outstanding poets were Akhṭal (*q.v.*), Farazdaq (q v.), Jarir (*q.v.*), and Dhu'r-Rumma (ed. Macartney, Oxford, 1919). In the work of the last-named it is already obvious that the qaṣīda is becoming a stereotyped and archaic exercise. In the partisan feuds which still rent, though on a wider scale, the Arab world, both major and minor poets carried on the traditions of tribal panegyric and satire. Yet at the same time, the new conditions of city life, both in the conquered lands and in the now metropolitan cities of Arabia, brought about a change in Arab manners and pursuits, which led to the rise of new modes in poetry. The love-lyric was established as an independent art by 'Omar ibn Abi Rabi'a of Mecca and his fellow-countryman Jamil. Simultaneously a sort of Platonic love became the theme of several poetic romances associated with the tribe of Udhra, and attributed to various poets and poetesses, of whom the most famous are Majnūn Bani 'Amir and Lailā. The poems of the Caliphs Yazīd I. (680–683) and Walid II. (743–744) were the precursors of the wine-songs and hunting-poems of the next period. An attempt to remodel the qaṣīda in the freest of Arabic metres, the iambic *rajaz,* was made by 'Ajjāj and his son Ru'ba. Although the experiment failed, the *rajaz* metre was retained for impromptus and long descriptive poems.

'Abbāsid Period. — While it is still an open question how far Persian influences contributed to these developments, there can be no doubt that the Persian atmosphere of the court of Baghdad after the establishment of the 'Abbasid caliphs in 750 strongly favoured the new tendencies, which reached their apogee in Abii Nuwās (*q.v.*) and a brilliant company of poets contemporary with him. Henceforward Arabic poetry flows in a number of channels. The exponents of the classical tradition, such as Buḥturi (*q.v.*), continued to imitate the subjects, mannerisms, and metres of the old desert poetry, with but one modification, the substitution for the old imaginative phrases of rhetorical tropes (*badi'*), a fashion set by Muslim ibn Walīd (d. 803), followed by Abii Tammiim, and carried to the verge of excess by Mutannabi. On the other hand the school of Abii Nuwās used metres with much greater freedom and excelled in anacreontic and occasional verse. Even for this later period the text or authenticity of many poems is far from certain. The only dīwān hitherto published in a critical edition is that of a comparatively unimportant poet, al-Wa'wā of Damascus (d. 988; ed. Kratchkowsky, Petrograd (Leningrad), 1914, with a valuable introduction on the poetic art of the post-Islamic period). Generally speaking, the poets sought less after depth and originality than elegance in expression and brilliance in metaphor, and the polished and delicate productions of the later writers, such as Baha ad-Din Zuhair (d. 1258), recall in some measure English 17th century and Augustan verse. Nevertheless there were some who struck out new paths; Abu'l-'Atāhiya (d. 828), whose moralizing verse is

expressed in unaffected popular language; Ibn al-Mu'tazz (d. 869), the author of a long historical poem and of other brilliant and original verse; Abu-l-'Ala al-Ma'arri (*q.v.*), in whose *Luzūmiyyāt* Arabic poetry touches its deepest human note; and the mystical poets Ibn 'Arabi (*q.v.*) and Ibn Fāriḍ (*q.v.*).

Western Poetry. — In Spain and the West, Arabic poetry at first continued along traditional lines, represented by Ibn Hāni of Seville (d. 973). In the following century Ibn Rashiq of Qayrawiin (d. 1070), Ibn Zaydūn of Cordova (d. 1071), Mu'tamid, king of Seville (d. 1095) and his wazir Ibn 'Ammār (d. 1078), with whom was associated also the most famous of the Arab poets of Sicily, Ibn Hamdis, were the principal among a galaxy of poets who released themselves from the old conventions, and made their verse a vehicle of self-expression. A still greater breach with tradition was the rise of strophic verse, which the stronger conservative influences had hitherto succeeded in repressing in the East. In Spain strophic verse took the form called muwashshah ("the girdled"), marked by internal rhymes with a rhyming refrain. Though it was practically confined to erotic verse, it made great strides; on the one hand it exercised a strong influence on the nascent Provençal poetry, while in the other direction it reached Egypt at the end of the 12th century and rapidly took root there. Several other popular forms of strophic verse were invented about the same time or shortly after, of which one, the *zajal,* in the colloquial language, was raised to literary rank by the troubadour Ibn Quzmān (d. 1160).[1]

The number of anthologies of the later poetry is very large. Many were devoted to special genres, especially wine-songs; amongst those of more general scope the most noteworthy are the Yatimat ad-Dahr of Tha'ālibī (*q.v.*); the *Qalā'id al-Iqyān* of Fath b. Khāqān (d. 1134), a brilliant anthology of Spanish-Arabic verse; and the *Khizānat* al-Adab of 'Abd al-Qiidir of Baghdad (d. 1682), professedly a commentary on the verses cited in an earlier work on grammar.

BELLES-LETTRES

The growing refinement of social life in the 8th and 9th centuries is reflected in the rise of a prose literature intended to entertain the reading public, supply the elements of polite education (adab), and convey moral instruction in a palatable form. The earliest books of this class were the translations by Ibn Muqaffa' (d. 760) of two old Persian works on manners, and of the Fables of Bidpai (*q.v.*), under the name of Kalila wa-Dimna. The last work has ever since been regarded as a classic. The development of the essay, a medley of citations and reminiscences from poetry, history, traditions, etc., was due to the genius of Jāḥiz (*q.v.*). Its contents were more systematically organized by Ibn Qutaiba (*q.v.*), especially in his *'Uyūn al-Akhbār,* which was the model for the most famous work of its kind, the 'Iqd *al-Farīd* of Ibn 'Abd Rabbihi (*q.v.*), of Cordova. In the following century the Faraj ba'd ash-Shidda and *Nishwār al-Muhāḍara* of Taniikhi (d. 994; latter ed. Margoliouth, London, 1921) mark the growing predominance of the anecdote. Of the numerous later works of this class the most famous is the *Mustaṭraf* of Abshihi (d. 1446).

With the introduction of rhyming prose (*saj'*) Arabic belles-lettres reached their most characteristic form. The credit for this step is given to Abii Bakr Khwiirizmi (d. 1002), whose Letters in this style set a fashion followed amongst others by Hamadhiini (*q.v.*) and Abu'l-'Alā. Hamadhiini was also the creator of the *Maqāma* or "Assembly," than which probably no more elaborate literary exercise has ever been conceived. The central figure of the *Maqāmāt* is always a witty vagabond, who in various assemblies of scholars puts all his rivals to shame by his wit, eloquence, scholarship and poetic gift. The most famous *Maqāmāt* are those of Hariri (*q.v.*).

The last class of works which may be included under this heading are the popular romances and story-cycles which found their way from the most diverse sources into Arabic literature. Of these works of entertainment the most familiar are the *Thousand and* one Nights (*q.v.*; see also SINDBAD **THE** SAILOR), and a collection of fables related to those of Aesop and ascribed to Luqmān (*q.v.*). The historical romances are dealt with in the following section. (H. A. R. G.)

[1] On Ibn Quzmān and the relations between Arabic and Provençal poetry see Ribera, *Discurso leido* ante la Real Academia *Española* (Madrid, 1912).

HISTORY AND BIOGRAPHY

Historical Composition. — The earlv Arabic historians differ from all others in the unique form of their compositions. Each event is related in the words of eye-witnesses or contemporaries, transmitted to the final narrator through a chain of intermediate reporters, each of whom passed on the original report to his successor. Often the same account is given in two or more slightly divergent forms, which have come down through different chains of reporters. Often, too, one event or one important detail is told in several ways on the basis of several contemporary statements transmitted to the final narrator through distinct lines of tradition. The writer, therefore, exercises no independent criticism except as regards the choice of authorities, and sometimes he states which of several accounts seems to him the best. A second type is that in which an author combines the different traditions into one continuous narrative, but prefixes a statement as to the lines of authorities used or followed. In this case the writer recurs to the first method, already described, only when the different traditions are greatly at variance with one another. In yet a third type of history the old method is entirely forsaken, and we have a continuous narrative only occasionally interrupted by a citation of the authority for some particular point. But the principle still is that what has been well said once need not be told again in other words. The writer, therefore, keeps as close as he can to the letter of his sources, so that quite a late writer often reproduces the very words of the first narrator.

The appearance of the Prophet with the great changes that ensued, the conquests that made the Arabs lords of half the civilized world, supplied a vast store of new matter for relations. Thus it came about that at Madina, where the Prophet had lived so long, and where his first successors and the majority of his companions continued to live, a school was gradually formed, where the chief part of the traditions about Mohammed and the rise of Islam took a form more or less fixed, supplemented by the traditions of various provincial schools. Thus by the end of the 1st century of Islam many dictata were already in circulation.

Early Compilations. — In the and century (719–816) real books began to be composed. The materials were supplied in the first place by oral tradition, in the second by the dictata of older scholars, and finally by various kinds of documents, such as treaties, letters, collections of poetry, and genealogical lists. The oldest extant history is the biography of the Prophet by Ibn Isḥāq (*q.v.*), at least in the revision of Ibn Hishām (*q.v.*). This work is generally trustworthy, though in dealing with Mohammed's early life and the story of his ancestors it is mixed with tables and illustrated by spurious verses. A second life of the Prophet, by Ibn 'Oqba (d. 758), exists only in fragments. We fortunately possess the Book of ***the*** Campaigns of the Prophet by Wāqidī (*q.v.*) and the important Book of Classes of his disciple Ibn Sa'd (*q.v.*). Wāqidī had much more copious materials than Ibn Isḥāq, and though he gives way much more to a popular and sometimes romancing style of treatment, the additional details he supplies set various events before us in a clearer light. The monographs of Abū Mikhnaf (d. 748) and Madā'inī (d. 840) are known only by excerpts contained in the works of later writers. A just estimate of the relative value of the historians can only be reached by careful comparison in detail. This has been essayed by Briinnow in his study on the Kharijites in which the conclusion is reached that Abii Mikhnaf and Madā'inī are both well-informed and impartial. Of the other early sources, the narratives of Sayf b. Omar have been thoroughly examined by Wellhausen, and found to be inferior in accuracy. Along with these should be mentioned Abii 'Ubaida (*q.v.*), and Azraqi, whose excellent History of Mecca was the first of many histories of the Holy cities. A further important point to notice

in the 2nd century is that in it Persians began to take part in the creation of Arabic historical literature. Ibn Muqaffa' translated the great Book of *Persian* Kings, and others followed his example. Tabari and his conremporaries preserve to us a good deal of the information about Persian history transmitted through such translations.

General Histories. — The 3rd cenlury (816–913) was far more productive than the 2nd in general works, in addition to monographs and works on special branches by various authors. Ya'qūbī (*q.v.*) wrote a short general history of much value and Ibn Qutaiba (*q.v*) a useful *Handbook* of History. Both are surpassed by Balādhurī, the author of a valuable narrative of *The Arab* Conquests and a large genealogical history of the Arabs. All these histories are more or less thrown into the shade by the great *Annals* of Tabari (*q.v.*), whose fame has never faded from his own day to ours. As a literary composition they do not rank very high, nevertheless the value of the book is very great. The author's selection of traditions is usually happy, and the most important episodes are treated with most fulness of detail. The Annals soon came to be dealt with in various ways. They were published in shorter form, with the omission of names of authorities and many poetical citations; on the other hand some interpolations were made, one in the author's lifetime and perhaps by his own hand, and many later writers added supplements. Miskawayh (or Ibn Miskawayh, d. 1030), the first writer to compose a general history as an organic structure with the aim of displaying its human and instructive aspects, drew almost entirely on Tabari down to 907; the two final volumes (Amedroz and Margoliouth, Eclipse of the Abbasid *Caliphate,* Oxford. 1920–21) contain original material and show him to be a writer of talent. In 963 an abridgement of the Annals was translated into Persian by Bal'amī, who, however, interwove many fables. Ibn Athir (*q.v.*) abridged the whole work, usually with judgment, but sometimes too hastily. Many other writers also took Tabari as their main authority, but sometimes consulted other sources and so add to our knowledge, notably Ibn Jawzi (d. 1201), who adds many important details. In later times Ibn Athir's abridgement supplanted the original work as a source, *e.g.,* in the works of Abu'l-Fedā (*q.v.*) and Ibn 'Amid (al-Makīn; see ELMACIN).

Later Works. — The number of historical and biographical works composed in the later centuries is very large. The most important writers, Mas'ūdī, Bīrūnī, Ibn Athir, Abu'l-Faraj (see BAR-HEBRAEUS), Ibn Khaldiin, Maqrizi, Suyūṭī, Maqqari, and Hajii Khalifa, are the subjects of special articles. Of other works several are worthy of special mention. The Annals of Eutychius (d. 940; ed. Cheikho, Paris, 1906) are important as representing the Christian tradition. The Book of *Wazirs* of Hilāl aṣ-Ṣābi' (d. 1056; ed. Amedroz, Beyrouth, 1904) is a mine of information for the social life of the 9th and 10th centuries. The history of Mahmud of Ghazna (*Kitāb al-Yamīnī*) of 'Utbi (d. 1036) set the fashion of rhetorical composition in history, which was followed by 'Imād ad-Din (d. 1201) in his histories of Saladin and of the Saljuq dynasty, and was carried to excess in the History of Tamerlane of Ibn 'Arabshāh (d. 1450). The later compilers could also draw on numerous local and dynastic histories, many of which are now lost. In most cases these works are of purely technical interest, being either bare statements of facts in chronological order, or else designed to glorify the dynasty and oozing adulation from every page. Full, scientific, and impartial accounts, such as was given (over a somewhat wider field) by 'Abd al-Latif (*q.v.*) in his Description of Egypt, are rare. Not all local histories, however, dealt with political events; some were more concerned with local theologians, scholars and saints. Of this class the most important surviving work is the still unedited History of Damascus of Ibn 'Asākir (d. 1176), a vast compilation in 30 volumes, in which history crosses the borderline into biography. Of the great biographical dictionaries proper, one, the famous work of Ibn Khallikān (*q.v.*), has already gained a reputation outside the Arabic world, but there are many others which scarcely yield to his in interest. Amongst these are the newly-recovered Dictionary of Men of Letters of Yāqūt (*q.v.*); the Lives of the Physicians of Ibn abi Usaibi'a (see IBN USAIBI'A); the History of the Philologists of Ibn Qifti (d. 1248); a number of early Spanish-Arabic biographies; the vast dictionary of Safadi (d. 1363), still scattered in loose volumes through half the libraries of Europe and the East; not to speak of numerous dictionaries of the early heroes of Islam, of students of tradition, of theologians and jurists of the various rites, and many other classes and groups. The value of these works is that they present to us, as the history-books seldom do, authentic portraits of the lives of the people, and extort our admiration for the many generations of teachers and scholars that patiently knitted up the threads of culture, again and again shattered by war, rapine and pestilence that bound the Mohammedan world together from Morocco to the Indies.

The 14th and 15th centuries are remarkable for the appearance of encyclopaedic compends, intended as handbooks for the official classes. The two earliest, the Encyclopaedia of Nuwayri (d. 1332) and the *Masālik al-Abṣār* of Ibn Faḍlallāh (d. 1348), are in course of publication at Cairo, a later work, the *Ṣubḥ al-A'shā* of Qalqashandi (d. 1418) having already been printed there in 14 large volumes (1913–19). Though the writing of memoirs and of historical compendiums (generally beginning with the Creation) continued during the following centuries, few works outside those of the writers already mentioned attained any note, until the publication of the History of Egypt and the Diary of Jabarti (Gabarti, d. 1825), who may be regarded as the last (and not the least worthy) representative of the old school of Arabic historiography.

Historical Romances — A word must be said of the historical romances, the beginnings of which go back to the first centuries of Islam. The veneration paid to the Prophet and love for the marvellous soon gave rise to fables about his childhood, his visit to heaven, etc., which, with many Jewish legends, and the Yemenite fables circulated by 'Abid ibn Sharya in the 1st century, have found their way even into sober histories. Romantic legends clustered round the history of the conquests, and the fortunes of 'Alī and his house, and history was often forged for party ends. The people accepted all this, and so a romantic tradition sprang up with a literature of its own. In the oldest specimens, such as the Conquest of Egypt and the *West* by Ibn 'Abd al-Hakam (d. 871; ed. Torrey, Yale univ., 1922), truth and falsehood are mixed. Most of the extant literature of this kind is, in its present form much more recent, *e.g.,* the *Story* of the Death of Husayn by the pseudo-Abti Mikhnaf and the *Conquest* of *Syria* (see WĀQIDĪ). Further enquiry into the origin of these works is needed, but some of them were plainly directed to stirring up fresh zeal against the Christians. In the 6th century A.H. some of these books had gained so much authority that they were used as sources, and thus many untruths crept into accepted history.

Distinct from these are the popular romances, which have never been taken for serious history. The most famous are the Story of *'Antar,* a romance of Arabian desert life (see under 'ANTARAH IBN SHADDAD); the *Story* of *Sayf* ibn Dhi *Yazan,* centred on Yemen and Abyssinia; and the *Story* of the *Banī Hilāl,* one of the Arab tribes which took possession of the Libyan desert in the 11th century. (M. J. DE G.; H.A.R.G.)

TECHNICAL AND SCIENTIFIC LITERATURE

Geography and Travel. — Arabic geographical literature was stimulated in the first place by Greek mathematical geography and the necessities of administration. The first road-book was written in the 9th century by Ibn Khūrdādhbih, the royal postmaster at Sāmarrā, to give particulars of the provinces and their revenues. Soon afterwards love of travel and intellectual curiosity produced a valuable series of descriptive works, of which those of Ya'qūbī (*q.v.*), Ibn Hauqal (*q.v.*), Mas'ūdī (*q.v.*), and Maqdisi (Mokaddasi) are the most famous. While these early writers prided themselves that their knowledge was derived from personal investigations, their successors, Bakri (*q.v.*), Idrisi (*q.v.*), Yāqūt (*q.v.*), and Abu'l-Fedā (*q.v.*), nevertheless contrived to compile excellent geographical treatises based almost entirely on written and narrative sources. There are also accounts of embassies and journeys both into Central Europe and the remoter parts of

Asia. Ibn Jubair of Valencia wrote an admirable journal of his travels to and from Mecca by way of Syria and Egypt in 1181–84. In the 14th century Ibn Baṭṭūṭa (*q.v.*) earned the title of "The Traveller of the Arabs" by his extensive journeys. The commercial relations long existing between the Persian Gulf and India and the Far East produced several exceedingly interesting works on those countries, notably the Chain of Histories and Marvels of *India,* besides manuals of navigation in prose and verse. In the 10th century some Spanish-Arab sailors even set out from Lisbon to cross the Atlantic. In later times geography shared the general decline, and, except for the geographical sections of the great encyclopaedias mentioned in the preceding section, was merged into cosmography. The works of the earlier cosmographers, Qazwini (d. 1283) and Dimishqi (d. 1327), are not indeed without interest and importance, but with the economic ruin of the Arabic world all study of geography ceased. (See further under GEOGRAPHY.)

Philology.— The beginnings of the study of Arabic grammar can be traced to 'Iraq early in the 8th century, where the two cities of Baṣra and Kiifa produced rival schools of philology, a third being afterwards established in Baghdad (see Fliigel, *Die grammatischen Schulen* der Araber, Leipzig, 1862). The earliest systematic treatise on grammar was written by Sibawaihi of Basra, and among the other members of this school were Abū 'Ubaida (*q.v.*), Asma'i (*q.v.*), Mubarrad, and Ibn Duraid (*q.v.*). The rival school of Kūfa claimed to be less antiquarian, but exercised less influence. The principal founder of the school of Baghdad was Ibn Qutaiba (*q.v.*). The most important services rendered by the older philologists were the collection of the old poetry and of materials for lexicography. On their shoulders stood the later systematizers, such as Jauhari (*q.v.*), Tha'ālibī (*q.v.*), Jurjānī (*q.v.*), Zamakhshari, Sakkākī (d. 12 29), author of the standard text-book on rhetoric, and Ibn Malik (d. 1273), who wrote a celebrated metrical summary of grammar in a thousand lines.

The great Arabic dictionaries are of late date; the two most esteemed are the *Lisān* al-'Arab of Ibn Manẓūr (d. 1311) and the commentary called *Tāj al-'Arūs* by Murtaḍā Zabidi (d. 1790) on the *Qāmūs* of Fairūzābādī (*q.v.*).

Philosophy and Science.—Arabic philosophical and scientific studies are dealt with elsewhere (see ARABIAN PHILOSOPHY and historical sections of ASTRONOMY, CHEMISTRY, MATHEMATICS, MEDICINE, etc.; a general survey is given by G. Sarton, *Introduction* to the history of Science, vol. i., Washington, 1927). All such studies came to the Arabs through Syriac translations from Greek, supplemented by Indian and possibly Persian influences, and were confined to comparatively small circles of students.

MODERN LITERATURE

While the writing of books and composition of poetry continued in Egypt and Syria, and sporadically elsewhere, throughout the 17th and 18th centuries, little of originality or value was produced. During the 19th century the new political, social, economic and intellectual movements resulting from contact with Europe prepared the way for a revival of Arabic letters, particularly in Syria and Egypt. This took on the one hand the form of a throw-back to Classical Arabic models, represented in Syria by Nāṣīf Yāzijī (1800–71), the author of *Maqāmāt* on the model of Hariri, and in Egypt by the activities of the orthodox theological seminary of al-Azhar. On the other hand the influences exerted by the missionary schools in Lebanon, and the Western sympathies of Mohammed 'Ali (*q.v.*) and Ismā'īl Pāshā (*q.v.*) led to a rapid and superficial assimilation of Western ideas, fostered by the translation of large numbers of French works, especially scientific works, novels and plays. The westernizing movement was strengthened by the creation, in the last decades of the century, of an Arabic daily press (see EGYPT: *Modern* History: Literature), which has contributed to the evolution of a new and more flexible literary style, and also of an Arabic theatre. While the modernist school has been represented by many influential writers in the East, its advanced wing is formed by the recent group of Syro-American writers belonging to the large Lebanese communities now settled in the United States, Brazil and elsewhere in the New World. In Egypt a movement of reconciliation between the two schools, initiated by Shaykh Mohammed 'Abduh (d. 1905) had much success, but in default of a leader to succeed him has itself broken into a conservative and a modernist wing. The present situation is therefore on the whole less productive than concerned with clearing the ground for new foundations. The effects of this instability and hesitation are most marked in the work of the leading modern poets. In subject and content Western influences tend to predominate, but the style and conventions remain for the most part those of the classical age. Nevertheless the many experiments now being made in Egypt and also in the Lebanon, where the modernist movement is triumphant, give abundant evidence of vitality. In Damascus and 'Iraq, the traditional disciplines have only within the last few years been challenged by Western influences, either directly, or mediated through Egypt and the Lebanon.

BIBLIOGRAPHY.--There is no complete history of Arabic literature. An exhaustive bio-bibliographical survey is given by C. Brockelmann, Geschichte der arab. *Litteratur* (Reimar, 1898–1902). R. A. Nicholson, A Literary History of the Arabs (1907, etc.,) is the best general work on the subject. It is full and reliable, and contains a classified bibliography of general works. A list of translations is contained in an appendix to Arabic Literature, An Introduction, by H. A. R. Gibb (Oxford, 1926). More elaborate biographical and bibliographical data will be found in the Encyclopaedia of Islam (Leyden, 1913, proceeding), and a large number of literary sketches in Carra de Vaux's Les *Penseurs* de *l'Islam* (1921–26). For 19th-century writers see article by H. A. R. Gibb in *Bulletin of* the School of *Oriental* Studies, vol. iv., part 4 (London, 1928). (H. A. R. G.)

ARABIN: see ARABIC ACID.

ARABI PASHA (1839?–1911), more correctly AHMAD 'ARĀBĪ, to which in later years he added the epithet *al-Miṣrī,* "the Egyptian," Egyptian soldier and revolutionary leader, was born in Lower Egypt in 1839 or 1840 of a fellah family and entered the army as a conscript. Said Pasha gave him a commission in 1862, and he served in the Abyssinian campaign of 1875 under Ismail Pasha. A charge of peculation, unproved, was made against him in connection with this expedition and he was placed on half-pay. He joined a secret society formed by Ali Rubi with the object of getting rid of Turkish officers in the Egyptian army. In 1878 he was employed by Ismail to foment a disturbance against the ministry of Nubar, Rivers Wilson, and de Blignières, and received in payment a wife from Ismail's harem and the command of a regiment. In the agitation against the government of Tewfik Pasha, Arabi was put forward as the leader of the discontented Egyptians; he was in reality little more than the mouthpiece and puppet of abler men such as Ali Rubi and Mahmud Sami. On Feb. 1. 1881., Arabi and two other Egyptian colonels, summoned before a court-martial for acts of disobedience, were rescued by their soldiers, and the khedive was forced to dismiss his. then minister of war in favour of Mahmud Sami. A military demonstration on Sept. 8, 1881, led by Arabi, forced the khedive to increase the numbers and pay of the army, to substitute Sherif Pasha for Riaz Pasha as prime minister, and to convene an assembly of notables. Arabi became under-secretary for war at the beginning of 1882. Sherif fell in Feb., Mahmud Sami became prime minister, and Arabi (created a pasha) minister of war. Arabi, after a brief fall from office, acquired a dictatorial power that alarmed the British Government. British and French warships went to Alexandria at the beginning of June; on the 11th of that month rioting in that city led to the sacrifice of many European lives. Order could only be restored through the intervention of Arabi, who adopted a more distinctly anti-European attitude. His arming of the forts at Alexandria was held to constitute a menace to the British fleet. On the refusal of France to co-operate the British fleet bombarded the forts (July 11) and a British force, under Sir Garnet Wolseley, defeated Arabi on Sept. 11, at Tel-el-Kebir. Arabi fled to Cairo where he surrendered and was tried (Dec. 3) for rebellion. In accordance with an understanding made with the British representative, Lord Dufferin, Arabi pleaded guilty, and sentence of death was imme-

diately commuted to one of banishment for life to Ceylon. The same sentence was passed on Mahmud Sami and others. After Arabi's exile had lasted for nearly 20 years, however, the khedive Abbas II. exercised his prerogative of mercy, and in May 1901 Arabi was permitted to return to Egypt. He died at Cairo on Sept. 21, 1911. Arabi, as has been said, was rather the figure-head than the inspirer of the movement of 1881–82 and was probably more honest, as he was certainly less intelligent, than those whose tool, in a large measure, he was. The movement which he represented in the eye of Europe, whatever the motives of its leaders, "was in its essence a genuine revolt against misgovernment" (Lord Cromer in Egypt, No. 1, 1905, p. 2), and it was a dim recognition of this fact which led Arabi to style himself "the Egyptian."

See EGYPT: ***History;*** also Lord Cromer's ***Modern Egypt*** (1908).

ARABISTAN, Persia: *see* KHUZISTAN.

ARABLE. The social movements of the age, especially the later developments of the industrial revolution in Britain, have given a peculiar emphasis to the word arable and the condition it describes. For purposes of agriculture the "land" is commonly divided in British official statistics into grass land and arable land, or soil that is left continuously undisturbed and soil that is at intervals ploughed or otherwise cultivated. But the two are not so easy to distinguish, either by the casual observer or the statistician, as they once were. The practice of sowing "leys" is now very common. "Seeds," as they are generally known among farmers, are sown on the arable land along with or rather later than the cereal crop, and when the corn is cut, giving place to sown mixtures of grass or clover, the field may assume very nearly the appearance of a meadow; and may never return to tillage.

In the period of depression of British farming that began in 1920 many farmers sowed "seeds" in order to watch events. If times continued bad, the "leys" would be allowed to remain for the maximum period and thereafter in the worse cases degenerate into grass. If, on the other hand, prosperity returned they would be ploughed up. But the general distinction holds. Arable land is usyally ploughed, or otherwise stirred once a year, but it is still classed as arable, if the intention is to use the plough again, as soon as the "seeds" have served their purpose. It is becoming a custom therefore in official statistics to divide the arable area in a country into two main groups: the land actually ploughed in any one year and the acreage carrying clover and sown rotation grasses.

Proportion of Tillage. — The proportion of tilled land at various junctures has changed more abruptly in Britain than in any other country of which authentic accounts exist. One of the most remarkable facts in Domesday Book is the great amount of arable land recorded at that date in many English counties. At its publication in 1086 the plough was a very simple machine — with a short handle and a big wheel — and the sods were broken with a mattock, the harrowing done with a large rake. Nevertheless, the arable area in general was much bigger at the end of the 11th century than at the beginning of the 19th. The most remarkable figures relate to Somerset and Gloucester. In Somerset the tilled area had reached 577,000 acres in 1086, and 238,456 in 1907. The end of the period of abundant tillage may be dated from 1348, the year of the Black Death. But other causes were at work, as well as pestilence. We know that meadow land was much more valuable than arable long before the plague, being rented on the average at 2s. as compared with 6d. for ploughed land. The relapse of arable to grass in the 14th century was not made good. The doggerel maxim "Up horn, down corn" was popular at a later age, and Tudor husbandmen in all parts of the country "substituted pasture for tillage, sheep for corn. They took their seats on the woolsack, and maidens of all degrees were spinsters." When mutton became more important than wool towards the close of the 18th century, farming improved, but there was no general break-up of the sheepwalk. The modern Danish proof that arable will carry more stock than grass land was not yet appreciated. In subsequent history the proportion of arable to pasture has oscillated this way and that, in rough relation to the price of wheat (which touched its highest points in 1855 and 1921). But the loss of arable has been continuous in Great Britain in modern times since the disastrous harvest of 1879. The weather of that year was the occasion for an acceleration of a change due to more lasting causes, such as cheaper transport and the ploughing of virgin land overseas, in North America, in the Argentine, in Australia and in other places.

Decline of British Arable. — Taking the single years 1871 and 1921 the arable area of Britain declined by about 4,300,000 acres, from 14,950,000 to 10,680,000; and the proportion of arable from 56·8% to 41·5%. If only the cultivated area is taken (excluding rough grazing) about one-third is ploughed annually and two-thirds are either permanent grass or rotation grasses. In regard to the proportion of arable in England the country may be roughly divided into three groups. The eastern counties from the Thames to Flamborough Head are markedly arable. The south-eastern counties of Kent, Sussex, Surrey, Hants and Berks, with Oxford and Worcestershire, occupy a middle place, and all western counties, with Northumberland, Durham and the West Riding are chiefly grass.

While the proportion of arable land to grass decreased in Britain it was notably augmented in many countries of a very different nature. When Danish farmers began to surrender corn-growing for dairying, they often increased the ratio of arable land, plus lucerne or some such cultivated green crop. They grew gramineous crops for fodder instead of grain for food, and diminished the permanent grass to a minimum.

The most salient extension of arable land in the world is to the credit of the so-called prairie provinces of Canada; and a like development continues to progress in Australia. A good example of the purposeful extension of the corn area is to be seen in the south of Western Australia. The Canadian figures are very remarkable. There were only a half million acres under wheat in 1871. Then the discovery of a wheat that would ripen in the north and endure the climate sent the ploughs to the far north, and the arable area for growing wheat alone had increased in 1926 to 23,000,000 acres, with prospects of yet greater extension.

While the arable area in northern Canada has been increased, thanks chiefly to the "creation" of new varieties of grain, many of the hot, dry lands of the south of the United States have come under cultivation thanks to the art of "dry farming," or so treating the surface by repeated but shallow tillage that the moisture cannot escape by capillary attraction. (W. B. T.)

(See AGRICULTURE and AGRICULTURAL STATISTICS.)

ARABS. The term Arab as used in the Sudan signifies any people professing Islam, however dark-skinned they may be, so that while the term has an obvious cultural value it is strictly speaking of little ethnic significance. But in a broad sense the word may be taken to denote a congeries of tribes claiming, even if they have it not, a predominantly Caucasian ancestry, boasting a particular historic tradition, and speaking a Semitic language. In this sense, in contrast with the older stocks of the Sudan, the Arabs are comparatively new comers. In spite of an early slow infiltration via the Abyssinian hills and spasmodic driftings towards the Nile Valley from Mediterranean lands, it seems certain that the Arabs did not exert any considerable influence in the northern Sudan before the decay of the Christian kingdoms of Dongola and 'Alwah after the 13th century. There seem to have been only two great movements into the Sudan, the first taking place in the 13th and 14th centuries as the result of the conquest of the Christian Kingdom of Dongola, the second following the Turkish conquest of Egypt in the 16th century. This seems to be the view taken by MacMichael, but before his work appeared J. W. Crowfoot, using material published (in Arabic) by Naum Bey Shoucair, had pointed out the influence exerted in the Arabization of the Sudan by the Fung, who appear in history as a horde of blacks under a leader tracing his ancestry to the Beni Ommayya. Makrizi (1366–1442) shows how completely at an earlier date the kingdoms of Dongola and 'Alwah barred the way to Arab penetration up the Nile valley, but there was no precise knowledge of the factors that led to the downfall of this barrier until the publication by MacMichael of a hitherto untranslated

passage in Makrizi referring to the Guhayna, who, in the pre-Islamic period occupied Nejd and the neighbourhood of Medina, where a section dwells to this day. Many migrated to Egypt, taking part in the conquest. They reached Aswan by the ninth century, and by the fourteenth century had penetrated far into Nubia. "At first the kings of the Nuba attempted to repulse them, but they failed; then they won them over by giving them their daughters in marriage. Thus was their Kingdom disintegrated, and it passed to certain of the sons of the Guhayna on account of their mothers, according to the custom of the infidels as to the succession of the sister or the sister's son. So their Kingdom fell to pieces, and the A'rab of Guhayna took possession of it. But their rule showed none of the marks of statesmanship . . . they remain nomads following the rainfall like the A'rab of Arabia."

This dual policy of following the rainfall and of intermarriage led to the rapid spread of those mixed stocks all now calling themselves Arab, though this process was for some time confined to the country north of the confluence of the two Niles and the Arabization of the Central Sudan was in great part a result of the conversion to Islam of the Fung, who, assisted by Arab immigrants, did much to overthrow the Kingdom of 'Alwah. But in spite of the spread of Islam no great spread of Arab mode of life or thought seems to have taken place in the central Sudan, the land being divided into small kingdoms subject to the Sultan of Sennar. The country may have continued in much the same condition for some three centuries, though doubtless throughout the whole of this period Arabic influence was slowly spreading. The last phase began scarcely a hundred years ago. The Egyptian conquest of the Sudan by Mohammed Ali broke down the last remains of the independent kingdoms, indeed the tendency of the whole of the last century, including the great upheaval with which it terminated, was towards the destruction of the older groupings and modes of thought and the substitution of the Arab tribal system and Arab speech.

Tribal Divisions.—The Arabs of the Sudan are divisible into two great moieties, one calling themselves Guhayna and tracing their origin to the eponymous founder of the tribe, the other claiming descent from 'Abbas, the uncle of the Prophet. Thus in the Sudan the name Guhayna is used in a broad as well as in a narrow (tribal) sense. In the latter it is restricted to certain nomads inhabiting the Sennar Province, but in the wider sense it is understood to include the Baggara and the vast group of camel nomads in Kordofan, all of whom if pressed will claim descent from Abdulla el Guhani. The other great division of the Sudan Arabs, even larger and more loosely knit than the Guhayna, that claiming 'Abbas as their ancestor, may be called the Ga'aliin. In the main this group is sedentary. The fusion of the Arabic element with the older settled inhabitants of Nubia was so close that MacMichael applies the term Ga'aliin-Danagla to this great moiety, which includes most of the riverain tribes as well as a number of sedentary tribes in Kordofan.

Apart from this genealogical and to a great extent ethnological classification there is another used by the Arabs themselves, *i.e.*, the broad division into nomads and sedentaries, the former being again divided into camel-nomads (Ahl Ibl), and cattle folk (Bakkara) (q v.), who are mainly nomads, while the sedentaries may be considered to-fall into two much less well defined groups, namely riverain cultivators, *i.e.*, users of the sakia and other sedentary villagers. However there are sedentary sections or divisions of many nomad tribes, and the condition of minor groups may vary from time to time The distinction between camel and cattle men is more radical, and is largely determined by geography, for camels should not be taken south of latitude 13° N., owing to fly, whereas cattle, which require more water, are successfully pastured south of this latitude as far as the Bahr el-Arab and westwards into southern Darfur. Moreover the great nomadic tribes, such as the Kababish and Kawahla, have a smaller infusion of negro blood than the riverain tribes of the north or the sedentaries of Kordofan, though the amount varies from tribe to tribe and even in different divisions of the same tribe, the richest divisions, *i.e.*, those possessing most slaves, tending to contain the highest proportion of members with negro or negroid features, so that most black blood is often found in the richest and most influential divisions of these tribes.

On the physical side it may be suggested that the great majority of the nomads are dolichocephalic, though stature and build vary; skins are of every colour, and noses of every form, nor can the shape of the nose and the colour of the skin be correlated.

Details concerning particular Arab tribes are given in MacMichael's works. Belonging to the Ga'aliin group are the Ga'aliin proper, and most of the northern riverain tribes such as the Gawabra and Bedayria (who might with as much truth be classed as Danagla, inhabitants of Dongola, *i.e.*, Nubians), the Rubatab, the Batahin, the Shaikia and also many of the tribes of Kordofan, including the Gawama'a (perhaps the most negroid of Kordofan Arabs), the Gima'a and the Ghodiat. To the Guhayna, using the term in its wider sense, belong the Rufa'a, the Shukria and the great mass of camel nomads of Kordofan such as the Kababish and their rivals the Kawahla, the Lahawiin and the Dar Hamid (the last with many sedentary sections). The Guhayna proper are now represented by a small group of tribes in the neighbourhood of Kassala where they are subject to the Shukria. The designation Fezara, common in writings of the 18th and earlier 19th centuries, when it was applied to certain of the strongest camel-owning nomads, *e.g.*, the Dar Hamid, is now scarcely used in Kordofan.

Mode of Life.—The typical organization of the Arabs is represented by the tribe, under the control of a sheikh, an office normally hereditary but sometimes elective. Within the tribe are a number of sections with patrilineal descent, themselves often formed by smaller groups, the term *khasham beit* being sometimes applied to the true section and sometimes to one of its smaller divisions. Each section has its own sheikh, subordinate to the tribal sheikh, and much importance is attached to the preservation of the tribal and sectional genealogies (nisba). The size of a tribe or section may fluctuate from time to time with the popularity and strength of its sheikh or leader; a strong and just man will attract to his unit families or groups of families from other tribes, and these in time may give rise to sections or lose their identity in that of their adopted unit. Among the sedentary population tribal organization is naturally weaker than among the nomads.

The daily life of the town Arabs of the Sudan probably varies but little from that of their fellow-townsmen throughout the Near East, and perhaps much the same may be said of the sedentary agriculturists. That of the nomads is conditioned by the severity of the dry season and the organized effort that is required to meet it. Movements of families are no casual wanderings, nor except in the wet season, are groups of tents to be found scattered over the country, but all movement takes place en *masse,* the whole life of the tribe being regulated by the supply of water and of grass for men and cattle. Since permanent watering places are few (their use formerly often led to fighting, and even nowadays is a fruitful source of bad feeling) it is necessary each year to dig temporary wells in localities in which the water bearing strata come within reasonable distance of the surface. This requires considerable man-power, hence the common dry season unit is a (tribal) section under its sheikh.

Although the Arabs of the Sudan observe the outward forms of Islam, including the fast at Ramadan and abstention from alcohol, there is a strong and widespread cult of the dead in one form or another, a belief which is hardly counterbalanced by confidence in the efficacy of holy writings. Thus, while almost every Arab wears a charm (*hegab*), which in fact or theory contains a passage from the Koran. the most valid oaths are sworn not upon the Holy Book but upon the shrine of some local holy man. The belief in the evil eye (*q.v.*), is universal, and many of the sedentary Arabs are as superstitious—using the word to signify unorthodox belief—as are the Egyptian peasantry- with whom they share the names of some of their spirits. The nomadic tribes on the other hand, if less religious in that their fear of the supernatural is less, are free from many unorthodox beliefs of their settled co-religionists. Among the leading men at least of the

Kababish the writer found none of that fear of the dark or of empty spaces, or belief in afrit, which is common in the mixed population of the towns, nor as far as he could discover are the *zar* and zikr—religious exercises inducing auto-hypnosis, and sometimes hystero-epileptic seizures—which are frequent enough among the town dwellers and villagers, found among the nomads.

But though the precepts of the Koran with regard to marriage, inheritance, and so forth, are followed where there is an explicit direction, there is everywhere an important substratum of pre-Islamic or non-Islamic beliefs, habit and custom being largely governed by an older social condition, which, if not matrilineal, at least had many matrilineal traits. Thus among the nomads of Kordofan the wedding tent is built in that part of the settlement in which live the bride's people, who provide by far the greater part of the tent material and its furniture; so too in the payment of blood money, it is not only relatives of the slayer's clan who provide this but his mother's people are also expected to contribute. Another most interesting series of pre-Islamic customs are described by Crowfoot (Sudan Notes and Records, Vols. I, 1918, II, 1919, V, 1922), in connection with the marriages, circumcision and pregnancy, of the riverain Arabs, and in northern and central Kordofan, though these customs are not found among the nomads of the west nor the Baggara of the south. Essentially these ceremonies centre round certain insignia called jirtik, the name being applied both to the rites and collectively to the insignia worn, one of the most important elements being a bracelet on which is threaded a blue or green stone, or sometimes a particular kind of glass bead. Usually the various ornaments are previously dipped in milk, and are worn thereafter during forty days. It is to be noted that in the case of marriage the jirtik ornaments can only be worn once, whether by boy or girl, so that even if marriage has not been consummated neither party wears the jirtik insignia for a second wedding.

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ARACAJÚ, a city and seaport of Brazil, capital of the state of Sergipe, 170 mi. N.N.E. of Bahia, on the river Cotinguiba, or Cotindiba, 6 mi. from the coast. The municipality, of which it forms a part, had a population in 1890 of 16,336, about two-thirds of whom lived in the city itself. Its population (1940) was 59,460. Aracajú is on the right bank of the river at the base of a ridge of sand-hills. Good limestone is quarried in its vicinity, and the country tributary to this port produces large quantities of sugar. Cotton is also grown, and the back country sends down hides and skins for shipment. The anchorage is good, but a dangerous bar at the mouth of the river prevents the entrance of vessels drawing more than 12 feet. The port is visited, therefore, only by the smaller steamers. The river is navigable as far as the town of Maroim, about 10 mi. beyond Aracajú. The city was founded in 1855.

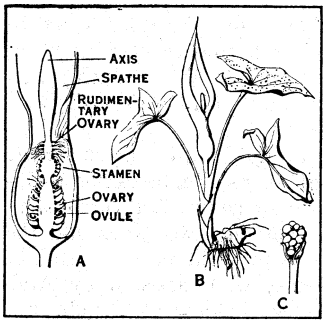
ARACATÍ or **ARACATY,** a city and port of Brazil, in the state of Ceará, 75 mi. S.E. of Fortaleza, on the River Jaguaribe, 8 mi. from the sea. Population of the municipality (1890) 20,182, of whom about 12,000 belonged to the city; (1940) 29,307, of whom about 18,000 belonged to the city. A dangerous bar at the mouth of the river permits the entrance only of the smaller coasting steamers, but the port is an important commercial centre, and exports considerable quantities of cotton, hides, maniçoba, rubber, fruit and palm wax.

ARACEAE or **AROIDEAE,** the arum family, a large group of monocotyledonous plants containing upwards of 100 genera and more than 1.000 species, of which the cuckoo-pint in Great Britain, and the jack-in-the-pulpit, found in eastern North America, are familiar examples.

Neither of these small plants, however, gives more than meagre indication of the characters of this interesting plant family, which attains its most conspicuous development in the tropics.

The aroids are generally herbaceous, often, however, reaching gigantic size; but they are sometimes shrubby climbing plants. Many are peculiar in form and habit and grotesque in appearance. Various climbing species of *Philodendron* have feeding roots which penetrate the soil and clasping roots that fix the plant to its support. Some are epiphytes, and a few, such as the water lettuce (*Pistia stratiotes*), are floating plants.

The leaves, which show great variety in size and form, are generally broad and net-veined, though sometimes sword-shaped and parallel-veined.' In Arum (*q.v.*) the blade is simple. In other genera the leaves are divided and sometimes very large; those of *Dracontium* (tropical America) may be 15 ft. high. In the ceriman (*Monstera*) the large perforated leaves appear as if cut full of holes. The small flowers are crowded on thick, fleshy spikes (spadix), which are usually enveloped by a large leaf (bract), the spathe, which is often the most conspicuous feature of the plant. For example, in the cuckoo-pint the spathe is large and green; in the jack-in-the-pulpit it is purple-striped; in the callas it is white or yellow; and in the anthuriums it is scarlet. In *Amorphophallus,* a genus of about 80 species characteristic of tropical Asia and Malaysia, the "flower" (really an inflorescence consisting of the spathe and the spadix) varies from a few inches to several feet in diameter. The largest is the *krubi* of Sumatra *Amorphophallus titanum,* its spathe being up to 4 ft. in diameter and its spadix attaining a height of 8½ ft. While this has been claimed to be the largest flower in the world, it is really an inflorescence. its numerous individual flowers being small in size. The true flowers are often extremely simple, sometimes, as in *Arum,* reduced to a single stamen or pistil. The fruit is a berry. Usually the plant tissues are exceedingly irritating when brought in contact with mucous membranes, because of the presence of myriads of minute needle-like crystals of oxalate of lime in the plant cells.



A. FROM GROOM, "ELEMENTARY BOTANY"; B. FROM STRASBURGER, "TEXTBOOK OF BOTANY"
WILD ARUM (ARUM MACULATUM), COMMONLY "LORDS AND LADIES"
A. Details showing mode of development of the flowers
B. The plant itself
C. The berries, exposed when the large sheathing leaf that encloses them withers

The underground stems (rhizomes or tubers) are rich in starch; those of the tropical taro (*q.v.*) providing a valuable article of food. From the rhizomes of the cuckoo-pint Portland arrowroot was formerly prepared.

The starchy corms of the jack-in-the-pulpit, after proper treatment to eliminate the raphides, were utilized for food by the Indians of eastern North America.

Besides the cuckoo-pint, the Acorus *calamus* (*q.v.*) or sweet flag occurs in Great Britain, though it is supposed to have been introduced. In North America about 15 native species of aroids are found, chiefly in the southern and eastern United States. Among these are the jack-in-the-pulpit, green dragon, golden club, skunk cabbage. wild calla, water-lettuce (*qq.v*) and sweet flag. Only one native species, the western skunk cabbage (Lysiclziton *kamschatensis*), occurs on the Pacific coast.

In tropical America taro (Colocasia) is replaced in cultivation by the yautia (Xantkosoma) which, like the taro, is an important food plant. Because of their unusual foliage and inflorescence numerous species of *Alocasia, Anthurium, Caladium,* Colocasia, *Dieffenbachia, Scindapsus, Xanthosoma,* and other genera are grown in greenhouses for ornament and as curiosities.

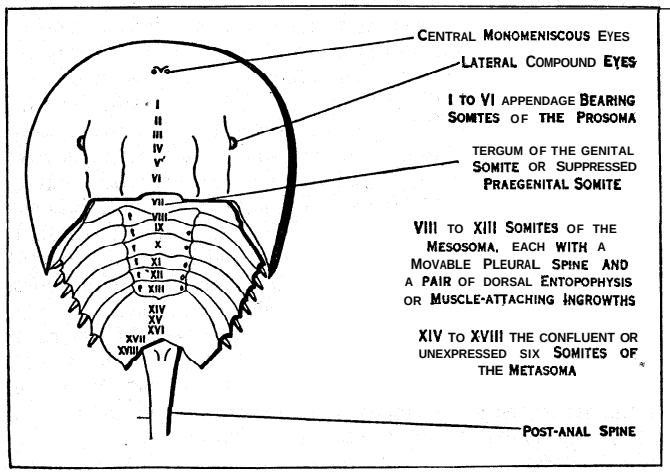
A good series of tropical aroids may be seen in the aroid house at Kew, and in the United States in the display greenhouse of the New York Botanical Garden. Perhaps the best collection in tropical gardens is that in the Botanical Garden at Buitenzorg, Java.

For a monographic treatment see A. Engler and A. Engler and K. Krause, Araceae. Pflanzenreich 24. 37, 48, 55, 60, 64, 71, 73, 74 (IV 23) (1908–20).

ARACHNE, in Greek mythology. the daughter of Idmon of Colophon in Lydia, a dyer in purple. She had acquired such skill

in the art of weaving that she ventured to challenge Athena. Offended at her having depicted the amorous adventures of the gods, and enraged at the perfection of her work, the goddess tore it to pieces. Arachne hanged herself in despair; but the goddess out of pity loosened the rope, which became a cobweb, while Arachne herself was changed into a spider. The name Arachne means "spider."

ARACHNIDA. The Arachnida are a class of animals belonging to the phylum Arthropoda and comprising the scorpions, spiders, mites and their allies, which are typically terrestrial air-breeders, and also a host of marine forms, mostly extinct, of which the king crabs are the only existing representatives. The name was originally restricted to the terrestrial species resembling the in-



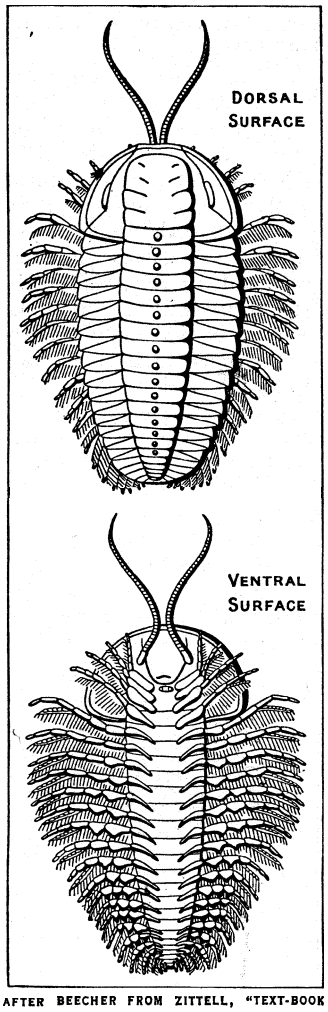
BY COURTESY OF THE "QUARTERLY JOURNAL OF MICROSCOPICAL SCIENCE"

FIG. 1.— DORSAL VIEW OF THE KING CRAB (LIMULUS), WITH THE POST-ANAL SPINE CUT SHORT

sects, centipedes, etc., in the possession of organs adapted for atmospheric respiration; king crabs possessing gills or branchia being for that reason associated with the Crustacea. But in 1881 Ray Lankester proved conclusively that the king crab (*"Limulus"*) must be regarded as an arachnid on account of the fundamental resemblance between it and the scorpion in all essential structural characters. This conclusion, which is generally accepted, focused attention upon the Trilobita (*q.v.*), a great group of extinct marine arthropods. previously classified as crustaceans but exhibiting many points of likeness to the king crabs. In 1902 Lankester gave cogent reasons for the belief that the Trilobites were primitive Arachnida and placed them in that class; and this opinion was confirmed by the subsequent discovery of numerous fossils linking them with king crabs and their allies. So far as external characters are concerned—and these are the only characters known in the extinct species—the arthropods here referred to as the Arachnida agreed in the following particulars:

(1) The body is divided into two main regions or parts, the prosoma or cephalothorax, and the opisthosoma or abdomen; (2) the prosoma, carrying the mouth, is composed of five or six somites or segments and is marked off from the opisthosoma by the fusion of more or fewer, generally all, of the dorsal plates or terga to form a heavy shield or carapace which bears the eyes, when present. It is usually attached to the opisthosoma by a movable joint and, excepting the Trilobites, is further separated from it by the structure and function of its appendages. (3) Except in one degenerate family of mites, each segment of the prosoma is provided with a pair of appendages or limbs of which one pair only is situated in front of the mouth (preoral). The next are behind the mouth, or postoral, and the first pair of these at least is concerned with the mastication of food or with feeding in some other way. The remaining three or four pairs are mainly or wholly locomotor in function. (4) The opisthosoma and its appendages are much more variable in structure and agreed throughout the different orders in two characters only, the anus opens upon the last segment and the genital ducts on the first or second. It is only by the position and function of the anterior appendages of the prosoma that the Arachnida mainly differ from the Crustacea. In the Crustacea there are two pairs of preoral appendages, the second pair, corresponding to the first postoral pair in the Arachnida, having taken up a preoral position and lost their masticatory function, the third pair, not the second pair as in the Arachnida, being the first pair of jaws. Possibly some representatives of the Trilobites will be found to link the Crustacea with the Arachnida, showing that we must look to the Trilobites as the common ancestors of the two classes.

According to the theory of the evolution of the Arachnida and the interpretation of this morphology propounded by Ray Lankester and adopted in this article, the better known terrestrial forms, the scorpions, spiders and mites traced their descent and their structural characters from marine forms of which the Trilobites are the oldest known representatives.



AFTER BEECHER FROM ZITTELL, "TEXT-BOOK OF PALAEONTOLOGY" MACMILLAN & CO.

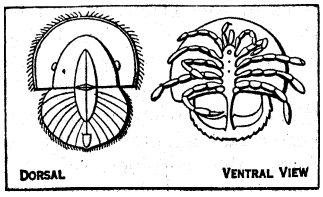
FIG. 2.—RESTORATION OF A TRILOBITE (TRIARTHRUS BECKI) SHOWING THE SINGLE PAIR OF TACTILE PREORAL APPENDAGES, AND THE FOUR PAIRS OF POST-ANAL APPENDAGES BELONGING TO THE ANTERIOR SECTION OF THE BODY

In the Trilobites the prosoma is composed of five segments, with its dorsal plates welded into a carapace provided with compound lateral eyes. The mouth, situated near the middle of its lower surface, is bordered in front by a plate acting as an "upper lip" or labrum and behind by a small plate, the "lower lip" or labium. The preoral appendages are long, many jointed feelers or antennae, and the basal segments, or coxae, of the four pairs of postoral appendages act as jaws. The rest of the limb consists of two branches: an endopodite, used for crawling, and an exopodite carrying a number of branchial filaments. The opisthosoma is very variable in the number of its segments; but in the earliest forms there is a great number of them, all freely jointed together in a series, and each segment except the last carries a pair of appendages approximately like those of the prosoma in structure and function, the last or telson, carrying the anus, being sometimes provided with a post-anal caudal spine.

The next stage was the restriction of the number of segments of the body to 18 or 19, the loss, in most cases at all events, of appendages on some of the posterior segments and a change in the structure in function of the appendages of the prosoma and opisthosoma, those of the prosoma losing to a great extent, if not wholly, their branchial function and becoming specialized for locomotion and the prehension and manipulation of food, those of the opisthosoma retaining for a time the double function of respiration and locomotion but later, as in the king crabs, losing their locomotive function and becoming specialized for the most part as carriers of the branchial plates attached, to the branchial filaments of the Trilobites, to the outer branch or exopodite.

In the stage represented by the king crabs and many of their extinct allies, the prosoma consists of six segments with six pairs of locomotor or prehensile limbs and the appendages of the opisthosoma are reduced to six pairs corresponding to the first six segments of this region in the adult. The appendages of the first

of these segments cover the genital apertures and form the genital operculum. It probably carried branchial plates in some forms, but these have disappeared in the living king crab. It must be noted, however, that this segment, the genital, is morphologically the second segment of the opisthosoma because in the course of its development the king crab shows in front of the genital somite a transient somite, which cannot certainly be traced in the adult. This pregenital somite is important because it appears again in some of the terrestrial Arachnida but its occurrence is so inconstant that the genital somite is regarded as the first of this region in this article. The limb-bearing region of the opisthosoma is called the mesosoma in contrast with the metasoma, the limbless region of the body behind it, which carries the anus and the caudal spine.

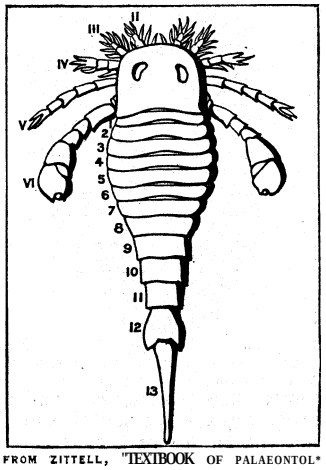


AFTER LEUCKART FROM KORSCHELT, AND HEIDER

FIG. 3.— TRILOBITE LARVA OF THE KING CRAB (LIMULUS)

The most important allies of the king crab as witnesses of the kinship between that group and the terrestrial air-breathing Arachnida are the Eurypterida which resemble scorpions much more closely than the king crab resembles them, namely in shape, in identity in the number of somites, 18, exhibiting precise differentiation into the three categories prosoma, mesosoma and metasoma, composed of six somites each and the narrowing of the freely jointed, limbless metasoma to form, with the postanal spine, a tail-like termination to the body. But since only the exoskeleton of the Eurypterida is known, we must look to the king crabs for the evidence of relationship in the internal organs.

The following are the principal anatomical resemblances between them: (1) The alimentary canal is provided with a powerful suctorial pharynx, worked by special muscles, and with lateral segmentally-arranged diverticula, the so-called "gastric glands." (2) The vascular system is highly developed, consisting of a dorsal many-chambered "heart," from which arises a rich supply of arteries enveloping or intimately connected with the central nervous system. There is also a paired series of veno-pericardial muscles passing from the great ventral venous sinus to the pericardium and constituting a mechanism aiding flow of blood along the veins which pass from the sinus to the heart. (3) On each side of the prosoma there is an excretory gland, the "coxal gland," which opens by a pore between the basal segments (coxae) of the fifth and sixth appendages. (4) Lodged in the prosoma between the ventral nerve-mass and the alimentary canal is an internal skeletal plate, the "entosternite," a fibro-cartilaginous structure giving support to the numerous muscles of the limbs and other organs and arising apparently from the solidation of connective tissue and of the inner portion of the great dorso-ventral and longitudinal and crural muscles. (5) The ovaries and testes form a closed network and are not in the form of simple, or simply branched, tubes. (6) Median and lateral eyes are present. The medians are composed of two layers of cells (diplostichous) and the laterals of a single layer (monostichous), the elements of the lateral eyes in the scorpions being separated, whereas in the king crabs they are coalesced to form a compound eye.



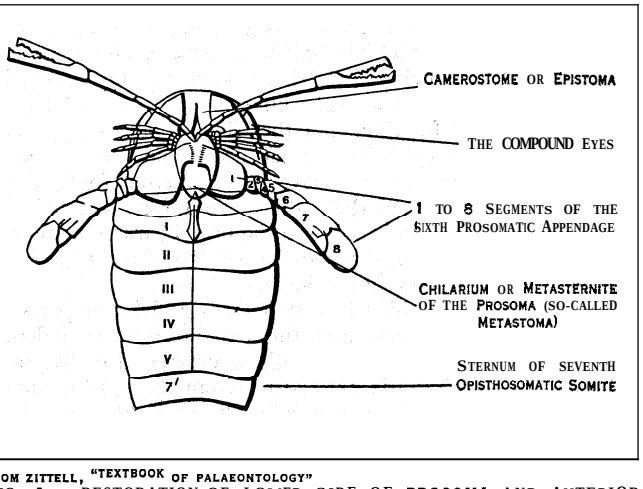
FROM ZITTELL, "TEXTBOOK OF PALAEONTOLOGY"

FIG. 4 — DORSAL VIEW OF PTERYGOTUS, SHOWING THE SCORPION-LIKE SHAPE OF THE BODY

The principal structural differences between the typical scorpions on the one hand and the king crabs and Eurypterida on the other are concerned with adaptations to life on the land, a new departure which marked a further stage in the evolution of the class. Of these adaptations atmospheric respiration is the most important. As already explained the respiratory organs of the king crabs are clusters of branchial lamellae, called gill-books, of which there is a pair upon the second to the fifth appendages of the opisthosoma. In the scorpions the respiratory organs are four pairs of small sacs, containing clusters of super-imposed lamellae, and they open by spiracles upon the sternal plates of the third to the sixth somites of the opisthosoma. These lamellae, called lung-books, are developed in the embryo behind the base of the four pairs of transient bud-like limbs. They closely resemble even in microscopic details the gill-books of the king crabs: and Lankester's query that they are modified insunk branchial lamellae is generally accepted. But in the embryo scorpion there is also a pair of bud-like limbs in the first and second segments of the opisthosoma. These persist, the first pair developing into a double or single plate, the genital operculum, and the second into a pair of peculiar tactile organs, called the combs or pectines, which consist of a jointed shaft provided with a series of teeth, the whole structure recalling and evidently representing the branchial exopodite of the Trilobite limb. Thus in their structure and development the pectines and lung-books of the scorpions bear out the view of the descent of this group from marine forms with branchial plates on the exopodite of five pairs of limbs of the opisthosoma; and further evidence of this head is supplied by the discovery in Silurian strata of a scorpion which lived in the sea and in a measure links the typical scorpions with the Eurypterida.

Less important adaptations to terrestrial life in scorpions are certain modifications of the last four pairs of limbs of the prosoma for walking on land and the forward shifting of the mouth from the middle of the lower side of the prosoma to the anterior end, thus freeing the basal segments of the last two pairs of limbs from function of manipulating or masticating food which they perform in the king crabs and Eurypterida.

Although according to the theory of the evolution of the Arachnida here briefly sketched, the scorpions are the most primitive of all the terrestrial orders of the class, they cannot be regarded as the direct ancestors of any one of them. Nor can any of these other orders, the most specialized or the most degenerate, being directly derived from another. In some cases they exhibit puzzling gross resemblances associated with profound structural differences. Throughout the series a general tendency is traceable towards the shortening and simplification of the opisthosoma, usually called the abdomen, towards the disappearance or fusion of its segments, its coalescence with the prosoma or cephalothorax, obliteration of the distinction between mesosoma and metasoma; and these changes are accompanied by simplification of the digestive, nervous and alimentary systems. The eyes also tend to disappear; but apart from them the organs connected with the cephalothorax are generally at least as elaborate as in the scorpions, sometimes more so, and these call for special mention.



FROM ZITTELL, "TEXTBOOK OF PALAEONTOLOGY"

FIG. 5.— RESTORATION OF LOWER SIDE OF PROSOMA AND ANTERIOR PART OF THE POSTERIOR REGION OF THE BODY OF THE PTERYGOTUS

I–V. are gill-bearing appendages of the posterior region

Alimentary System.—The Arachnida subsist almost wholly upon the soft tissues of their prey which are drawn into the minute mouth by suckers. The labrum may act in this manner (Solifugae, Palpigradi, Acari), or the pharynx, which is in front of the brain, as in the Scorpiones, Pedipalpi and Araneae; or the stomach which is just behind the brain as in the Araneae and Pedipalpi, which are thus provided with two alimentary suckers. In the scorpions there is only one pair of diverticula from the midgut in the cephalothorax, but there are four pairs of segmentally arranged diverticula in the Araneae (spiders) or even five in some Pedipalpi (*Thelyphonus*).

Excretory Organs.—Excretory tubules physiologically similar to those of insects but morphologically different from them open into the gut in the abdomen in scorpions, Pedipalpi, Araneae and Solifugae, but are absent in the Opiliones. The coxal glands have been found in all the orders; but they are more elaborate in the Pedipalpi and Araneae than in the Scorpiones. The position of the orifice varies. In some (Chelonethi, Mygalomorph spiders) it is close to the base of the fifth appendage as in scorpions and king crabs; in others (Pedipalpi, typical Araneae, Palpigradi, Solifugae) it is behind the base of the third appendage. No doubt in the ancestor of the Arachnida, possibly in Trilobites, there was a pair of coxal glands in each somite of the prosoma.

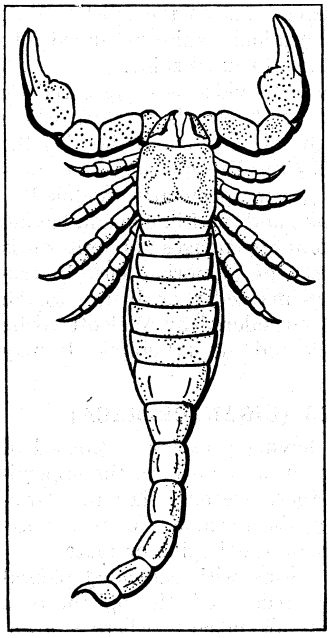
Entosternite.—The most highly developed entosternite is found in the Pedipalpi and Araneae, which also contain the primitive pregenital somite. In these orders this plate is more like the entosternite of the king crabs than it is in the scorpions; in the Solifugae it is largely, if not wholly, replaced by a chitinous ingrowth (entosclerite) from the ventral surface.

The Generative Organs.—The essential glands, testes and ovaries are usually simple and tubular but in the Chelonethi they are joined by transverse bands and are reticulated, as in the scorpions and king crabs. Some remarkable phenomena connected with the copulation of the Arachnida may be referred to in this connection. In the king crabs fertilization is effected after the eggs are laid; but in the air-breathing forms the eggs are fertilized within the body of the female but the sperm of the male is introduced in a variety of singular ways. The scorpions copulate front to front, the genital orifices of the two sexes being mutually applied during the process. The same method is probably adopted by the Pedipalpi and Chelonethi. In the Opiliones, so far as is known, the male and female stand facing one another and the male thrusts forward his penis, which is relatively of great length, beneath the cephalothorax of the female into her generative orifice which in many genera opens only a short distance behind the mouth. In other orders, however, the method of pairing is quite different, one of the pairs of cephalothoracic appendages being modified as an intromittent organ. In the spiders (Araneae), the terminal segment of the second pair, or palpi, is furnished with an apparatus adapted for taking up the liquid sperm after it has been deposited on a sheeting of web, and carrying it until the male finds a female and fertilizes her by inserting the organ into her generative ducts. Functionally similar organs occur upon the terminal segment or tarsus, of the fifth pair of limbs in the Ricinulei and upon the mandibles or chelicerae of the Solifugae. But in these cases the apparatus is adapted for the transmission of spermatophores into the female.

The Respiratory Organs of air-breathing Arachnida have been extensively used in classification on account of the diversity in structure and position they exhibit. Pulmonary sacs with "lung-books" very similar to those of scorpions are found in the Pedipalpi and many Araneae (spiders); but in these orders they open behind the sternal plates of the first and second abdominal somites. In other spiders, however, the lung-books of the second somite, and occasionally of the first as well, are replaced by tracheae, called "tufted tracheae," composed of a wide sac from which a number of fine tubes are given off. Two pairs of similar tracheae opened by spiracles upon the sides of the second and third somites of the abdomen in the Chelonethi. In the Solifugae there is a pair of spiracles on the sterna of the second and third and occasionally of the fourth somites; but the tracheae which arise from these are of a different type, consisting of long branching tubes strengthened by a spiral thread as in the insects. A pair of similar tubular tracheae open ventrally upon the second abdominal somite in the Opiliones; and four pairs open dorsally upon the first four somites in some Acari (Notostigmata).

Spiracles are also present in the cephalothorax and are equally variable in position. In the Ricinulei there is a single pair of tufted tracheae opening above the base of the appendages of the fifth pair, and in the Solifugae a pair of tubular tracheae open ventrally behind the base of the appendages of the fourth pair. In the Acari, in which the tracheae may be tufted or tubular, spiracles may open above the appendages of the first pair, above the fourth pair or in the articular sockets of the third, fourth, fifth or sixth pairs; and in some Opiliones there is a spiracle from the fifth segment (tibia) of the last four pairs of appendages.

The Tracheae and the **Ancestry** of Air-Breathing **Arachnida.**—The tracheae are a morphological puzzle upon the solution of which two diametrically opposed hypotheses of the descent of the Arachnida mainly rest. In accordance with the view that the lung-books of the scorpions, Pedipalpi and some Araneae (spiders) were derived from branchial lamellae like those of the king crabs, their presence upon the first and second abdominal somites in the Pedipalpi and Araneae and upon the third to the sixth in the scorpions suggests that in earlier members of the king crab and Eurypterine stock they were also present upon the genital operculum, making altogether six pairs of clusters. It also involves Lankester's conclusion that the lung-books were the primitive type of respiratory organs in the air-breathing form, that they were subsequently partly suppressed or replaced by tracheal tubes on the abdomen and were functionally supplemented by additional tracheae with spiracle opening upon various parts of the cephalothorax; and the belief that these cephalothoracic spiracles and tracheae are adventitious organs gained support from their presence on the tibia of the legs of some Opiliones.



RESTORED AFTER THORELL S INDICATIONS BY R. I. POCOCK

FIG. 6.—DORSAL VIEW OF PALAEOPHONUS, A MARINE SCORPION OF THE SILURIAN PERIOD

This view of the matter has not, however, been accepted by all authorities. Leuckart, and following him, Hansen and Sörensen, believed that segmentally arranged typical tubular tracheae, like those of insects, were the earliest form of respiratory organs in the Arachnida and that from these they derived the tufted tracheae and from the tufted tracheae, lung-books. The primitive Arachnida in fact were terrestrial air-breathers. Hansen also believed that in these primitive forms the cephalothorax was divided into two regions, a head, or cephalon, composed of four somites and bearing the eyes, mouth and four pairs of appendages, and a thorax consisting of two free somites with separate terga and two pairs of appendages. The acceptance of this opinion compels the belief that the Palpigradi are the most primitive of existing Arachnida so far as the cephalothorax is concerned, with the Solifugae standing next to them. Bernard went a step farther and pictured the primitive Arachnida as a terrestrial air-breathing arthropod composed of 18 somites, each provided with a pair of limbs, approximately alike throughout the series, a pair of tracheal spiracles and alimentary diverticula.

These theories need not be further discussed. But it may be pointed out that neither involves a denial of the kinship between the scorpions and the king crabs and their allies because the branchial lamellae of the latter may have been derived from the pulmonary lamellae of the former. They involve, however, the

conclusion that the king crabs and Eurypterida were derived from air-breathing land forms which became adapted to living in the sea, a conclusion diametrically opposed to theconclusion upheld in this article which maintains their descent from the Trilobites whose kinship with the king crabs was never questioned until the affinities of the latter with scorpions were established.

CLASSIFICATION

The Arachnida are classified as follows:—

Grade **1. Anomomeristica.**—Number of somites typically great and variable, usually exceeding eighteen. All the somites of the opisthosoma except the last with a pair of appendages structurally and functionally like the postoral appendages of the prosoma. The dorsal area trilobite.

SUB-CLASS TRILOBITA

The tergal plates of the anterior five somites fused to form a dorsal shield or carapace, The preoral appendages long and antenniform. All the postoral appendages biramous, the external branch branchial, the internal locomotor or also maxillary in function. For the other characters and classification see TRILOBITA.

Grade **2. Nomomeristica.**—Number of somites never exceeding 18 in the adult. Some of the somites of the opisthosoma without appendages. When appendages are present on this area, they are structurally and functionally differentiated from those of the prosoma. The dorsal area, except in some Xiphosura, not trilobite.

SUB-CLASS LIMULAVA

Resembling the Trilobita in having the prosoma composed of five somites, the preoral appendages antenniform and the appendages of the opisthosoma provided with a locomotor inner and a branchial outer branch.

Order Copura. Nine pairs of appendages on the opisthosoma, none on its last three somites, the terminal somite expanded into a swimming plate but without a postanal caudal spine.

This order containing the family Sidneyidae is represented by genera of mid-Cambrian age. The best known is Sidneyia which in its 12-jointed opisthosoma and absence of "trilobation" of the dorsal surface superficially resembles the Eurypterida. The postoral appendages of the prosoma are very peculiarly modified.

Resembling apparently the Trilobita and the Limulava in having prosoma five-segmented as the preoral appendages antenniform is a group, the Agalaspina (*Agalaspius*), of Cambrian age. In certain other respects this group shows marked resemblance to the Xiphosura, which follow, and it is considered by Walcott to be the intermediate between that order and the Trilobites. It may for the present be left unclassified.

SUB-CLASS MEROSTOMATA (GIGANTOSTRACA)

Differing from the Limulava in having prosoma composed of six somites, the preoral appendages not antenniform, the appendages of the opisthosoma, of which there are only six pairs, laminate and not locomotor in function, the terminal somite not expanded into a caudal fin but with a postanal spine or plate.

Order Xiphosura. Trilobite-like forms with expanded pleural areas, the dorsal surface generally "trilobate," the opisthosoma with nine or ten somites and its appendages, where known, biramous.

Most of the genera of this order are Palaeozoic and extinct. They differ from the Mesozoic and existing king crabs (Limulidae) in having the opisthosoma distinctly segmented. Well defined genera are *Belinurus, Hemiaspis, Pseudoniscus,* and others; but their classification needs revision. The discovery in these that some genera related to *Agalaspius,* formerly regarded as closely akin to these forms, have Trilobite-like appendages and other characters may show that these ancient forms are not so nearly related to the Limulidae as has been supposed.

Order Eurypterida. Chiefly differing from the Xiphosura in being typically scorpion-like in shape, without pleural areas, with the opisthosoma composed of 12 somites of which the posterior six are limbless and the anterior six provided with unbranched plate-like appendages, the first carrying a median rod which probably acted as an ovipositor in the female, as a penis in the male.

The Eurypterida occur in Palaeozoic strata and are wholly extinct. Some of them, being over two yards in length, are the largest arthropods known. They exhibit great variation in the structure of their prosomatic limbs, the last pair being frequently modified as broad paddles (*Eurypterus,* Pterygotus), or the last two pairs may be very long and act as oars (Stylomurus). The preoral appendages may be long, massive pincers (Pterygotus) or insignificant in size. By these and other characters the group is divisible into a number of families and sub-families.

SUB-CLASS PECTINIFERA

Differing from the Merostotana in having the first pair of appendages of the Mesosoma (abdomen) represented by a very small genital operculum, without a rod-like ovipositor or penis, and the second pair converted into the pectinei or combs; in the last of all external trace of the remaining four pairs in the adult; in the small size of the basal segment of the last pair of legs and its loss of maxillary function, the breaking up of the lateral eyes into separate ocelli and the presence of poison glands in the postanal spine.

Order Scorpiones. The first pair of appendages (mandibles) small, three jointed and chelate; second pair (palpi) long, massive and chelate, the remaining four pairs (legs) locomotor, with the basal segments of at least the two first acting as jaws.

Sub-order Apoxypoda. Legs short, composed of stout sub-equal segments, the last or tarsus pointed and armed at most with a single claw, the basal segments of the last two pairs meeting in front of the sternal plate of the cephalothorax and the pectines with a short inner branch (endopodite). Family Palaeophoridae (*Palaeophorus.*)

This sub-order contains the Silurian scorpion which was undoubtedly marine. It has no trace of spiracles and probably breathed by means of branchial lamellae as in the Eurypterida.

Sub-order Dionychopoda. Legs long, with unequal segments, the last truncated and armed with two claws; the last two pairs of legs with their basal joints (coxae) abutting against the sternal plate; the pectines without endopodite.

To this sub-order belong all the recent scorpions which are referred to four families, Buthidae, Pandinidae, Vaegovidae and Bothorinidae. A number of genera from the Coal Measures mostly resembling recent forms in essential characters are also known. One nf them (Eobuthus), however, has no trace of spiracles, the respiratory lamellae being probably concealed beneath the ventral plates of the abdomen as in *Palaeophorus.* It may have been a water-breather, living in the Carboniferous marshes.

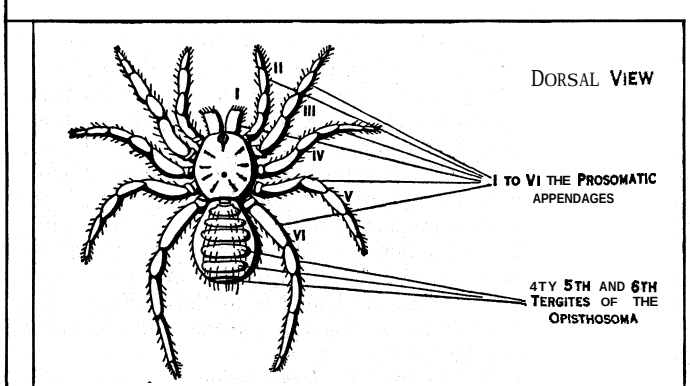


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FIG. 7.— DORSALVIEW OF LIPHISTIUS, A PRIMITIVE SPIDER

SUB-CLASS EPECTINATA

Distinguished from the Pectinifera by the absence of pectines and of a long tail-like termination to the body, by the presence of not more than 11 somites in the abdomen, excluding the pregenital somite, and of at most four pairs of small appendages upon the abdomen in the embryo. Also when lung-sacs are retained, they belong to the first and second abdominal somites not to the third, fourth, fifth and sixth.

SUPER-ORDER Caulogastra. Distinguished from the rest of the Epectinate Arachnida, as well as from the Scorpiones, by the deep constriction of the retained pregenital somite to form a slender, stalk-like waist between the cephalothorax and abdomen and by the presence of a pair of spiracles opening alongside the genital orifice on the first abdominal somite.

Order Pedipalpi. Abdomen composed of 11 somites with distinct tergal and sternal plates, without spinning appendages. Mandibles chelate or hernichelate, without poison-glands. Palpi very large and prehensile, their basal segments meeting in the middle line. Legs of first pair long slender clawless and tactile; see PEDIPALPI.

Sub-order Uropygi. Abdomen with a postanal sclerite, which, with the narrowed last three somites, forms a tail-like termination to the .body. The last somite with a pair of defensive, acid-secreting glands. The cephalothorax long and narrow. Basal segments of the palpi almost immovably fused to form a trough beneath the mouth. Legs of the first pair with only the terminal segments many-jointed.

Tribe Urotricha (Oxopaei). Postanal sclerite forming many-jointed flagellum. Two pairs of lung-sacs. Carapace unsegmented with median and lateral eyes. Palpi chelate, folding almost in a horizontal plane.

The single family Thelyphonidae contains many genera (*Thelyphonus, Hypoctonus, Mastigoproctus,* etc.), occurring in the tropics of Asia and America. **A** genus (Geralinura) has been found in the Coal Measures.

Tribe Tartarides. The postanal sclerite short, unjointed. Only one pair of lung-sacs retained. Cephalothorax segmented, its last two somites free. A mere trace of eyes at most remaining. Palpi not chelate, folding in a vertical plane and armed with a terminal piercing claw.

The single family Hubbardiidae (Hubbardia, *Schizomus,* Tri*thyreus*) is distributed in the warmer parts of Asia, Africa and America, and contains very small, less highly organized form than the Thelyphonidae.

Sub-order Amblypygi. Differs from the Uropygi in the absence of a caudal termination to the body and of acid-glands, in having a broad cephalothorax with its appendages radiating round a broad sternal area, the palpi more freely movable and armed with many spines, and the legs of the first pair long and antenniform.

The numerous genera (*Phrymus, Tarantula, Charis,* etc.), belonging to the group, which is found in the warmer parts of Europe, Asia, Africa and America, are referred to three families. The genus *Graeophorus* occurs in the Coal Measures.

Order Araneae (Spiders). Distinguishable from the Pedipalpi mainly by the following characters: (1) The abdomen is provided

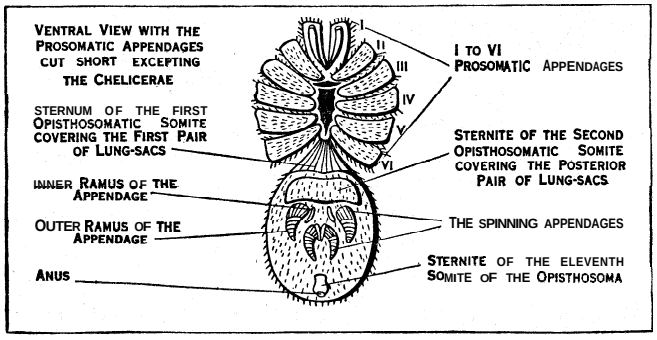

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FIG. 8.— VENTRAL VIEW OF LIPHISTIUS, WITH THE LEGS CUT SHORT

with two pairs of appendages, which belong morphologically to the third and fourth somites and are the manipulators of the silk secreted in the abdominal glands, the ducts of which open upon them. (2) The mandibles are provided with the poison-gland opening close to the tip of the second segment which is transformed into a piercing fan. (3) The palpi are small, pectiform, not prehensile; their basal segments are not united but are separated by the labial sternal plate which forms a lower lip to the mouth. In the males the terminal segment carries the intromittent organ. (4) The first pair of legs are locomotor, like the other pairs.

That the Araneae are tolerably closely related to the Amblypygi is forcibly attested by the structure of the coxal glands, the endosternite and the alimentary canal.

Sub-order hfesothelae. Abdomen segmented, with 11 tergal plates and two sternal plates covering the lung-sacs and genital orifice, followed by the two pairs of biramous spinning appendages which retain their embryonic position in the middle of the lower.

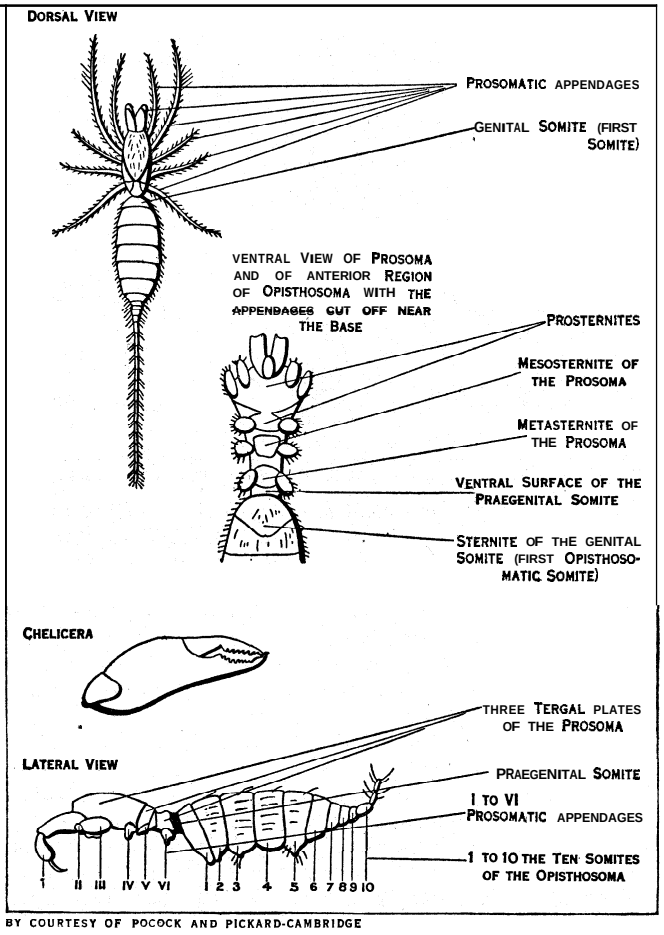

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FIG. 9.—KOENENIA, THE ONLY GENUS OF THE PALPIGRADI

surface of the abdomen, traces of seven sterna between these appendages and the anus.

The single genus *Liphistrus* of the family Liphistiidae, restricted to the East Indies, is the most primitive spider known. Apparently related is *Arthrogiosa* from the Coal Measures.

Sub-order Opisthatheae. Abdomen at most indistinctly segmented posteriorly, without tergal plates and the sternal plates represented only by the pulmonary opercula. The spinning appendages at the posterior end of the body close to the anus.

All existing spiders, except the Lithistiidae, belong to this sub-order which is divisible into two tribes.

Tribe hfygalomorphae. The plane of the articulation of the mandibles to the cephalothorax is vertical, distal segment or fang closing backwards in a line sub-parallel to the long axis of the body. Coxal glands opening on the fifth cephalothoracic somite. Two pairs of lung-sacs always present.

This tribe, confined to tropical and temperate regions of the world, contains the bird-eating spiders (*Avicularia,* Thevaphosa, etc.), often called tarantulas, the trap-door spiders (Cteniza, *Nemesia,* etc.), the purse–web spiders (*Atypus,* etc.) and others. They are referred to several families, the Theraphosidae, Ctenizidae, Atypidae, etc., the Theraphosidae being the largest spiders known.

Tribe Arachnomorpha (Araneae verae). The plane of the articulation of the mandibles horizontal, the fangs closing almost transversely inwards; the coxal glands opening on the third somitc of the cephalothorax.

This tribe, the most specialized section of the order in struc-

ture and instincts, contains most of the living species of spiders. They exhibit great variation in the structure and position of their breathing order, in the formation of the mouth parts, the number and distribution of the eyes, the construction of their spinning appendages and of their external genital organs. By these variations they have been classified into a number of families, Araneidae (Aranae, *Nephila*), Lycosidae (Lycosa, *Ocyale*), Attidae (Attus), Phaleidae (*Pholeus*), Dysderidae (Dysdera) and others too numerous to mention. (See SPIDER, TARANTULA.)

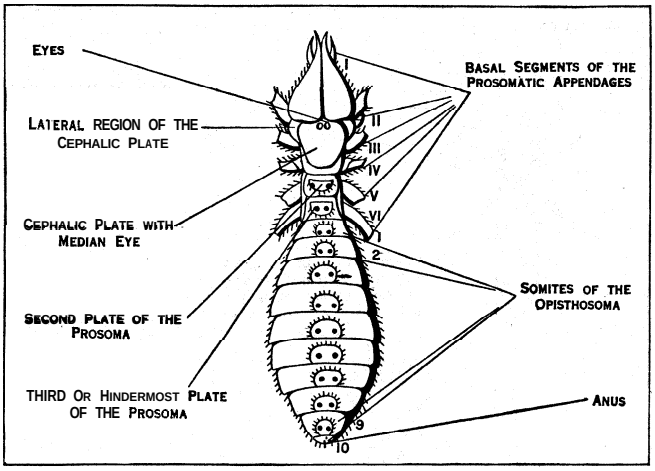

FIG. 10.— DORSAL VIEW OF GALEODES, WITH THE LEGS CUT SHORT

Order Palpigradi. Resembling some Pedipalpi in the tail-like termination of the body and the segmented carapace, but differing essentially from them in having ten abdominal somites without separated terga and sterna, in the absence of breathing organs in the large, chelate, three-jointed mandibles, the slender, pediform palpi with their basal segments widely separated, jointed to the sides of a large sternal plate and disconnected from the mouth, which opens at the end of a projecting proboscis, and in the palpiform locomotor first pair of legs.

The order contains one genus *Koenenia;* family Koeneniidae. It is a minute arachnid found in Europe and America.

SUPER-ORDER Cucullata. Distinguished from the rest of the Arachnida by the presence of a large plate jointed to the front of the carapace and folding like a hood over the mandibles, by the construction of the first and second abdominal segments and their concealment between the third segment and the cephalothorax which can be locked together by means of the basal segment by the last pair of legs; and by the telescoping of the reduced last three segments of the abdomen within the enlarged sixth segments.

Order Ricinulei (Podogona). Mandibles chelate, two jointed, palpi small, chelate, basally united to form a suboral trough and in contact with the corresponding segments of the second legs, which like those of the succeeding pairs meet in the middle line practically obliterating sterna. A single pair of tufted tracheae above the base of the third pair of legs. Intromittent organ of male on the tarsus of these limbs.

Family Cryptostemmidae (*Cryptostemmus, Cryptocellus*). These remarkable arachnids are found in tropical Africa and America. Related genera (Paliachera, etc.) occur in the Coal Measures.

This order was classified by Hansen and Sörensen with the orders above referred to the Caulogastra, the group being comprehensively called the Micrura.

SUPER-ORDER Pseudoscorpiones. Differing from the Caulogastra in the absence of a "waist" the large size of the dorsal plate of the pregenital somite, the absence of spiracles on the first abdominal somite, the presence in the cephalothorax of silk glands opening upon the mandibles, which are provided with a special organ, the serrula, for manipulating the silk.

Order Chelonethi. Carapace unsegmented. Mandibles two jointed, chelate. Palpi very large and chelate, their basal segments and those of the four pairs of legs meeting in the middle line and replacing the sterna. Abdomen sometimes with 11 freely jointed somites, second and third with a pair of spiracles.

Sub-order Panctenadactyli. The serrula, on the movable digit of the mandible fixed throughout its length, an accessory process on the immovable digit. Carapace narrow in front, mandibles small. Families Cheliferidae (Chelifer), Garypidae (Garypas).

Sub-order Hemictenodactyli. The serrula, free at its distal end; no accessory process; carapace wide, mandibles large. Families Obisidae (*Obisium*), Chthoniidae (Chthonius).

The arachnids of this group are all of small size, their large pincer-like palpi giving them a superficial resemblance to scorpions. Their old-fashioned popular name, book-scorpion, was due to the discovery of specimens in libraries. Most of the species, however, live under stones or bark where they feed upon mites. etc.

SUPER-ORDER Mycetophora. Differing from the foregoing orders of Epectinate in having the first, or genital, somite of the abdomen jointed to the cephalothorax without the intervention of a waist or of the pregenital somite and in the presence of spiracles on the fourth segment of the cephalothorax; and distinguishable from all orders by the firm articulation of the mandibles to the sides of the carapace, the partial freedom of the fourth tergal plate from the carapace and the presence of racket-shaped processes or malleli on the basal segments of the fourth legs.

Order Solifugae. Cephalothorax jointed, its fifth and sixth segments free. Mandibles two jointed, powerful and chelate. Palpi pediform and tactile, their basal segments fixed, dissociated from the mouth which is at the apex of a porrect proboscis. Legs with their basal segments fused across the middle, replacing the sterna. Abdomen with ten somites, the second, third and sometimes the fourth with ventral spiracles. Intromittent organs of the male situated on the mandibles.

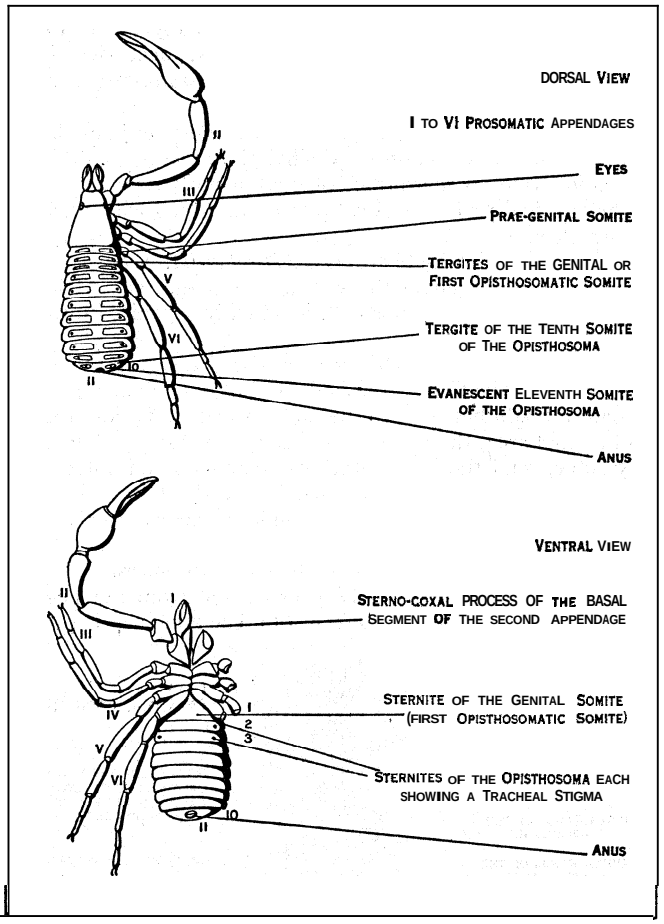

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FIG. 11.— DORSAL AND VENTRAL VIEWS OF GARYPAS, ILLUSTRATING THE CHARACTERS OF THE PSEUDOSCORPIONES. THE LEGS OF THE LEFT SIDE ARE CUT SHORT

Families Galeodidae (Galeodes), Solpugidae (Solpuga). The Solifugae, mostly large active, rapacious Arachnida, are found in the warmer parts of the eastern and western hemispheres. They

are a very distinct group, showing some resemblances to the Palpigrada.

SUPER-ORDER Phalangiomorphae. Distinguished from the preceding groups of Epectinates in the following characters:—(1) The cephalothorax and abdomen are widely confluent. (2) The sternum of the genital somite is indistinctly defined in the adult, the genital orifice being thrust forward between the last pair of

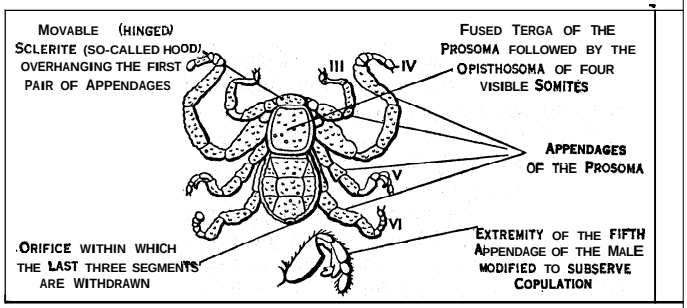

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FIG. 12.—DORSAL VIEW OF CRYPTOSTEMMA, ONE OF THE PODOGONA

legs. (3) There is a pair of foetid glands opening upon the cephalothorax. (4) The basal segments of the first and generally of the second pair of legs act as jaws.

Order Opiliones. Mandibles chelate and three jointed. Palpi variable, their basal segments acting as jaws. Legs locomotor in function. Abdomen containing ten somites more or less fused together, the second with a pair of spiracles. Male and female respectively with a long penis and ovipositor.

Sub-order Palpatores. Palpi small, pediform. Sternum of cephalothorax short.

Tribe Eupnoi. With accessory spiracles on the fifth segment of the legs. Family Phalangiidae (Phalangidum).

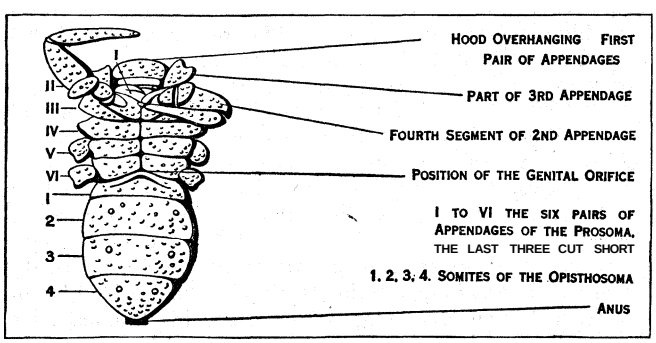
Tribe Dyspnoi. No accessory spiracles on the legs. Families Nemastomidae, Trogulidae, etc.

Sub-order Laniatores. Palpi prehensile with a piercing claw. Sternum of cephalothorax long and usually very narrow. Families Gonyleptidae (*Gonyleptis*), Oncopodidae (*Oncopus*), etc.

Sub-order Cyphophthalmi. Palpi pediform; sternum of cephalothorax minute or absent, the foetid glands are glands on a high tubercle. Family Sironidae (*Siro*, Stylocellus).

The Opiliones are found in temperate and tropical latitudes of the eastern and western hemispheres. Most of the British species, belonging to the Phalangiidae, are remarkable for the extreme length and thinness of their legs and the small pill-like bodies.

SUPER-ORDER Rhynchostomi. Resembling the Phalangiomorphae in the wide confluence of the cephalothorax and abdomen; but



BY COURTESY OF POCOCK AND PICKARD-CAMBRIDGE

FIG. 13.—VENTRAL VIEW OF CRYPTOSTEMMA

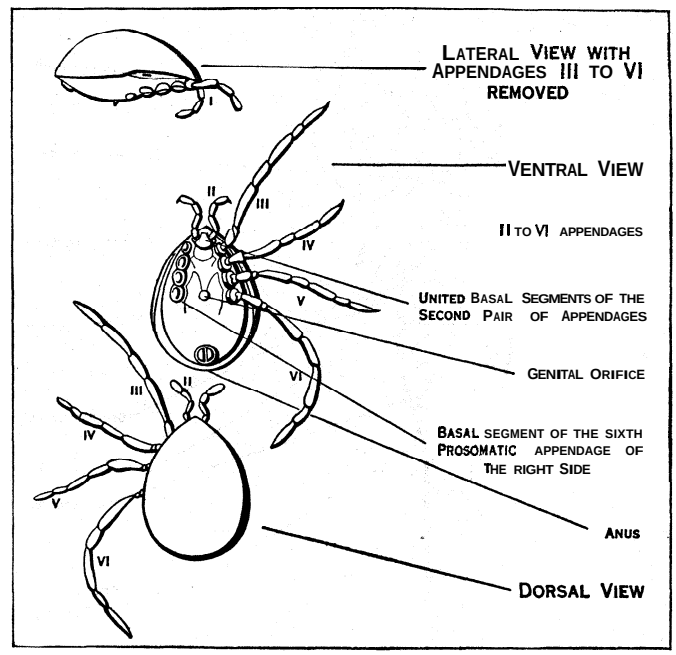
essentially distinguished by the presence of a wide sternal area between the basal segments of the legs, which are disassociated from the mouth and have no maxillary function, and by the fusion of the basal segments of the palpi beneath the mouth which lies at the front end of the body.

Order Acari (mites and ticks). Mandibles and palpi very variable, either the one or the other, frequently both, modified, closely associated with the labrum to form a suctorial proboscis which may be borne on a special segment, the capitulum, Abdomen sometimes showing indications of ten segments defined by shallow grooves, typically without trace of segmentation.

Sub-order Euacari. Parasitic or free-living, sometimes aquatic or marine, forms with a short abdomen and four pairs of normal locomotor legs. Families Oribatidae, Gamasidae, Ixodidae, Trombidiidae, etc., classified by the spiracles.

Sub-order Tetrapoda. Vegetable parasites with the abdomen very long and annulated, the third and fourth pairs of legs absent. Family Eriophyidae (Gall-mites).

Sub-order Vermiformia. Parasitic forms living in the hair-follicles of Mammalia, with the abdomen long and annulated and



AFTER THORELL

FIG. 14.—ONE OF THE ORDER OF ACARI, ILLUSTRATING THE STRUCTURE OF THE MITES AND TICKS

four pairs of legs, short, conical and three-jointed. Family Demodicidae (Demodex), the cause of follicular mange. (See MITE, TICK.)

Most of the existing orders of terrestrial Arachnida are represented in the Coal Measures. But those deposits have yielded remains of genera referable to three distinct orders, the Haptopoda, Phalangiotarbi and Anthracomarti.

The Haptopoda in the wide confluence of the cephalothorax and abdomen, the apparent fusion of the abdominal segments and the pediform palpi superficially resemble some Opiliones; but in the presence of 11 abdominal segments, the structure of the abdominal sterna, the separation of the basal segments of the postoral appendages of the cephalothorax by a distinct sternal area and the tactile function of the legs of the first pair resemblance may be traced to some of the Caulogastra. One genus only, Plesiosiro, family Plesiosiromidae is known.

The Phalangiotarbi also recall the Opiliones in the above mentioned characters, but are distinguished from all the other orders by the progressive increase in length of the abdominal segments from the first to the ninth, and in the radial arrangements of the large wedged-shaped basal segments of the four pairs of legs round the small sternal area, those of the first pair concealing the basal segments of the other palpi; the genital sternal plate was situated between the last pair of legs. Families Phalangiotarbidae (*Phalangiotarbus*), Architarbidae (Architarbus, *Geraphrynus*).

The Anthracomarti had a wide movable joint between the cephalothorax and abdomen, the abdomen consisting of as many as ten segments provided with pleural plates, those of the eighth overlapping small ninth and tenth segments; the pediform palpi and four pairs of legs were separated by a distinct sternal area very much as in the Araneae; but the structure of the abdomen is distinctive of the order. Families Brachypygidae (Brachypyge),

Anthracomartidae (*Anthracomartus*), Anthracosironidae (*Anthracosiro*), Eophrynidae (*Eophrynus*).

It is significant that although these extinct orders show gross resemblances to existing orders of epectinate Arachnida, serving to link more closely constituents of that section into a coherent assemblage, no fossil forms are known bridging in any way a structural interval between the Epectinata and the Pectinifera.

Certain other groups, namely the Pycnogoniea or Pantopoda, the Tardigrada and the Linguatulida or Pentastomida were formerly referred to the Arachnida. The last two seemed to have no claim to be so classified. For particulars concerning them see TARDIGRADA, and PENTASTOMIDA. The Pycnogonida (*q.v.*), however, are like the Arachnida in some respects and were retained in the class by Lankester. But they are here regarded as a distinct class on account of several important characters they possess. There may be, potentially at all events, eight pairs of appendages set apart for locomotion, prehension or other purposes instead of the six pairs seen in the Nomomeristis Arachnida. Also the abdomen, always large and conspicuous in the Arachnida, as here understood, is reduced to a mere anal knob. More important still is the lodgement in the four parts of the body of the genital glands which open upon the basal segments of more or fewer of the appendages. These features in the organization of the Pycnogonida cannot be brought into agreement with that of the true Arachnida the orders of which form a coherent assemblage of more or less intergradational types of Arthropoda. (R. I. P.)

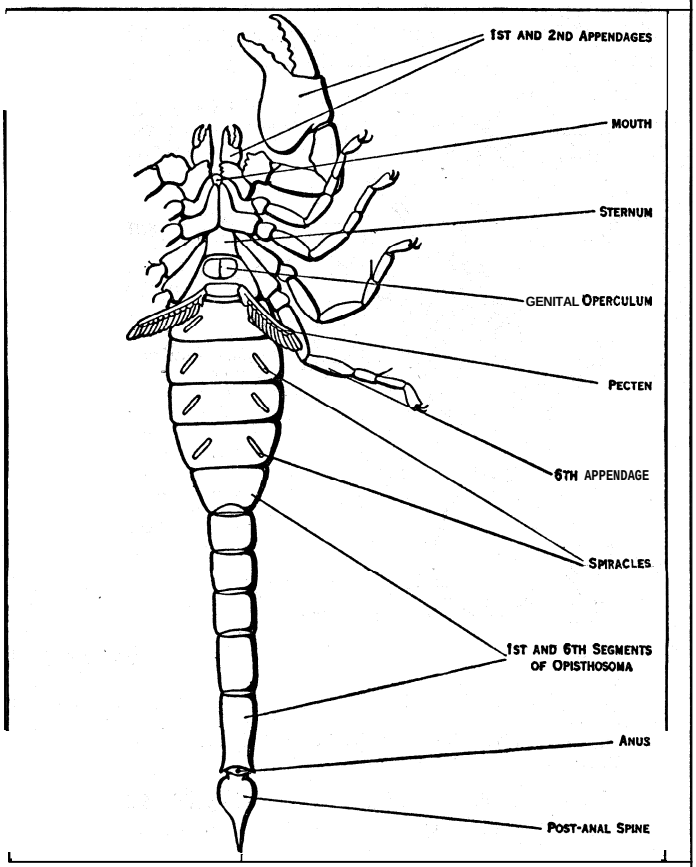


FIG. 15—VENTRAL VIEW OF SCORPION (PANDINUS), WITH THE POST-ORAL APPENDAGES OF THE PROSOMA CUT SHORT ON THE LEFT SIDE

ARACHOSIA, a far eastern province of the Persian empire and that of Alexander. It was early lost by the Seleucids and became part of the rising Parthian empire. It lay north of Gedrosia (Baluchistan) and occupied the southern portion of Afghanistan (*q.v.*). Its chief town was Alexandria Arachosiorum. (See also PERSIA: *Ancient History.*)

ARAD, a town in western Rumania, capital of the department of the same name. The population of the town in 1939 totalled 75,725. It lies on the right bank of the River Mures and consists of the inner town and five suburbs. Arad is a modern-built town and contains many handsome buildings, including a cathedral. It is the seat of a Greek-Orthodox bishop and possesses a Greek-Orthodox theological seminary, two training schools for teachers — one Hungarian and the other Rumanian — and a conservatoire for music. It has a museum containing relics of the Hungarian revolution of 1848–49. One of the public squares contains a martyrs' monument, erected in memory of the *13* Hungarian generals shot here on Oct. 6, *1849,* by order of the Austrian general Haynau. Arad is an important railway junction and the largest industrial and commercial centre of western Rumania. Its principal industries are distilling, milling, machinery-making, leather-working and saw-milling. A large trade is carried on in grain, flour, alcohol, cattle and wood. Arad was a Turkish fortress during the 17th century. The new fortress, built in *1763,* played a great rôle during the Hungarian struggle for independence in *1849.* It was captured by the Hungarians on July *1, 1849,* and was their headquarters during the latter part of the insurrection. Here Kossuth issued his famous proclamation (Aug. 1849), and here he handed over the supreme military and civil power to Görgei. The fortress was recaptured shortly after Görgei's capitulation at Világos.

The town of New Arad, on the opposite bank of the Mureș, is practically a suburb of Arad, with which it is connected by a bridge. It was founded during the Turkish wars of the 17th century, growing up round works erected by the Turks for the capture of Arad.

ARAGO, DOMINIQUE FRANÇOIS JEAN (1786–1853), French physicist, was born Feb. *26 1786,* at Estagel, Perpignan, eastern Pyrenees. He was the eldest of four brothers. Jean (1788–1836) emigrated to America and became a general in the Mexican army. Jacques Etienne Victor (1799–1855) took part in L. C. de S. de Freycinet's exploring voyage in the Uranie from *1817* to *1821,* and on his return to France devoted himself to journalism and the drama. The fourth brother, Etienne Vincent (1802–92), is said to have collaborated with Balzac in the *Héritière* de *Birague,* and from *1822* to 1847 he wrote a great number of light dramatic pieces, mostly in collaboration. A strong republican, he was obliged to leave France in *1849,* but returned after the amnesty of *1859.* In *1879* he was nominated director of the Luxembourg Museum.

François Arago was educated at the municipal school of Perpignan and at the Ecole Polytechnique, but instead of entering the army as had been intended, he became secretary to the Paris observatory. He became acquainted with Laplace, and through his influence was commissioned, with J. B. Biot, to complete the meridional measurements which had been begun by J. B. J. Delambre, and interrupted since the death of P. F. A. Méchair (1744–1804). The two left Paris in *1806,* and began operations among the mountains of Spain, but Biot returned to Paris after they had determined the latitude of Formentera.

Arago was left alone to make the geodetical connection of Majorca with Iviza and Formentera. The expedition coincided with the French invasion of Spain, and the astronomer was involved in a series of amazing adventures. In making his escape from the Balearic islands to Algiers he was captured by a Spanish corsair, and spent three months in Spanish prisons. Released with other prisoners at the demand of the Dey of Algiers, he spent six months in Africa before he returned to Marseilles. He was in quarantine there when he received his first letter from A. von Humboldt, who became his lifelong friend. Through all his vicissitudes Arago had preserved his observations and records. Though he was still only *23* years of age he succeeded J. B. L. Lalande in the chair of analytical geometry at the École Polytechnique, and became one of the astronomers at the Royal Observatory.

In *1830* he entered the chamber as republican deputy for Seine Inférieure. In the chamber he advocated many important practical measures for the advancement of science and for technical development in railways, telegraphs, etc. In the same year he was made director of the observatory, and perpetual secretary of the Academy of Sciences. During the reign of Louis Philippe he was absorbed in his scientific work, but after the

revolution of 1848 he joined the Provisional Government as minister of war and marine. Arago carried important reforms during his short tenure of office. He improved the sailors' rations, abolished flogging, and did away with political oaths. He also secured the abolition of Negro slavery in French colonies.

In 1852 when Louis Napoleon's Government demanded an oath of allegiance from all its functionaries Arago resigned his post as astronomer at the Bureau des Longitudes, but the Prince-President declined to accept his resignation. Arago died in Paris on Oct. 2 1853.

Arago's fame as an experimenter and discoverer rests mainly on his contributions to magnetism and optics. He found that a magnetic needle made to oscillate over non-ferruginous surfaces, such as water, glass, copper, etc., falls more rapidly in the extent of its oscillations according as it is more or less approached to the surface. This discovery was followed by another, that a rotating plate of copper tends to communicate its motion to a magnetic needle suspended over it ("magnetism of rotation"). Arago is also fairly entitled to be regarded as having proved the long-suspected connection between the aurora borealis and the variations of the magnetic elements.

In optics he has the credit of stimulating the genius of A. J. Fresnel, with whose history, as well as with that of E. L. Malus and of Thomas Young, this part of his life is closely interwoven. In the beginning of the 19th century these three philosophers were shaping the modern doctrine of the undulatory theory of light. Fresnel's arguments in favour of that theory were not acceptable to Laplace, Poisson and Biot, the champions of the emission theory; but they were ardently espoused by Humboldt and by Arago, who had been appointed by the Academy to report on the paper. An intimate friendship sprang up between Arago and Fresnel. They carried on together further researches, which led to the enunciation of the fundamental laws of the polarization of light known by their names.

Arago constructed a *polariscope,* which he used for observations on the polarization of the light of the sky. To him is also due the discovery of the power of *rotatory polarization* exhibited by quartz, and last of all, among his many contributions to the support of the undulatory hypothesis, comes the *experimentum crucis* which he proposed to carry out for comparing directly the velocity of light in air and in water or glass. On the emission theory the velocity should be accelerated by an increase of density in the medium; on the wave theory, it should be retarded. In 1838 he communicated to the Academy the details of his apparatus, which utilized the revolving mirrors employed by Sir C. Wheatstone in 1835 for measuring the velocity of the electric discharge; but owing to the great care required in the carrying out of the project, and to the interruption to his labours caused by the revolution of 1848, it was not until the spring of 1850 that he was ready to put his idea to the test; and then his eyesight suddenly gave way. Before his death, however, the retardation of light in denser media was demonstrated by the experiments of H. L. Fizeau and J. B. L. Foucault, which, with improvements in detail, were based on the plan proposed by him.

BIBLIOGRAPHY.—Arago's *Oeuvres* were published after his death under the direction of J. A. Barral, in 17 vols., 8vo (1854–62); also separately his *Astvonomie populaire,* 4 vols.; *Notices biogvaphiques,* 3 vols.; *Notices scientifiques,* in 5 vols. *Voyages scientifiques,* in 1 vol.; *Mémoires scientifiques,* in 2 vols.; *Mélanges,* in 1 vol.; and *Tables analytiques et documents importants* (with portrait) in 1 vol. English translations of various portions of his works have appeared.

ARAGON, constituent kingdom of the Spanish monarchy, administrative unit until 1833, now divided into the three provinces of Saragossa, Huesca and Teruel (*qq.v.*). The north frontier of Aragon follows the Pyrenean water-parting, from the peak of Anie (2,504m.), the last of the great peaks towards the west, to the peak of the Aneto (3,404m.) in the Maladetta group. Thus Aragon is backed by the western, or forward, *échelon* of the high Central Pyrenees, nearly to the point where the headwaters of the River Garonne separate it from the eastern. From this background of high peaks the descent to the lowlands of the Ebro is less rapid (average gradient $3\frac{1}{2}$ in 100) than the descent towards the Garonne on the French side (7 in 100). The difference is due to the much greater development on the south side of topographical features parallel to the principal axis of the chain. Thus the River Aragon—finding at Jaca the soft marl which runs from east to west in a belt from Pamplona, in Navarre, to Boltaiia—is diverted west and forms the broad valley of the Canal de Berdun; the influence of this belt is seen also in the course of the Cinca and of certain minor streams. East of Boltaiia the rivers flow directly south, and the first of these, the Noguera Ribagorzana, gives the eastern boundary of Aragon. South of the belt of marl, a series of sierras—roughly aligned from west-north-west to east-south-east—of which the Sierra de Guara (2,070m.) is the most important, runs from the River Aragon to the Sierra del Montsech (1,693m.) in Catalonia; these sierras overlook the great, saucer-shaped central lowland on their south, across which runs the River Ebro. The heart of Aragon is this lowland and more strictly that part to which the descent from the crest of the Pyrenees is most obviously a descent by steps. The approaches to the defile by which the Ebro cuts its way from this enclosed basin through the Catalan coastal chain to the sea belong to Catalonia from Fayón downstream. The western boundary of Aragon runs more or less diagonally across the sierras bordering the central plateau so as to include within Aragon, in the south, the greater part of the sierra belt, while in the north the commanding Sierra del Moncayo (2,315m.), immediately overlooking the Ebro lowland, forms an advanced bulwark of Castile. The descent from the central plateau is again by steps, and the border of Aragon is defined so as to cover the important structural depression, occupied in part by the River Jiloca, which runs from Calatayud, on the river Jalón, to Teruel. From the eastern limit of this depression the boundary runs to the Ebro at Fayón so as to include in Aragon the headwaters of the streams flowing to the Mediterranean. It is clear from the above that Aragon divides naturally into zones, parallel in the north to the Pyrenees and in the south to the border of the plateau. In the first zone, that of the high Pyrenean valleys, cultivated patches sustain scanty village populations; there is some mining—the cobalt mines are interesting—but the forest and the high summer pastures are the chief resources.

The next, the limestone zone to the south, includes picturesque scenic forms carved by the rivers; it is represented as high as the Pyrenean crest in the Monte Perdido (3,352m.), one of the Three Sisters group. The zone is of no economic importance, but its strategic interest is obvious from the structure. Behind the protecting sierras to the south, Sierra di Guara, etc., beyond which the Muslims made no lasting conquest or impression, sprang up early in the Muslim period the countships of Aragon, with centre at Jaca, Sobrarbe, with centre at Ainsa, and Ribagorza, at first forming a single fief with Pallás. Until its establishment as an autonomous fief in 875, Ribagorza-Pallás was dependent on Toulouse through Cerdagne, and the influence sf the easy Segre-Cerdagne pass across the Pyrenees extended as far westwards as the Ésera, the western boundary of Ribagorza. The separation of Pallás, the amalgamation (between 1034 and 1038) of Ribagorza with the western countships, which had always looked west to Navarre, and the declaration of Aragon as an independent kingdom (*c.* 1034) defined the boundaries of Upper Aragon as dmcribed above.

The lowland zone, which dips from an altitude of 500m. to the Ebro (at zoom. near Saragossa) and rises again to the south towards the sierras, is by no means uniform. The frequency of local regional names, Monegros, Desierto de Calanda, Llano de Violada, indicates variations which express themselves sometimes in the nature of the soil (especially in the presence or absence of gypsum), but principally in the presence or absence of a non-brackish water-supply. Huesca, in the north of the zone, on the old road from the coast by Lerida which, to-day as always, avoids the arid, waterless plateau of Los Monegros, was an important town long before Saragossa, the natural centre of the lowlands. In the period following the final establishment by Augustus of Roman authority in the entire peninsula and with the new appreciation of the importance of the line of the Ebro as a base-line in strategical schemes envisaging the peninsula as a

whole, Saragossa became a most important nodal point of communications. Standing at the point of confluence with the Ebro of the Gallego valley, by which came the road from the Pyrenean pass of *Summus Portus,* and of the Huerva on the south, Saragossa was also within 15 miles of the mouth of the Jalón, the entrance to the pass leading by the Sierra Ministra and the river Henares to the Tagus, and in Saragossa was focussed the importance of the central lowland from which radiated all the routes to the interior of the peninsula. These advantages of site the city has always enjoyed, *mutatis mutandis,* in a degree corresponding with the degree of unification of the peninsular regions. The central lowland of Aragon had its most complete historical expression in the Muslim period as the kernel of the kingdom of Saragossa. Not always able to maintain its independence of the Umaiyads of Cordova or of the Moroccan dynasties controlling the south, nor able always to control the north of its own area where the cities had climatic advantages and where Huesca had a much older tradition, the kingdom did not long survive the capture by Aragon of Monzfrn (1089) and of Huesca (1096); Saragossa itself fell in 1118. The union of the enlarged kingdom of Aragon, now centred in Saragossa, with the maritime state of Catalonia (1135) gave it a new Mediterranean outlook. The circumscription of Aragon by Castile both on the north, where the district of La Rioja and the plateau of Soria became finally Castilian, and on the south, where the conquest of Murcia for Castile drove a wedge between Valencia, held by the Aragonese, and the Muslims of Granada, forced eastwards the expansion of Aragon and led to the foundation of the Aragonese empire, for which *see* general article on Spain.

The southern part of Aragon would form one single zone of hill country were it not for the strip of sheltered valleys along the line of the Jalón and of the depression marked by the towns of Calatayud, Daroca and Teruel. With Albarracin, on the upper Guadalaviar, these towns formed the four communities which dominated the hill pastures for many centuries. The peach ripens in the valleys, where the irrigated lands are intensely cultivated; apart from these the sheep pastures on the hills are the principal resource.

In temperature Lower Aragon is intermediate between that of Old Castile with its low mean winter temperatures and that of New Castile with its high mean summer temperatures. Northward from the Sierra de Guara the seasons are reduced more and more to long severe winters and short cool summers; in a lesser degree the same is true of the highlands of Aragon. The rainfall is small save on the Pyrenean front, and we note the approximate equality both of the winter and summer minima and of the spring and autumn maxima. The deficiency of the rainfall, which does not exceed 500mm. annually over the greater part of Aragon, and falls below 300mm. in the neighbourhood of Saragossa, has made irrigation a prime necessity. For irrigation conditions are less favourable than they appear at first sight to be if one considers only the schematic arrangement of lowland with surrounding hills and mountains and the apparent abundance of the water-supply in the rivers. This ideal *schema* is discounted by the unfavourable conditions of relief and of soil, which have made the provision of canals proper, as opposed to mere trenches, imperative for irrigation, and by the extreme seasonal variation in the rivers, to meet which schemes are now in progress for the construction of enormous dams on their upper courses. Large capital expenditure under State leadership has made irrigation in Aragon a political question; the phrase *política hidráulica* was coined here to describe the impassioned campaigns of Joaquin Costa (1846–1911) on its behalf. In the most recent times a new and wider conception of the whole problem of irrigation in the north-east has led to the establishment by royal decree (March 5, 1926), of the *Confederación Sindical Hidrográfica del Ebro* with headquarters in Saragossa, which grew from a scheme for a reservoir at Reinosa, province of Santander, of capacity 550,000,000 cubic metres to regulate the Ebro. The indirect social and political consequences of assembling round one table delegates from Castile, the Basque Provinces, Navarre, Aragon and Catalonia for vital economic business may be even greater than the direct economic consequences of a unified irrigation policy. Of the canals the most important are the Imperial canal (96 kilos in length with 12 kilos of annexes), with intake from the Ebro on the right bank below Tudila and terminating at El Burgo, below Saragossa; the Canal de Tauste (34½ kilos), on the opposite side of the river; the Canal de Aragon y Cataluiia, with intake from, the Ésera near Olvena, the principal canal terminating near the junction of the rivers Segre and Cinca. The largest reservoir is that of La Peña, on the River Gallego, with a capacity of 25,000,000 cubic metres. The Moneva reservoir, on the River Aguas, with a capacity of 11,000,000 cubic metres, is the largest in south Aragon. These figures are dwarfed by those of the proposed new reservoirs and canals. Besides the Reinosa reservoir mentioned above, those of Sotonera on the Gallego and of El Mediano on the Cinca enormously exceed in capacity any existing reservoir; they form part of a scheme for the irrigation of Upper Aragon, which includes the construction of a canal 146 kilos in length for the irrigation of Los Monegros, a canal which, if constructed, will be the longest in Europe after the Cavour canal, in Italy.

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ARAGONITE, one of the mineral forms of calcium carbonate ($CaCO_3$), the other form being the more common mineral calcite. It crystallizes in the orthorhombic system, and the crystals are either prismatic or acicular in habit. Simple crystals are, however, rare; twinning on the prism planes being a characteristic feature of the mineral. This twinning is usually repeated often on the same plane and gives rise to striations on the terminal faces of the crystals; often, also, three crystals are twinned together on two of the prism planes of one of them, producing an apparently hexagonal prism. The mineral is colourless, white or yellowish, transparent or translucent, has a vitreous lustre, and, in fact, is not unlike calcite in general appearance. It may, however, always be readily distinguished from calcite by the absence of any marked cleavage, and by its greater hardness (H.=$3\frac{1}{2}$—4) and specific gravity (2.93); further, it is optically biaxial, whilst calcite is uniaxial.

The mineral was first found as reddish twinned crystals with the form of six-sided prisms at Molina in Aragon, Spain, where it occurs with gypsum and small crystals of ferruginous quartz in a red clay. It is from this locality that the mineral takes its name. Fine groups of crystals of the same habit are found in the sulphur deposits of Girgenti in Sicily. Fibrous forms are also common. A peculiar coralloidal variety known as *flosferri* ("flower of iron") consists of radially arranged fibres: magnificent snow-white specimens of this variety have long been known from the iron mines of Eisenerz in Styria. The calcareous secretions of many groups of invertebrate animals consist of aragonite (calcite is also common); pearls may be specially cited as an example.

Aragonite is the more unstable of the two modifications of calcium carbonate. A crystal of aragonite when heated becomes converted into a granular aggregate of calcite individuals: altered crystals of this kind (paramorphs) are not infrequently met with in nature, whilst in fossil shells the original nacreous layer of aragonite has invariably been altered to calcite. The thermal springs of Carlsbad deposit spherical concretions of aragonite, forming masses known as pisolite or *Sprudelstein.*

ARAGUA, one of the smaller States of Venezuela lying principally within the parallel ranges of the Venezuelan Cordillera and comprising fertile and healthful valleys. It is bounded on the east by the Federal District and State of Miranda, on the south by Guarico and on the west by Carabobo. Pop. (1941) 138,108.

Aragua has a short coast-line on the Caribbean, west of the Federal district, and a port at Ocumare is growing. Cattle, swine and goats are raised, and the state produces coffee, sugar, cacao, beans, cereals and cheese. The climate of the higher valleys is sub-tropical, the mean annual temperature ranging from 74° to 80°. The capital, Maracay (population, 1936, 29,759), is situ-

ated in the fertile Aragua valley 1,500 ft. above sea level and 77 mi S.W. of Caracas, with which it is connected by a fine highway. There is also a highway to Ocumare, to La Victoria, to Valencia, etc. Other important towns are La Victoria (population 8,000); Villa de Cura (population 7,550); and Cagua. The most important features of recent progress are the 225 mi. of highways traversing the state (1940), providing outlets for agricultural and other products.

ARAGUAYA, ARAGUAY or **ARAGUIA, a** river of Brazil and principal affluent of the Tocantins, rising in the Serra do Cayapó, where it is known as the Rio Grande, and flowing in a north by east direction to a junction with the Tocantins at São João do Araguaya, or São João das Duas Barras. Its upper course forms the boundary line between Goyaz and Matto Grosso. The river divides into two branches at about 13° 20′ S. lat., and unites again at 10° 30′, forming the large island of Santa Anna or Bananal. The eastern branch, called the Furo, is the one used by boats, as the main channel is obstructed by rapids. Its principal affluent is the Rio das Mortes, which rises in the Serra de São Jeronymo, near Cuyabá, Matto Grosso, and is utilized by boatmen going to Pará. Of other affluents, the Bonito, Garças, Cristallino and Tapirapé on the west and the Pitombas, Claro, Vermelho, Tucupá and Chavante on the east nothing definite is known as the country is still largely unexplored. The Araguaya has a course of 1,080m., considerable stretches of which are navigable for small river steamers, but as the river below Santa Anna island is interrupted by reefs and rapids in two places—one having a fall of 85ft. in 18m., and the other a fall of 50ft. in 12m.—it affords no practicable outlet for the products of the State. It was explored in part by Henri Coudreau in 1897.

See Coudreau, *Voyage au Tocantins-Araguaya (1897).*

ARAKAN, a division of Burma (*q.v.*), a strip along the eastern seaboard of the Bay of Bengal, from the Naaf estuary, on the borders of Chittagong, to Cape Negrais. Length from northern extremity to Cape Negrais, about 400m.; greatest breadth in the northern part, 90m., gradually diminishing towards the south, as it is hemmed in by the Arakan Yoma mountains, until, in the extreme south, it tapers away to a narrow strip not more than 15m. across. The coast is studded with islands, the most important of which are Cheduba, Ramree and Shahpura. The Arakan Division does not extend as far south, the coastal strip for a hundred miles northwards from Cape Negrais lying in the Bassein District of the Irrawaddy Division. The division has its headquarters at Akyab and consists of four districts—namely, Akyab, Northern Arakan Hill Tracts, Sandoway and Kyaukpyu, once called Ramree. Its area is about 16,000 sq.m. The population at the time of the British occupation in 1826 did not exceed 100,000. In 1831 it amounted to 173,000; in 1839 to 248,000; in 1901 to 762,102; in 1911 to 839,896, and in 1931 to 1,008,535.

The principal rivers of Arakan are—(I) the Naaf estuary, in the north, which forms the boundary between the division and Chittagong; (2) the Mayu river, an arm of the sea, running a course almost parallel with the coast for about 50m.; (3) the Kaladan river, rising near the Blue mountain, in the extreme north-east, and falling into the Bay of Bengal a few miles south of the Mayu river, navigable by vessels of from 300 to 400 tons burden for a distance of 40m. inland; and (4) the Lemro river, a considerable stream falling into the bay and a few miles south of the Kaladan. Farther south nearness of the boundary range makes the rivers short. Among them the Dalet and the An are navigable by boats; others are the Sandoway, the Taungup and the Gwa streams, the latter of which alone has any importance, owing to its mouth forming a good port of call or haven for vessels of from 9 to 10ft. draught. There are several passes over the Yoma mountains, the easiest being that called the An (or Aeng) route, leading from the village of that name in Arakan to Ngapè and Minbu in Central Burma, and the Taungup route leading from Taungup in Arakan to Prome on the Irrawaddy. Only one-tenth of this very hilly division is cultivated and rice occupies over nine-tenths of the cropped area. Other crops include fruits, chillies, dhani and tobacco. The natural vegetation of the lower slopes of the hills (up to 3,000ft.) is evergreen forest, in most areas too wet for teak; of the higher slopes a forest of evergreen oaks. But the forests have been destroyed over huge areas by native cultivators and their place taken by a useless tangle of bamboo.

The natives of Arakan trace their history as far back as 2666 B.C., and give a lineal succession of 227 native princes down to modern times. According to them, their empire had at one period far wider limits, and extended over Ava, part of China and a portion of Bengal. This extension of their empire is not, however, corroborated by known facts in history. At different times the Moguls and Pegus carried their arms into the heart of the country. The Portuguese gained a temporary establishment in Arakan; but in 1782 the Burmese conquered the province and it was ceded to the British in 1826, under the treaty of Yandaboo. The former capital, Arakan, is on an inferior branch of the Kaladan river. Remoteness from ports and harbours, and extreme unhealthiness have led to its gradual decay and Akyab (*q.v.*) is now the chief town in Arakan. The old city (now Myohaung) lies 50m. north-east of Akyab.

The Arakanese are Burmese, but separated from the parent stock by the Arakan Yoma mountains, and they have a dialect and customs of their own. Like the Burmese, they are Buddhists.

(L. D. S.)

ARAKCHEYEV, ALEKSYEI ANDREYEVICH, COUNT (1769–1834), Russian soldier and statesman, was descended from an ancient family of Great Novgorod. In July 1791 he was made an adjutant on the staff of Count N. I. Saltuikov, who recommended him to the tsarevich Paul Petrovich for reorganizing the army corps maintained by the prince at Gatchina. Arakcheyev won the confidence of Paul by his zeal and technical ability. His inexorable discipline soon made the Gatchina corps a model for the rest of the Russian army. On the accession of Paul to the throne Arakcheyev was immediately promoted, and was entrusted with the reorganization of the army. He remorselessly applied the iron Gatchina discipline to the imperial forces, beginning with the Preobrazhenskoe Guard, of which he was colonel. He soon became generally detested, but pursued his course unflinchingly and introduced many indispensable hygienic reforms. Nevertheless the opposition of the officers proved too strong for him, and on March 18 1798 he was dismissed from all his appointments. Arakcheyev's first disgrace only lasted six months. On Aug. 11 he was reinstated and on May 5 1799 was created a count, the emperor himself selecting the motto: "Devoted, not servile." Five months later he was again dismissed, this time on the strength of a denunciation subsequently proved to be false.

During the earlier years of Alexander I., Arakcheyev was completely overlooked; but on April 27 1803 he was recalled to St. Petersburg, and employed as inspector-general of the artillery. His wise reorganization of the whole department contributed essentially to the victories of the Russians during the Napoleonic wars. The commissariat scandals which came to light after the peace of Tilsit convinced the emperor that nothing short of the stern and incorruptible energy of Arakcheyev could reach the sources of the evil, and in Jan. 1808 he was appointed inspector-general and war minister. When, on the outbreak of the Swedish war of 1809, the emperor ordered the army to cross the ice of the Gulf of Finland, it was only the presence of Arakcheyev that compelled an unwilling general and a semi-mutinous army to begin a campaign which ended in the conquest of Finland. On the institution of the "Imperial Council" (Jan. 1 1810), Arakcheyev was made a member of the council of ministers and a senator, while still retaining the war office. Subsequently Alexander was alienated from him owing to the intrigues of the count's enemies, who hated him for his severity and regarded him as a dangerous reactionary. The alienation was not for long. True, Arakcheyev took no active part in the war of 1812, but all the correspondence and despatches relating to it passed through his hands, and he was the emperor's inseparable companion during the whole course of it. In Alexander's last years Arakcheyev was his chief counsellor and friend, to whom he submitted all his projects for consideration and revision. On the accession of Nicholas I.,

Arakcheyev, thoroughly broken in health, gradually restricted his immense sphere of activity, and on April 26 1826 resigned all his offices and retired to Carlsbad. His last days he spent on his estate at Gruzina, carefully collecting all his memorials of Alexander. Arakcheyev died on April 21 1834. In 1806 he had married but lived apart from his wife.

BIBLIOGRAPHY.—*See* Vasily Ratch, Memorials of Count Arakcheyev (Rus.) (1864); Mikhail Ivanovich Semevsky, Count Arakcheyev and the Military Colonies (Rus.) (1871); Theodor Schiemann, Gesch. Russland's *unter* Kaiser Nikolaus I., vol. i., Alexander I., et~ (1904).

ARAL, a lake or inland sea in western Asia, between lat. 43° 30' and 46° 50' N., and long. 58° 0' and 62° E. It was known to the ancient Arab and Persian geographer6 as the Sea of Khwbrizm or Kharezm, from the neighbouring district of the Chorasmians, and derives its present name from the Kirghiz designation of Araldenghiz, or Sea of Islands. It is the fourth largest inland sea of the world having a total length of 280 miles and a width of some 130 miles. The maximum depth is only 63 metres, in a depression parallel to the west coast, and the average is only 16 metres. Its altitude is 74 metres above the Caspian, *i.e.*, 48 metres above the ocean. It is surrounded on the north by steppes; on the west by the rocky plateau of Ust-Urt, separating it from the Caspian; on the south by the alluvial district of Khiva; and on the east by the Kyzyl-kum or Red Sand Desert. The north shores are low, and broken by irregular bays such as those of Sary-chaganak and Paskevich. On the west an almost unbroken wall of clay formation extends from Tschernyshewa bay southwards, and attains a height of some 250 feet. On the south is the delta of the Oxus (Jihūn, Amu-darya), one of the arms of which, the Laudan, forms a swamp, 130km. long and 30km. broad, before it discharges into the sea. The Jaxartes (Sihūn, Syr-darya) enters in the north-east and is suspected to be shifting its embouchure to the north. These rivers bring down vast quantities of sediment; the delta of the Syr-darya increased by 34 sq.km. between 1847 and 1900. The eastern coast is fringed with multitudes of small islands, and others, some of considerable size, lie in the open towards north and west. Frequency and violence of storms, and almost total absence of shelter hinder navigation; there is little shipping save some flat-bottomed boats of the Kirghiz. The north-east wind is the most prevalent, and sometimes blows for months together. The salinity of Aral is only 10·7 per cent. The surface temperature varies between 32°F. in winter, when long stretches of the coast are ice-fringed, and 80°F. in late summer (E. Berg, 1900–8). Variations of level are remarkable and irregular and quite unconnected with the Briickner 35-year cycle, but the old idea that the sea disappears at times is wrong. Until 1880 the sea had long been diminishing and this gave rise to the idea, in western Europe, that the inland basins of west central Asia were drying up, but from 1880 to 1908 the level rose by nearly 3 metres, and there was increased utilization of the waters of Amu-darya and Syr-darya in their upper courses for irrigation. Islands previously linked with the shore became widely separated from it. Between the 13th and 16th centuries and in antiquity the Amu-darya may have sent an arm to the Caspian south of the Ust-Urt plateau. Within historic times also the Aral sea may have had a connection with the Mertyyi Kultuk gulf of the north-east Caspian, and in this case would then have been a freshwater lake. Its level was much higher in post-Pliocene times, for shells of Pecten and Mytilus species occur in the Kara-kum desert 55km. to the south of, and 24 metres or even perhaps 65 metres above, the present sea. The fish of Aral are freshwater species and some of its rapid streams still preserve the ancient fish type *Scaphirhynchus.* Fishing is not so productive as in the Caspian but fish are sent to Turkistan, Merv and Russia. The shores are uninhabited, the nearest settlements being Kazala, 90km. east on the Syr, and Chimbai and Kungrad in the Amu delta. The Orenburg-Tashkent Railway passes near the north-east corner of Aral.

BIBLIOGRAPHY.—Makshéev, Description of Lake Aral, Zapiski, Russ. Geogr. Soc., 1st ser., vol. v.; Kaulhar, Delia of the *Amu,* ibid., new ser., vol ix.; Mushketov, *Turkestan,* vol. i. (1886); Berg, *Izvestia,* Turkistan Branch of Russ. Geogr. Soc. (Tashkent, 1902 and 1908); Woeikof, Der Aralsee, Peterm. Mitt. (1909); Xalbiass, Die *Seen der Erde* (1922).

ARALIA, a genus of aromatic herbs, shrubs and small trees of the aralia or ginseng family (Araliaceae), containing about 35 species, in North America, Asia, Malaya and Australia. Some are cultivated for ornamental foliage and some possess medicinal properties. The stems and leaf stalks are often spiny or bristly; the leaves are usually much divided into toothed leaflets; and the small flowers, which are borne in panicled umbels, are sometimes very numerous, the entire inflorescence being showy. Among the North American members of the genus are the American spikenard (*A. racemosa*), which grows from 3 ft. to 6 ft. high in rich woods from New Brunswick to South Dakota and south to Georgia and Missouri; the Virginian sarsaparilla (*A. nudicaulis*), a foot in height, found in woods from Newfoundland to British Columbia, south to North Carolina and Colorado; the bristly sarsaparilla (*A. hispida*), about 2 ft. high, native to sandy clearings from Newfoundland to Hudson bay and southward to North Carolina and Indiana; the Elk clover (*A. californica*), a robust form, sometimes 10 ft. high, found along mountain streams in California and Oregon; and the angelica tree, Hercules' club or devil's walking-stick (*A. spinosa*), a spiny shrub or small tree, sometimes 40 ft. high, native to low grounds from New York to Indiana and southward to Florida and Texas, frequently planted for ornament and sometimes escaping to roadsides and thickets. The Chinese angelica tree (*A. sinensis* and *japonica*) is the east Asian counterpart of the North American *A. spinosa,* but is less prickly and has more showy flowers. Many hardy varieties of the Chinese angelica tree are in cultivation. Nurnerous greenhocse plants called aralias are species of *Polyscias* and related genera of the aralia family. Ginseng (*q.v.*) is obtained from *Panax shenseng,* native to China, a plant closely related to the aralias.

ARAM, EUGENE (1704–1759), English scholar, and murderer, was born of humble parents at Ramsgill, Yorkshire. In 1745, when he was schoolmaster at Knaresborough, a man named Daniel Clark, his intimate friend, after obtaining a considerable quantity of goods from some of the tradesmen, suddenly disappeared. Suspicions of being concerned in this swindling transaction fell upon Aram. His garden was searched, and some of the goods found there. As, however, there was not evidence sufficient to convict him of any crime, he was discharged, and soon after set out for London, leaving his wife behind. For several years he travelled through parts of England, acting as usher in a number of schools, and settled finally at Lynn, in Norfolk. During his travels he had amassed considerable material for a projected Comparative Lexicon of the English, Latin, Greek, **Hebrew** and Celtic Languages. He was undoubtedly an original philologist, who realized, what was then not yet admitted by scholars, the affinity of the Celtic language to the other languages of Europe, and could dispute the then accepted belief that Latin was derived from Greek. But he was not destined to live in history as the pioneer of a new philology. In Feb. 1758 a skeleton was dug up at Knaresborough, and some suspicion arose that it might be Clark's. Aram's wife had more than once hinted that her husband and a man named Houseman knew the secret of Clark's disappearance. Houseman was at once arrested and confronted with the bones that had been found. After denials, he confessed that he had been present at the murder of Clark by Aram and another man, Terry, of whom nothing further was heard. He also gave information as to the place where the body had been buried in St. Robert's Cave, a well-known spot near Knaresborough. A skeleton was dug up here, and Aram was immediately arrested, and sent to York for trial. Houseman was admitted as evidence against him. Aram conducted his own defence, and did not attempt to overthrow Houseman's evidence, although there were some discrepancies in that; but made a skilful attack on the fallibility of circumstantial evidence in general, and particularly of evidence drawn from the discovery of bones. He brought forward several instances where bones had been found in caves, and tried to show that the bones found in St. Robert's Cave were probably those of some hermit who had taken up his abode there. He was found guilty, and condemned to be executed on Aug. 6 1759, three days after his trial. While in his cell he confessed his guilt. and asserted that he had discovered

a criminal intimacy between Clark and his own wife. On the night before his execution he made an unsuccessful attempt at suicide by opening the veins in his arm.

His story has been romanticized in verse by Thomas Hood ("The Dream of Eugene Aram") and in prose by Bulwer Lytton *(Eugene Aram).* Reports of the trial are in (Borrow's) *Celebrated Crimes,* the *Newgate Calendar, Tyburn Chronicle* and similar publications. The best study is E. R. Watson, *Eugene Aram* (1913).

ARAMAIC LANGUAGES: *see* SEMITIC LANGUAGES.

ARAMEANS, the former inhabitants of Aram, a country or north Semitic kingdom extending from the western borders of Babylonia to the highlands of western Asia. Their central city was Zenjirli to the north of Aleppo and here many inscriptions have been found. In the Septuagint and Vulgate the name of this territory appears as Syria and the Arameans were in race, language and religion a part of the north Semitic family.

ARANDA, PEDRO PABLO ABARCA DE BOLEA, COUNT OF (1719–98), Spanish minister and general, was born at the castle of Siétamo, a lordship of his family near Huesca, in Aragon, Aug. 1 1719. The first half of his life was spent alternately in travel, in soldiering and in diplomacy. He introduced the Prussian system of drill into the Spanish army, and was director-general of artillery under Ferdinand VI. He threw up that post because he was not allowed to punish fraudulent army contractors, and was for some time in disgrace. But he came into favour again under Charles III., and when riots in Madrid (1766) compelled the king to leave the capital, Aranda was summoned to restore order. As president of the council of Castile he showed himself an inflexible administrator, and carried out many important reforms.

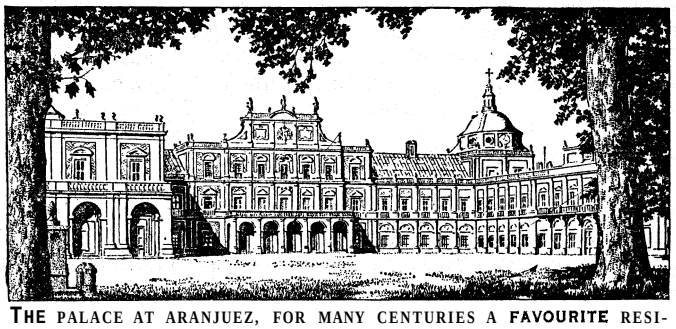
The chief event of his ministry, which lasted until 1773, was the expulsion of the Society of Jesus from Spain. During his travels Aranda had come under the influence of Voltaire, and he probably persuaded the king that the Jesuits were plotting against him. In 1767 the Order was expelled, its members being transferred to Italy. They suffered great hardships, and their brethren in South America, who were also expelled, suffered even more. Aranda's ability, his remarkable capacity for work, and his popularity made him indispensable to the king. But he was a trying servant, for his temper was captious and his tongue sarcastic, while his aristocratic arrogance led him to display an offensive contempt for the *golillas* (the stiff collars), as he called the lawyers and public servants whom the king preferred to choose as ministers, and he permitted himself an amazing freedom of language with his sovereign. He was held responsible for the diplomatic humiliation of Spain over the Falkland Islands, and at last, in 1773, Charles III. sent him as ambassador to Paris in a disguised disgrace. Aranda held this position till 1787.

In the reign of Charles IV., with whom he had been on familiar terms during the life of the old king, he was for a very short time prime minister in 1792. In reality he was merely used as a screen by the queen, Maria Louisa and her favourite, Godoy. His temper, which had become perfectly uncontrollable with age, made him insufferable to the king. He was imprisoned for a short time at Granada, and was threatened with a trial by the Inquisition. The proceedings did not go beyond the preliminary stage, and Aranda died at Epila, Jan. 9 1798.

Sre Don Jacobo de la Pezuela in the *Revista de España,* vol. xxv. (1872); Don Antonio Mª Fabié, in the *Dtccionario general de politica administracion* of Don E. Suarez Inclan (Madrid, 1868), vol. i.; M. Morel Fatio, *Études sur l'Espagne* (2nd series, Paris, 1890).

ARAN ISLANDS or SOUTH ARAN, three islands lying across Galway bay, on the west coast of Eire, in a southeasterly direction, forming a natural breakwater. They belong to County Galway, and their population was 2.109 in 1936. They are Inishmore (or Aranniore), the great island in the north; Inishman, the middle island; and Inisheer, the eastern island. The first has an elevation of 354 ft., the second of 259 ft., and the third of 202 ft. Their formation is carboniferous limestone. These islands are remarkable for a number of architectural remains of early date. In Inishmore there are remains of a circular cyclopean tower, called Dun-Aengus, ascribed to the Fir-holg or Belgae, or to Aengus, who reached Aran islands from Scotland in the 1st century A.D. There are seven similar structures in the group. Inishmore also bears the name of *Aran-na-naomh,* Aran-of-the-Saints, from the number of its religious recluses. On Inishmore are remains of the abbey of Killenda. When Christianity was introduced, Aran became one of the most famous island-resorts of religious teachers and ascetics. The total area of the islands is 18 sq.mi. The works of the Irish dramatist, John Millington Synge, are partly responsible for the general fame of the islands.

ARANJUEZ, a town of central Spain, 30 mi. S. of Madrid, on the Tagus, which above this receives few tributaries for a long distance, but here joins with the Jarama from the north. This



THE PALACE AT ARANJUEZ, FOR MANY CENTURIES A FAVOURITE RESIDENCE OF THE KINGS OF SPAIN

is the crossing point for the southern road and rail from Madrid. Pop. (1930) 15,245. The *vega* or united flats of the two rivers is very large and fertile and forms a market garden for Madrid (especially for asparagus and strawberries). Part is pasture for brood-mares, and the Hippodrome is the "Epsom Downs" of Madrid. The Grand Masters of the Order of Santiago moved from Ocaña (7 mi. S.E.) in the 14th century to this natural oasis. Their summer residence and the perpetual mastership passed to the crown in the 16th century, a succession of royal residences was built here, rivalling for a while the Escorial, Buen Retiro and San Ildefonso. Ferdinand VI. (1746–59) built the town, one of the few in Spain on a prearranged plan; it was closely associated with Charles IV. (1788–1808), for whom his father laid out the Jardín del Principe, and who built the Casa del Labrador (1803). Charles was forced to abdicate (1808).

See O. Jiirgens, *Die Spanische Stiidte* (Hamburg, 1926).

ARANY, JANOS (1817–1882), Hungarian poet, was born at Nagy-Szalontá on March 2, 1817. His family were small Calvinist yeomen of noble origin, whose property consisted of a rush-thatched cottage and a tiny plot of land. An only son, late born, seeing no companions of his own age, hearing nothing but the voices of his parents and the hymns and prayers in the little Calvinist chapel, Arany grew up a grave, gentle, and precocious child. From 1832 to 1836 Arany was a teacher, then a travelling actor. Remorse for the despair of his father, who had meant to make a pastor of this prodigal son, drove him home, carrying all his property tied up in a handkerchief. Shortly after his home-coming his mother died and his father became stone-blind. Arany at once resolved to remain with his father. He obtained a conrectorship and in 1840 a notaryship. He married Juliana Ercsey, the penniless orphan daughter of an advocate. The next few happy years were devoted to his profession and a good deal of miscellaneous reading, especially of Shakespeare (he learnt English in order to compare the original with his well-thumbed German version) and Homer. Meanwhile the reactionaries of Vienna were goading the Magyar Liberals into revolt, and Arany composed a satirical poem in hexameters, entitled "The Lost Constitution," for which he received a prize (1846) from the Kisfaludy Society, the great literary association of Hungary. He won a second prize with his *Toldi* (the first part of his epic trilogy), and found himself famous. Petofi was the first to greet him as a brother. In 1848 the people of Szalontá elected him their deputy to the Hungarian parliament. But neither then nor subsequently (1861, 1869) would he accept a parliamentary mdndate. In 1819-he was in the civil service of the revolutionary government, and after the final catastrophe returned to his native place, living as best he could on his small savings till 1850,

when Lajos Tisza, the father of Kálmán Tisza, the future prime minister, invited him to his castle at Geszt to teach his son Domokos the art of poetry. In the following year Arany was elected professor of Hungarian literature and language at the Nagy-Koros gymnasium. He also attempted to write another epic poem, but the time was not favourable for such an undertaking. The miserable condition of his country, and his own very precarious situation, weighed heavily upon his sensitive soul. Moreover, reflection on past events made clear to him not only the sufferings but the defects and follies of the national heroes, and a bitterly humorous vein in his writings dates from this time. Thus *Bolond Istók,* the first canto of which he completed in 1850, is full of sub-acrid merriment. During his nine years' residence at Nagy-Koros, Arany composed some beautiful Magyar ballads, and wrote two dissertations on the technique of the ballad in general: "Something concerning assonance" (1854), and "On Hungarian National Versification" (1856).

When the Hungarian Academy opened its doors again after a ten years' cessation, Arany was elected a member (1858). In 1860 he was elected director of the revived Kisfaludy Society, and went to Pest. In November, he started *Szépirodalmi Figyelö,* a monthly review of Magyar criticism and literature, better known by its later name, *Koszeru.* He also edited the principal publications of the society, including the translation of Shakespeare's works, to which he contributed the *Midsummer Night's Dream* (1864) *Hamlet* and *King John* (1867). The same year he won the Nádasdy prize of the Academy with his poem "Death of Buda." From 1865 to 1879 he was the secretary of the Hungarian Academy.

He issued an edition of his collected poems in 1867, and in 1880 won the Karácsonyi prize with his translation of the *Comedies of Aristophanes* (1880). In 1879 he completed his epic trilogy by publishing *The Love of Toldi* and *Toldi's Evening,* which were received with universal enthusiasm. He died suddenly on Oct. 24 1882. The first edition of his collected works was published in 1884–85.

Arany first gave Hungarian literature a national direction. He compelled the poetry of art to draw nearer to life and nature, extended its boundaries and made it more generally intelligible and popular. He wrote not for one class or school but for the whole nation. He introduced the popular element into literature, but at the same time elevated and ennobled it. What Petofi had done for lyrical he did for epic poetry. Yet there were great differences between them. Petofi was more subjective, more individual; Arany was more objective and national. As a lyric poet Petofi naturally gave expression to present moods and feelings; as an epic poet Arany plunged into the past. He took his standpoint on tradition. His art was essentially rooted in the character of the whole nation and its glorious history. His genius was unusually rich and versatile; his artistic conscience always alert and sober. His taste was extraordinarily developed and absolutely sure. To say nothing of his other great qualities, he is certainly the most artistic of all the Magyar poets.

See *Posthumous Writings and Correspondence of Arany,* edited by László Arany (Hung.) (1887–89); article "Arany," in *A Pallas Nagy Lexikona,* Kot 2 (Budapest, 1893); Mór Gaal, *Life of Janos Arany* (Hung.) (1898); L. Gyöngyösy, *János Arany's Life and Works* (Hung.) (1901). Translations from Arany; *The Legend of the Wondrous Hunt* (canto 6 of *Buda's Death),* by D. Butler (1881); *Toldi, poème en 12 chants* (1895); *Dichtungen* (Leipzig, 1880); *Konig Budas Tod* (Leipzig, 1879); *Balladen* (1886).

ARAPAHO, an Algonkin Plains tribe, bison hunting, and tepee dwelling, on the upper Platte and Arkansas rivers at the time of the first white settlement. In 1942 there were approximately 1,900 on reservations in Wyoming and Oklahoma. Besides the northern and southern divisions now recognized, there are submerged remnants of two or three other groups, once perhaps tribally independent, since they spoke distinct dialects; besides the Atsina or Gros Ventre, close to the Arapaho in speech, but chiefly associated with the Blackfoot during the 19th century. Arapaho is one of the most divergent Algonkin languages, suggesting that its speakers have been long separated from the body of the stock, presumably on or at the edge of the Plains. They were non-agricultural and clanless, kept a bundle containing a tubular pipe as tribal fetish and were divided into seven age-graded ritual societies for men and one for women, besides practising the Sun dance in elaborate form. Their ceremonial system, decorative art and other traits indicate them as one of the nuclear or typical tribes participating in Plains culture.

They adhered vigorously to the messianic Ghost dance religion of 1889–1891.

See A. L. Kroeber, *Bull. Amer. Museum Natural Hist.,* vol. xviii., 1902; G. A. Dorsey, *Field Mus. Publ. Anthr. Ser.,* vol. iv., 1903; Dorsey and Kroeber, *ibid.,* vol. v., 1903.

ARARAT, a municipal town in Ripon county (Western district) in about the S.W. centre of Victoria (Australia). It is situated towards the western end of the western Victorian highlands and is flanked on the south and east by a range of hills, the Pyrenees. The "mountains" in this area are worn-down plateau-like remnants of very early formations composed of rocks of granitic character. But in addition extensive lava-flows (basalt) have occurred and the soils derived from these are very fertile. Ararat, therefore, standing at about 1,030ft. above sea-level, and having a fairly regular rainfall of 23–24in. (mean annual) is the centre of a flourishing agricultural and pastoral area (wheat, vines, sheep, etc.). Gold mining (reef as well as alluvial gold from "deep leads"), besides quarrying, is carried on in the vicinity, and the excellent timber resources of the area have been exploited.

Ararat is a railway junction of local importance. It is situated on the main overland (Adelaide-Melbourne) line, about 130m. from Melbourne. The lines of the South-western system (Casterton, Hamilton) take off from here, and Portland and Warrnambool are rising ports of this area. Ararat's population has increased steadily from 3,580 in 1901 to 4,653 in 1921 (1940, 4,960)

ARARAT, the culminating point of the Armenian plateau, 17,000ft. above the sea. The *massif* of Ararat rises on the north and east out of the alluvial plain of the Aras, here from 2,500ft. to 3.000 ft. above the sea, and on the south-west sinks into the plateau of Bayezid, about 4,500ft. It is thus isolated on all sides but the north-west, where a *col* about 6,900ft. high connects it with a long ridge of volcanic mountains. Out of the *massif* rise two peaks, "their bases confluent at a height of 8,800ft., their summits about 7m. apart." The higher, Great Ararat, is "a huge broad-shouldered mass, more of a dome than a cone"; the lower, Little Ararat, 12,840ft., is "an elegant cone or pyramid, rising with steep, smooth, regular sides into a comparatively sharp peak" (Bryce). On the north and west the slopes of Great Ararat are covered with glittering fields of unbroken *névé.* The only true glacier is on the north-east side, at the bottom of a large chasm which runs into the heart of the mountain. The great height of the snow line, 14,000ft., is due to the small rainfall and the upward rush of dry air from the plain of the Araxes. The middle zone of Ararat, 5,000–11,500ft., is covered with good pasture, the upper and lower zones are for the most part sterile. There is poetical fitness in the legend that Ararat was the resting-place of Noah's Ark, inasmuch as this mountain is about equally distant from the Black Sea and the Caspian, from the Mediterranean and the Persian Gulf. Round Mt. Ararat gather many traditions connected with the Deluge. The Garden of Eden is placed in the valley of the Araxes; Marand is the burial-place of Noah's wife; at Arghuri, a village near the great chasm, was the spot where Noah planted the first vineyard, and here were shown Noah's vine and the monastery of St. James, until village and monastery were overwhelmed by a fall of rock, ice and snow, shaken down by an earthquake in 1840.

From the Armenian plateau Ararat rises in a graceful isolated cone far into the region of perennial snow. It was long believed by the Armenian monks that no one was permitted to reach the "secret top" of Ararat, with its sacred remains, but on Sept. 27, 1829, Dr. Johann Jacob Parrot (1792–1840) of Dorpat, a German in the employment of Russia, set foot on the "dome of eternal ice." Ararat has since been ascended by a number of climbers, among them D. W. Freshfield (1868), James Bryce (1876), A. V. Markov (1888), P. Pashtukhov and H. B. Lynch (1893). There are a number of glaciers in the upper portion, and

the climate of the whole district is very severe. The greater part of the mountain is destitute of trees, but the lower Ararat is clothed with birches.

Both Great and Little Ararat consist entirely of volcanic rocks, chiefly andesites and pyroxene andesites, with some obsidian. No crater now exists at the summit of either, but well-formed parasitic cones occur upon their flanks. There are no certain historic records of any eruption. (*See* also ASSYRIA.)

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ARAROBA POWDER, a drug occurring as a yellowish-brown powder, varying in tint, which derives an alternative name —Goa powder—from the Portuguese colony of Goa, where it appears to have been introduced about the year 1852. The tree which yields it is *Andira araroba* of the natural order *Leguminosae*. It is met with in low and humid spots in the province of Bahia. The tree is from 80 to 100ft. high and has large imparipinnate leaves, the leaflets of which are oblong, about 1½in. long and ⅔in. broad, and somewhat truncate at the apex. The flowers are papilionaceous, of a purple colour and arranged in panicles. The Goa powder or araroba is contained in the trunk, filling crevices in the heartwood, and yields to hot chloroform 50% of crude chrysarobin, which has a definite therapeutic value and is contained in most modern pharmacopoeias. It occurs as a micro-crystalline, odourless, tasteless powder, very slightly soluble in either water or alcohol which contains pure chrysarobin ($C_{15}H_{12}O_3$), di-chrysarobin methylether ($C_{30}H_{23}O_6{\cdot}OCH_3$), di-chrysarobin ($C_{30}H_{24}O_7$). Chrysarobin is a methyl trioxyanthracene and exists as a glucoside in the plant, but is gradually oxidized to chrysophanic acid (a dioxy-methyl anthraquinone) and glucose.

The drug is a powerful irritant. Modern dermatologists use only chrysophanic acid, which may be applied externally and given by the mouth in doses of about one grain in cases of psoriasis and chronic eczema.

ARAS, the anc. *Araxes, Phasis* (Xenophon), *Ras* (Turkish and Arabian), *Yerash* (Armenian), *Rashki* (Georgian), a river which rises south of Erzerum, near the source of the Euphrates, in the Bingeul-dagh, and flows east through Armenia. It is about 600m. long, and its chief tributary, the Zanga, flows by Erivan and drains Lake Gokcha. It is a rapid muddy stream, dangerous when swollen by the melting snows of Armenia, but fordable in its ordinary state. It formerly joined the Kura; but in 1897 it changed its course, and now runs directly into the Caspian. On an island in the river stood Artaxata, the capital of Armenia from 180 B.C. to A.D. 50.

ARASON, JON (1484–1551), Icelandic bishop and poet, succeeded Gottskalk in the see of Holar in 1522; but he was soon driven out by the other Icelandic bishop, Ogmund of Skalholt. In 1548, when a large number of the islanders had accepted the reformed doctrines, Arason and Ogmund joined their forces and attacked the Lutherans. Civil war broke out, and in 1551 the bishop of Holar and two of his sons were captured and executed. Arason, who was the last Roman Catholic bishop in Iceland, is celebrated as a poet and as having introduced printing there.

ARATOR, of Liguria, a Christian poet, who lived during the 6th century. He was educated by Laurentius, archbishop of Milan, and Ennodius, bishop of Pavia. He practised as an advocate, and was appointed to an influential post at the court of Athalaric, king of the Ostrogoths. About 540 he took orders. He gained the favour of Pope Vigilius, to whom he dedicated his *De Actibus Apostolorum* (written about 544), which was much admired in the middle ages. A text was published by Hübner, 1850.

See Leimhach, "Der Dichter Arator," in *Theologische Studien und Kritik* (1873); Manitius, *Geschzchte der christlich-lateinischen Poesie* (1891).

ARATUS, of Soli in Cilicia, a minor Greek didactic poet, a contemporary of Callimachus and Theocritus, was born about 315 B.C. He resided at the courts of Antigonus Gonatas and Antrochus I. of Syria and died in Macedonia about 245 B.C. His only extant works are two short poems, or two fragments of his poem *Phainomeiza* written in hexameters; an imitation of a prose work on astronomy by Eudoxus of Cnidus, and *Diosēmeia* (on weather signs), chiefly from Theophrastus. The work has all the characteristics of the Alexandrian school of poetry. His poem attracted the notice of specialists, such as Hipparchus. Amongst the Romans it enjoyed a high reputation (Ovid, *Amores*, i. 15, 16). Cicero, Caesar Germanicus, and Avienus translated it; the two last versions and fragments of Cicero's are still extant. Virgil has imitated the *Prognostica* to some extent in the *Georgics*. One verse from the opening invocation to Zeus has become famous from being quoted by St. Paul (Acts xvii. 28).

BIBLIOGRAPHY.—Editio princeps (1499); later editions, Buhle (1793); Maass (1893); *Aratea* (1892); *Commentariorum in Aratum Reliquiae* (1898), by the same. English translations: Lamb (1848); Poste (1880); R. Brown (1885); Prince (1895); Mair (1921). On recently discovered fragments, *see* H. I. Bell, in *Classical Quarterly* (April 1907); also *Berliner Klassikertexte*, Heft, v. 1., pp. 47–54.

ARATUS OF SICYON (271–213 B.C.) Greek politician. He set up a democracy in Sicyon (251) and brought it into alliance with the Achaean League (*q.v.*) of which he became the moving spirit, being elected general in alternate years. From 243, when he captured from Antigonus the fortress of Corinth, the League aimed at replacing Macedonian ascendancy in the Peloponnese by free democracy; Megalopolis joined in 234, Attica was freed in 229, and the League reached its zenith in 228 with the accession of Argos. But Aratus could not brook a rival, and rather than admit the supremacy of Cleomenes III. of Sparta (*see* CLEOMENES) he undid his own work and called in Antigonus Doson. Cleomenes was defeated (221), but the League became subject to Macedonia. Aratus was a skilful diplomatist but an unsuccessful general.

BIBLIOGRAPHY.—*See* Piutarch, *Aratus, Cleomenes;* Freeman, *History of Federal Government* (new ed. 1893); W. Tarn, *Antigonus Gonatas* (1913).

BY COURTESY OF THE MUSEUM OF THE UNIVERSITY OF PENNSYLVANIA

AN ARAUCANIAN INDIAN WOMAN OF CHILE WHO HAS ADOPTED THE EUROPEAN STYLE OF DRESS

ARAUCANIA, the name of a large territory of Chile, South America, south of the Bio-Bio river, belonging to the Araucanian Indians at the time of their independence of Spanish and Chilean authority. The loss of their political independence has been followed by that of the greater part of their territory, which has been divided up into the Chilean provinces of Arauco, Bio-Bio, Malleco and Cautin, and the Indians, much reduced in number now live in the wooded recesses of the three provinces last named.

ARAUCANIAN, a linguistic stock of South American Indians, comprising a number of different tribes, originally occupying a considerable area in central Chile. Some have regarded them as allied to the tribes of the Argentine Pampas, and therefore as invaders and immigrants in Chile, where the true Araucanians have probably long been residents, being quite distinct from the nomadic Puelchean tribes of the Pampas. Considerable invasions of the latter probably occurred in pre-Spanish times, when the originally sedentary Araucanian group was divided into two parts, the Picunche north of the Maule river, and the Huilliche from the Tolten river south to Chiloe. The newcomers who occupied the region in between, mixed with the older Araucanians and ultimately adopted their speech, although retaining something of their old nomad culture. They stopped the Inca conquest at the Maule, and successfully opposed the full strength of the Spanish forces for two hundred years—a struggle immortalized in Ercilla's epic poem entitled "La Araucana." Under

Spanish pressure considerable bodies of Araucanians moved eastward across the Andes into the Pampas, where since the latter part of the 16th and particularly in the 18th and early 19th centuries they occupied considerable areas.

The Araucanians were a sedentary, agricultural and hunting folk, living in numerous small villages, in houses of poles and thatch. In Araucania proper, these were small, for single families; elsewhere large and communal. Their clothing was of wool or skins, and generally rather meagre. They made considerable use of body painting but not of tattooing. The bow, spear and club (the club often flattened and bent at the end) were their main weapons, and hides or occasionally united strips of whalebone, together with skin shields served for body armour and protection. Reed and pole *balsas* or rafts were in use for coastwise navigation, while toward the south, three-plank boats, called *dalcas* with rudimentary sails, were known. The totemic clan was the basis of their social organization, the clan chiefs being the normal leaders of the rather scattered population. The elaborate and centralized form of government, with tribal chiefs and "national" leaders was a post-Spanish development. The Araucanians had no religious structures or temples, but had a well-developed religious ritual, centred in the veneration of the clan ancestors and the clan totems, puberty rites and victory in war. In the last mentioned case, human sacrifices occurred, with ritual cannibalism. The dead were normally buried, either in heavy, canoe-shaped wooden coffins, or in stone cists. Persons dying away from home were cremated.

See R. E. Latcham, *La organizacion social y las creencias religiosas de los antiguos Araucanos* (Pub. Museo de Etnologia y Antropologia de Chile vol. iii., pp. 245–868); J. T. Medina, *Los Aborijenes de Chile* (Santiago, 1882).

ARAUCARIA, a genus of coniferous trees included in the tribe *Araucarineae.* They are magnificent evergreen trees, with apparently whorled branches, and stiff, flattened, pointed leaves, found in Brazil and Chile, Polynesia and Australia. The name of the genus is derived from Arauco, the name of the district in southern Chile where the trees were first discovered. *Araucaria imbricata,* the Chile pine, or "monkey puzzle," was introduced into Britain in 1796. It is largely cultivated, and usually stands the winter of Britain; but in some years, when the temperature has fallen very low, the trees have suffered much. Care should be taken in planting to select a spot somewhat elevated and well drained. The tree grows to the height of 1 joft. in the Cordilleras of Chile. The cones are from 8 to 8½in. broad, and 7 to 7½in. long. The wood of the tree is hard and durable. This is the only species which can be cultivated in the open air in Britain. *Araucaria brasiliana,* the Brazilian pine, is a native of the mountains of southern Brazil, and was introduced into Britain in 1819. It is not so hardy as *A. imbricafa,* and requires protection during winter. It is grown in conservatories for half-hardy plants. *Araucaria excelsa,* the Norfolk Island pine, a native of Norfolk Island and New Caledonia, was discovered during Captain Cook's second voyage, and introduced into Britain by Sir Joseph Banks in 1793. It cannot be grown in the open air in Britain, as it requires protection from frost, and is more tender than the Brazilian pine. It is a majestic tree, sometimes attaining a height of more than 220ft. The scales of its cones are winged, and have a hook at the apex. *Araucaria Cunninghamii,* the Moreton Bay pine, is a tall tree abundant on the shores of Moreton Bay, Australia, and found through the littoral region of Queensland to Cape York Peninsula, also in New Guinea. It requires protection in England during the winter. *Araucaria Bidwilli,* the Bunya-Bunya pine, found on the mountains of southern Queensland, between the rivers Brisbane and Burnett, at 27° S. lat., is a noble tree, attaining a height of 100 to 150ft., with a straight trunk and white wood. It bears cones as large as a man's head. Its seeds are very large, and are used as food by the natives. *Araucaria Rulei,* which is a tree of New Caledonia, attains a height of 50 or 60ft. *Araucaria Cookii,* also a native of New Caledonia, attains a height of 150ft. It is found also in the Isle of Pines, and in the New Hebrides. The tree has a remarkable appearance, due to shedding its primary branches for about five-sixths of its height and replacing them by a small bushy growth, the whole resembling a tall column crowned with foliage, suggesting to its discoverer, Captain Cook, a tall column of basalt.

ARAUSIO, BATTLE OF. From 202 B.C., when the battle of Zama "gave the world to Rome," the tide of Roman expansion rolled onwards without serious check or menace for nearly a century. Then, however, a thunder-cloud gathered beyond the Alps which sent a shiver of fear through Italy. It was the first—and after it came a long interval—of the great migrations which lapped and ultimately submerged the bulwarks of Rome. The two principal tribes—or, really, nations—were the Cimbri and the Teutones, and after a pause of several years in Gaul they moved afresh towards Italy. So seriously was the menace viewed that the consul Maximus was sent (105 B.C.) with an army to reinforce the existing army of the proconsul Caepio. Caepio resented the loss of his independent authority, although he joined Maximus at Arausio (mod. Orange) on the lower Rhone. While Maximus was prudently negotiating, Caepio attacked the Cimbri single-handed, although having to fight with the river at his back. He was overwhelmed and the consular army was drawn into the disaster—comparable in scale with Cannae. Happily for Rome the Cimbri and Teutones inexplicably turned aside from Italy and followed the route to Spain. The disaster at Arausio and the urgent need to raise fresh forces gave the *coup de grâce* to the traditional system of citizen armies, already decaying, and supplied the impetus which enabled Marius, elected consul two months later, to develop the highly-trained long-service professional army. The new model was soon to be "christened" at Aquae Sextiae (Aix) (*q.v.*). (For an account of the modern town *see* ORANGE.)

ARAVALLI HILLS, an Indian mountain range; running for 300m. in a north-easterly direction, through the Rajputana states and the British district of Ajmere-Merwara, situated between 24° and 27° N., and between 72° and 73° East. The series of ridges and peaks, with breadth varying from 6 to 60m., are generally from 1,000 to 3,000ft. in elevation, the highest point, Mount Abu (5,650ft.), being in the extreme south-west. Geologically they belong to the primitive formation characteristic of the Indian Deccan-granite, compact dark blue slate, gneiss and syenite. Masses of rose-coloured quartz give a dazzling snow-like appearance to the peaks. The Luni and Sakhi rivers, from the steep north-western slopes, turn south-west to the Gulf of Cutch. Two distinct river systems drain the south-eastern slopes; one debouches in small streams on the Gulf of Cambay, while the other unites to form the Chambal river, a tributary of the Jumna and the Ganges system. The Aravalli hills are for the most part bare and thinly populated, with large areas of sand and stone, or huge masses of quartz. The valleys are generally sandy deserts, with sparse oases of cultivation. Occasionally, however, a fertile tract marks a natural drainage line, *e.g.,* that of Ajmer city, with its lake. The Aravalli hills send off rocky ridges north-east through the states of Alwar and Jaipur, which reappear in the form of isolated hills near Delhi.

ARAWAKAN, one of the most important and widely extended of the linguistic stocks of South American Indians, whose name is taken from the Arawaks, one of the earliest and best known tribes. The Guana, the most southerly tribe of this stock, were on the upper Paraguay river, in southern Matto Grosso in Brazil. The Moxos and Baures were in northern Bolivia, whence a practically continuous belt of Arawakan tribes extended northwards and north-westwards from the upper Tapajoz across the whole of the upper Amazon drainage to the mouth of the Orinoco and the Guiana coast. The Antis or Campas on the Apurimac river north-west of Cuzco in Peru were outlying members of the stock in the west, as were the Goajiras in the peninsula of the same name in Colombia. Tribes of this stock also held the whole northern and eastern coast of the continent from the Amazon delta to the Orinoco, and may, prior to the Carib invasions, have extended westward continuously through Venezuela far into Colombia. From the South American mainland they extended northward through the whole chain of the Antilles to the Bahamas. At the end of the 15th

century, however, the Caribs had ousted them from all the Lesser Antilles, and were beginning to raid the larger islands, held by tribes known as the Tainos, further north.

Physically the Arawakan tribes are in the main of medium or slightly under medium stature, and appear to be prevailingly brachycephalic or round-headed. Culturally they rank among the more advanced tribes of the eastern half of the continent, being sedentary agriculturalists and makers of excellent pottery and textiles.

BIBLIOGRAPHY.—See A. F. Chamberlain, "Nomenclature and Distribution of the Principal Tribes and Sub-tribes of the Arawakan Linguistic Stock" (Journ. *Soc. Americanistes* de Paris, n.s. vol. x. pp. 473–496); M. Schmidt, Die Aruaken (Leipzig, 1917).

ARBACES, according to Ctesias (Diodor. ii. 24 ff. 32), one of the generals of Sardanapalus, king of Assyria and founder of the Median empire about 830 B.C. But Ctesias's whole history of the Assyrian and Median empires is fabulous; his Arbaces and his successors are not historical personages. From the inscriptions of Sargon of Assyria we know one "Arbaku Dynast of Arnashia" as one of 45 chiefs of Median districts who paid tribute to Sargon in 713 B.C. *(See* MEDIA.)

ARBE (Serbo-Croatian RAB), an island in the Adriatic sea, forming the northernmost point of Dalmatia, Yugoslavia. Population 6,354. Arbe is 13 mi. long; its greatest breadth is 5 mi. The capital of the same name is a beautiful walled town on a steep ridge on the west coast. At the seaward end is the 13th-century cathedral, behind which the belfries of four churches, at least as ancient, rise in a row along the crest of the ridge; behind these again are the castle and a background of desolate hills. In another part of the island are excellent state forests. One of the palaces is the birth-place of Marco Antonio de Dominis. Fishing, agriculture, tobacco growing, marble quarrying, and the ancient silk industry are maintained. There are excellent springs. Arbe was occupied by Italy in World War II.

ARBELA (modern Erbil), an important foothill town in N.E. Mesopotamia (Iraq), about 48 mi. E. by S. of Mosul in 36° N. and 44° West. In ancient times Arbela (Arba-'ilu) formed one of the group of cities of Assur, the other members of the group being Ashur, Nineveh and Nimrud, all close to one another. It was, however, an old Sumerian settlement and its goddess appears to have been Ninlil, who there became the consort of the god Ashur. The town lies in the centre of a very productive wheat country, lying as it does on the edge of the mountains between the greater and lesser Zab, with a more abundant supply of water than to the south. The modern district still is engaged in the production of cereals, which are traded down the Tigris to Baghdad. Arbela has an estimated population of 25.000, most of whom are Kurds. It lies on the caravan route between Mosul and Baghdad. and Mosul and Rowanduz. It is also the projected terminus of a branch line from Mosul. Owing to its command of the foothill routes and its water supply, Arbela, unlike most other ancient cities in Mesopotamia, has preserved its position ever since early times. Arbela is the name popularly but not quite correctly given to the decisive battle in which Alexander the Great overthrew Darius and the Persian empire in 331 BC. *See* GAUGAMELA *(ARBELA).* BATTLE OF.

ARBER, EDWARD (1836–1912), English man of letters, was born in London on Dec. 4, 1536, and was killed in a taxi-cab accident in London on Nov. 23, 1912. Arber is associated with the "English Reprints" (1868–80), by which an accurate text of the works of many English authors, formerly only accessible in rare or expensive editions, was placed within reach of the general public. Among the 30 volumes of the series were Gosson's *School of Abuse,* Ascham's *Toxophilus,* Tottel's *Miscellany,* Naunton's *Fragmenta Regalia,* etc. It was followed by the "English Scholar's Library" which included the *Works* (1884) of Captain John Smith, governor of Virginia, and the *Poems* (1882) of Richard Barnfield. In his *English Garner* (1877–96) he made an admirable collection of rare old tracts and poems; in 1899–1901 he issued *British Anthologies,* and in 1907 began a series called *A Christian Library.* He also accomplished single-handed the editing of two invaluable bibliographies: *A Transcript of the Registers of the Stationers' Company, 1553–1640* (1875–94), and *The Term Catalogues, 1668–1709; with a number for Easter Term 1711* (1904–06), edited from the quarterly lists of the book-sellers.

ARBITRAGE, the term applied to the system of equalizing prices in different commercial centres by buying in the cheaper market and selling in the dearer. These transactions, or their converse, are mainly confined to stocks and shares, foreign exchanges and bullion, and are carried on between the various financial centres of the world. When prices are affected in any country by some local financial or political event of outstanding importance, all other markets are sooner or later influenced. For instance, a crisis in France would immediately depress all French securities, and by exciting the fears of capitalists, would stimulate transfers of funds and raise all the exchanges against France.

The scale of profit on arbitrage transactions varies with the risks entailed. Take for instance arbitraging in exchange. Dealing in francs between London and Paris in terms of sterling is a simple operation and the risk of loss is very small, since such transactions are almost invariably carried on by telephone and can be closed almost immediately. When on the other hand arbitrage dealers in London and Paris operate in guilders, Swiss francs or dollars, there is a double risk and the margins of profit aimed at are somewhat larger. Nevertheless, the slightest advantage in any market is put to profit, and International exchanges are adjusted with extreme rapidity.

For example, a dealer wishes to buy French francs which he can obtain in London at 176.70 and he telephones to his Paris correspondent asking him how he would buy sterling. If he bids 176.71, it is clear that Paris offers him an advantage of 1 cent per £ sterling. The dealer may, however, think that a still better rate can be obtained in the international market, and he rings up his agent in Amsterdam and asks him at what price he will sell French francs. The reply is fl. 4.933 for each frs. 100. in order to ascertain whether or not this offer is advantageous, the dealer has to learn the rate at which he can obtain the guilders with which to reimburse his Amsterdam agent and he finds that he can get fl. 8.73 per £: on this basis he calculates what will be the net outturn.

Arbitrage in exchanges is usually calculated by chain rule as follows:—

$$\frac{8.73 \times 100}{4.93\frac{3}{4}} = 176.81$$

Another example: When a purchase of Swiss francs is desired the arbitrageur finds that London sells Zürich at 20.72½ Swiss francs per £, Paris quotes 853.70 French francs for 100 Swiss francs, and New York offers Swiss francs at $22.57 per 100, and he can buy dollars from the "Control" in London at 4.68⅛. He figures by the chain rule, and as a result buys his Swiss francs in New York, buying dollars with which to do so in London:—

$$\frac{176.80 \times 100}{853.70} = 20.71$$

$$\frac{4.68\frac{1}{8} \times 100}{22.57} = 20.74$$

Pure arbitrage in foreign exchange has been curtailed by the establishment of Equalization Funds in various countries, the administrators of which funds "peg" the exchanges so that arbitrage profits are eliminated. The Tripartite Agreement between Great Britain, France and the United States is an outstanding example of how the arbitrageur is being squeezed out of the market. By agreement the participants "earmark" the gold for one another to cover the operations in exchange, in that way saving the heavy cost of freight and insurance which the arbitrageur has to pay in moving gold from one country to another.

Arbitrage in Stocks.—Arbitrage in stocks and shares is more complicated and fraught with considerably greater risks. The expense of transferring stocks from one country to another is heavy. Not only is interest lost while the actual stocks are travelling, but

in many countries bonds have to bear the burden of local stamps, and however high the stamp duty may be in one country, there is no reduction in the amount that must be paid to render bonds negotiable in another.

To give an example, Geduld Proprietary Mines are good delivery in London and also in Paris. The stamp duty in 1939 was 2 per cent in England, and about 3 per cent in France, so that before these shares could be actually transferred to London from Paris, with a profit to the dealers, allowance must be made for cost of insurance, shipping, brokers' commission, and the full stamp duties.

There are other elements of speculation that beset stock and share arbitrageurs, even if on both sides they are members of the Stock Exchanges of their respective countries and so avoid paying brokerages. When the London operator buys abroad, unless his seller elects to keep the result of his sale in sterling, the London buyer has to provide foreign currency and run the risk of any variation in the rate of exchange. He may find also that it is more costly to fix his exchange for forward delivery than for actual spot. Again, he is constantly up against Government restrictions of all sorts, both British and foreign, which are formulated whenever a Government desires to counteract any tendency on the part of its subjects to export capital and so depreciate its exchange. So long as these difficulties exist, the volume of business done by arbitrageurs in stocks and shares by no means keeps pace with any increase in the amount of stocks and shares dealt in in the Stock Exchanges of the world, and the tendency is for investors and speculators to send their Stock Exchange orders abroad to the country where the market is the most free and is the least penalised by taxes and restrictions.

Examples of arbitrage transactions with Paris and New York:—

LONDON TO PARIS

Bought in London:

100 East Geduld, 11 3/32		£1,109. 7. 6
Commission		7.10. 0
Contract Stamp		3. 0
Insurance		1. 0. 0
		£1,118. 0. 6

converted at 176.72 = frs. 197,577.37

Sold in Paris:

100 East Geduld at 20.43		frs. 204,300.00
Commission 2‰	frs. 408.60	
Insurance	792.00	1,200.60
		203,099.40

leaving a profit of frs. 5,522.03 at 176.72 = £31.5.0d.

LONDON TO NEW YOXK

Bought in London:

100 U. S. Steel at 50 1/8		£1,002.10. 0
Commission		5. 0. 0
Contract Stamp		3. 0
		£1,007.13. 0

Sold in New York:

100 U. S. Steel at 47 7/8		$4,787.50
Commission	$17.00	
Sales Tax	9.00	
Borrowing Tax	4.00	30.00
		$4,757.50

Dollars sold at 468.32 = £1,016.1.8d., leaving an arbitrage profit of £8. 7. 6d.

It often happens that the margin of profit is not as big as the examples quoted, so it follows that in order to save the expense of shipping, insurance, stamps, etc., the arbitrageur endeavours to turn his position by re-buying abroad and selling in London.

Operations in Gold.—For restoring the equilibrium of international balances, recourse is frequently had to gold and again the arbitrageur exercises his ingenuity in finding out where gold can be obtained at the cheapest rate and whether, after he has paid expenses, the net outturn will be better than remittance by telegraphic transfer. The profit is often small, as will be seen by the following example in which the arbitrageur buys 174 bars of gold and sells his exchange a week ahead at 4.67½, making a profit of £354.14.5d:—

Purchase in London:

Say 174 bars. Fine ozs. 70,244.097 at 148/6½	£521,708.15. 2
Plus buying commission, ¼‰	130. 8. 6
	£521,839. 3. 8
Freight, £521,500 at 5s.6d. per cent	1,434. 2. 6
Insurance, £532,000 at 2s.6d. per cent	665. 0. 0
Boxes and packing	8.16. 0
Consular invoice	10.10
Interest, 7 days at 1%	100. 9. 8
	£524,048. 2. 8

Realization in New York:

Fine ozs. 70,242.678 at $35.00		$2,458,493.72
Less ¼‰ and $1 per 1,000 ozs. melting (U. S. Assay Office charges)		6,216.74
		$2,452,276.98
Trucking charges and Customs entry in New York	$80.57	
New York Bank's handling commission	613.07	693.64
		$2,451,583.34

at 4.67½ = £524,402.17s.0d.

If the arbitrageur could only sell his dollars at 4.68, for the $2,452,276.98 he would only obtain £523,842.16s.0d., leaving him a loss of £200.

Sometimes, when exchanges are under such strict control that exchange arbitrage is rendered almost impossible, it occurs that arbitrage in stocks and shares becomes simpler and more active for this reason. In normal times if one contemplated doing business of this nature, it is necessary if one wishes to avoid speculation as much as possible, to guard not only against fluctuations in the prices of the stocks dealt in, but also against possible adverse movements in exchanges. For instance, if the arbitrageur buys U. S. Steel shares in London and sells them in New York, the estimated profit might vanish, or even turn into a loss, if the value of the pound sterling were to depreciate materially in New York before he covered his exchange. A transaction that would leave a normal profit if the pound were obtainable at $4.68 might result in a loss if the exchange were to move to $4.70 before he had time to purchase his sterling. But when the dollar-sterling exchange is under strict control both in Great Britain and in the United States, the rate of exchange does not play so important a part in the transaction. which can be covered at leisure without undue risk.

Arbitrage in stocks and shares is continuous between the London and the Provincial stock exchanges. Exchange does not enter into these transactions at all. Nor does it to any appreciable extent in arbitrage between London and Johannesburg. A very large volume of business is done in gold mining shares between these two cities.

Before China was forced off the silver standard on Nov. 4, 1935, a large and profitable arbitrage business used to be done in that metal between London and Shanghai. The method was a simple one. If the arbitrageur foresaw a profit in shipping silver from China to London he could at all times sell it "forward" in London, as there has been for a very long time an official quotation on the London market for silver for delivery in two months' time. On the other hand if he visualized a profit in buying silver in London and shipping it to Shanghai, he could buy it either for prompt delivery or for delivery in two months' time. The advantage of the latter would be that, should the Anglo-Chinese exchange veer round during the interval between the purchase of the silver and its delivery, he could reverse his position by reselling his silver in London and, simultaneously, reselling

his sterling in Shanghai, thereby saving the cost of freight and insurance twice over and also the loss of interest while the silver was in transition. This, in fact, was very frequently done. The arbitrageur did not confine himself to direct business between Shanghai and London. Considerable arbitrage transactions took place also with India and the United States. Should China at any future time return to a silver standard there is no doubt but that arbitrage in silver with that country would be resumed.

To be a successful arbitrageur, it is of vital importance to be well informed, to be quick so as to get in before one's competitors, and to have a reliable and energetic counterparty. Tendencies change very rapidly and demands or supplies of stocks, shares and exchange are rapidly filled up. (S.; E. L. F.)

ARBITRATION, a term derived from the nomenclature of Roman law, and applied to an arrangement for taking, and abiding by, the judgment of a selected person in some disputed matter, instead of carrying it to the established courts of justice. In disputes between States, arbitration has long played an important part. (*See* ARBITRATION, INTERNATIONAL.) The present article is restricted to arbitration under municipal law; but a separate article is also devoted to the use of arbitration in labour disputes. (*See* INDUSTRIAL RELATIONS.)

Law **of** England. — The law of England as to arbitration is now substantially included in the Arbitration Act, 1889, and certain amending statutes. The principal act is an express code as to proceedings in all arbitrations, but "criminal proceedings by the Crown" cannot be referred under it (ss. 13, 14). The statute subdivides its subject matter into two headings: I., References by consent out of court; II., References under order of court.

I. Here the first matter to be dealt with is the submission. **A** submission is defined as a written agreement to submit present or future differences to arbitration, whether a particular arbitrator is named in it or not. The capacity of a person to agree to arbitration, or to act as arbitrator, depends on the general law of contract. **A** submission by an infant is not void, but is voidable at his option. (*See* INFANT.) Counsel has a general authority to deal with the conduct of an action, which includes authority to refer it to arbitration, but he has no authority to refer an action against the wishes of his client, or on terms different from those which his client has sanctioned; and if he does so, the reference may be set aside, although the limit put by the client on his counsel's authority is not made known to the other side when the reference is agreed upon (*Neale* v. Gordon Lennox, 1902, A. C. 465). The committee of a lunatic, with the sanction of the judge in lunacy, may refer disputes to arbitration. (See INSANITY IN LAW.) As an arbitrator is chosen by the parties themselves, the question of his eligibility is of minor importance; and where an arbitrator has been chosen by both parties, the courts are reluctant to set the appointment aside. This question has arisen chiefly in contracts for works, which frequently contain a provision that the engineer shall be the arbitrator in any dispute between the contractor and his own employer. The practical result is to make the engineer judge in his own cause. But the courts will not in such cases prevent the engineer from acting, where the contractor was aware of the facts when he signed the contract, and there is no reason to believe that the engineer will be unfair (Ives and Barker v. *Willans,* 1894, 2 Ch. 478; *Hickman &* Co. v. Roberts, 1913, A. C. 229). So, too, where a barrister was appointed arbitrator, the court refused to stay the arbitration on the mere ground that he was the client of a firm of solicitors, the conduct of one of whom was in question (Bright v. River Plate Construction Co., 1900, 2 Ch. 835). The Arbitration Act, 1889, provides that a submission, unless a contrary intention is expressed in it, is irrevocable except by leave of the court or a judge, and is to have the same effect in all respects as if it had been made an order of court. Provision is made for failure to appoint arbitrators or umpires. The court may compel parties to carry out an arbitration, not only in the above cases by directly appointing an arbitrator, etc., or by allowing one appointed by a party to proceed alone with the reference, but also indirectly by staying any proceedings before the legal tribunals to determine matters which come within the scope of the arbitration. Where the agreement to refer stipulates that the submission of a dispute to arbitration shall be a condition precedent to the right to bring an action in regard to it, an action does not lie until the arbitration has been held and an award made. The court will refuse to stay proceedings where the subject matter of the litigation falls outside the scope of the reference, or there is some serious objection to the fitness of the arbitrator, or some other good reason of the kind exists. Under the Arbitration Clauses (Protocol) act, 1924, proceedings may also be stayed in respect of matters to be referred to arbitration in pursuance of agreements to which the protocol of Sept. 24, 1923, on arbitration clauses applies.

An arbitrator is not liable to be sued for want of skill or for negligence in conducting the arbitration (*Pappa* v. Rose, 1872, L.R. 7 C.P. 525). When a building contract provides that the certificate of the architect, showing the final balance due to the contractor, shall be conclusive evidence of the works having been duly completed, the architect occupies the position of an arbitrator, and enjoys the same immunity from liability for negligence in the discharge of his functions (Chambers v. *Goldthorpe,* 1901, 1 Q.B. 624).

An arbitrator (and the following observations apply *mutatis mutandis* to an umpire after he has entered on his duties) has power to administer oaths to, or take the affirmations of, the parties and their witnesses; and any person who wilfully and corruptly gives false evidence before him may be prosecuted and punished for perjury (Arbitration act, 1889, sched. i. and s. 22). At any stage in the reference he may, and shall if he be required by the court, state in the form of a special case for the opinion of the court any question of law arising in the arbitration. The arbitrator may also state his award in whole or in part as a special case (*ibid.* s. 19), and may correct in an award any clerical mistake or error arising from an accidental slip or omission. The costs of the reference and the award — which, under sched. i. of the act, must be in writing unless the submission otherwise provides — are in the arbitrator's discretion, and he has a lien on the award and the submission for his fees, for which — if there is an express or implied promise to pay them — he can also sue (Crampton v. Ridley, 1887, 20 Q.B.D. 48). **A** professional man, undertaking the duties of arbitrator without any stipulation as to payment, cannot be presumed to be giving his services gratuitously, and is therefore entitled to remuneration (*Macintyre* Bros. v. Smith, 1913, S.C. 129, p. 132).

If there is no express provision on the point in the submission, an award under the Arbitration act 1889 must be made within three months after the arbitrator has entered on the reference, or been called upon to act by notice in writing from any party to the submission. The time may, however, be extended by the arbitrator or by the court. An umpire is required to make his award within one month after the original or extended time appointed for making the award of the arbitrators has expired, or any later day to which he may enlarge it. The court may by order remit an award to the arbitrators or umpire for reconsideration, in which case the reconsidered award must be made within three months after the date of the order. An arbitrator is a competent witness in an action to enforce his award, and in modern practice in commercial arbitrations he is entitled to support in the arbitration or before an umpire, the case of the party appointing him.

An award must be *intra* vires; it must dispose of all the points referred; and it must be final, except as regards certain matters of valuation, etc. (see In Re *Stringer* and Riley Brothers, 1901, 1 K.B. 105). An award may, however, be set aside where the arbitrator has misconducted himself (an arbitrator may also be removed by the court on the ground of misconduct), or where it is ultra vires, or lacks any of the other requisites — above mentioned — of a valid award, or where the arbitrator has been wilfully deceived by one of the parties, or some such state of things exists. An award may, by leave of the court, be enforced in the same manner as a judgment or decree to the same effect. Provisions for the arbitration of special classes of disputes are contained in many acts of parliament; *e.g.,* the Acquisition of **Land**

(Assessment of Compensation) act, 1919, the Agricultural Holdings act, 1923, the Small Holdings and Allotments acts, 1908–26, the Light Railways acts, 1896 and 1912, the Lands Clauses acts, the Housing act, 1925, the Rating and Valuation act, 1925, and the Workmen's Compensation act, 1925–26. In 1892 a chamber of arbitration for business disputes was established by the joint action of the corporation of the City of London and the London Chamber of Commerce. The London Chamber, or as it is now styled, Court of Arbitration is simply a joint committee of persons nominated partly by the City Corporation and partly by the London Chamber of Commerce, which appoints arbitrators to deal with disputes referred to it irrespective of the nationality of the parties.

II. The court or a judge may refer any question arising in any cause or matter to an official or special referee, whose report may be enforced like a judgment or order to the same effect. This power may be exercised whether the parties desire it or not. The official referees are salaried officers of court. The remuneration of special referees is determined by the court or judge. An entire action may be referred, if all parties consent, or if it involves any prolonged examination of documents, or scientific or local examination, or consists wholly or partly of matters of account. (See the Supreme Court of Judicature [Consolidation] act, 1925, ss. 88–97.)

Scots Law.—The Arbitration (Scotland) act, 1894, unlike the English Arbitration act, 1889, did not codify the previously existing law, and it becomes necessary, therefore, to deal with that law in some detail. It differs in important particulars from the law of England. Although (as in England apart from the Arbitration act, 1889) there is nothing to prevent a verbal reference, submissions are generally not merely written but are effected by deed. The deed of submission first defines the terms of the reference, the name or names of the arbiters or arbitrators, and the "oversman" or umpire, whose decision in the event of the arbiters differing in opinion is to be final. Formerly, where no oversman was named in the submission, and no power given to the arbiters to name one, the proceedings were abortive if the arbiters disagreed, unless the parties consented to a nomination. But under the Arbitration (Scotland) act, 1894, s. 4, where arbiters differ in opinion, they, or, if they fail to agree on the point, the court, on the application of either party, may nominate an oversman whose decision is to be final. The deed of submission next gives to the arbiters the necessary powers for disposing of the matters referred (*e.g.*, powers to summon witnesses, to administer oaths and to award expenses) and specifies the time within which the "decree arbitral" is to be pronounced. If this date is left blank, practice has limited the arbiter's power of deciding to a year and a day, unless, having express or clearly implied power in the submission, he exercises this power, or the parties expressly or tacitly agree to its prorogation. The deed of submission then goes on to provide that the parties bind themselves, under a stipulated penalty to abide by the decree arbitral, that, in the event of the death of either of them, the submission shall continue in force against their heirs and representatives, and that they consent to the registration, for preservation and execution, both of the deed itself and of the decree arbitral. The power to enforce the award depends on this last provision. Under the common law of Scotland a submission of future disputes or differences to an arbiter, or arbiters, unnamed, was ineffectual except where the agreement to refer did not contemplate the decision of proper disputes between the parties, but the adjustment of some condition, or the liquidation of some obligation, contained in the contract of which the agreement to submit formed a part. And by the Arbitration (Scotland) act, 1894, s. 1., an agreement to refer to arbitration is not invalid by reason of the reference being to a person not named, or to be named by another, or to a person merely described as the holder for the time being of any office or appointment. An arbiter who has accepted office may be compelled by an action in the court of session to proceed with his duty unless he has sufficient cause, such as ill-health or supervening interest, for renouncing. The court may name a sole arbiter, where provision is made for one only and the parties cannot agree (Arbitration [Scotland] Act, 1894, s. 2); and may name an arbiter where a party having the right or duty to nominate one of two arbiters will not exercise it (ibid. s. 3). Scots law as to the requisites of a valid award is practically identical with the law of England. The grounds of reduction of a decree arbitral are "corruption," "bribery," "false hood" (Scots Act of Regulations, 1695, s. 2j). An attempt was made to include, under the expression "constructive corruption," among these statutory grounds of reduction, irregular conduct on the part of an arbitrator, with no suggestion of any corrupt motive. But it was definitely overruled by the House of Lords (*Adams* v. Great *North* of Scotland Railway [1891], **A.** C. 31). The statutory definition of the grounds of reduction was intended, however, merely to put an end to the practice which had previously obtained of reviewing awards on their merits, and it does not prevent the courts from setting aside an award where the arbitrator has exceeded his jurisdiction, or disregarded any one of the expressed conditions of the submission, or been guilty of misconduct. The original rule was that a private arbiter could not demand remuneration except in virtue of contract, or by implication from the nature of the work done, or if the reference was in pursuance of some statutory enactment (c g., the Lands Clauses [Scotland] act, 1845, s. 32). The view taken by the courts of this question in modern times is expressed in the case of Mncintyre Bros. v. Smith, cited on p. 219.

Judicial references have been long known to the law of Scotland. When an action is in court the parties may at any stage withdraw it from judicial determination, and refer it to arbitration. This is done by minute of reference to which the court interpones its authority. When the award is issued it becomes the judgment of the court. The court has no power to compel parties to enter into a reference of this kind, and it is doubtful whether counsel can bind their clients in such a matter. A judicial reference falls like the other by the elapse of a year; and the court cannot review the award on the ground of miscarriage. By the Court of Session act, 1850, s. 50, a provision is introduced whereby parties to an action in the supreme court may refer judicially any issue for trial to one, three, five or seven persons, who shall sit as a jury and decide by a majority.

Law of Ireland.—The Arbitration act, 1889, did not extend to Ireland. There has been no independent legislation on the subject since the treaty of 1922, either in Northern Ireland or in the Irish Free State. In both, the Common Law Procedure (Ireland) act, 1856, provides, on the lines of the English Common Law Procedure act, 1854, for the conduct of arbitrations and the enforcement of awards. Irish statute law, both before and since the establishment of the Free State, contains numerous provisions for arbitration under special enactments.

Indian and Colonial Law.—The provisions of the English Arbitration act, 1889, have in substance been adopted by the Indian Legislature (see act ix. of 1899), and by many of the colonies; *e.g.*, No. 24 of 1898, Natal; c. 20 of 1899, Bahamas; No. 10 of 1895, amended by No. 4 of 1923, Gibraltar; No. 29 of 1898, Cape of Good Hope: s. 7 of this last statute excluded from submission to arbitration criminal cases, so far as prosecution and punishment are concerned, and, without the special leave of the court, matters relating to status, matrimonial causes, and matters affecting minors or other persons under legal disability; Trinidad and Tobago, No. 35 of 1898; Ontario, No. 3j of 1909 (consolidating), No. 36 of 1909 (appointment of Chambers of Arbitration); Leeward Islands, No. 11 of 1907; Saskatchewan, No. 20 of 1920 (consolidating); Nigeria, No. 17 of 1914; Federated Malay States, No. 17 of 1912; Victoria, No. 2,265 of 1910. In Newfoundland the Board of Trade was authorized in 1910 (No. 1 of 1910) to appoint committees of arbitration and committees of appeals to decide matters voluntarily referred to them. The award of any such committee is to have the effect of a judgment of the supreme court.

Law **of** France.—Voluntary arbitration has always been recognized in France. In cases of mercantile partnerships, arbitration was formerly compulsory, but in 1856 (law of July 17, 1856) jurisdiction in disputes between parties was conferred on the Tribunals of Commerce (as to which see ***Code de Commerce,***

arts. 615 *et* seq.). The subject is fully dealt with in the Code de *Procédure* Civile (arts. 1,003–1,028). The submission to arbitration (*compromis*) must, on pain of nullity, be acted upon within three months from its date (art. 1,007). The submission terminates (i.) by the death, refusal, resignation or inability to act of one of the arbitrators; (ii.) by the expiration of the period agreed upon, or of three months if no time had been fixed; (iii.) by the disagreement of two arbitrators, unless power be reserved to them to appoint an umpire (art. 1,012). An arbitrator cannot resign if he has once commenced to act, and can only be relieved on some ground arising subsequently to the submission (art. 1,014). Each party to the arbitration is required to produce his evidence at least 15 days before the expiration of the period fixed by the submission (art. 1,016). If the arbitrators, differing in opinion, cannot agree upon an umpire (*tiers* arbitre), the president of the Tribunal of Commerce will appoint one, on the application of either party (art. 1,017). The umpire is required to give his decision within one month of his acceptance of the appointment; before making his award, he must confer with the previous arbitrators who disagreed (art. 1,018). Arbitrators and umpire must proceed according to the ordinary rules of law, unless they are specially empowered by the submission to proceed as amiables *compositeurs* (art. 1,019). The award is rendered executory by an order of the president of the Civil Tribunal of First Instance (art. 1,020). Awards cannot be set up against third parties (art. 1,022), or attacked by way of opposition. An appeal against an award lies to the Civil Tribunal of First Instance, or to the court of appeal, according as the subject matter, in the absence of arbitration, would have been within the jurisdiction of the justice of the peace, or of the Civil Tribunal of First Instance (art. 1,023).

Up to the end of 1925 the law of arbitration in France had regard only to the submission of existing disputes, although clauses were sometimes incorporated into contracts providing that they should be governed by English law and thus rendering the reference of future disputes possible. The law of Dec. 31, 1925, for the first time makes general arbitration valid in French law (Sirey, Lois Ann., 1925). A law of June 21, 1924, codifies the law as to arbitration between master and servant, the institution of arbitration courts for dealing with differences, the election of judges, and the extent of their jurisdiction. The law becomes part, and is entitled Book IV., of the Code du Travail.

Other Foreign Laws.—The provisions of French law as to arbitration were followed in Belgium (Code de Proc. *Civ.*, arts. 1,003 et seq.); and a convention (July 8, 1899) between France and Belgium regulates, *inter alia,* the mutual enforcement of awards. The law of France was also reproduced in substance in Holland (Code of Civil Procedure, art. 62 et seq.). The German Imperial Code of Procedure did not create any system of arbitration in civil cases. The matter is at present regulated by the Code of Civil Procedure, 1879 (arts. 1,025 et seq.). Courts of Arbitration, connected with large trade associations, chambers of commerce and stock exchanges were set up. Provision is made for the reference of existing or future disputes. The reference is to two arbitrators, unless the submission otherwise provides. If the arbitrators reach a deadlock and notify it to the parties, the submission is void. There is apparently no provision for the appointment of an umpire. An order of court is necessary for the enforcement of the award. The law is unsatisfactory and its early amendment is considered probable (43 Law Quarferly Review, 205). Spain followed the French Law (Code Civ. Proc., arts. 1,003–1,028; Civil Code, arts. 1,820–1,821). In Norway the "Arbitration Bureau for Goods," which had been operating in connection with the exchange since 1870, was in 1905 rearranged and subjected to a new regulation as "the Arbitration Bureau of the Exchange." See also the following foreign laws: Brazil C.C. arts. 1,037–1,048; Japan, general law, Code Civ. Proc., and special provisions for mediation, as regards leased lands and houses, Nos. 41 and 339 of 1922, and 17 of 1924, and as regards commercial cases, No. 42 of 1926.

The legality of agreements for genera1 arbitration was recognized by a protocol signed at Geneva under the League of Nations on Sept. 24, 1923. This occasioned the Act of Great Britain, chap. 39 of 1924; the French law of Dec. 31, 1925, above mentioned, and those laws of other ratifying States.

(For commercial arbitration see INDUSTRIAL RELATIONS.)

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The United States.—Beginning with the English common law of arbitration as it existed in the early 18th century, including perhaps the substance of 9 and 10 William III. ch. 15 (Shriver v. State, Md., 1837, 9 Gill and J. 1; contra, Shearer v. Mooers, Mass., 1837, 19 Pickering 308), the several jurisdictions of the United States have in the past deviated far less from that system than has the mother country. Thus, the dictum in *Vynior's* Case (1609, 8 Coke 81 b) as to revocability and the doctrine of the illegality of attempts to "oust the court of its jurisdiction" are still put forth as common law (Cochrane v. Forbes, 1926, 257 Mass. Rep. 13j. Echoes are still found in cases of a rule going back to feudal times excluding titles to realty from the list of arbitral matters (*Bunnel* v. Reynolds, 1920, 205 Mo. App. 653). The rule that none but actual controversies already arisen can be made the subject of an agreement of arbitrators is still repeated (Cocalis v. *Nazlides,* 1923, 308 Ill. 152). Though there are numerous references in the statute books to arbitration in particular cases such as disputes among stockholders of corporations, in the main the statutes prior to the New York Act of 1920 (except in Pennsylvania) hardly went beyond 9 and 10 William III. ch. 15, making it possible by agreement to give to a submission the quality and effect of a rule of court.

Among the causes contributing to the tardiness of this legislation were the spirit and the letter of several clauses in the Federal and State Constitutions, such as those making the courts coordinate with the legislatures and those pertaining to the right of trial by jury and to due process of law. In fact, the question of the constitutionality of arbitration statutes is still occasionally raised in the courts (Cf. *Exell* v. Rocky *Mountain* Bean and Elevator Company, Colorado, 1925, 232 Pacific Rep. 680). Compulsory arbitration unless accompanied by adequate provisions for an appeal to the ordinary courts has been deemed unconstitutional (St. Louis, I. M. and *S.* Ry. Co. v. *Williams,* 1887, 49 Ark., 492; In re compulsory *arbitration,* 1886, 9 Colo. 629). When such appeal is provided for, as in the Pennsylvania Act of 1836, compulsory arbitration has been upheld.

Blackstone (3 *Com.* 16) speaks of an award as the equivalent of "the agreement of the parties, or the judgment of a court of justice." As between the views assimilating the award to the one or the other, with their corollary treatment of the arbitrators as agents or as judges, and of the entire proceeding as a business negotiation or as a mode of trial, the tendency of the U.S. courts has been generally in the direction of the view that arbitration is essentially a mode of trial. At least holdings are found contrary to those in England under the common law: giving arbitrators judicial exemption from civil liability for mistakes or even fraud in the performance of their functions; allowing them to tax their own costs; to correct errors after an award is made; and many minor points (Harvard Law Review, xl., 129).

In spite of this conservatism of the courts and the legislature the use of arbitration has increased in the United States for commercial matters, largely under the influence of chambers of commerce and trade associations. The New York State Chamber of Commerce has printed (1913) its earliest arbitration records, consisting of minutes of its committees from 1779 to 1792. The Year Book on Commercial Arbitration in the United States for 1927 contains the provisions for arbitration including forms, rules and regulations, and panels of arbitrators in trade associations in 30 principal branches of commerce, and a comprehensive list of chambers of commerce, exchanges, municipal courts, legal aid societies, and bar associations furnishing arbitration facilities in every part of the country. The attitude of bar associations, and particularly

the American Bar Association, has been friendly and, in view of a possible conflict of interest, even generous. Largely through the efforts of the latter there has been passed a Federal arbitration act (in effect Jan. 1. 1926) limited, of course, to types of disputes cognizable in the Federal courts (cases in admiralty, inter-state commerce, diversity of citizenship) and excluding employment contracts even from these. The act embodied, like the earlier New York (1921) and New Jersey (1923) acts and the contemporary Massachusetts (1925) and Oregon (1925) acts, these three principles: arbitration agreements in writing are valid; they are made enforceable and irrevocable; they may embrace matters not yet in dispute. With the exception of the provision for future disputes these principles are also embodied in the act drafted (1925) by the Commissioners on Uniform State Laws affiliated with the American Bar Association (adopted in Nevada, 192j, North Carolina, 1927, Wyoming, 1927). Provision is further made for guidance by the court on questions of law, for the aid of the court in compelling the attendance and testifying of witnesses, for a limited judicial review, and, in the case of the Uniform act, for provisional and ancillary remedies for the preservation of the property involved and for securing satisfaction of the award.

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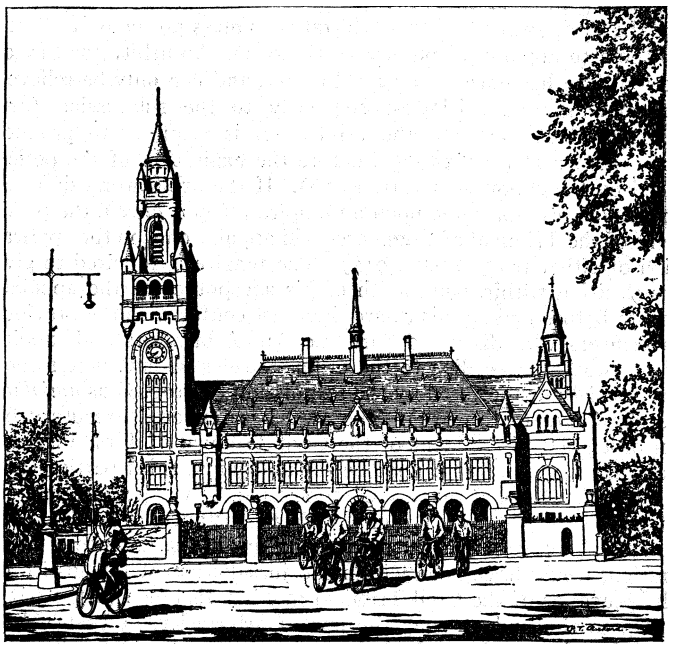
ARBITRATION, INTERNATIONAL. International arbitration is a proceeding in which two nations refer their differences to one or more selected persons, who, after affording to each party an opportunity of being heard, pronounce judgment on the matters at issue. It is understood, unless otherwise expressed, that the judgment shall be in accordance with the law by which civilized nations have agreed to be bound, whenever such law is applicable. Arbitration differs from mediation (*q.v.*) in so 6ar as it is a judicial act, whereas mediation involves no decision, but merely advice and suggestions to those who invoke its aid.

Arbitral Tribunals. — An international arbitrator may be the chief of a friendly power, or he may be a private individual. When he is head of a state he is not expected to act personally; he may appoint a delegate or delegates to act on his behalf, and avail himself of their labours and views, the ultimate decision being his only in name. In civil arbitration an arbitrator cannot delegate his office without express authority. The analogy between the two fails to hold good in another respect also. In civil arbitration, the decision or award may be made a rule of court, after whicli it becomes enforceable by writ of execution against person or property. An international award cannot be enforced directly; in other words it has no legal sanction behind it. Its obligation rests on the good faith of the parties to the reference, and on the fact that, with the help of a world-wide press, public opinion can always be brought to bear on any state seeking to evade its moral duty. The obligation of an ordinary treaty rests on precisely the same foundations. Where there are two or any other even number of arbitrators, provision is usually made for an umpire. (See BERING SEA ARBITRATION and "ALABAMA" ARBITRATION.)

Arbitral tribunals may have to deal with questions either of law or fact, or of both. When they have to deal with law only, that is to say, to lay down a principle or decide a question of liability, their functions are judicial or quasi-judicial, and the result is arbitration proper. Where they have to deal with facts only; *e.g.*, the evaluation of pecuniary claims, their functions are administrative rather than judicial, and the term commission is applied to them. "Mixed commissions," so calied because they are composed of representatives of the parties in difference, have been frequently resorted to for delimitation of frontiers, and for settling the indemnities to be paid to the subjects of neutral powers in respect of losses sustained by non-combatants in times of war or civil insurrection.

Awards. — International awards, as already stated, differ from civil awards in having no legal sanction by which they can be enforced. On the other hand, they resemble civil awards in that they may be set aside; *i.e.*, ignored, for sufficient reason, as, for example, if the tribunal has not acted in good faith, or has not given to each party an opportunity of being heard, or has exceeded its jurisdiction. An instance under the last head occurred in 1831, when it was referred to the king of the Netherlands as sole arbitrator to fix the north-eastern boundary of the state of Maine. The king's representatives were unable to draw the frontier line by reason of the imperfection of the maps then in existence, and



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he therefore directed a further survey. This direction was beyond the terms of the reference, and the award, when made, was repudiated by the United States as void for excess. The point in dispute was only finally disposed of by the Webster-Ashburton treaty of 1842.

Subject-matter. — The history of international arbitration is dealt with in the article PEACE, where treaties of general arbitration are discussed. The rapid growth of international arbitration may be gathered from the following figures. Between 1820 and 1840, there were eight such instances; between 1840 and 1860, there were 30; between 1860 and 1880, 44; between 1880 and 1900, 90. Of the governments which were parties in these several cases Great Britain heads the list in point of numbers, the United States of America being a good second. The present article is concerned exclusively with arbitration in regard to such existing differences as are capable of precise statement and of prompt adjustment. These differences may be arranged in two main groups:

(a) Those which have arisen between State and State in their sovereign capacities;
(b) Those in which one State has made a demand upon another State, ostensibly in its sovereign capacity, but really on behalf of some individual, or set of individuals, whose interests it was bound to protect.

To group (a) belong territorial differences in regard to ownership of land and rights of fishing at sea; to group (b) belong pecuniary claims in respect of acts wrongfully done to one or more subjects of one state by, or with the authority of, another state. To enumerate even a tenth part of the successful arbitrations in recent times would occupy too much space.

Permanent Court of Arbitration **of** The Hague. — The establishment of a permanent tribunal at The Hague by the convention of 1899, for the pacific settlement of international disputes marks a momentous epoch in the history of international arbitration. This tribunal realized an idea put forward by Jeremy Bentham towards the close of the 18th century, advocated by James Mill in the middle of the 19th century, and worked out later by Mr. Dudley Field in America, by Dr. Goldschmidt in

Dates of agreement to refer.	Parties.	Arbitrating authority.	Subject-matter.	Date of award.
		TABLE I. Territorial Disputes (*Ownership*).		
1817	Holland and Venezuela	Queen of Spain	Island of Aves in Venezuela	1865
1869	Great Britain and Portugal	President of United States	Island of Bulama on West Coast of Africa	1870
1872	Great Britain and Portugal	President of French Republic	Delagoa Bay (part of), Inyack and Elephant Is., South-East Africa	1875
1876	Argentine Republic and Paraguay	President of United States	Territory between the Verde and the Pilcomayo river of Paraguay	1878
1885	Great Britain and Germany	Mixed Commission	Islets and guano deposits on South-West Coast of Africa	1886
1886	Bulgaria and Servia	hfixed Commission	Territory near the village of Bregovo	1887
1896	Great Britain and Venezuela	Mixed Commission	British Guiana	1899
1902	Austria and Hungary	Mixed Commission (with President of Swiss Federal tribunal as umpire)	Territory in the district of Upper Tatra	1902
		TABLE II. Delimitation *of* Frontiers.		
1869	Great Britain and the Transvaal	Lieutenant Governor of Natal	The southern boundary of the South African Republic	1870
1871	Great Britain and the United States	The German emperor	The San Juan water boundary	1872
1873	Italy and Switzerland	Mixed Commission (with U.S. minister at Rome as umpire)	The Canton of Ticino	1874
188;	Great Britain and Russia	Mixed Commission	North-Western Afghanistan	1887
1890	France and Holland	Tsar of Russia	French Guiana and Dutch Guiana	1891
1895	Great Britain and Portugal	President of the Italian Court of Appeal	Manicaland	1897
1897	France and Brazil	President of the Swiss Confederation	River Yapoe named in the Treaty of Utrecht 1813	1900
1901	Great Britain and Brazil	King of Italy	British Guiana	1904
1903	Great Britain and Portugal	King of Italy	Barotseland	1905
1903	Great Britain and the United States	Mixed Commission	Alaska	1903
1917	Colombia and Venezuela	Swiss Federal Council	Boundaries of Colombia and Venezuela	1922
1923	Great Britain and Turkey	Council of the League of Nations	Boundary of Iraq	1925
		TABLE III. Pecuniary *Claims* in *respect* of Seizures and Arrests.		
1851	United States and Portugal	President of French Republic	Seizure of the American privateer "General Armstrong"	1852
1863	Great Britain and Brazil	King of the Belgians	Arrest of three British officers of the ship "La Forte"	1863
1863	Great Britain and Peru	Senate of Hamburg	Arrest at Callao of Capt. Melville White, a British subject	1864
1870	United States and Spain	Mixed Commission	The American s.s. "Col. Lloyd Aspinwall"	1870
1873	Japan and Peru	Tsar of Russia	The Peruvian barque "Maria Luz"	1875
1874	United States and Colombia	Mixed Commission	The American s.s. "Montijo"	1875
1879	France and Nicaragua	French Court of Cassation	The French ship "Le Phare"	1880
1885	United States and Spain	Italian Minister at Madrid	The American s.s. "The Masonic"	1885
1888	United States and Denmark	British Minister at Athens	The s.s. "Benjamin Franklin" and the barque "Catherine Augusta"	1890
1895	Great Britain and the Netherlands	Tsar of Russia, who delegated his duties to Prof. F. de hfartens	Arrest of the master of the "Costa Rica" packet (a British subject)	1897

Germany, and by Sir Edmund Hornby and Mr. Leone Levi in England. The credit of the realization is due, first to the tsar of Russia, who initiated the Hague Conference of 1899; secondly to David Jayne Hill, at that time assistant secretary of State of the United States; and thirdly to Lord Pauncefote (then Sir Julian Pauncefote, British ambassador at Washington), who urged before a committee of the conference the importance of organizing a permanent international court, the service of which should be called into requisition at will, and who also submitted an outline of the mode in which such a court might be formed. The result was embodied in the following articles of the convention, signed on behalf of 16 of the assembled powers on July 29, 1899.

(Art. 23.) Each of the signatory powers is to designate within three months from the ratification of the convention four persons at the most, of recognized competence in international law, enjoying the highest moral consideration, and willing to accept the duties of arbitrators. Two or more Powers may agree to nominate one or more members in common, or the same person may be nominated by different powers. Members of the court are to be appointed for six years and may be re-nominated. (Art. 25.) The signatory powers desiring to apply to the tribunal for the settlement of a difference between them are to notify the same to the arbitrators. The arbitrators who are to determine this difference are, unless otherwise specially agreed, to be chosen from the general list of members in the following manner:—each party is to name two arbitrators, and these are to choose a chief arbitrator or umpire (*sur-arbitre*). If the votes are equally divided the selection of the chief arbitrator is to be entrusted to a third power to be named by the parties. (Art. 26.) The tribunal is to sit at The Hague when practicable, unless the parties otherwise agree. (Art. 27.) "The signatory powers consider it a duty in the event of an acute conflict threatening to break out between two or more of them to remind these latter that the permanent court is open to them. This action is only to be considered as an exercise of good offices."

Several of the powers nominated members of the permanent court pursuant to Art. 25, quoted above, those nominated on behalf of Great Britain being Lord Pauncefote, Sir Edward Malet, Sir Edward Fry and Professor Westlake. On the death of Lord Pauncefote, Major-General Sir John C. Ardagh was appointed in his place.

Another institution created by this Convention (*see* Art. 9) is the so-called international commission of enquiry, designed to facilitate a solution of a dispute arising from a difference of opinion on points of fact, and not involving the honour or vital interests of the parties.

The contracting Powers also agreed to have recourse to the good offices or mediation of one or more friendly Powers, in cases of serious disputes, before appealing to arms, and that such recourse should not be regarded as an unfriendly act.

At the Second Peace Conference of The Hague in 1907 the convention was redrafted, but in essentials remained unchanged. One important addition was the creation of summary procedure by means of a smaller tribunal composed of three judges. Each party is represented by an agent only and the proceedings are in writing.

Hague Cases and Commissions of Enquiry.—Since the first case, The *Pious Fund* of *the* Californias, heard in 1902, some 18 disputes have been submitted to the Permanent Court of Arbitration and three to investigation of the facts by commissions of enquiry Some of these are now regarded as authoritative expressions of the law upon the issues raised. The pre-war cases are reported in The Hague Court Reports (1916), edited by James Brown Scott, and the post-war in vols. 16, 17 and 20 of the American Journal of International Law.

In the Dogger Bank incident of 1904 the commission of enquiry was empowered by the parties, Great Britain and Russia, not only to ascertain the facts, but also to determine the liability.

Arbitral Procedure.—Not the least of the benefits of The Hague convention of 1899 (strengthened by that of 1907) is that it contains rules of procedure which furnish a guide for all arbitrations whether conducted before The Hague court or not. These may be summarized as follows:—The initial step is the signing of a compromise by the parties clearly defining the subject in dispute and other terms and conditions of the arbitration. The next is the choice of the arbitrators and of an umpire if the number of arbitrators is even. Each party then by its agents prepares and presents its case in a narrative or argumentative form, annexing thereto all relevant documents. The cases so presented are interchanged by transmission to the opposite party. The hearing consists in the discussion of the matters contained in the several cases, and is conducted under the direction of the president who is either the umpire, or, if there is no umpire, one of the arbitrators. The members of the tribunal have the right of putting questions to the counsel and agents of the parties and to demand from them explanation of doubtful points. The award is delivered in open court by the president in the presence of the parties, the agents and counsel. Any application for a revision of the award must be based on the discovery of new evidence of such a nature as to exercise a decisive influence on the award and unknown up to the time when the hearing was closed, both to the court itself and to the party asking for the revision. These general rules are universally applicable, but each case may require the application of special rules which each tribunal must make for itself. One such special rule relates to the language to be used. This must vary according to convenience and is therefore made ad *hoc.*

LATER TREATIES

Until 1911 progress in arbitration had been confined within certain limits, questions involving national honour or vital interests being excluded from its operation. In 1911, however, an effort was made to widen its scope. The credit for the innovation is probably due to the United States, as the new idea was first embodied in treaties between that power and France and Great Britain respectively, though these treaties were not ratified.

Arbitration Treaties Before the War.—As between other powers, various arbitration treaties embodying to a greater or less extent the idea of an all-embracing agreement were made; and it is regrettable to record that those which were put to a severe test failed entirely to prevent a resort to force of arms, thus apparently demonstrating the truth of the argument that arbitration on questions involving national honour or vital interest was foredoomed to failure. In July 1914, arbitration on the disputed points in Austria-Hungary's ultimatum was proposed by Serbia, and Britain proposed mediation. But this conciliatory procedure was unsuccessful.

In the Italo-Turkish War no time was given for any possible pacific intervention, and in the Austro-Hungarian conflict with Serbia the same method of excluding pacific intervention was adopted. In the Italian conflict with Greece over the Janina murders it was the same again, in spite of the parties being pledged to arbitration. These instances show that arbitration must be of immediate and automatic application if it is to prevent a disaster.

Some account of the leading provisions of the arbitration treaties of 1911 between Great Britain and the United States and between France and the United States must be given. Apart from the provision that the treaties were to embrace all manner of disputes and differences, various preliminary stages of procedure were provided, which may be summarized as follow:

1. Request by either party to submit any difference between them to a joint high commission of inquiry.
2. Power to either party to postpone the reference to the high commission for one year from the date of the request, in order to afford an opportunity for diplomatic discussion and adjustment of the questions in controversy.
3. Appointment by each party of three of their nationals, these to form the joint high commission.
4. Holding of the inquiry by the joint high commission, the inquiry to be followed by a report upon the particular question or matters referred to it, for the purpose of facilitating the solution of the disputes by elucidating the facts and defining the issues, the report to include also such recommendations and conclusions as may be appropriate.
5. If the diiference persist, the case becomes the subject of an agreement to refer the matter to arbitration, such agreement to provide for the organization of the tribunal which will arbitrate, and to determine the question or questions at issue.

The object of the treaties, however, was not only to provide automatic application, but also to divert attention from the issue to the method of settlement, and thus to enable diplomacy to gain time, while providing the means of obtaining a calm examination of the points involved.

Arbitration under the Covenant.—Since the World War a new era for arbitration has begun. Arbitration had been regarded as having attained a sufficiently high status in international relations in being promoted by permanent treaties to the position of a recognized adjunct of diplomacy. The Covenant of the League of Nations gave it a much higher rank, and the activities with which it was sought to invest the League would practically displace diplomacy in its present representative form. Arbitration tended to replace direct negotiations between the ministers whose departments were concerned, suppressing, or at any rate relegating to a secondary position, the use of the diplomatic channel.

Under the Covenant the members of the League agree that if there should arise between them any dispute likely to lead to a rupture, they will submit the matter either to arbitration or to enquiry by the Council of the League, and they bind themselves in no case to resort to war until three months after the award by the arbitrators or the report by the Council.

The members of the League agree that whenever any dispute shall arise between them which they recognize to be suitable for submission to arbitration and which cannot be ,satisfactorily settled by diplomacy, they will submit the whole subject-matter to arbitration.

The members of the League also agree that they will carry out in full good faith any award that may be rendered, and that they will not resort to war against a member of the League which complies herewith. In the event of any failure to carry out such an award, the Council shall propose what steps should be taken to give effect thereto.

It is seen that these provisions do not pretend to include all difficulties, but are confined to such matters as all parties may regard as arbitrable. Another clause, however, provides that "disputes as to the interpretation of a treaty, as to any question of international law, as to the existence of any fact which if established would constitute a breach of any international obligation, or as to the extent and nature of the reparation to be made for any such breach, are declared to be among these which are generally suitable for submission to arbitration."

The attitude of the British Government in respect of these provisions of the Covenant was expressed in a speech made by Lord Balfour on July 6, 1925, in which he stated:

Arbitration is the thing; there is no question which can arise which will not be submitted to arbitration. If arbitration be really observed, war will be impossible. If either party to a dispute refused to arbitrate or to carry out a decision of arbitration, our obligation and that of the other parties would be to throw in our whole strength to defend the aggrieved party.

On the continent of Europe this confidence in the future of arbitration is equally strong. Before the World War, arbitration was regarded as a permissive method and though the term "compulsion" was used, it mas merely in the sense that contracting parties had bound themselves to submit the cases specified in their engagement to arbitration. Under the Covenant, as Lord Balfour interprets it, compulsion is given a much more effective sense.

Geneva Protocol — To secure further the inclusion of all differences between nations, and to apply compulsory arbitration as a substitute for war, the Geneva Protocol, adopted on Oct. 2, 1924, but never ratified by the Powers, provided a systematic procedure of conciliation, arbitration, and forced compliance with the League's decisions, for the prevention of war. This took the form of an exhaustive amplification of the above-cited articles of the Covenant.

Its provisions were as follows:—

1. If the dispute submitted to the Council is not settled by it, . . . the Council shall endeavour to persuade the parties to submit the dispute to judicial settlement by arbitration.

2. (a) If the parties cannot agree to do so, there shall, at the request of at least one of the parties, be constituted a committee of arbitrators. The committee shall so far as possible be constituted by agreement between the parties.

(b) If within the period fixed by the Council, the parties have failed to agree, in whole or in part, upon the number, the names, and the powers of the arbitrators and upon the procedure, the Council shall settle the points remaining in suspense. It shall, with the utmost possible despatch, in consultation with the parties, select arbitrators and their president from among persons who, by their nationality, their personal character, and their experience, appear to it to furnish the highest guarantees of competence and impartiality.

(c) After the claims of the parties have been formulated, the committee of arbitrators, on the request of any party, shall through the medium of the Council request an advisory opinion upon any points of law in dispute from the Permanent Court of International Justice (*q.v.*), which in such case shall meet with the utmost possible despatch.

3. If none of the parties asks for arbitration the Council shall again take the dispute under consideration. If the Council reaches a report which is unanimously agreed to by the members thereof, other than the representatives of any of the parties to the dispute, the signatory States agree to comply with the recommendations therein.

The Protocol unfortunately amplified also the coercive clauses, military and economic, in case either party to a dispute failed to comply with the pacific solution proposed or arrived at by the League. Owing more particularly to these coercive provisions Great Britain repudiated the Protocol. The United States, which had been foremost in promoting arbitration, did not adopt the Covenant owing mainly to these very coercive provisions which the Protocol made the mistake of amplifying. Great Britain's repudiation of the Protocol prevented its general application.

As regards economic coercion against a power which declines to accept arbitration, it is not a principle much more feasible than coercion by force. Suspension of trade between any two industrial countries may be as much a loss to the one as to the other. Feeling in Great Britain and the United States seems practically unanimous in distrusting the application of any coercive method whether or not a domestic interest is involved. Until some new method is found of accentuating moral force which will not have the defects of the sanctions provided by the Covenant, the moral force of universal public opinion seems destined to be the only guarantee of respect for arbitration and its award.

Meanwhile Germany, Sweden, Finland and S itzerland have concluded treaties of arbitration in which questions of national honour and vital interests are not reserved. In these a new element has been added to the system of compulsory treaties, in the form of a standing committee of competent persons appointed by the two contracting States, to which all difficulties can be referred for examination and counsel.

At the sixth meeting of the Assembly of the League of Nations the failure of the Protocol of 1924 was dealt with in a report containing the following paragraph:—

At the moment when the declarations of certain governments have shown that an early entry into force of the Protocol for the pacific settlement of international disputes is not to be expected, several delegations have been anxious to affirm the fidelity and unanimity with which the members of the League remain attached to the triple object underlying that draft treaty, namely, arbitration, security, and disarmament, and to indicate methods or measures by which an approach might be made to this object, pending the achievement of a general settlement which many consider indispensable.

The government most particularly concerned in the wrecking of the Protocol was that of Great Britain. Its attitude produced among the other members of the League of Nations the impression that Great Britain, in spite of her active championship of arbitration, was not prepared to accept the obligations resulting from strict compliance with the provisions of the Covenant. This impression was shared by many Englishmen, but Lord Balfour's statement made it clear that it was erroneous; and it was not surprising that, later on, the foreign secretary, Sir Austen Chamberlain, should take the lead in calling a special conference to deal with the problems existing in Central Europe, under the auspices of the Covenant itself. Great Britain thus showed that while observing her traditional attitude of distrust towards international generalities, she was genuinely attached to the principle of arbitration and was ready to give it the widest feasible scope.

Locarno Pact. — The result of the conference called by the British Government at Locarno in Oct. 1925 was a pact under which the Powers between whom difficulties are most likely to arise undertake in no circumstances whatever to resort to war. They pledge themselves to submit disputes of every kind to some form of peaceful procedure. This agreement must be taken in conjunction with Article 16 of the Covenant, which provides that disputes as to the interpretation of a treaty, as to any question of international law, as to the existence of any fact which, if established, would constitute a breach of international obligation, or as to the extent and nature of the reparation to be made for any such breach, are declared to be among those generally suitable for submission to arbitration or judicial settlement.

Both the Geneva Protocol and the Pact of Locarno adopted the same principle as that which underlay the abortive Anglo-American treaty of 1897; though that treaty was called a treaty of arbitration it was at the same time a treaty of conciliation. It is interesting to note that Lord Salisbury, who acted, it is believed, on the advice of Lord Alverstone, initiated the negotiations for the treaty in question in a draft, the first proposition of which was as follows:

Her Britannic Majesty and the President of the United States shall each appoint two or more permanent judicial officers for the purposes of this treaty, and on the appearance of any difference between the two Powers which, in the judgment of either of them, cannot be settled by negotiation, each of them shall designate one of the said officers as arbitrator; and the two arbitrators shall hear and determine any matter referred to them in accordance with this treaty.

This principle, though it was not adopted in the treaty of 1897, has been adopted in practically all the new treaties of arbitration entered into since the conclusion of the World War.

The important object of international arbitration is further dealt with in a number of articles of which the following may be mentioned: EUROPE: HISTORY; LEAGUE OF NATIONS; LOCARNO, PACT OF; SANCTIONS AND GUARANTEES; TACNA-ARICA; WORLD COCRT.

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International Law (1921); Lord Bryce, *International Relations* (1922); *Documents for the Year 1924, International Conciliation* (Carnegie Endowment, 1924); P. J. N. Baker, *The Geneva Protocol* (1925); W. R. Bisschep, *The Locarno* Pact (Grotius Soc. trans. vol. xi. 1926). (M. H. C.; T. B.)

ARBOGAST (died 394), a barbarian officer in the Roman army at the end of the 4th century. His nationality is uncertain, but Zosimus, Eunapius and Sulpicius Alexander (a Gallo-Roman historian quoted by Gregory of Tours) all refer to him as a Frank. Having served with distinction against the Goths in Thrace, he was sent by Theodosius in 388 against Maximus, who had usurped the empire of the west and had murdered Gratian, and completely defeated him. Tbeodpsius then appointed him chief minister for his young brother-in-law, Valentinian II. In 392, Valentinian died mysteriously at Vienne (in Gaul); Arbogast named as his successor Eugenius, a rhetorician, and proclaimed himself the champion of paganism. In May, 394, Theodosius marched against him and defeated him at the battle of the Frigidus. Arbogast escaped to the mountains, where he committed suicide (Sept. 8 394). Arbogast appears to have been an energetic statesman and one of the greatest soldiers of the later empire.

See T. Hodgkin, *Italy and her Invaders* (1892), vol. i. chap. xi. and note at end.

ARBOIS, a town of eastern France, among the wine-growing northern foothills of the Jura, about 30 mi. S S.W. of Besançon, in the department of Jura. Pop. (1936) 3,434. The church of St. Just, founded in the 10th century, has a 16th-century belfry and good wood-carving. Two towers of the old walls remain, and there is a chbteau of the dukes of Burgundy. A church of 1384 is used as market-hall. At Arbois Pasteur spent most of his youth. The red and white wines of the vicinity are famous.

ARBOIS DE JUBAINVILLE, MARIE WENRI D' (1827–1910), French historian and philologist, was born at Nancy Dec. 5 1827. In 1S51 he left the École des Chartes with the degree of palaeographic archivist. He was placed in control of the departmental archives of Aube, and remained in that position until 1880, when he retired on a pension. Appointed in 1882 to the newly founded professorial chair of Celtic at the Collège de France, he began the *Cours de littérature celtique* which in 1908 extended to 12 volumes. For this he himself edited the following works: *Introduction a l'étude de la litttrature celtique* (1883); *L'Épopée celtique en Irlande* (1892); *Etudes sur le droit celtique* (1895); and *Les principaux auteurs de l'antiquité à consulter sur l'histoire des Celtes* (1902).

He was among the first in France to enter upon the study of the most ancient monuments of Irish literature with a solid philological preparation and without empty prejudices. We owe to him also *Les Celtes depuis les temps les plus reculés jusqu'à l'an 100 avant notre ère* (1904); a study of comparative law in *La Famille celtique* (1905); *Recherckes sur l'origine de la propriété foncière* (1890). He died in Feb. 1910.

ARBON, a town of Switzerland, on the Lake of Constance 18m. S.E. of Konstanz. Pop. (1844) 660; (1930) about 8,570. The name comes from the Latin *Arbor Felix.* It has Neolithic pile-dwellings and a castle begun in the 4th century. Linen manufacture began in the 18th century and cotton followed in the 19th. Motor-cars are also made.

ARBOR DAY, the name applied to an annual tree-planting day generally observed throughout the United States. It originated in Nebraska, where it was first observed on April 10, 1872. The plan of devoting a certain day each year to the public planting of trees and the name Arbor Day were proposed by J. Sterling Morton, then a member of the State board of agriculture and later U.S. secretary of agriculture. In 1885 Arbor Day was made a legal holiday in Nebraska, and since that date about a third of the States have made similar enactments. At first the efforts to extend its celebration were made chiefly through agricultural associations and town authorities, but about 1882 the plan of making it a school festival was inaugurated. As such, the observance of Arbor Day has spread throughout the United States and far beyond its borders. Moreover, its scope and purpose have been greatly broadened. From simple exercises and the planting of single trees to beautify public grounds, it has become the occasion for impressing on the minds of school children the importance of forestry and for the planting of thousands of seedling trees to reforest otherwise waste lands. The time of celebration varies in different States—sometimes even in different localities in the same State—but April or early May is the rule in the northern States, and February, January and December are the months in the various southern States.

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ARBORETUM, a place where trees and shrubs are cultivated for scientific, ornamental or other educational purposes; that portion of a botanical garden used for woody plants. There are many such collections of hardy plants in cities and private parks. Rich men often spare neither pains nor money to get important collections to adorn their estates, many of which have later been given to cities to be used as public parks. When properly maintained they make creditable arboretums. The modern arboretums contain plants as specimens or collections arranged according to some definite method—it may be systematic relationships, or commercial uses, or perhaps, to show ecological adaptations. The entire field of possibilities is seldom covered by any one arboretum, but each one specializes in a few projects for which it is particularly equipped or well situated.

As early as the middle of the 16th century Rent du Bellay of Touvoys, France, in co-operation with Pierre Belon made a good collection of trees and brought into France seeds of exotic species from western Asia. This collection long remained the richest and most beautiful in France or perhaps the world. About 1720, Duhamel du Monçeau, head of the French Marine, and a scientist, gathered plants from all over Europe and North America to plant on his two estates. The plants were classified, arranged and planted in a methodical manner resulting in what might be called the first arboretum made with scientific purposes. From his experience with the collection, du Monçeau wrote and published in 1755 a book on characteristics and cultivation of trees and shrubs. This collection of plants and the publication had a great influence on study and early distribution of imported plant species. Many of these imported types can still be found in France.

One of the most complete arboretums in the world is that at Kew, England, in the Royal Botanical Gardens. It had its beginnings as far back as 1762 though it was not thrown open to the public until 1841. To the latter date the ground, not exceeding 11ac., had been held as a private estate by members of the royal family. In 1845 the pleasure grounds and Royal Gardens at Kew, occupied by the king of Hanover, were given to the nation and placed under the care of Sir William Hooker for the purpose of establishing an arboretum. Hooker and his son, Sir Joseph, kept steadily at the task until the gardens and arboretum were among the finest and most complete in the world. The arboretum monopolizes a large portion of the entire garden (288ac.) with trees and shrubs representing some 4,500 species and varieties. In addition to the arboretum at Kew, important collections of trees and shrubs in Great Britain are those at the Royal Botanic Gardens in Edinburgh and at the Glasnevin Garden in Dublin, and a small select collection at Oxford. On the continent of Europe the classical example is the *Jardin des Plantes* in Paris. Here the gardens are very formal and make a striking effect.

In the United States the Arnold arboretum at Boston ranks with Kew in size and completeness. This institution had its beginnings in 1869 when James Arnold left in trust $100,000 to be used for the promotion of agriculture or horticulture. Through an agreement made with Harvard college officials in 1872, the Arnold bequest was used together with a 125ac. tract of land, bequeathed by Benjamin Bussey, for the establishment of a tree garden Charles Sprague Sargent was made the first director. He held the position until his death in 1927. During this time he

made a notable arboretum, the best in the United States and ranking favourably with the best in the world. Its 260 ac. in 1943 were planted with more than 6,536 species and varieties of trees, shrubs and vines belonging to some 340 genera. Of these, 2,418 species or varieties are exotic, coming particularly from Japan, China, Siberia and the Himalayas. The Arnold arboretum by agreement is a part of the regular park system of Boston, but, being under the management of a great university like Harvard, it has an aspect differing entirely from an ordinary park.

Among the other most outstanding arboretums in the United States are the Missouri Botanical garden in St. Louis, Mo., the Morton arboretum near Chicago, Ill., and the Hilland gardens in Rochester, New York, the Boyce Thompson arboretum in connection with the Boyce Thompson Institute for Plant Research, Yonkers, New York, and the Boyce Thompson Southwest arboretum at Superior, Ariz. The Boyce Thompson arboretum combines a large collection of trees and shrubs with a great plant research institute thus utilizing the greatest range of possibilities of an arboretum. The National arboretum at Washington, D.C., was established by an act of congress in 1927. It has an area of some 400 ac., owned and controlled by the United States department of agriculture. The California Botanical garden at Los Angeles, Calif., received a gift of 2,000 ac. of land, part of which is being used for the arboretum and part of which can be sold for capital and maintenance.

To serve most people an arboretum must have a scientific, an economic and a cultural aspect. On the scientific side the arboretum furnishes all types of hardy plants for the systematic botanist, the plant pathologist, the plant physiologist, the plant breeder and the entomologist. From this will come a thorough study of diseases and rational control measures; a better knowledge of soil requirements and cultural methods; many new plant hybrids from controlled cross breeding; and new methods of combating insect pests. The nurserymen and horticulturists look upon an arboretum as a place where plants are tested and displayed for the purpose of showing their economic possibilities. In this way the forester selects the species which fulfil specific needs for paper pulp, trees for hardwood lumber, etc. The nurserymen select from the arboretum species that they can fit into the landscape for the increasing demands of the public. Lastly, the public in general looks upon an arboretum as an unusually fine park, a place to go when in need of peaceful rest and a place that offers a chance to increase one's knowledge about nature.

For a directory of 161 botanical gardens and arboretums in the United States giving acreage, location, ownership, number of species, annual budget and name of present director, *see* American Association of Nurserymen *Proceedings*, 64th Annual Convention. For a historical sketch of botanical gardens and arboretums of the world, *see* Brooklyn Botanic Garden *Record*, vol. 27, no. 3, pp. 151–406, July, 1938. (*See* also BOTANIC GARDEN; FORESTS AND FORESTRY; HORTICULTURE.)

(P. W. Z.)

ARBORICULTURE, the scientific management of trees (Lat. *arbor*, a tree). In its broadest sense arboriculture includes that part of horticulture which deals with selection and cultivation of ornamental and fruit trees and shrubs and that part of forestry known as silviculture. Because of its broad meaning the word arboriculture is seldom used in practice. More specific meanings can be conveyed by such words as pomology which means the scientific cultivation of fruit trees or silviculture which means the scientific management of trees for commercial timber purposes.

The growing of woody plants for educational and scientific purposes has been practised since the middle of the 16th century when a collection of trees was made at Touvoys in France by René du Bellay. Many of the different phases of arboriculture have received particular attention from scientists and there are specialists in different fields; *e.g.*, systematic relationships, diseases of trees and shrubs, insect pests, pruning of trees and shrubs, soil management, ecology and propagation.

The systematists classify plants according to likes and unlikes, placing them in their proper genera and families. The pathologist studies diseases of plants and works out rational control measures. The entomologist is interested in insects that feed on economic plants and, like the pathologist, tries to find ways to exterminate or control the pests. The ecologist studies the habitats and environmental effects on plants, ever trying to find ideal conditions which would insure their maximum development. The plant propagator specializes in the multiplication of plants by means of seeds, cuttings or grafting. It is his problem to find the best and most economical methods to multiply valuable plants. If plants do not come true from seed, as is the case with varieties and hybrids, he must work out methods for vegetative propagation.

(P. W. Z.)

GENERAL PRACTICE

In arboriculture the cultivator's aim is to produce specimen trees with fine trunks carrying evenly balanced heads of well developed branches, whereas in silviculture well-grown trunks free from branches, produced in the shortest possible space of time, are the first requirement, and the minimum branch area only is tolerated that will keep a tree in good health and help in providing the necessary food required to build up the trunk. Isolated, the one is seen as a handsome specimen, the other as a gaunt trunk bearing meagre branches about the upper part. Further, in arboriculture trees are widely spaced in order to facilitate branch development and display, but in silviculture they are grown close together so as to suppress side branches, encourage height growth, and to obtain the largest possible quantity of timber from the area on which they stand. However, there are common grounds on which the two sections meet and function together. The best marked instances are park and hedgerow trees which are grown partly for decorative purposes and partly for profit. Such trees are often allowed to form large heads of branches but they are usually felled at the time of their greatest commercial value.

Propagation and Pruning. — Arboriculture may be regarded from many different standpoints. The scientist considers it from the point of view of collections of different kinds of trees drawn together from many parts of the world for the purpose of study. The owner of a large estate practises it in connection with the amenities of his property; the ordinary householder in connection with the adornment of his garden; municipal and county council suthorities as a means of beautifying the parks, gardens, streets and roads under their control, and so on. However, in whichever way arboriculture may be practised there are certain fundamental operations. Of these propagation is one. There are many methods of propagation. Some trees are raised from seeds, others from cuttings, grafts or layers. In some instances a tree may succeed quite well if propagated by one of two or three methods, but there are others that must be raised by one and one only of the several means if the best results are required. Propagation must be followed in most cases by one or more years in nursery quarters, where, by careful attention and training the foundation for the future tree is laid.

Pruning constitutes a very important item in this early training. A tree must be encouraged to develop with a single strong leading shoot. Branches are very liable to develop at the expense of the leading shoot. If side branches are suppressed or removed too rapidly there is a tendency for the tree to become spindly and unable to support its own weight, therefore pruning is so directed that the correct balance is maintained between the main axis and leaf-bearing branches, by first shortening and later on very gradually removing side branches. Root pruning is also practised during the nursery period. This is done by biennial transplanting. At that time long roots are shortened to encourage fibrous roots, for the more fibrous roots a tree possesses, the better is it likely to re-establish itself when removed from the nursery to a permanent position. Trees may sometimes be transferred to permanent positions when no more than two or three years old and a foot or two in height, or they may be allowed to remain many years. Street and avenue trees are often allowed to remain in nursery quarters until they are eight or 10 years old and 1j to 18ft. high. Some kinds of trees cannot be transplanted successfully after they have attained a height of 3ft. or 4ft. Pines succeed very much better if they are planted in permanent positions when less than 1ft. high. As a rule deciduous trees transplant

better than evergreens after they have attained a height of several feet.

Securing Vertical Growth. — Trees that are growing in open positions have a very decided tendency to develop in a lateral rather than vertical direction and to counteract this defect it is necessary to shorten and sometimes remove side branches. Trees should be pruned every second year until such a time as a single, strong leading shoot is keeping well in advance of side branches. After that less frequent pruning may be required. For a considerable time, however, it will be necessary to remove the lower branches now and then. Once the trees have attained the desired height branch development may be allowed to go on unchecked. In the case of old trees it is often necessary to remove one or more lower branches to balance the tree or lift the lower branches from the ground in order to disclose distant objects, open out vistas, or expose the trunk, for in some instances a view of the trunk adds very materially to the effectiveness of the tree. The removal of dead and broken branches from old trees is a very necessary practice in arboriculture. When dead branches are allowed to remain on the trees they are not only a source of danger to living parts but to other trees and dangerous living branches should also be shortened or cut off.

When the higher branches of trees such as oaks or elms die, the tree may often be rejuvenated by lowering the whole head to a point well below the dead part. With care the contour of the head can be left rather similar to the original, and in the course of a few years new branches will be formed, which will effectively hide the wounds and form a new head. Whether branches are removed from young or old trees they should, whenever possible, be removed in a line parallel with the bark of the trunk. A wound formed in this manner is almost sure to heal well but should only a short snag be left it will not heal properly. All wounds must be covered with a coat of coal-tar or some other antiseptic and protective substance as soon as made. Where cavities of dead wcod occur in trees they should be cleaned out, as much as possible of the dead wood removed, the surface painted with a strong solution of carbolic acid, and afterwards with coal-tar if possible. The cavity should then be built up with cement, concrete or asphalt, the surface being so finished that water will be thrown off. Ivy should not be allowed to encircle young trees but there is little use in removing it from old and fully matured trees. In some instances it may even help to support decaying trees and is certainly effective during winter. Pruning may be carried out during summer, autumn or early winter.

Botanical Grouping. — When arboriculture is practised for scientific purposes it is a good plan to arrange the trees in botanical sequence, placing the species of each genus together and allowing the related genera to follow each other. Soil conditions may not always allow this; then digressions must be made. More than one tree of each kind should be planted and they should be allowed enough space to develop to their full size. This will probably necessitate nurse trees being planted between the permanent examples, which can be removed as occasion warrants. Proper records must be kept of all collection trees, whence obtained, when planted, height and condition when planted and any other pertinent matters. They must also be properly labelled.

Garden **Plantings.**—When trees are planted for decorative purposes care must be taken to select kinds suitable for the available positions and they must be given ample space for their full development. Conifers should not upon any account be chosen for gardens in or about manufacturing towns where the atmosphere is heavily smoke-laden, or impure-through chemical fumes. Deciduous trees give better results, but they must be very carefully chosen for such places. When the atmospheric conditions are fairly clear of impurities and the soil is good, almost any hardy tree will thrive. Ericaceous plants, arbutuses, rhododendrons and the like, however, do not thrive where lime is present in the soil to any appreciable extent. For public parks arboriculture should take an educational form; trees suitable for the neighbourhood should be planted and given every chance of developing into fine specimens, in order that residents in the neighbourhood may make a choice of those suitable for their own gardens.

Street **Plantings.**—Too little thought is given to trees planted in streets and by the sides of roads, yet they have a very great bearing upon the amenities of towns and the countryside. Trees should not be planted in very narrow streets and roads; they are in the way, are often injured by traffic, and their branches must be constantly cut back to keep them within bounds. Where gardens adjoin narrow roads it is better to encourage the owners to plant small trees in their gardens in order that they may overhang the footpath, rather than plant trees on the sidewalk. In wide streets trees can be used with very great advantage. Even in such positions, however, they are often planted too close together and it is doubtful whether upon any occasion they need be spaced closer than 60ft. Close planting results in severe pruning and it is wise to avoid heavy pruning as much as possible. In the past, street and road trees have had a great deal to contend with by the presence of water and gas-pipes, etc., laid near the roots. Each time one of the services requires attention the roots of the trees are injured and very often premature death of the trees can be traced to such injury. New roads should be provided with proper accommodation for such services in order that injury to the trees may be avoided.

Care is necessary in selecting the right kinds of trees for definite soils and positions, and vigorous trees should be specially prepared for the purpose. Park, hedgerow and coppice trees should either be native trees or such exotics as will harmonize with native trees. Kinds with variegated foliage for instance are more in place within the confines of the garden than planted in association with common species. (See also ARBORETUM; TREE PLANTING.) (W. D.)

ARBORVITAE (Tree of Life), a name given by Clusius to species of *Thuja*. The name *Thuja* was adopted by Linnaeus from the *Thuya* of Tournefort and seems to be derived from the Greek word *θύος*, signifying sacrifice, presumably because the resin procured from certain species was used as incense. *Thuja* comprises a genus of five species belonging to the cedar or cypress family (Cupressaceae). *Thuja occidentalis* is the eastern arborvitae or northern white-cedar of eastern North America and ranges from Canada to the mountains of North Carolina and Tennessee. The tree attains a height of 40 to 50 ft. and features decussate. scale-like leaves borne in flattened sprays; when bruised they exhale an aromatic odour. Members of the Cartier expedition to Canada in the early 16th century were given a brew by the Indians which they claimed would cure scurvy. Having high regard for its medicinal worth they took back several trees on their return to France. Gerard's *Herbal* records the introduction of this tree in Britain prior to 1597, where it has long since become a favourite ornamental.

The giant arborvitae or western redcedar (*Thuja plicata*), is a native of western North America. It attains gigantic proportions in the forests along the Pacific slope, where it is often 150 to 200 ft. tall and 5 to 10 ft. in diameter. The wood is exceedingly durable and is used for shingles, siding, poles, posts, and mine props.

Another species of arborvitae is *Thuja orientalis,* known also as *Biota orientalis.* The latter generic name is derived from the Greek adjective *βιωτός,* formed from *βίος,* life, probably in connection with the name "tree of life." This is the Japanese hiba or Chinese arborvitae. It was cultivated in the Chelsea Physic garden in 1752, and was believed to have been sent to Europe by French missionaries. It has roundish cones, with numerous scales and wingless seeds. The leaves, which have a pungent aromatic odour, are said to yield a yellow dye. There are numerous varieties of this plant in cultivation, one of the most remarkable being *pendula,* with long, flexible, hanging, cord-like branches. The variety *pygmaea* forms a small bush of only a few inches in height. (E. S. HR.)

ARBÓS, E. FERNANDEZ (1863–1939), Spanish violinist and composer, was born in Madrid and trained at the conservatoire there, and later at Brussels and at Berlin under Joachim. He became a professor at Hamburg and then at Madrid, becoming known meanwhile as one of the finest violinists of the day; and after visiting England in 1890 and establishing his reputation there he became professor at the Royal College of Music in London. In 1908 he returned to Spain and became conductor of the symphony orchestra of Madrid, the post he retained until his death. As a composer he is best known by his violin pieces, and by a comic opera. El *Centro de la* Tierra (1895).

ARBOUR, originally "herber" or "erber" (O.Fr. *herbier,* from Lat. *herbarium,* "a collection of herbs," *herba,* "grass"); the word came to be spelt "arber" through its pronunciation, as in the case of Derby, and by the 16th century was written "arbour," helped by a confusion of derivation from Lat. arbor, a tree, and by change of meaning. A grass-plot or lawn, a herb-garden and a shady bower of interlaced trees, or climbing plants trained on lattice-work. The application of the word has shifted from the grass-covered ground to the covering of trees overhead. "Arbor" is a term applied to the spindle of a wheel, particularly in clock-making.

ARBROATH or ABERBROTHOCK, royal, municipal, and police burgh and seaport, Forfarshire (Angus), Scotland, at the mouth of Brothock water, 17m. N.E. of Dundee by the L.N.E.R. Pop. (1938) 18,173. The town is under provost, bailies, and council, and, with Brechin, Forfar, Bervie, and Montrose, returns one member to parliament. It makes sailcloth, canvas, and coarse linens, boots and shoes, spins flax, tans, bleaches, works in iron, builds ships, and has fisheries. The harbour, 'originally constructed and maintained by the abbots, by an agreement between the burgesses and John Gedy the abbot in 1394, was enlarged in 1725 and 1844 and the old part made into a wet dock (1877) when the entrance to the new harbour was deepened. A signal tower, 1oft. high, communicates with the Bell Rock (*q.v.*) lighthouse on the Inchcape Rock, 12m. S.E. The parish church dates from 1570, but has been much altered, and the spire was added in 1831. Hospitalfield, ½m. E., once the abbey hospice, and the "Monks-barn" of Scott's Antiquary, is now an art school with a collection of Scottish art. The ruins of the abbey, once one of the richest in Scotland, stand in High street. It was founded by William the Lion in 1178 for Tironensian Benedictines from Kelso, and consecrated in 1197, being dedicated to St. Thomas Becket, whom the king had met at the English court. It was William's only personal foundation, and he was buried within its precincts in 1214. Its style is mainly Early English, the western gable Norman. The cruciform church measured 276ft. long by 160ft. wide. Here parliament met on April 6th, 1320 to send the pope the notable letter, asserting the independence of their country and reciting in eloquent terms the services which their "lord and sovereign" Robert Bruce had rendered to Scotland. Arbroath was created a royal burgh in 1186, and its charter of 1599 is preserved. King John exempted it from "toll and custom" in every part of England excepting London. Arbroath is "Fairport" of Scott's Antiquary. Auchmithie, 3m. N.E. ("Musselcrag" of the same romance), is an old-fashioned fishing village in picturesque coast scenery. At the 14th-century church of St. Vigeans, 1m. N. of Arbroath, stands one of the most interesting of the sculptured stones of Scotland, thought to be the only legible Pictish inscription. The parish—originally called Aberbrothock and now incorporated with Arbroath for administrative purposes—takes its name from a saint or hermit whose chapel was situated at Grange of Conon, 3½m. N.W. Two miles west by south are the stone quarries of Carmyllie.

ARBUTHNOT, ALEXANDER (1538–1583), Scottish ecclesiastic and poet, educated at St. Andrews and Bourges, was principal of King's College, Aberdeen, from 1569 until his death. His extant works are (a) three poems, "The Praises of Wemen" (224 lines), "On Luve" (10 lines), and "The Miseries of a Pure Scholar" (189 lines), and (b) a Latin account of the Arbuthnot family, *Originis et Incrementi Arbuthnoticae Familiae Descriptio* Historica (still in ms.), of which an English continuation, by the father of Dr. John Arbuthnot, is preserved in the Advocates' Library, Edinburgh.

The particulars of Arbuthnot's life are found in Calderwood, Spottiswood, and other Church historians, and in Scott's Fasti Ecclesiae Scoticanae. The poems are printed in Pinkerton's Ancient Scottish Poems (1786), i. pp. 138–155.

ARBUTHNOT, JOHN (1667–1735), British physician and wit, the friend of Swift and Pope, was born at Arbuthnot, Kincardineshire. The son of an episcopalian minister who had been deprived of his living, he supported himself for some time in London by teaching mathematics, and then in 1692 entered University College, Oxford. He was graduated M.D. at St. Andrews in 1696. His papers on mathematical subjects, notably an Essay *on the Usefulness* of Mathematical Learning (1701), brought him an F.R.S. He became a fashionable physician, and later became royal physician in ordinary to Queen Anne; but his memory lives for the wit and varied learning which made him the chosen friend and counsellor of Swift and Pope, and for his genius as a Tory pamphleteer. Arbuthnot fixed the popular conception of John Bull, though he did not invent the character, in the five tracts printed as "The History of John Bull" in *Miscellanies* in Prose and Verse (1727), the preface to which is signed by Pope and Swift.

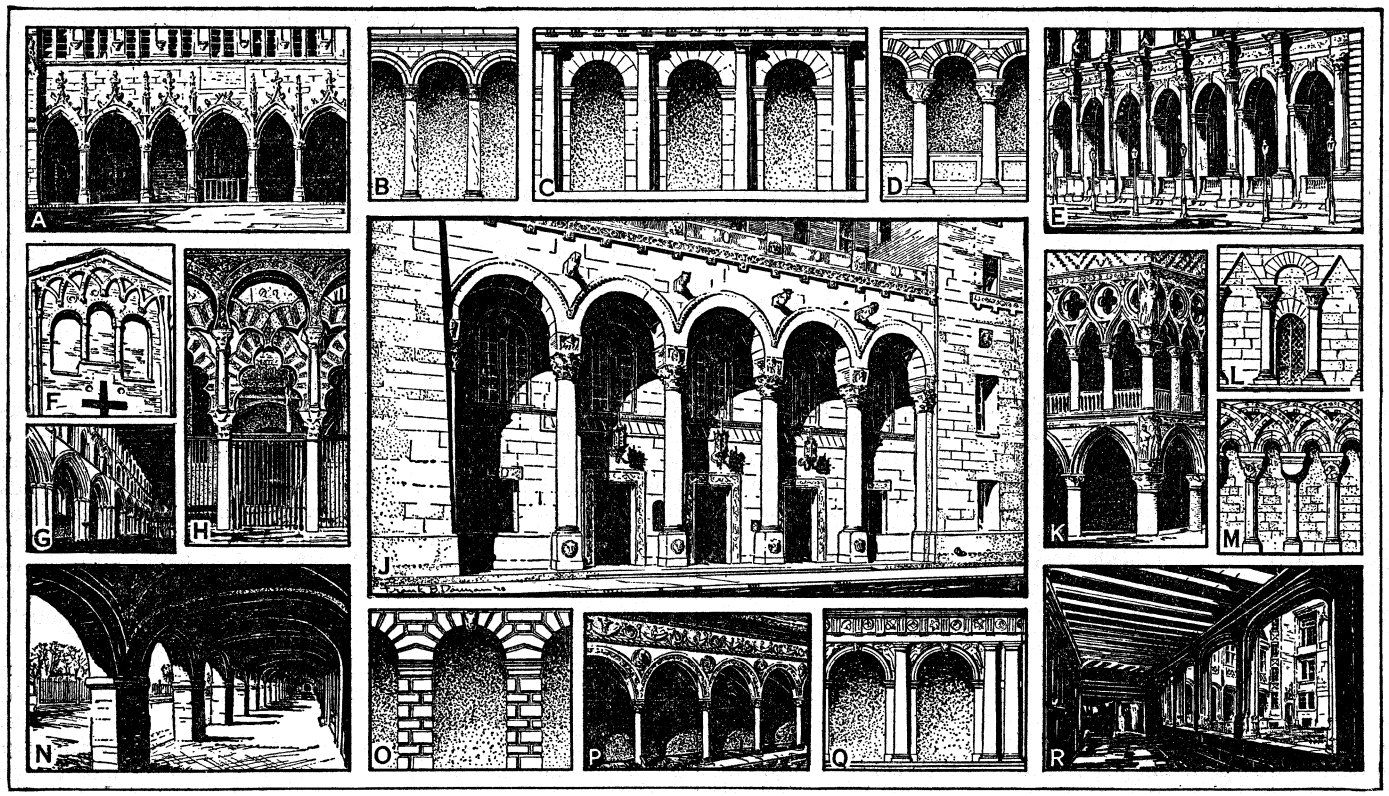
Arbuthnot was one of the leading spirits in the Scriblerus Club, whose members were to collaborate in a universal satire on the abuses of learning. *The* Memoirs of the *extraordinary* Life, *Works,* and Discoveries of *Martinus Scriblerus,* of which only the first book was finished, first printed in Pope's Works (1741), was chiefly the work of Arbuthnot, who is at his best in the whimsical account of the birth and education of Martin. Swift, writing on July 3, 1714 to Arbuthnot, says: "To talk of Martin in any hands but yours, is a folly. You every day give better hints than all of us together could do in a twelvemonth; and to say the truth, Pope who first thought of the hint has no genius at all to it, to my mind; Gay is too young; Parnell has some ideas of it, but is idle; I could put together, and lard, and strike out well enough, but all that relates to the sciences must be from you."

The death of Queen Anne put an end to Arbuthnot's position at court, but he still had an extensive practice. Lord Chesterfield and William Pulteney were his patients and friends; also Mrs. Howard (Lady Suffolk) and William Congreve. His friendship with Swift was constant and intimate; he was friend and adviser to Gay; and Pope wrote (Aug. 2 1734) that in a friendship of twenty years he had found no one reason of complaint from him. Arbuthnot's youngest son died in Dec. 1731. He never quite recovered his former spirits and health after this shock. On July 17 1734 he wrote to Pope: "A recovery in my case, and at my age, is impossible; the kindest wish of my friends is Euthanasia." In Jan. 1735 was published the "Epistle to Dr. Arbuthnot," which forms the prologue to Pope's satires. He died on Feb. 27 1735 at his house in Cork Street, London.

The Miscellaneous Works of the late Dr. Arbuthnot were published at Glasgow in an unauthorized edition in 1751. This includes many spurious pieces. See also The Life and Works of John Arbuthnot (1892), by George A. Aitken.

ARBUTUS, a genus of evergreen trees and shrubs of the heath family (Ericaceae) characterized by smooth, red, exfoliating bark, handsome foliage, showy flowers in terminal clusters and attractive, red, berry-like fruits. There are about 12 species, found chiefly in the Mediterranean region, Central America and western North America. In mild climates several species of *Arbutus* are planted for their beautiful foliage, flowers and fruit. Of these, the best known is the strawberry tree (A. *unedo*), a native of southern Europe and Ireland. The Madrona (*A. menziesii*), a handsome tree of the west coast of North America, is sparingly transplanted. The trailing arbutus or mayflower (see ARBUTUS, TRAILING) of eastern North America, belongs to a different genus (*Epigaea*) of the heath family. (E. S. HR.)

ARBUTUS, TRAILING (*Epigaea repens*), a fragrant, flowering plant of the heath family (Ericaceae), also called mayflower, common in rocky woods and on hillsides from the Maritime provinces to Florida and westward to Minnesota. The flowers appear as early as April, while the snow still lingers, and are eagerly sought as one of the first signs of spring; in regions near towns they are often stripped from the woods by ruthless persons and also sold on street corners. The plant stems are tough and sturdy, rough-hairy, and creep close to the ground under the dead leaves of the preceding season. The old leaves are rusty, dull green and heavily mid-veined. New leaves develop in June, rough in texture with fine netted veins and paler on the lower surface than on the upper. The small nectar-bearing flowers, which exist in four forms (see C. Darwin, Forms of Flowers), are white to pale pink and delicately scented, five-lobed and tubular, and grow on stems 6 to 12 in. in length.



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B AND C, ROMAN; D, BYZANTINE; F, L AND M, ROMANESQUE; (M, AN INTERLACING ARCADE): A, G, K, AND R, GOTHIC: A, HÔTEL DE VILLE. S. QUENTIN: K, DOGE'S PALACE. VENICE: R, HOUSE OF JACQUES COEUR AT BOURGES: H. MOORISH (MOSQUE AT CORDOVA): O, P AND Q, ITALIAN RENAISSANCE: N. FRENCH RENAISSANCE: E, 19TH-CENTURY FRENCH (NOUVEAU LOUVRE. PARIS): J, MODERN AMERICAN (HOTEL SHELTON, NEW YORK, A. L. HARMON. ARCHITECT); F, L AND M ARE PURELY DECORATIVE, ALL OTHER EXAMPLES ARE STRUCTURAL

ARC, ELECTRIC: *see* LIGHTING.

ARCACHON, town and bathing resort, S.W. France, in the department of Gironde, 37 mi. W.S.W. of Bordeaux on the Southern railway. Pop. (1936) 13,102. It is on the south shore of a large bay, the Bassin d'Arcachon, at the foot of pine-clad dunes and is renowned for its oyster breeding. The summer town, extending for $2\frac{1}{2}$ mi. along the shore, is frequented by bathers; the winter town, farther inland, is a climatic station among the pine woods.

ARCADE, in architecture, a series of arches assembled in a single composition, particularly when the arches are of approximately the same size and placed upon the same level. Arcades are used structurally as in the arcade between the nave and aisles of a church, which supports the clerestorey wall and the nave roof. They are also used, purely decoratively, where a band of horizontal decoration is required. Although the arch was known to many of the peoples of antiquity, it was the Romans who first appreciated its decorative possibilities and who made it, again and again, a dominant feature of great architectural importance, as in the Tabularium (*q.v.*) and in any Roman amphitheatre. An arcade, such as those used by the Romans, with the front face of each pier ornamented by a pilaster or engaged column that carries an entablature running over the tops of the arches, is known as a Roman arcade, and was a favourite motive of the Renaissance. During the late Empire, the Romans started to build arcades whose arches were carried directly upon the capitals of a range of columns (*e.g.,* the great court of the palace of Diocletian at Spalatro), and during the Romanesque and Gothic periods this became the normal type, although in the Byzantine work of the eastern empire, spreading blocks, known as impost blocks, were often placed between the capitals and the arches.

Arcades were used decoratively, to a great extent, in north Italian Romanesque. Some fronts, such as that of the cathedral at Pisa, consist entirely of rows of freestanding arcades. In the mediaeval architecture outside Italy (except for the Romanesque churches on the Rhine, where Italian influence *is* strong) decorative arcades were almost always actual parts of the wall and are known as wall arcades.

Interlacing arcades are those in which every arch spans the space, not to the adjacent support, but to one of those beyond. All of the arches are of the same size and, therefore, apparently overlap or intersect each other. They form a favourite motive for the decoration of walls, both exterior and interior, in the Romanesque work of northern Europe generally and the Gothic of England. The word arcade is also used, at the present time, to designate any covered passageway on which shops open. (T. F. H.)

ARCADELT or **ARCHADELT, JACOB** (c. 1514–c. 1575), celebrated Netherlands composer, who lived and worked chiefly in Italy. Among his numerous compositions five books of madrigals, published at Venice, probably gave a great stimulus to the beginnings of the Venetian school of composition. After 1555 he published three volumes of masses, besides contributing motets to various collections.

ARCADIA, in Greece, the central district of Peloponnesus. Shut off from the coast on all sides by mountain barriers (in the north Erymanthus [mod. *Olonos*] rises to 7,400ft., and Cyllene [*Ziria*] to 7,900ft.; in the south Parthenium and Lycaeum exceed 5,000ft.) this inland plateau is again divided by numerous subsidiary ranges. In east Arcadia these enclose a series of plains drained only by underground channels or *zerethra.* The west country is more open, with isolated mountain-groups and the winding valleys of the Alpheus (*q.v.*) and its tributaries the Ladon and Erymanthus. The ancient inhabitants were shepherds and hunters, worshipping Pan, Hermes and Artemis, primitive nature-deities. The difficulties of communication and especially the lack of a seaboard seriously hindered intercourse with the rest of Greece. Consequently the same population held the land throughout historic times, without admixture of Dorian immigrants, the dialect maintaining a peculiar resemblance to that of Cyprus. Arcadia was weak owing to chronic feuds between the towns. Its fortunes in Greek history turned on its position between Sparta and the

Isthmus. Unable to force their way through Argolis, the Spartans early set themselves to secure the passage through the central plateau. The resistance of single cities, and the temporary union of the Arcadians during the second Messenian war, did not defer complete subjugation past the 6th century. In 469 and again in 420 disaffected cities, backed by Argos, came near to establishing their independence. In 371, after the battle of Leuctra, a political league grew out of an old religious synod, and a federal capital was founded in a commanding strategic position at Megalopolis (*q.v.*). But a severe defeat by Sparta in 368 (the "tearless battle") and internal discord paralysed this movement. Megalopolis accentuated mutual jealousy. During the Hellenistic age Megalopolis stood staunchly by Macedonia; the rest of Arcadia rebelled against Antipater (330, 323) and Antigonus Gonatas (266). Similarly the cities divided their allegiance between the Achaean and the Aetolian Leagues, and fell a prey to Sparta and Macedonia. In Roman times Arcadia had fallen into decay. An influx of Slavonic settlers in the 8th century A.D. checked depopulation, but Arcadia suffered severely from the constant quarrels of its Frankish barons (1205–1460). Turkish rule, combined with Albanian immigration, raised the prosperity of the land, but in the Wars of Independence the strategic importance of Arcadia once more made it a centre of conflict. The population remains sparse, and pending complete restoration of the water conduits the soil is unproductive. The modern department of Arcadia extends to the Gulf of Nauplia, with a sea-coast of about 40 miles.

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ARCADIUS (378–408), Roman emperor, the elder son of Theodosius the Great, mas created Augustus in 383, and succeeded his father in 395. The empire was divided between him and his brother Honorius, Honorius governing the two western prefectures (Gaul and Italy), and Arcadius the two eastern (the Orient and Illyricum). There was estrangement between the two governments throughout the reign of Arcadius. Honorius's general Stilicho (q.v.), was always on the watch to annex the prefecture of Illyricum. Arcadius was guided at first by the praetorian prefect Rufinus, and, after his murder, probably instigated by Stilicho (end of 395), by the eunuch Eutropius (executed end of 399). His wife Eudoxia (daughter of a Frank general, Bauto), had great influence over him; she died in 404. In the last years of his reign, Anthemius (praetorian prefect) was his minister. In 395–96 the West Goths, under Alaric, ravaged Greece. In 399–400 the Gothic General Gainas, with the aid of partisans in Constantinople, tried to set up a German domination. But he fell after having held the city for six months, and the German danger was averted from the east. The banishment in 404 of John Chrysostom (q.v.), patriarch of Constantinople, who had offended the empress and quarreled with the bishop of Alexandria, was important, as determining the supremacy of the emperor to the patriarch.

AUTHORITIES.—Ancient: Fragments of Eunapius and Olympiodorus (in Muller's *Fragmenta Historicorum Graecorum,* vol. IV), fragments of Philostorgius, Socrates, Sozomen, Zosimus, Synesius of Cyrene ("The Egyptian"), Claudian.

Modern. Gibbon's *Declzne and Fall,* vol. *III.,* ed. Bury; J. B. Bury, *Later Roman Empire* (395–565) (1923), chap. v.; T. Hodgkin, *Italy and her invaders,* vol. 2nd ed. (1892); Gildenpenning, *Geschichte des oströmischen Reiches unter den Kaisern Arcadius und Theodosius* II. (1885).

ARCADIUS, of Antioch, Greek grammarian, flourished in the 2nd century A.D. According to Suidas, he wrote treatises on orthography and syntax, and an onomasticon (vocabulary). An epitome of Herodian's work on general prosody, wrongly attributed to Arcadius, is probably the work of Theodosius of Alexandria or a grammarian named Aristodemus. The 20th book of this epitome is the work of a forger of the 16th century.

See text by Barker, 1823; Schmidt, 1860; *see* also Galland, *De Arcadii qui fertur Eibro de aicentibus* (1882), and Cohn in Pauly-Wissowa s.v. *Arkadios.*

ARCA MUSARITHMICA, an instrument or machine for the composing of music mechanically, by the arranging and combining of notes according to rule in various ways; described by Athanasius Kircher in his *Musurgia universalis,* Rome, 1660. Samuel Pepys possessed such a "composition box," which is still to be seen in the Pepys library at Magdalene college, Cambridge.

ARCESILAUS (316–241 B.C.), Athenian philosopher and founder of the New, or-Middle, Academy *(see* ACADEMY,-GREEK). His doctrines, which must be gathered from the writings of others (Cicero, *Acad.,* i. 12, iv. 24; *De Orat.,* iii. 18; Diogenes Laertius iv. 28; Sextus Empiricus, *Adv. Math.,* vii. 150, *Pyrrh. Hyp.* i. 233), represent an attack on the Stoic φαντασία καταληπτική *(Criterion).* He held that strength of intellectual conviction cannot be regarded as valid. The uncertainty of sensible *data* applies equally to the conclusions of reason, and therefore man must be content with *probability* which is sufficient as a practical guide. "We know nothing, not even our ignorance"; therefore the wise man wiil be content with an agnostic attitude.

BIBLIOGRAPHY.—*See* R. Brodeisen, *De Arcesila philosopho* (1821); Aug. Geffers, *De Arcesila* (1842); Ritter and Preller, *Hist. philos. graec.* (1898); Ed. Zeller, *Phil. d. Griech.* (iii. 1448); and general works under SCEPTICISM.

ARCH, JOSEPH (1826–1919), English politician, founder of the National Agricultural Labourers' Union, was born at Barford, a village in Warwickshire, Nov. 10 1826, and died there Feb. 12 1919. He founded, in 1872, the National Agricultural Labourers' Union, of which he was president. Temporary rises in wages were secured, but the farmers were able within 18 months to break up the union. Arch was returned to Parliament for north-west Norfolk in 1885, and although defeated next year owing to his advocacy of Irish home rule, he regained his seat in 1892, and held it in 1895, retiring in 1900. He was deservedly respected in the House of Commons.

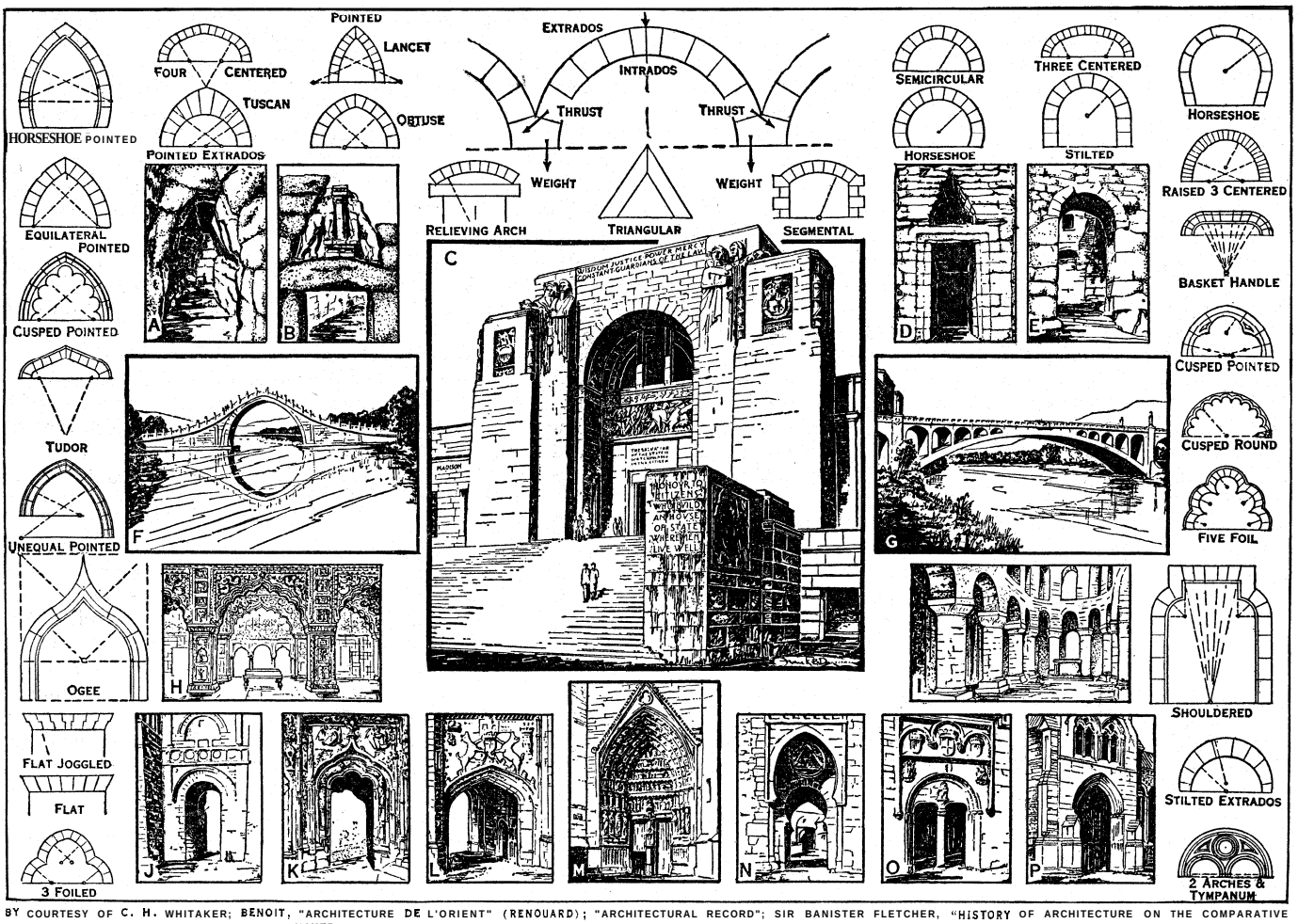
A biography written by himself, or under his direction, and edited by Lady Warwick (1898), tells the story of his career.

ARCH, any combination of blocks of building material, generally wedge-shaped and with radial joints, employed to cap an opening wider than any of the blocks themselves capping it. In form, arches are usually, though not always, built with the soffit (*q.v.*) following a curved line. By extension, the word arch is used for any curved head of an opening or recess, even when the material is homogeneous, as in a concrete arch. From the use of arch forms, to bridge the spaces between the beams in early fireproof construction, the word arch is employed technically for any structure between steel beams, even when the structure may be of reinforced concrete, and, therefore, theoretically a beam, and not an arch at all.

In the normal arch, the inside face or soffit is known as the intrados, the outside face as the extrados, the wedge-shaped blocks as voussoirs, the centre voussoir as the keystone and the two end voussoirs as the springers. The spring of the arch is the level of the bottom of the springers, which usually coincides with the beginning of the curvature, but a stilted arch is one in which the apparent spring is well below this beginning. The haunches of an arch are the parts between keystone and springer. A continuous arch, such as a tunnel, is known as a vault.

Due to the nature of its construction, with wedge-shaped blocks, any arch exerts at its spring, not only a downward weight, but a tendency to spread, which is known as thrust, and for the arch to remain stable it is necessary for this thrust to be resisted adequately by abutments, buttresses or the strength of the wall itself in which the arch is placed. This quality of exerting thrust has profoundly affected architecture *(see* BUTTRESS, FLYING BUTTRESS, GOTHIC ARCHITECTURE).

The principle of the arch has been known from very early times. When neolithic man discovered that a wide opening could be spanned by leaning tuo stones together at its apex, the first arch was made, and such triangular arches are widely found throughout the Mediterranean basin (for example, one at Alea in Arcadia; a similar triangular shape, though in corbelled construction is seen in the Gate of the Lions at Mycenae). The



BY COURTESY OF C. H. WHITAKER; BENOIT, "ARCHITECTURE DE L'ORIENT" (RENOUARD); "ARCHITECTURAL RECORD"; SIR BANISTER FLETCHER, "HISTORY OF ARCHITECTURE ON THE COMPARATIVE METHOD," EIGHTH ED. (1928), BATSFORD; MAYER, "ARCHITECTURE AND APPLIED ARTS IN OLD SPAIN", (DELPHIN)

A AND E, ETRUSCAN: A. TOMB AT CERVETRI; E, CITY GATE. FERENTINO; B AND D, PRIMITIVE GREEK (AEGEAN) CORBELLED ARCHES: B, GATE OF LIONS; D. THOLOS OR TOMB OF ATREUS, MYCENAE; C, MODERN AMERICAN. NEBRASKA STATE CAPITOL (B. G. GOODHUE, ARCHITECT): F, CHINESE, SUMMER PALACE. PEKIN: G, MODERN CANADIAN. PETERBOROUGH. CANADA; H, INDIAN. PALACE AT DELHI; I. ENGLISH ROMANESQUE, CHAPEL. TOWER OF LONDON: J, ROMAN. GATE OF AUGUSTUS, PERUGIA; K, LATE SPANISH GOTHIC, EL PAULAR; L, ENGLISH TUDOR. ST. JOHN'S COLLEGE. CAMBRIDGE: M, FRENCH GOTHIC, AMIENS CATHEDRAL: N. MOORISH. PUERTA DEL SOL, TOLEDO: O, SPANISH RENAISSANCE, ESCUELAS MINORES. SALAMANCA: P, ENGLISH GOTHIC, SALISBURY CATHEDRAL

earliest known developed arches with curved sides that occur in the Tigro-Euphrates valley, at least as early as 4000 B.C. In Egypt, also, the arch was known, although it was used only for utilitarian purposes. Almost all of these early examples are over drains, where the abutment question was simple, but in Asia, the Assyrians, at least, used the arch monumentally in gateways. It was, however, in Italy, at the hands of the Etruscans, that the arch received its most important early architectural treatment, as in the famous gate of Perugia. Following the Etruscans the Romans (see ROMAN ARCHITECTURE) adopted the arch as perhaps the chief structural feature in the design of their monumental buildings and by them its use was spread all over the civilized world to become an integral feature of all the architecture succeeding them until the middle of the 19th century. Since that time the discovery of the fact that iron, and later steel, could be formed into beams of great strength over long spans has reduced the use of the arch to a subsidiary and often merely decorative position.

For the different types of arch see the illustration and for its history the general articles under the headings of the various styles of architecture. See also ARCADE. (T.F. H.)

ARCHAEOLOGICAL ARTICLES. In addition to the general article ARCHAEOLOGY, where the development of the science is fully treated, there are numerous archaeological subsections to continents and countries (these subsections are found under the names of the territories). Special articles on individual civilizations appear under their distinctive names, *e.g.*, AEGEAN CIVILIZATION. As is the case with ANTHROPOLOGY (*q.v.*), large territories (*e.g.*, Africa) are subdivided for archaeological purposes into different areas of varying importance. Numerous short articles deal with some of the most prominent gods and rulers of ancient vanished peoples. So that APIS or HAPI; AMON; etc. receive adequate treatment and carry cross-references to articles where comparative material may be found.

Special subdivisions of archaeologic study have individual articles, *e.g.*, CAHOKIA MOUND, THE; CARNAC: Megalithic *Monuments*; CATACOMBS; CAVE; CLIFF-DWELLINGS; DEAD, DISPOSAL OF THE; EOLITHS; ETRUSCANS; FLINTS; HITTITES; IBERIANS; INSCRIPTIONS; LABYRINTH; LAKE DWELLINGS; LA TÈNE; MOUND-BUILDERS; PAPYROLOGY; SABAEANS; SARCOPHAGUS; SCARAB; SEQUENCE DATING; SHELL-MOUNDS; SPHINX; STONE MONUMENTS, PRIMITIVE; STRATIGRAPHY; TYPOLOGY; VILLANOVANS; and VITRIFIED FORTS.

Archaeological terms are defined and treated in short special articles having cross-references to the main articles, where more detailed information is given. Ample bibliographies to the larger articles give references to the most recent authoritative works.

ARCHAEOLOGICAL SOCIETIES: see LITERARY, HISTORICAL AND ARCHAEOLOGICAL SOCIETIES.

ARCHAEOLOGY is at the same time a science and an art. It is or should be a scientifically ordered branch of knowledge professed by men of truly scientific training, of a certain subject, namely the remains of ancient human activity. It is or should be also the art that deals scientifically with these remains, that excavates them from the earfh where they have been buried, conserves them and restores them (but only so far as to make them

intelligible), and publishes them for the information of ourselves and posterity. It is a science that has some difficulty in keeping true to its ideal, because the human interest of the subject attracts to its study many persons of untrained minds. The general public realizes that expert work is necessary in order to conserve and set up antiquities in the way they are seen in a public museum. And it will probably realize in time that expert work is necessary in order to dig properly as well. Quite rightly, therefore, the laws of some countries in which archaeology is an important matter take cognizance of the damage that may be done by untrained seekers after antiquities: Egypt, for instance, allows no person, however well-known he may be from the scientific point of view, to dig except under the aegis of a museum, university, or some other scientific body, and the amateur is totally barred unless he has a scientific explorer, authenticated as such, with him to control his digging.

Methods.—The methods of archaeology are exemplified in the study and in the field. The recent Glozel controversy showed that in France at any rate public opinion as reflected in the journals is still inclined to regard the archaeologist as the purely stay-at-home arm-chair "savant" of the old school, and that the modern field archaeologist is a conception new to it. It is perhaps a fact that the real old type of antiquarian scholar has survived untouched by new ideas longer in France than in England, where he is nearly extinct. The volume of work in the field that has been done by British archaeologists during the last half-century has impressed itself so deeply upon the minds of teachers and students here that the purely scholarly type hardly counts as an archaeologist at all in the modern sense of the word. Yet he has his uses still, and the most efficient all-round type is the man who is at once scholar, historian and worker in the field. Work in the study has still to be done and indeed becomes more and more necessary. The purely "scientific" field-worker in Egypt or Mesopotamia cannot progress without the help of his student colleague who reads the hieroglyphic or cuneiform inscriptions that he finds, or that of the historian and the anthropologist; and obviously the most useful man is he who can combine all these functions. But it is difficult to find men who are equally competent in all these spheres, and the work now is being done by an intimate alliance of the men who are primarily field-workers, but have a working knowledge of the languages and history of the ancient peoples whose relics they unearth, with those who are primarily scholars or historians but have a working knowledge of excavation and of conservation. Museum archaeologists should be of the latter type with a special knowledge of conservation. No excavator, whatever the excellence of his technique, can be really efficient unless he himself is also as much as possible a *savant* or he works in close association with *savants* on the "dig." If one merely brings things home for the scholars to appraise, efficiency is lost.

Thus the archaeologist's work is done in the study as well as in the field. The work of the student is obvious. When, as in the case of prehistoric Europe or America, there are no ancient languages to be known, it is much lightened. But in the case of Minoan Greece their place is taken by the classical knowledge that is indispensable to all workers in that sphere and in Italy, without which the results of excavation cannot satisfactorily be interpreted. The work is greatest in Egypt and Mesopotamia, where the scholarly archaeologist has to know at least something of scripts as complicated and difficult as Japanese, and of various types and in various languages! It is no wonder that the field-worker often has no time for more than a smattering of these tongues, and when this is the case has all the more to associate himself with his more scholarly colleagues. Only in the prehistoric field can he work with anthropological knowledge merely in addition to his praxis of excavation.

In the field the excavator has to be more or less expert in many ways. He has to have some knowledge of elementary engineering and of lifting heavy weights. He should be a practical photographer. He should be able to improvise practical methods of attacking any problem in digging and of conserving any object he may find: it is "up to him" to do this in the most efficient way possible with the means at his disposal; and the better he does it the better excavator he is; but he must be used to making good bricks without straw. He must know how to manage men, and especially Orientals, without friction: he may have to deal suddenly with strikes, he may find himself "in a tight place" at any moment: he must be able to work tactfully with others. He must have an eye for the lie of the land: the man who cannot diagnose what he is likely to find from the appearance of the terrain is not likely to be so successful as the man who can. He must know whether there is "likely to be anything there" or not. The random digger is not a scientific digger. And in a country like Egypt, where digging has gone on continuously for over fifty years, there is a *corpus* of experience to be drawn upon and to be learnt in a matter like this, where also the assistance of intelligent native helpers whose ancestors have dug for *antikas* for generations is by no means to be despised. This "eye for country" is one of the greatest assets of an excavator. And obviously the more he knows of the more studious side of his work, of the styles of art or of tomb-construction characteristic of the various periods of development of the ancient civilization he is investigzting, the better. Without such knowledge he remains but a hewer of wood or drawer of water for those who have it, despite all his field-technique, and despite the opinion of the market-place. So we see that the scientific excavator is indeed a labourer "worthy of his hire," which, by the way, is generally absurdly small.

Differences in Soil.—The actual methods employed in excavation vary of course with the nature of the soil. One does not work anywhere with steam nawies or pneumatic drills! The work is far too delicate for that. It is much too delicate for the ordinary North-European or American labourer to undertake at all except under the strictest supervision. Picks and shovels wielded by British navvies would do more harm than good. In the East the slow native methods of hoe and basket are the most efficient, allowing the archaeologist to intervene when necessary to do the fine work with his pen-knife. There large numbers of men may be employed. In the West only a few intelligent and well-trained workers can be safely employed. The happy mean between the two is probably found in Greece, where the diggers combine the delicate touch of the Oriental with the intelligence of the European. Different styles of work are required in the wet clay of Britain, the dry stony soil or the crumbling *kouskouras* rock of Crete, the sand, the limestone rubbish, or the argillaceous shale of Egypt, the compact earth of 'Iraq. As an instance of the care that is requisite, may be mentioned the ancient Babylonian walls of mud-brick, which it needs a practised eye to distinguish from the surrounding indurated earth. Only a trained archaeologist with native workmen using their primitive tools would ever be able to trace and clear them accurately. British Tommies, hacking with their entrenching tools with all the good will in the world to help (as they did in the World War), would never even see them. In Upper Egypt, where it only rains once in five years, or in Chinese Turkistan, with its dry cold, things are easier, on account of the aridity of the earth; the soil is easily removed, and because of this dryness in these regions objects are found preserved in a manner unequalled elsewhere, save in the peat-bogs of the North. An old boot thrown out on to the Egyptian desert will remain there, if not removed, unaltered for centuries. Palaeolithic flint implements are found on the desert surface in the *ateliers* where they were made: where one has lain over another the upper is burnt black by the oxidizing effect of the sun of centuries, while the lower remains unpatinated. In Crete, with its rain in winter, conditions somewhat resemble those in 'Iraq.

Conservation and Reconstruction.—A very difficult piece of excavation and reconstruction—a classical example of archaeological method—was the digging out and rebuilding of the grand staircase, corridors and halls on the east slope of the palace-hill at Knossos by Sir Arthur Evans. The building, three or more stories high, was found collapsed, but with its arrangement still recognizable. It has been re-erected as it was. ("It is indeed rarely that natural conditions allow an ancient building of three or four stories to be dug out, its charred beams carefully replaced by iron girders, and its calcined pillars replaced by new on the old lines, so that we can mount, as at Knossos, an ancient grand stairway of three

flights on its original steps, and with the original steps above us as we mount, in their proper place as they were built.") And this is not the only part of the Knossian palace in which Sir Arthur Evans has carried out reconstruction work of the kind, all, be it remembered, at his own personal expense. It is an ideal way of doing things, when it can be done, as in the present case, with some certainty of accuracy. Otherwise of course it should not be permitted to be attempted, however convinced the archaeologist himself may be of the accuracy of his theory; it is human to err.

An extension of the reconstruction method is exemplified at Knossos by Sir Arthur Evans's recent specimens of partially restored Minoan buildings, such as the South-East House, and part of the Hall of the Procession Frescoes. Whether it is advisable to carry out such reconstructions as these must always be a matter on which opinions may differ. In the present case they serve to show what the actual buildings probably were like, and are shelters for the reproductions of the frescoes (the originals being of course preserved in the Candia Museum) which it is a good idea to exhibit on the actual spot where they were found.

Analogous to the conservation of buildings is the conservation of objects found, not only in the field, but also in the laboratory at home. Objects can only be brought home somewhat summarily preserved in a "first field dressing" so to speak (well exemplified by Mr. Woolley at al-'Ubaid and Ur), and must be treated expertly on their arrival by chemists, if they are to survive. Examples of such work are to be found in the treatment of the copper and inlaid objects from Ur in the laboratory of the British Museum under Dr. Alexander Scott and Dr. Plenderleith, and the tissues and other objects from the tomb of Tut'ankhamun in the laboratory-tomb at Thebes by Dr. Scott and by Mr. A. Lucas.

Accuracy of Record; Scope of Publication. — A point of modern archaeological method is accurate recording. This was rare in early days, especially among French archaeologists, by whom *les* menus objets were not taken seriously. The ideal of anthropological science, to note everything, even the most insignificant matters, lest anything be ignored that present or future generations might consider important, was unknown to them. But a Scotsman, Rhind, working at Thebes in the 'sixties, had seen its importance, and made careful record of his work, though the absolute necessity for this was first emphasized by Prof. Sir Flinders Petrie, who astonished the old school of antiquaries in the early 'eighties by his insistence on the careful record of what seemed to them mere rubbish. What seemed rubbish to the elderly scholars of forty years ago does not always seem rubbish to us now. But this method may be too rigid. In many excavations now it is an impossibility to record and catalogue everything found, still less to publish everything found, to illustrate as well as describe everything. Reisner has tried to do the latter; Evans has not. Reisner's method of publication is that of the scientific catalogue. Evans writes a readable book. There is no doubt that with the first method we are in danger of not being able to see the wood for the trees, and money will not run to publication on a completely comprehensive scale. How could it be possible to publish Knossos on Reisner's method? And would it serve any good purpose to do so?

Also in publication there is the question nowadays of references to literature. While the results of excavation were still manageable and the number of workers few it might fairly be expected of an archaeological writer that he should show himself to be acquainted with the whole literature of his subject and be able to quote in his footnotes authority for every statement he makes. But with the great extension of the subject-matter of late years and the increase of the literature dealing with it, it has become almost impossible to keep tally of everything written on the subject in all countries (for the scientific man, it must be remembered, is international, and must have at least a working knowledge of many tongues). To give all references would make publications too lengthy and unreadable; and is unnecessary. So that it will soon be impossible, as it now is unjust, to criticize an archaeological writer for not referring to everything published that is germane to his argument. He must be allowed to omit references without being accused of being ignorant of them, which indeed he may often be, so far as obscure papers, say in Russian or Magyar, are concerned, without his work being seriously affected thereby. An example of the fullest footnote references, as complete as they can possibly be made, is Sir Arthur Evans's book on Knossos (*The* Palace of *Minos*), already mentioned, which well exhibits the author's wonderful knowledge of the literature of the subject and unrivalled power of illustration and comparison. In publication the question of footnotes versus end-notes is a theme of discussion.

Without copious illustration of course scientific publication is impossible. And the preparation of these illustrations begins in the field. The excavator should be himself a capable photographer, or have an expert with him, though elaborate apparatus is not generally necessary, and native boys can be trained to develop negatives admirably. Photographs must be taken of all the successive stages of the disinterment of an ancient burial, of the dkblaiement of an ancient building. Here Reisner's example is to be followed generally, though the number of photographs that can be taken is limited by the expedition's purse, and of course only a selection can be published; the rest kept for examination by students. As much as possible should be photographed on the ground. Photographs left to be done in the studio at home are rarely satisfactory, unless of course they are of objects the complete restoration of which was only possible in an European laboratory. Illustrations should be mainly photographic, and when possible in collotype; but it is a mistake to suppose that everything can be illustrated by photography. Line drawing is often necessary. Photography will not turn a corner satisfactorily nor will it reproduce faint indications. Neither will it satisfy as an illustrator of design. An ideal archaeological publication will then include illustrations not of everything, but of everything that is necessary to exhibit the results. The illustrations will be photographic (and in collotype) when possible: otherwise in line. Illustrations of the results should be as far as possible in plates at the end of the book. Illustrations in the text should be rigidly confined to purely "illustratory" pictures from other sources, designed to illustrate the finds further or to reinforce the argument of the text. Otherwise confusion with the plates and with the actual results of the "dig" is likely to occur. Every picture must have its scale given. And no book, however short, should be without an index.

Limits and Material. — It may be asked: what are the limits of the subject? what precisely is the material of archaeology? and how late a time does it concern itself with? or in other words when does the archaeologist become an antiquary? I take it that the material consists of what has been defined above as "the remains of ancient human activity," and that it begins at the beginning. The Palaeolithic period belongs to the sphere of the archaeologist, not the geologist; the Piltdown skull and its successors are archaeological as well as craniological material. Archaeology takes cognizance of all of ancient Man and his works. The boundary between archaeology and antiquarianism is an unreal one, for the scientific antiquary is an archaeologist, even if he be dealing only with the relics of the 'sixties, or let us say "Middle Victorian II*a*." But for practical purposes the line of division may be placed in England, France and Germany at the Renaissance: the middle ages belong to archaeology, whereas the sixteenth century is modern, and does not. In the Near East the division-line may be placed at the time of the taking of Constantinople: in Spain at that of the expulsion of the Moors: in Italy earlier, at the end of the trecento.

The actual nature of the material will of course differ according to the nature of the land; the objects are preserved well when the surrounding earth is dry, or if they are buried in such a preservative medium as peat. So dry is the earth in Egypt that tombs are found, like that of Tut'ankhamun, intact with all their objects in them as they were left. In wetter lands like Babylonia and Crete tombs are usually found full of infiltrated earth which has more or less damaged the contents unless they are of pottery or, as at Mycenae and Ur, of gold. Pottery is indestructible, for after it has been smashed the fragments survive. Silver oxidizes as does bronze or copper, and perishes more quickly than they — gold is inoxidizable, and only the most ancient objects show a ruddiness that is gold-rust. Leather and linen and cloth perish every-

where but in Egypt, in Chinese Turkistan, and in the bogs of the North. Dry cold in Greenland has preserved intact clothes of the fourteenth century. We have the actual garments that Egyptians wore in the days before Agamemnon; the cloth coats and breeks of Danish men of the Bronze Age. We have food and bread placed in the Egyptian tombs of the XIth Dynasty (c. 2000 B.C.), and fancy pastry from Astara near Turfan in Turkistan of the eighth century A.D. In Egypt we have the actual mummified bodies of many of the kings and great men. So the material is greatest in Egypt. We have more of the actual objects used by the Egyptians, especially those made of delicate material, than of those used by the Greeks and Romans. This contributes the special interest of Egyptian archaeology.

Conditions.— The special conditions of archaeological work have already been touched upon. Work in the field, or a good knowledge of it by the ordinary stay-at-home archaeologist is the first requisite condition. One can no longer be an archaeologist by reading books, however intelligent one may be. There is always much that cannot be understood without actual experience of excavation. A regular and uniform development of archaeological knowledge all over the world is hampered by the fact that so much more is known from the literary side of some civilizations and peoples than of others. To classical Greece and Italy, and the countries described by the classical authors, and to Palestine and Syria, we have for a century past been able to add Egypt as known not only from the classical writers but also from her own inscriptions and papyri, and for eighty years past the lands of the cuneiform script, Assyria, Babylonia, Elam and Persia, have also told us their story in their own words. We cannot yet add Minoan Crete and Greece, or the hieroglyphs of the Hittites of Anatolia to the list in spite of various efforts, though we can read Hittite when written in cuneiform, as it often is. Nay, nearer home, we have not yet been able to translate Etruscan, though, written as it is in Greek characters, we can read it. The same is the case with the fragments of the Eteocretan script, that no doubt enshrine words of the old Minoan tongue. The Cyprian syllabary, of Minoan origin, reads in Greek, so we understand the values of its signs, which would seem to point a way for the decipherment of Minoan. And we have the new "Indo-Sumerian" writing of Sind and the Punjab, recently discovered with remains of a culture contemporary with and connected with that of early Babylonia before 2500 B.C., by Sir John Marshall. When we cannot read the writing of a people our interpretation of its archaeology must necessarily remain one-sided. If we could not read Egyptian would our reconstitution of Egypt's history on archaeological grounds alone be likely to be anything near correct, however careful and scientific our method? The literary side of archaeology cannot be safely ignored if existent, while if non-existent, owing to the language remaining a sealed book, we can only hope that decipherment will soon bring it into existence. It may be regarded as ancillary to the practical side (the scholar would put the matter the other way), but the two factors must work hand in hand if correct results are to be obtained. So that nothing is more to be desired than a decipherment of the Minoan writing, to take one instance, and perhaps the most important one in view of the special importance to the early history of European culture and knowledge of the origins of Greek legend of a correct cognizance of the history of Bronze Age Greece. Till then, Aegean archaeology must necessarily present a one-sided and undeveloped character in comparison with that of Egypt or of Mesopotamia. To a less degree this is the case with the Hittites and even the Etruscans. Still more is it the case with the early peoples of Central Europe or South America. As in early Greece, what we know of the former is the history of the development of their pottery and their stone and bronze weapons, and the hints of manners and customs and of convulsions or invasions that study of their settlements may provide. We know of no historical events beyond those indicated by classical authors or by legend. Our information is merely better in the case of Greece, where also we hsve invaluable historical connections and synchronisms with Egypt, and even with Babylonia, to help us. We know more of the real history of the Maya in Yucatan, some of whose writing we can read, than of the Bronze Age Scandinavians. We know the names of Sumerian kings of 3200 B.C., though we do not know who the historical original of king Arthur was. The Swedes pride themselves on being the oldest constituted state in Europe, but we have no real historical knowledge of Sweden at any earlier date than we have of England: and Menes and the Thinites are more historical than are the Ynglingar. So archaeology, and with it ancient history, continues to develop in a somewhat lop-sided manner.

Relation to Other Studies.— If archaeology is not to become a tenth Muse herself, she is at least one of the most important handmaids of Clio. Of all the sciences, it is to that of History that Archaeology bears the closest relation. No modern historian can neglect archaeology. History nowadays is not conceived as the record of wars and of the reigns of kings primarily, but as the organized knowledge of the development of human civilization. Religion and art, the progress of invention, the housing of the people, the changes of fashion in costume of men and women, the growth of luxury, and the economic questions that have been the real cause of wars in the past as in the present, the impinging of one people on another and the conflict of characteristics that arises therefrom, all these things are the subject-matter of history and in the correct delineation of them archaeology must bear her share. Then comes the relation to anthropology. No archaeologist can neglect what the anthropologists can tell him of the culture of various races in modern times, if he is to understand those of ancient days: every anthropologist must have some knowledge of archaeology,-if he is to know anything of the origins and reasons of what he is observing. Of the relationship of the archaeologist to the engineer and the chemist we have already spoken. In this case we are mainly dealing with a temporary indebtedness for a specified purpose, but archaeology does owe much both to engineering and to chemistry. With the art of architecture the connection of archaeology is close. Without trained architects and surveyors in the field we could not secure reliable plans of our finds. And the architects have learnt much of use to them in the practice of their art from the results of archaeological research. Modern plans, elevations and decorations once more show the scholarly attention to fine ancient models that distinguished them at the end of the 18th century: the archaeological leaven is working, and is working truly, whereas the unconsidering enthusiasm of the Romantic period for mediaeval architecture was not based on scientific investigation of its models, and only succeeded in giving a meretricious mediaeval exterior appearance to Victorian interiors. Enthusiasts for mediaevalism in church architecture and liturgy may nowadays, if they employ architects and sacristans with the requisite modern archaeological knowledge, have their churches built and their rites performed as they should be, without tasteless and ignorant modern accretions of the 17th–19th centuries. And artists and actors, if they are not going to paint the Crucifixion or act Julius Caesar in modern dress, must consult the archaeologists if they want, to get things right.

History.— The history of archaeology begins with the end of the period with which it deals, viz., with the Renaissance. It naturally began in Italy in the fifteenth century when the minds of intelligent men began to concern themselves with the ruins of antiquity that lay around them. The coming of the Greek scholars to Europe after the fall of Constantinople brought the first knowledge of ancient Greece into the west, and in the sixteenth century the Humanists were the first real archaeologists. The great artists of the time studied the antique as the basis of their work, both in sculpture and architecture. The artistic Popes and Princes of Italy in the sixteenth century made the first collections of ancient sculptures, a taste which first the French and later the English acquired. In England in the seventeenth century an intelligent merchant like Tradescant collected antiquities, some of which still survive in the Ashmolean Museum at Oxford. We all know what the great nobles and landowners of England, the "Dilettanti," did in the eighteenth century to accumulate here the antiques that were admired by the taste of their day. Excavation began in Italy for the purpose of finding antique sculpture. At Naples in

the eighteenth century Pompeii and Herculaneum were discovered, and the regular excavation of Pompeii began. France, that has so often given the signal for new movements of culture, inaugurated Egyptian archaeology when Buonaparte took the *savants* with him to Egypt: the *Description* de *l'Égypte* was the first book on Egyptian archaeology, for the seventeenth century aberrations of the Jesuit Kircher can hardly be taken seriously. Then in the early nineteenth century improved taste led collectors and students, under the influence of Winckelmann, to Greece, and when Lord Elgin brought back to London the marbles of the Parthenon, the foundations of modern Greek archaeology were laid. Roman and Etruscan accretions were sloughed off gradually, and by the 'sixties Greek art was fully appreciated for itself. The work of Champollion unlocked the key of Egyptian lore. The museums of Europe were filled with Egyptian sculpture and other objects, brought back by Salt, Belzoni and others. Champollion himself led the first really scientific Egyptological expedition: the work of Rosellini was followed by that of the great Prussian expedition of the 'forties under Lepsius, which contributed to make the Berlin Museum one of the most up-to-date in Egyptian matters at that time. Then came the work of Botta and Layard in Assyria, and the bulls of Nineveh and Rhorsa'oad were set up in the halls of the new British Museum and under the vaults of the Louvre. This was the first modern excavation, to be soon followed by that of Mariette in Egypt, the results of which were to fill the new Viceregal Museum at Cairo. Mariette inaugurated a new system in Egypt, by which none was allowed to excavate but he. This monopoly persisted from the middle 'fifties to the early 'eighties, when after the British occupation a liberal policy allowed the Egypt Exploration Society to begin its work, under Naville and Petrie, which still successfully continues, though its activity seems likely to be hampered by the present restrictions, which though incorrectly described as a partial return to the system of Mariette, yet deprive the excavating societies of the full legitimate fruits of their labours, which for forty years had been divided amicably and justly on the half-and-half principle between them and the Cairo Museum. Mariette's system has not been completely imitated elsewhere, but Italy presents the nearest approach to it, for there no foreigner may dig: a curious piece of strictness. Greece has followed a different policy. There the help of learned and rich foreign societies has been welcomed, although the objects found by them have mostly been required to stay in the country. This is not felt to be such a grievance as is the present restrictive action of Egypt after experience of the more liberal Egyptian policy, which will always be associated with the honoured name of Maspero. 'Iraq follows a sensible policy, which reserves to Baghdad all objects of real outstanding importance and value while liberally giving to the excavating museums or learned bodies duplicates and all objects the conservation of which is beyond the powers of the nascent Baghdad Museum.

The modern epoch of archaeology the world over begins with the inception of the work of the Egypt Exploration Fund in 1883. Its dawn had been heralded by the enthusiastic and brilliantly successful work of Schliemann at Mycenae in 1875, which revealed—after Biliotti's tomb-digging at Rhodes (to the cost of which Ruskin contributed) in 1871—the first known relics of prehistoric Greece, the first found remains of the Minoan civilization. But Schliemann was an unscientific digger, as he showed at Troy. It was reserved for Petrie in Egypt to inaugurate the new system of careful excavation, recording and speedy publication which has always been characteristic of his work, whether for the Egypt Exploration Fund or for his own later organization, the Egyptian Research Account, which he called the British School of Archaeology in Egypt, a name that has survived, though it is not a British School of Archaeology in the same official sense as the schools at Athens and at Rome. For forty years he has laboured, to find himself at the last unable to agree with the new regulations, obliged to dig just beyond the borders of Egypt, in Palestine. His way of work, which is simply the way of common-sense tinctured by certain idiosyncracies, has inspired, with modifications and improvements, that of all other excavators since.

In Egypt during the forty-five years that have elapsed since 1883, de Morgan has discovered the predynastic age and Petrie has given it its chronology; and Petrie excavated the tombs of the earliest Egyptian kings scientifically; Naville has excavated Bubastis, the temples of Dair al-bahri and the Osireion at Abydos; and both he and Petrie considered that they had settled the question of the route of the Israelites though this is by no means considered so certain now. A list of the names of all the other international workers in this field would be too long even if only the protagonists were enumerated. De Morgan was even more distinguished by his work in Persia, and in Babylonia de Sarzec was the first to take up for France the mantle of Botta with his discoveries at Telloh of the Sumerian antiquities that are now the glory of the Louvre. And now the Germans, Koldewey and Andrae, with their work at Babylon and Assur, and the Englishmen Langdon and Woolley, for Oxford-Chicago and London-Philadelphia respectively at Rish and Ur, have made far-reaching discoveries. In Syria Hogarth inaugurated the excavation at Hittite Carchemish for the British Museum of which political conditions have prevented the continuance. Montet for France has revealed an astonishing Egyptian colonial settlement at Byblos (Jebail) in Phoenicia, dating back to 3000 B.C. In Anatolia, Hittite finds at Boghàz Kyöi and Cappadocian at Kül Tepè, Dorpfeld's work at Troy, the Americans at Sardis, Ramsay's journeys throughout Anatolia and Hogarth's excavation at Ephesus have been outstanding events. And in Crete the great excavation of Knossos by Sir Arthur Evans, and those of Phaistos and Hagia Triada by the Italians, have been epoch-making. In Greece itself the German work at Olympia and Tiryns, the French at Delos, the British at Sparta have been achievements of the great archaeological schools at Athens. In the other work done in Greece Americans have taken a leading part, and the Greeks have been by no means behindhand, especially in Crete (Xanthoudides). In Sicily (Orsi) and Malta (Zammit), important work has been done, and in Italy the labours of Boni and Lanciani at Rome and the continued excavation of Pornpeii are world famous. In Northern Africa the French have efficiently explored such mighty remains of Roman dominion as Timgad, and the Italians are undertaking the excavation of Leptis Magna At Constantinople the excavation of the Hippodrome has been started. All over Central Europe the labours of hundreds of archaeologists, German, Swiss, Austrian, Russian, Serbian, have revealed the Danubian, "Black Earth," Hallstatt and La Tène cultures; in Northern Europe those of men like Montelius in Sweden and Shetelig in Norway and many others have continued to tell us an enormous amount of the Stone, Bronze and Iron Age cultures of Scandinavia. In France prehistoric archaeology has taken the first place, and there the name of the Abbé Breuil is the most honoured. All know something of the story of the discovery and excavation of the caves of the Dordogne in France and those of Northern Spain, such as Altamira, which have given us such astonishing revelations of the most primitive human civilization in the West. Of British excavation such work as that at Silchester on a Roman site, of Sarum on a mediaeval one, the discovery of the Traprain hoard of Roman plate in Scotland, the recent use of the aeroplane to discover ancient traces on Salisbury Plain, and many another important archaeological event might be mentioned.

Passing eastward, we have modern discoveries of the most important nature in the Caucasian region by Russian archaeologists, and Sir Aurel Stein's epoch-making campaigns in Chinese Turkistan, that have connected up Chinese with classical civilization. followed by the German Lecoq; Prof. Pelliot's studies of Chinese archaeology; and the discoveries of the T'ang tombs (*c.* 700 A.D.) with their coloured pottery figures of guards, servants, horses and demons which are now such a feature of our museums. And the Swedes have now found the poetry of prehistoric China, while Japanese archaeologists (Umehara) have successfully excavated the tombs of ancient Korean kings. Finally, and with the exception of the latest finds at Ur, the newest of all, and certainly by far the most surprising of all, is the discovery by Sir John Marshall of the early bronze age "Indo-Sumerian" culture of the Punjab and Sind, with its undeniable connection with early Baby-

lonia c. 2500 B.C. The excavation of Taxila, interesting in itself, belongs to the historic period.

American archaeology is well illustrated by the work on the Maya cities of Yucatan and Guatemala, now followed by a British Museum expedition in British Honduras. And the discoveries of early culture on the coast of Ecuador and Peru show how much may yet be recovered from the land of the Inca.

Space fails in which to say more of the history of excavation. And it must be remembered that besides the publication of all this field-work, the study-work of the Egyptologists, the Assyriologists, the Sanskritists and the Sinologists has gone on, ever increasing the sum-total of our knowledge of the ancient peoples of the world.

The Future. — If one asks to what end all this labour, it can be replied that no labour is in vain which teaches us what our forerunners and culture-ancestors did in the world. To know the past is to be better equipped to deal with the question of our civilization in the present and in the future. We have seen what addilions to our knowledge have already been made: what of the future in archaeology? New realms have opened to us undreamt of before in prehistoric Greece, in Egypt, in Turkestan, in Central Europe and in America. New realms are opening in Anatolia, Syria, China, India and possibly even in Africa, where though Zimbabwe may be mediaeval, there are in the region east and north of the Great Lakes probable fields of far older human activity. The possibilities of Egypt may be nearly exhausted by the intensive work of half-a-century, though the tomb of Tut-'ankhamun has shown us that she still has surprises for us. Mesopotamia and India are comparatively untouched, and we are now going forward on the full tide of their new excavation with the modern methods practised long in Greece and Egypt but as yet poorly represented further east. It is there that the earliest revolutionary discoveries may be expected. The other fields open out beyond them a vista of undreamt possibilities. "Regions Caesar never knew, our posterity shall sway." But much depends on the intelligent co-operation of governments. A narrow policy of mere acquisitiveness, nominally for the national museums, really because politicians and officials, especially in the newly enfranchised countries of the East, have a vague idea that these things are "valuable property," will defeat its own object. For the nations that have developed archaeological work such as Britain, France, Germany, Scandinavia, America, Greece and Italy, and have the money (especially America) with which to carry it out efficiently, cannot be expected to do so if they are not permitted to possess a fair share of the results, not only for study, but to keep, in return for their expenditure of money and toil. Italy does not permit foreign excavation on her soil, so that there is no question there of foreign workers being badly treated by not being permitted to possess a fair proportion of their finds. Also in the past foreign museums have been well provided with the spoils of Italy. But work in the East will be seriously hampered unless the owner-nations realize that the excavator-nations should be generously, not parsimoniously treated in this matter. After all, the past of Greece or of Egypt is not, as their schoolmasters and politicians seem to think, exclusively the concern of Greece and Egypt: it is the concern of the whole civilized world, which equally with modern Greece is the heir of ancient Greece, far more than modern Egypt is the heir of ancient Egypt.

In England and America the tradition is that work of this kind should be carried on almost exclusively by private subscription (whether of the universities or of societies of private persons), except in England in so far as it is the work of the national museums. The British Government also contributes a small subsidy to the British Archaeological Schools at Rome and Athens. It is to be hoped that the newly founded school at Jerusalem (working now in collaboration with the old established Palestine Exploration Fund) will shortly justify a renewed official contribution to its funds, if it receives sufficient private support. But the sum-total of this official help is very much less than that afforded by some other nations, and despite the pressure of taxation, it is devoutly to be hoped that it may be found possible in the future to increase it. For, after all, archaeological exploration is not very expensive work on the whole; and it is a sound investment for a great nation to show that it has enlightened views as to the educational value of work of this kind, and is desirous of showing that it has officially and as a nation an appreciation of aesthetic and historical as well as of mere mechanical knowledge, that, in fact. it is really civilized and not merely barbarous.

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It is impossible to give even a selected list of principal archaeological works, so large is the literature of the subject: the chief are the publications of the various learned societies, such as the Hellenic Society, the Egypt Exploration Society, British Schools of Archaeology at Athens and in Egypt, and the Palestine Exploration Fund; of the museums such as the British Museum and Philadelphia Museum (Excavations at Ur), the *Service des Antiquités* of Egypt and the Government of India Archaeological Service; and of private or subsidized investigators like Sir Arthur Evans or Sir Aurel Stein.

(H. **R.** H.)

1. STONE AGE

Although no fixed chronological epoch in world-history is understood by the words stone age, the term has the same connotation in the history of Asia as in that of Africa. It denotes the condition of a people or an ethnic unit unacquainted with the working of metal. Thus stone of various kinds is used as the material from which cutting implements and weapons are manufactured. It is the stone age of man's development in his appreciation and use of the materials by which he finds himself surrounded. It is obvious, therefore, that the stone age of some peoples is far behind them, while, with others, their present development indicates that their stone age ended but yesterday.

PALAEOLITHIC

In 1836 Christien Thomsen suggested that human history could be divided into three main stages: the first during which metal was unknown and all tools, weapons, etc., were made of wood, stone, bone, antlers or ivory; a second when the smelting of copper and the hardening effect produced by alloying it with tin (that is the manufacture of bronze) had been discovered and was practised; and finally the third when mankind had learned to prepare and work iron for all purposes.

We are here concerned with the earliest of these stages, generally known as the stone age, which is divided into a "dawn" or eolithic period, the old stone age (palaeolithic), the transitional (mesolithic), and the new stone age, or neolithic period.

In palaeolithic times men fashioned their stone tools exclusively by a chipping technique. The climatic conditions, too, were very dissimilar from those obtaining to-day, for this period coincided with the great ice age and geologically with Quaternary times. The mesolithic period commences with a complete change in climatic conditions and is intermediate between the end of the old stone age and the beginning of the new stone age, when agriculture, the domestication of animals and pottery making, had begun to be understood, and when tools were often manufactured by a grinding and polishing technique.

The following technical terms may be defined thus: —

Artefact: Any object fashioned by man.
Industry: An assemblage of artefacts at a given locality and of the same age.
Culture: The sum of the activities of the people as shown by their industries and other discoverable characteristics.

Excavation and typological study have shown that the palaeolithic period can be subdivided, there resulting a chronological sequence of cultures which show the different phases, through which mankind has passed. This sequence is obtained by studying the stratigraphy (*q.v.*) found in a large number of cave and rock shelter habitations. Naturally the cultures do not all occur universally. The best known sequence is that observed in western Europe, especially in France; it is called the Archaeological Record and can be tabulated as over: —

		Cultures.	Derivations of Names.
Palaeolithic Period	Upper Palaeolithic	Magdalenian	La Madeleine, a rock shelter near Les Eyzies (Dordogne).
		Solutrean	A rock shelter at Solutré near Mâcon.
		Aurignacian	A cave at Aurignac in the Pyrenees, now quarried away.
	Middle Palaeolithic	Mousterian	A rock shelter at Le Moustier (Dordogne).
		Micoquean	La Micoque, a rock shelter near Les Eyzies (Dordogne).
	Lower Palaeolithic	Acheulean	Gravel pits at St Acheul, Amiens.
		Chellean	Gravel pits at Chelles-sur-Marne.
		Prechellean	

Each of the cultures can be further divided into a number of stages partly on stratigraphical and partly on typological grounds. These smaller divisions, however, need not concern us further.

As to the climatic conditions prevailing during Quaternary times, whose effect on the contemporary cultures was profound, towards the end of the Tertiary period the climate of western Europe gradually became cold and a glacial period set in. There followed a succession of glacial maxima with warm intervals between. The number of these maxima is in dispute. Some authorities claim that there were two (Bayer), others three (Boule), and the more orthodox school four (following Penck and Obermaier). The latter have named the glaciations after four little rivers in the Alps. Günz (the earliest), Mindel, Riss and Wiirm. The intervening warm periods are called Günz-Mindel, Mindel-Riss and Riss-Wurm respectively. After the last glaciation the temperature rose but then fell again, though not far enough to constitute a glacial epoch except in the north. This is known as the Biihl oscillation. From Biihl times onwards the climate definitely ameliorated. Even during the glacial maxima Europe was not entirely covered by ice sheets and the mean annual temperature was probably only a few degrees lower than at present. But near mountain masses existing glaciers were very large and swept out into the plains in such districts as southern and eastern France, while in northern England veritable ice sheets existed and huge glaciers flowed down the eastern side of the country reaching nearly as far as the Thames. Naturally these great changes in climate affected the plant and animal life of Europe. For example, during a glacial maxima reindeer abounded and red deer were very rare; during an interglacial period the opposite was the case.

The correlation of the archaeological and geological records is naturally controversial. The Magdalenian culture, however, is clearly post-Wdrm, as at Schweizerbild, near Schaffhausen; Magdalenian industries have been found in a deposit resting on a glacial moraine of Würmian age. The Solutrean and Aurignacian cultures seem to be connected with some later phase of the Würm glaciation and the Mousterian in some areas with an early phase of Wiirm, in others as early as a late phase of the Riss glaciation. On stratigraphical grounds the Acheulean and Chellean cultures precede the Mousterian. From a study of the animal bones found associated with these cultures it seems that the former occurred while moderate or cool conditions prevailed, while the latter, apparently covering a long period of time, existed under various climatic conditions.

Lower Palaeolithic Cultures.— The distribution of lower palaeolithic industries is nearly world-wide. It is therefore possible that in them we are dealing with one of the main features of human development. Naturally the age in time of the cultures is not the same in widely separated regions. We do not know exactly where the cradle of the cultures was. They apparently reached Europe from north Africa and are found all over the western part of the continent and in the British Isles up to somewhere about the latitude of Hull. Coups de poing, the pear-shaped chipped stone tools typical of these cultures, are frequently found in the gravels of many English rivers, especially in East Anglia. They are common in the valley of the Hampshire Avon and in the gravels of the upper terraces of the Thames valley, and have been found in the older gravels of the Severn in Gloucestershire. In France their classic place of origin is the Somme valley, whence they were discovered in the middle of the last century by Boucher de Perthes, and after an investigation in 1859 by Prestwich and Evans were accepted as contemporary with the gravels in which they were found. Prechellean implements, tools similar to but rougher than those of the succeeding cultures, are found in the upper gravels of the Somme valley, but one of the best places for finding industries of this description is in the Cromer forest bed at Cromer. Here they consist mainly of large irregular flakes. Many such flakes have been washed out of the deposit and can be readily picked up at low tide from the pebble sheets which are then exposed on the beach. True Chellean industries yield many rough coups de poing, as well as rude borers and scrapers.

The animal remains most typically associated with them are those of a warmth-loving fauna, which includes *Machairodus neogaeus* (the sabre-toothed tiger), *Hippopotamus anzphibius*, *Elephas antiquus* and *Rhinoceros merckii*. The vegetable remains include those of the fig tree and canary laurel; the molluscs those of *Corbicula fluminalis*. In Acheulean industries the coups de poing are better made and an oval form known as the ovate develops. Also the "S" twist along the sides of the tools is found (FLINTS, *q.v.*). The fauna is a mixed warmth and cold loving one, indicating that a cool climate prevailed. It includes the Chellean fauna without the sabre-toothed tiger but with the addition of the *Elephas primigenius* (mammoth). *Rhinoceros tichorhinus* (woolly rhinoceros), etc. The Acheulean culture is quite evidently an autochthonous development from the Chellean in western Europe. At La Micoque small slender coups de poing occur, sometimes showing a large flake surface on the under side; though reindeer bones are not found in association, cold conditions had set in and industries of this type are probably due to influences from the approaching Mousterian culture.

So far no skeletons have been discovered that can be ascribed with certainty to the lower palaeolithic cultures.

The famous Piltdown skull cannot unfortunately be dated exactly, although in all probability it is of early Pleistocene age and would therefore be Prechellean. The equally well known Heidelberg jaw, found in the Mauer sands, is probably of the same age in time, but it must be connected on anatomical grounds with an early appearance of middle palaeolithic man.

The Middle **Palaeolithic** Culture.— The middle palaeolithic period is occupied only by the Mousterian culture which was brought into western Europe by the Neanderthal race, so named from a small valley near Dusseldorf, where a skull of peculiar type was found in 1856 which resembles several other skulls since discovered in association with Mousterian industries.

The Mousterian industries were first recognized in the French caves and occur there stratigraphically above the Acheulean, They are found associated with an Arctic fauna including *Cervus tarandus* (reindeer), *Elephas primigenius* (mammoth), *Canis lagopus*. L., etc. This epoch must then have coincided with the on-coming of a glacial period, and there is evidence to show that this was the last of the great glacial maxima. In central Europe where lower palaeolithic tools are rare their place is taken by what appear to be early prototypes of typical Mousterian tools, associated with a warmth-loving fauna such as is found with Chellean industries in France. This early Mousterian also occurs in one or two instances in England, in Belgium and in northern France at Montières, where it replaces the Acheulean. It would seem probable, then, that so far as western Europe is concerned, the Neanderthal folk arrived from central Europe, introducing the Mousterian culture. By the time the Dordogne district of France was reached the last glacial maximum was approaching. Whether the Mousterian culture developed in central Europe or was evolved still earlier elsewhere, merely sojourning for a time in central Europe until driven to migrate by the approach of cold condi-

tions, is not yet known. Its distribution is very wide, though perhaps not quite as extensive as that of the lower palaeolithic cultures. Typical industries have been found in Britain, France, Spain, north Africa, Italy, Germany, Switzerland, Czechoslovakia, Poland, Jugoslavia, Crimea, Siberia and perhaps China, Asia Minor and Palestine.

Typical tools found in Mousterian industries are the side-scraper, the point, the levallois flake and tortoise core. As regards technique the tools are made from flakes, there being as a rule a faceted platform, and the secondary working edge shows "resolved" flaking (FLINTS, g.~.).In the case of the point, both edges are so trimmed that they intersect and form a sharp tip. The levallois flake is oval and its upper side boldly flaked to form a flat surface, the edges often being made even and sharp by some "resolved" flaking.

The Mousterian culture in France is subdivided into three stages. In the industries belonging to the earliest we find many reminders of the former Acheulean industries, there being a numbers of coups de poing, though generally small in size, neatly made and often triangular or slightly heart-shaped. In mid-Mousterian times the coups de poing become rare and the tools though themselves well made exhibit but few types. In upper Mousterian times the coups de poing cease, and we find for the most part only a monotonous series of small neatly made side-scrapers and points.

A fact of extraordinary interest is the occurrence as early as Mousterian times of ceremonial burial, which shows that the Mousterian must have had some definite ideas about death. At La Chapelle-aux-Saints a skeleton was found by itself in a small cave buried in a carefully prepared trench together with beautifully made implements. No trace of any habitation was found at the site. This would clearly seem to indicate a careful burial. But at La Ferrassie the remains of a child were found in a trench below a large rock artificially placed there, the surface of the rock itself being covered with carefully made cup markings, which must not be confused with cup and ring markings.

The skeletons of Mousterian man exhibit distinctive characteristics. The skull have great beetling brows; the eyebrow ridges expand beyond the limits of the side of the head; the forehead is receding; the upper lip is long and the jaw is projecting and chinless. The thighs are curved and the arms long. It is questionable how far speech was possible, and casts of the inside of the skull exhibit a very simple form of brain. What has been said then as regards ceremonial burial becomes still more interesting. The more important Mousterian human remains are: a skull cap at Neanderthal, two skeletons at Spy (Belgium), a skeleton at La Chapelle-aux-Saints (Corrèze, France), a skull at La Quina (Charente, France), and recently a skull at Galilee, Palestine, and the skull of the child at Gibraltar, the discovery of which helps to substantiate the find of a Neanderthal-like skull made there long ago, the exact details of which were lost.

Upper Palaeolithic Cultures.— Three different cultures, the Aurignacian, the Solutrean and the Magdalenian, occupy the upper palaeolithic period. They were brought into Europe by neoanthropic man, a being quite different in appearance from and far more advanced than his Neanderthal predecessor who arrived apparently from the south, and spread over the whole of Europe and in Great Eritain, as far north as Derbyshire, coming perhaps from somewhere in north Africa where, at any rate, rich industries, generally called Capsian from the type station at Gafsa in Tunis, have been found along the northern margin of the continent. This area, at any rate, seems to have been the jumping off ground from which the new people entered Europe. The wealth and variety of the tools found in upper palaeolithic industries is astonishing and examples of most of the tool families occur. Tools made from bone, horn, antler and ivory appear for the first time and are especially common in Magdalenian industries, a number of types being confined to this period.

Aurignacian times appear to be just subsequent to the last glacial maxima of the great ice age, but cannot be dissociated from the glacial period. The fauna found with the industries remains cold-loving and the Pleistocene species still survive. The climatic conditions indicated by this fauna which includes the *Cervus tarandus* (reindeer), *Elephas primigenius* (mammoth), *Rhinoceros tichorhinus* (woolly rhinoceros), *Canis lagopus* (Arctic fox), *Bos priscus* (bison), *Cervus elaphus* (stag), *Ursus arctos* (brown bear), *Ursus spelaeus* (cave bear), etc., continued with smaller variations throughout upper palaeolithic times, the reindeer being especially prominent in Magdalenian times, which are therefore often known as the "reindeer age."

Aurignacian Culture.--On grounds of stratigraphy (*q.v.*) and typology (*q.v.*) the Aurignacian period can be subdivided into five stages or more simply into an earlier middle and later phase. Tools belonging to the earliest phase appear in the latest Mousterian industries in the Dordogne. The older culture, however, is soon replaced by that of the new and develops in France into the rich middle Aurignacian, the tools of which often show a wonderful fluting technique difficult to copy even to-day. The last phase in France does not seem to be derived from this middle Aurignacian and may be due to a fresh migration perhaps from north Africa. Finally the Aurignacian culture was submerged by the Solutrean incursion, except in areas not reached by the new folk; where therefore the Aurignacians continued to develop undisturbed, such as in western Europe, the Pyrenees, the western foothills of the Alps, and England, though here in the south-western and eastern regions a Solutrean influence, at any rate, seems to have been felt.

The tools of this period are quite unlike the Mousterian ones. Gone are the endless side-scrapers with "resolved" chipping. Instead we have beautifully made end-scrapers, keeled or otherwise, in which percussion flakes rise fanwise to a central point. Burins (*q.v.*) are numerous, and points having a sharp working edge and blunted back appear and develop. Sometimes there are double tools, a graver at one end and an end-scraper at the other, and also some bone tools among which the bone point with a split base is common in middle Aurignacian industries.

Ceremonial burial is known, the bodies being often buried in red ochre with beautifully made implements as well as ornaments and necklaces, sometimes made from sea shells, which must have been imported from a considerable distance. The skeletons are of more than one type, denoting either an intermixture of races or the development in *situ* in Europe or elsewhere of variations of the original stock. These variations, all covered by the generalized term "neoanthropic race" include Cro-Magnon man, Combe-Capelle man and perhaps, too, the Grimaldi "infants," an old woman and young man, who are said to possess some negroid characteristics. They resemble modern man in many ways, and the characteristics especially associated with Neanderthal have disappeared.

Solutrean Culture.— This culture has been divided into a proto, lower and upper Solutrean stage. The Solutreans seem to have been small in number who, through the invention of a type of slender javelin head, known from its shape as the laurel leaf, and made possible by the discovery of a pressure technique for flint flaking (FLINTS, *q.v.*), dominated for a time large parts of western Europe. They originated probably in Hungary and may perhaps be a hybrid product of Neanderthal and Aurignacian man. They seemed to have swept through central Europe into France. Traces of their influence can be noted in eastern and southwestern England. They appear as far west as Cantabria in north Spain, are not found around the Mediterranean nor in Palestine, and it is difficult to connect the laurel leaves found in certain African industries with the true Solutrean culture. The laurel leaf therefore must not be taken as typical of Solutrean industries only. In upper Solutrean times a certain type of tool, the shoulder point, developed by late Aurignacian man, reappears modified often by the peculiar pressure technique employed by Solutrean man. These herald the end and the Solutreans seem to have rapidly disappeared, their place being retaken by the folk of the earlier stock who, however, had developed considerably in the interval. Solutrean times must be considered as a sort of parenthesis in an evolutionary sequence from the early Aurignacian to the late Magdalenian.

Very few burials of undoubtedly Solutrean man have been made known. As has been suggested the Aurignacians probably

continued to exist throughout the period and it is difficult in any one case to be sure that we are really dealing with a specimen belonging to the invading and dominating people. An interesting burial, however, has been discovered at Klause in Bavaria where a Solutrean skeleton was buried in red ochre which probably indicates a ceremonial burial.

Magdalenian Culture.—The Magdalenian culture appears to have been mainly evolved in France, whence it spread far and wide, although there is very little evidence in such areas as Great Britain and Moravia for any replacement on a large scale of the Aurignacian inhabitants by Magdalenian folk themselves. As has been stated the Magdalenian culture is definitely post-glacial. Tools made from bone, horn, antler and ivory appear throughout upper palaeolithic times and in Magdalenian industries are most numerous and most beautifully made. The skill in bone working of these people is indicated by their beautiful fine-eyed needles. In this culture, too, prehistoric art, first noticed in Aurignacian times, reached its highest development. A six-fold division of the Magdalenian culture has been rendered possible by a stratigraphical and typological study of the industries, certain bone tools being utilized as type fossils. Lance-heads are used for this purpose in the earlier, harpoons in the later stages. Flint implements, too, abound and are beautifully made, although the perfection and vigour of middle Aurignacian workmanship is hardly again attained. At the end of the Magdalenian times certain Aurignacian types of tools reappear, at first in the Pyrenees district and later in the Dordogne. This would seem due to the arrival of the Azilian cultures belonging to the mesolithic period, which were, in all probability, themselves a late development from the basic Capsian stock.

The "Home" Art.—An engraving on a flat piece of bone was found in the cave Chaffaud at Sévigné (Vienne, France) as long ago as 1834, though its great antiquity was not then recognized. During extensive diggings in the Dordogne in the 60's undertaken by M. Lartet in association with Mr. Christy, however, a rich collection of decorated objects was discovered. Their age is unquestionable as the decorated objects are found associated with datable tools and the remains of a Quaternary fauna.

It was formerly stated on psychological grounds that sculpture must precede line engraving. But though sculpture is at first commoner than engraving, the latter is found from the earliest times.

It is doubtful whether Solutrean man practised any form of art, unless he was in contact with and influenced by the folk among whom he had penetrated, for little trace of it is found in Solutrean times. The "home" art is therefore divided into an Aurignacian and Magdalenian cycle. In the former the art is still crude though vigorous. Especially to be noted are the famous sculptures representing human beings, generally known as "Venuses," found at Brassempouy (Landes), at Mentone, at Willendorf (lower Austria), at Unter Wisternitz (Moravia) and elsewhere. Other human figures in high relief come from Laussel. (Les Eyzies, Dordogne), one example depicts a steatopygous woman with a bison's horn raised aloft in her right hand. An engraving of a horse on a fragment of bone has been found in an Aurignacian industry at the cave of Hornos de la Peña (Cantabria). Painting, as might be expected, is rarely preserved in the "home" art, but at Sergeac (St. Léon, Dordogne) human hands were found painted in red on a piece of rock with a late Aurignacian industry.

In Magdalenian times the "home" art flourished exceedingly, and hundreds of sculptures, reliefs, bone silhouettes and engravings, representing animals, as well as geometric patterns have been discovered. Frequently tools, such as spear-throwers, spatulae, etc., were decorated. Painting, too, has been noted but is naturally but rarely preserved.

The Magdalenian culture was in a stage of rapid evolution, and great developments, therefore, took place in the styles and technique of the art. Not only can an improvement and an increased skill in the use of the burin be noted, but also certain types of geometric patterns, etc., are made only at certain times.

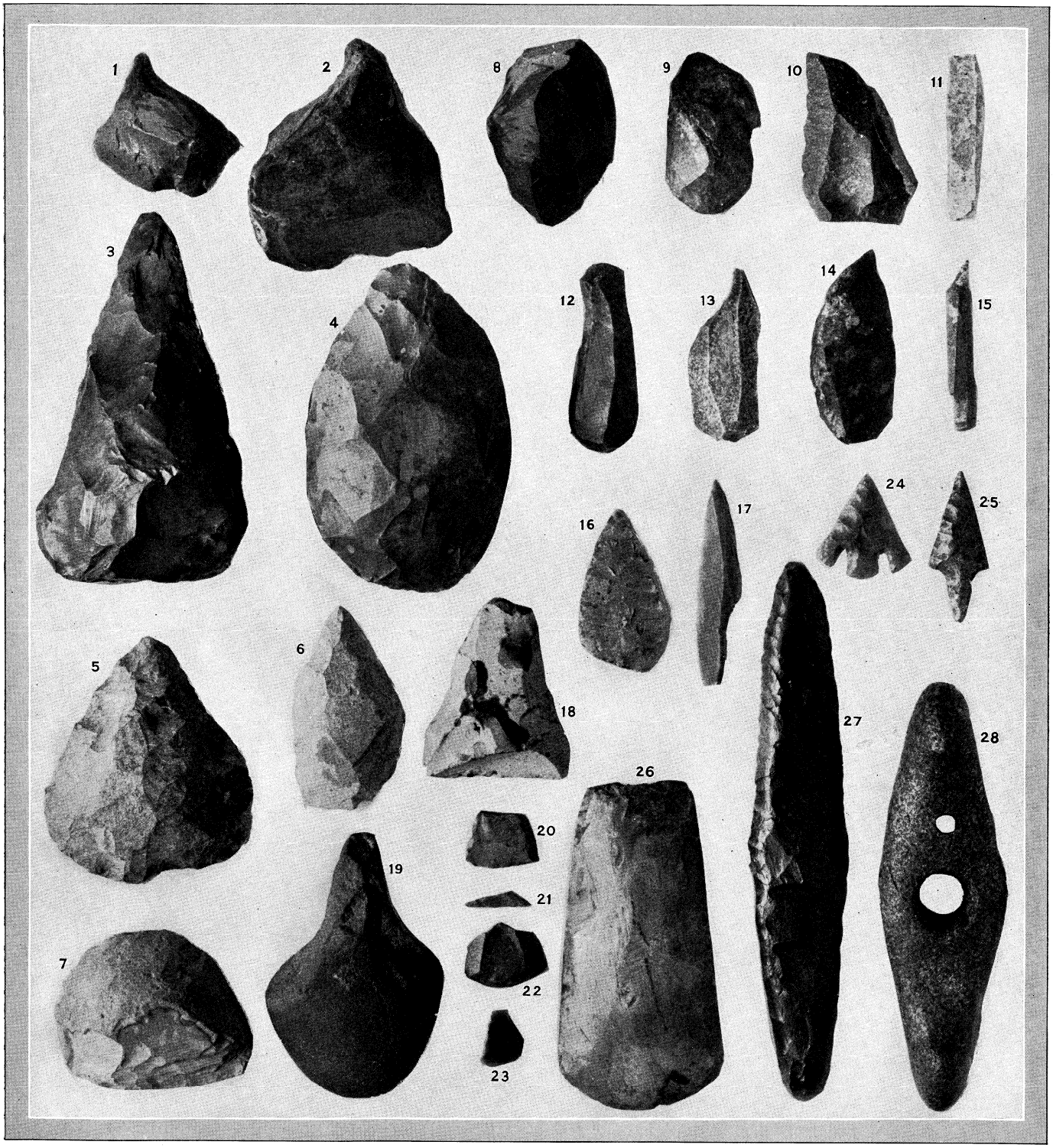
The "home" art can therefore be utilized by the prehistorian in subdividing the Magdalenian period, with results which agree in a remarkable way with those obtained from analysis of the industries. In the course of the evolution of the art the increase in the conventionalization of animal figures depicted is interesting, and a study of the conventionalizations themselves forms an important investigation. Series can be found starting with naturalistic representations of the animals and finishing with what appear to be mere patterns derived from them. Besides these "schematic" figures there are sometimes found what might be called "suggestion pictures." For example, in one case a herd of reindeer is depicted on a fragment of bone, but the first three and the last animals alone are reasonably well drawn, while between them are merely a number of engraved lines representing a forest of antlers.

The distribution of the "home" art in Magdalenian times is not perhaps quite so wide as it was in earlier Aurignacian days. This is to be expected; the Magdalenian culture was essentially a western European, not to say a French product. In western Europe itself we find the Magdalenian "home" art commonly in the Dordogne, in the Pyrenees, and in Cantabria. Eastwards it occurs in the Jura and its influence can perhaps be traced in Moravia, but the culture to which the art there belongs appears to be an autochthonous development of the Aurignacian, contemporary with the Magdalenian of France. "Home" art has been rarely found in England; the best known specimen is a poorly drawn figure of a horse which was found long ago at Cresswell Crags in Derbyshire.

The motives for this "home" art were probably many and varied. In some instances no doubt pure decoration was the reason; in other cases it may have been due to a desire for self-expression among what undoubtedly must have been an artistic people. Again the artist may have wanted to make sketches from nature, to be elaborated later into cave masterpieces. Undoubtedly, too, the drawings were often made as amulets or to ensure efficacy to weapons thus decorated. This is in accord with what is often found among modern primitive peoples. A certain amount of evidence exists to show that something in the nature of art schools must have been in existence. At a "home" like La Madeleine, for instance, only well made drawings and sculptures occur, but at Les Eyzies thousands of fragments of bone have been found, covered with attempts at drawing such as beginners would make.

The Cave Art.—It was in 1879 that the marquis de Sautuola and his little daughter, aged 5, went up to the cave of Altamira near the village of Santillana del Mar (Cantabria). The cave had been recently discovered while digging out the quarry in the course of a hunt and the marquis hoped by excavating in the floor of the vestibule to discover some bones and stone implements. He busied himself in this occupation while his daughter, becoming bored, walked about with a candle amusing herself. The ceiling is very low but owing to her small size she was, unlike her father, able to stand upright. Happening to look upwards she caught sight of one of the bison belonging to the now famous frieze, and called out to her father, "Toros! Toros!" *i.e.*, bulls! bulls! The marquis came to examine the spot and thus were the famous Altamira frescoes discovered. At first they were not accepted as prehistoric by the scientific world, and it was only in 1895 that evidence from La Mouthe finally convinced the sceptics. La Mouthe is a cave not far from Les Eyzies and consists of a large vestibule, formerly inhabited by prehistoric man, from the back of which a passage opens leading to corridors and chambers with engraved and painted walls. The entrance to this passage, however, was filled with archaeological deposits, the upper layers containing a Magdalenian industry, and it was not discovered or made passable for a human being until excavation had taken place. No one then had entered the decorated corridors behind since Magdalenian times. Since 1895 numerous painted and engraved caves have been discovered in the Dordogne, in Corrèze, in the central districts of the Pyrenees, and in Cantabria. A similar art occurs in south Spain, in the districts of Malaga and Ronda; there is also a site in the "heel" of Italy and one or two in Provence. Up to date no palaeolithic cave paintings have been discovered in Great Britain.

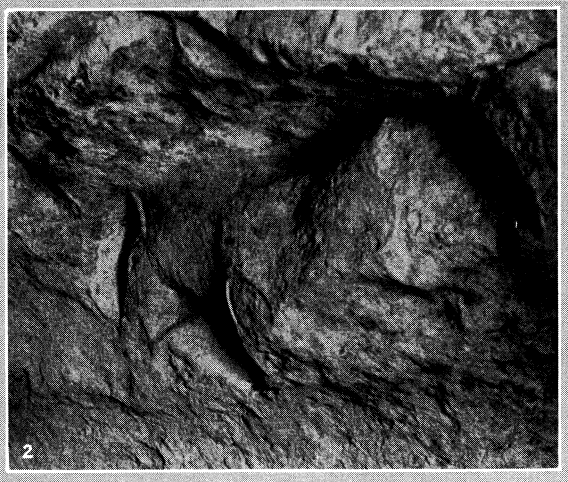
The engravings were made with sharp flint tools called burins (*q.v.*), examples of which are very common in upper palaeolithic industries, though from their number it would seem that they can-

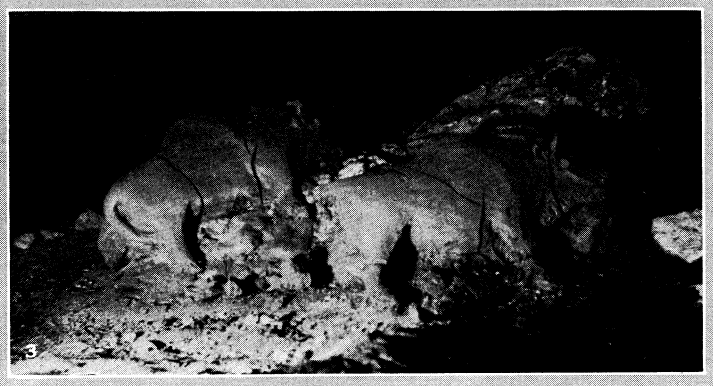


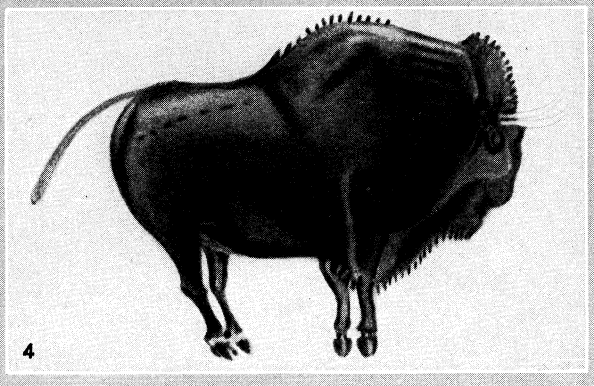
IMPLEMENTS AND WEAPONS OF THE STONE AGE

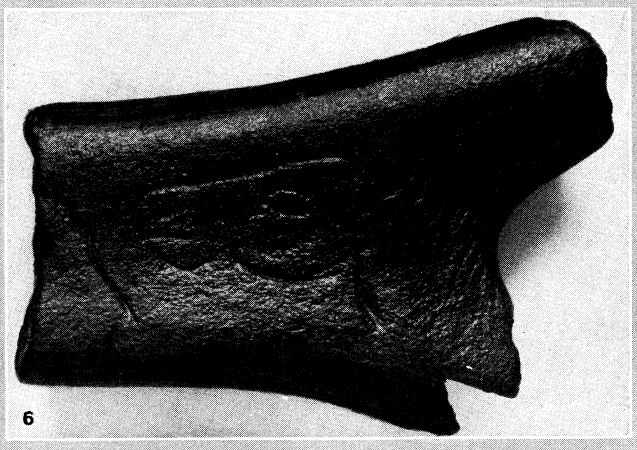
1, 2. Eoliths from near Ipswich, England
3. Coup de Poing, Lower Paiaeolithio
4. Ovate, Lower Palaeolithic
5. Coup de Poing, Middle Palaeolithic
6. Point, Middle Palaeolithic
7. Side Scraper, Middle Palaeoiithic
8. Core Scraper, Upper Palaeoiithic
9. Keeled-Scraper, Upper Palaeoiithic
10. Audi Point, Upper Paiaeolithic
11. Gravette Point, Upper Palaeoiithio
12. Double End Scraper, Upper Palaeolithic
13, 14. Burins, Upper Palaeolithic
15. Awl, Upper Palaeoiithic
16. Solutrean Laurel Leaf, Upper Paiaeolithio
17. Upper Solutrean Shouldered Point, Upper Palaeoiithic
18. Campigny Axe, Mesoiithic
19. Asturian Pick, Mesolithic
20–23. Pigmy tools, Mesolithic
24. Tanged and Winged Arrow-Head, Neolithic
25. Tanged Arrow-Head, Neolithic
26. Polished celt, Neoiithio
27. Flint dagger, Neolithic
28. Battle axe. Neolithic

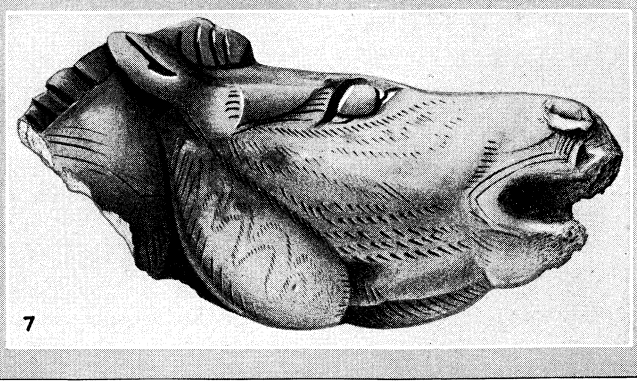
ARCHAEOLOGY











BY COURTESY OF (7) MASSON AND COMPANY FROM PIETTE, "L'ART PENDANT L AGE DU RENNE"; PHOTOGRAPHS, (1, 2) DELL AND WAINWRIGHT

EXAMPLES OF STONE AGE ART

1. Engraving described as reindeer discovered in the cavern of Cornbarelles, Dordogne. Probably Lower Magdalenisn period. 2. Sculpture of horse in high relief, Abri Cap Blanc, Dordogne. Probably Lower Magdalenian period. 3. Two bisons modeled in clay, from Cave of Tuc D'Audoubert, Pyrenees. 4. Polychrome picture of bison from cave at Aitamira, Spain (after tracing by H. Breuil). 5. The "Venus of Willendorf" sculptured out of a fine oolite limestone; from a cast, the original of which is in Vienna. Of the Upper Aurignacian Age. 6. Engraving of a horse, from Laugerie Basse, Dordogne. Late Magdalenian in style. 7. Horse's head carved in reindeer horn, from Mas d'Azil (Pyrenees) Palaeolithic

not have been exclusively used for this purpose. In one instance (Trois Frères) a burin was actually found lying on a projection from the cave wall just under an engraving of a lion. Doubtless when the artist had finished he laid down his tool and while surveying his work, forgot it; and there it remained for 10,000 years or more.

The painting material, as a rule, consisted of mineral oxides; those of iron gave various shades of red, that of manganese a blue-black. Besides these oxides, carbonates of iron were utilized, giving colours ranging from yellow to dark orange, and finally burnt bones provided the artists with black, a more fugitive pigment than that from the mineral oxides but sufficiently permanent when not exposed to weathering action. The raw colours were pounded and mixed with fat; bone paint tubes and palettes have actually been found in the industries. How the colours were applied is not actually known. Lamps which would be necessary in the darkness of the caves have been found hollowed out from a lump of stone, though a fragment of skull was often doubtless utilized for this purpose. The fuel was fat and the wick probably moss, as is the case with Eskimo lamps to-day. It must be remembered that some of the caves are of great length and the paintings often occur a long way underground; the necessity for a good light is obvious, as without illumination it would at times not be at all easy ever to find the exit.

The cave paintings are not all alike, nor of one age. They range in date from early Aurignacian to late Magdalenian times, though once again it is doubtful whether Solutrean man ever practised a pictorial art. A combination of the evidence obtained from stratigraphical and typological considerations applied to the art has given us a chronological sequence comprising a number of different styles and techniques. This has been made possible by the finding of a large number of painted palimpsests showing a sequence of different styles superimposed one upon another and by noting that whenever observed the sequence of the various styles is always the same. In this way four distinct phases, as they are called, of different age and assignable to definite cultures have been determined. Each of these phases shows a number of different styles of drawing which do not differ much from one another in age and belong to the same culture. They often have a limited geographical distribution. The artistic progress was not always constant, and there is evidence for a considerable degeneration at one period.

Phase 1.—The engravings consist of meandering parallel lines and poorly drawn outlined figures of animals. Except towards the end of the phase only two legs are represented, the animals' bodies are depicted in profile, while the head is shown full face. The same is true of the paintings with the addition that representations of the human hand occur. Where it is a direct impress it is known as a positive hand; where the hand has been placed on the cave wall and colour applied round it so that the surface of the wall is coloured; except where the hand actually was, it is known as a negative hand. Examples of both methods are known.

Phase 2.—The engravings show great progress; no longer do we find merely a simple outline; the figures of animals are vigorous and very true to life. All the little details like the cloven hoof in the ox family and so on have been carefully remembered. Another style especially common in Cantabria has been recognized where the engraving is much finer and the whole body of the animal is filled in with fine lines. The result is perhaps a little less naturalistic, but none the less vigorous. The paintings, too, show very great improvement and two styles have been isolated, "stump drawing," the shading producing an effect of relief and a technique where the outlines of the animal figures are made by delicate punctuations. Sculpture and reliefs are also known, and man's desire to obtain a figure in three dimensions is further exemplified by his habit of making use of natural bosses of stalactite in the caves, more or less resembling the figures of apimals, and painting on them such necessary details as horns, nostrils, hoofs, etc., so as to turn them into good representations of the animals ciesired.

Phase 3.—The engravings exhibit a certain falling off in vigour, though not in skill, but the paintings show great degeneration. The fine shaded paintings of phase 2 are replaced by poor effects in silhouette or "flat wash," the figure being often first engraved and the colour applied afterwards in such a may that the "register" is not exact. While the artist still took careful note of anatomical details, his painting of them was by no means always naturalistic.

Phase 4.—The engravings developed into fine scratchings which, though perhaps rather wooden, still show considerable artistic merit. The vigour of the paintings lost in phase 3 is regained, not by a return to the former techniques, but by the use of several colours resulting in the well known polychrome pictures.

By finding in the industries fragments of bone engraved in the same style, it is possible to correlate certain styles and therefore phases of the cave art with definite industries and therefore cultures. Again certain styles of engravings have been found covered by deposits containing datable industries. The engravings must then be older than the deposit by which they are covered. By a combination of these two methods phase 1 can be assigned to the Aurignacian period, phase 2 to the lower Magdalenian, phase 3 to the middle Magdalenian, and phase 4 to the late Magdalenian cultures.

The drawings were almost certainly made for purposes of "sympathetic magic." There are only two other possible explanations, namely that they were made for motives of decoration or self "expression." An examination of the circumstances in the caves disproves these two latter. Man never lived deep in the heart of the mountains where the paintings occur, and no trace of his industries is there found, so decoration of the "home" can be ruled out. Again not only do styles belonging to different phases, and therefore differing considerably in age, form palimpsests, but sometimes styles belonging to the same phase, and therefore not very different in time. occur one on top of another. The result is hardly decorative! The occurrence of the art in obscure crannies difficult of access argues against the desire of expression explanation! On the other hand "sympathetic magic" offers a reasonable and likely motive, comparable with many of the manifestations of "sympathetic magic" that have been observed among modern primitive peoples. The underlying fundamental desire was food—a dire necessity in the case of a hunting people living under difficult conditions, and practising neither agriculture nor domestication of animals, and having only inferior weapons, and no means of storing food. Doubtless as with many modern primitive peoples pent-up emotion gave rise to ceremonial dances and the like; but it would appear that part of the ritual consisted in taking the hunter into the long cave and then showing him pictures of animals, very often with an arrow represented in their sides, and then the sending him forth suggesting to him that he would likewise successfully hunt and kill them. The weirdness of the caves must have induced a state of mind on which suggestion would work easily, and the officiating sorcerer would induce self-confidence in the hunter. And since in matters of the chase self-confidence is half the battle, the sorcerer's rites were no doubt quite effective. That at any rate, in Magdalenian times, the artist-sorcerers formed a definite class is probable; similar changes in the phases take place simultaneously over wide areas, a fact which argues for definite schools of tradition; and further, a very interesting site has been discovered at Trois Frères (Montesquieu-Ariège, France), where there is a small chamber, with engraved walls which is dominated by a sort of pulpit, 12ft. from the ground and reached from behind, where no doubt the actual artist-medicine man-priest, stood. On the blank wall to the left is a representation of the sorcerer himself, showing a man masked with antlers of a stag and the tail of an ox or horse.

Another late palaeolithic art group is found covering the walls of rock shelters in eastern Spain. The best known sites are at Cogul near Lérida and Alpera. The whole appearance of this art is totally different from that with which we have been dealing. Scenes, rare in the former, are here common; human beings, generally conventionalized, are frequent; the bow and arrow is figured. Drawings of Quaternary animals, though known, are rare. Instead of occurring in long deep mysterious caves the paintings are found on the walls of shallow rock shelters, protected from the

weather, as is shown by the absence of lichen growths on the walls where paintings have survived.

The motives underlying this eastern Spanish group are quite unknown. The places were not homes, but possibly sacred spots, where ritual practices took place, which had been decorated for much the same reason as many of our churches are ornamented. The numerous hunting scenes depicted seem to show, as might be expected, that the quest for food was a dominant consideration. The situation in full daylight, however, is dissimilar to that of the cave paintings, and it would seem likely that the explanations which there held good do not here apply.

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MESOLITHIC

The close of the palaeolithic period coincided with a sudden change in climate. The Arctic conditions which had obtained throughout its middle and later phases disappeared, the mean annual temperature rose, forests appeared and most of the old quaternary fauna either became extinct or migrated to cooler regions farther north. The cause of this sudden and complete climatic change is unknown, but it may perhaps have been connected with some such phenomenon as the final break through of the Strait of Dover and the resulting redistribution of ocean currents.

Magdalenian man with his wonderful culture and art disappeared, his place being taken by a number of different, more or less isolated, peoples who occupied most of Europe until the arrival of the true neolithic civilization. They have left us their industries which, though productive of many problems for the prehistorian, are for the most part unrelieved by artistic manifestations. The various cultures had different origins and some at least had their roots in the older upper palaeolithic cultures. But none the less in view of the new conditions under which they persisted, the interconnections between some of them and the fact that in general they certainly cannot be classed as palaeolithic, it has become advisable to create a new main stage in the archaeological record between the palaeolithic and neolithic periods. Several descriptive names—Transitional, Epipalaeolithic, Mesolithic—have been suggested for the new period; in many ways the last of these seems to be the most satisfactory.

The following different mesolithic cultures have so far been recognized in Europe: the Azilian, the Tardenoisean, the Asturian, the Maglemosean, the Kitchen Midden and the Campignian. This list of cultures does not indicate any chronological sequence; their relations to each other have not yet been completely determined.

The Azilian Culture.—This culture was first recognized at and named after a site above the village of Mas d'Azil (Ariège, France) on the left bank of the Arise just as the river enters a famous natural tunnel through the hill. While digging there the well known prehistorian M. Piette observed the following stratigraphy:—

Surface soil.
Neolithic and bronze age industries (with foundry).
Loam with the new industry (=Azilian).
Sterile loam with reindeer bones.
Black loam with reindeer bones and Magdalenian industries similar to some already excavated on the right bank of the river.
Sterile gravels.

The intermediate position of the new industry between upper palaeolithic and neolithic industries is here clearly seen. In place of the splendid Magdalenian bone and stone tools, the former often beautifully decorated, the Azilian industries comprise poorly made bone polishers, spatulae or chisels, rough bone awls and a monotonous series of flint tools, including scrapers, many being of the small round type. The only new variety of tool that appears is a broad, flat harpoon with poorly formed barbs which differ from their Magdalenian forerunners in that instead of being prominently cut out and much projecting from the round stem they are now formed by notches cut in the sides of the flat piece of material. This is usually stag antler, reindeer antler, almost exclusively used by the Magdalenians, being now very rare. There is generally a central attachment hole (round or almond shaped) cut through the base of the implement.

Hardly any engraved objects of Azilian date are known. There is one example from Sordes consisting of a small stone covered with meaningless lines. However, many river pebbles have been found painted in red ochre with dots and lines or combinations of both, forming veritable patterns. For what purpose these so-called "painted pebbles" were made is unknown. At one site a number were found, and every one had been carefully broken in two, a fact which might suggest that they had some definite ritual significance. They have been compared with Australian churingas: it has been suggested that they were toys, money, counting boards, etc. Dr. Obermaier considers that the painted patterns on the pebbles may represent highly conventionalized figures of human beings. Similar conventionalizations of the human form appear in a rock-shelter art group in southern Spain belonging to the late neolithic or copper age. But it is very uncertain whether any of this later conventionalized art can be referred to an Azilian culture, and comparisons therefore are dangerous unless a cultural connection between the two manifestations of art can be determined. The so-called Azilian painted pebbles long ago discovered in the precincts of a late Celtic broch in Caithness (Scotland) are quite unlike true Azilian painted pebbles and have no connection with them.

Using the flat harpoon as the "type fossil," Azilian industries have been recognized in north Spain as far west as Asturias; in the central districts of the French Pyrenees; in east France; in Switzerland just south of Basle; in Bavaria; in Belgium near Liége; in Great Britain at Victoria Cave near Settle (Yorks), near Kirkcudbright, at Oban, on Oronsay island and elsewhere.

Azilian man as well as his industries apparently developed from upper palaeolithic predecessors under stress of the new climatic conditions. Whereas the palaeolithic folk were almost invariably long-headed, an interesting Azilian burial found at Ofnet in Bavaria shows among a considerable total a certain proportion of round-headed individuals; this may perhaps indicate that the Azilians were a mixed race. The burial in question consists of two small pits or nests containing decapitated skulls arranged in concentric circles, all facing west; there is much ochre present as well as a number of necklaces and other objects of decoration. At one place at least the bones of a dog have been found in an Azilian site.

The Tardenoisean Culture.—The industries belonging to this culture and named after the type station at Fère en Tardenois in the department of the Aisne, in France, consist mainly of pygmy tools comprising crescents or lunates, triangles, blunted backs and the like. There is also a small burin which is typical of the culture. The pygmies indicate that Tardenoisean man had discovered the advantage of a composite tool which has the haft made of one material and the working edges of another. Thus a wooden or bone haft which is light and tough could be used to mount the flint pygmy knife blades or saw teeth which are sharp though brittle. Apart from their small size—crescents less than half an inch in length are known—the characteristic feature that all pygmy industries have in common is that, unlike the implements of the older types, the secondary chipping which they show is generally intended to make an edge blunt in order that it shall not cut into its haft rather than to shape or toughen a working edge. The working edge itself is simply formed by the intersection of two flake surfaces.

Pygmy industries have a world-wide distribution, but it is unsafe to class them all as Tardenoisean in culture. The discovery of the advantages of a composite tool may have been made by many peoples at very different times. Nevertheless the distribution of the Tardenoisean culture is wider than that of the Azilian. It occurs all round the shores of the Mediterranean and penetrates

northwards at each end of the alpine massif, being found in England, France and Belgium on the one hand and in the Crimea and Poland on the other. It is clearly connected with the late Capsian industries of north Africa and was undoubtedly evolved from an upper palaeolithic, probably late Capsian, culture. At Valle in north Spain Tardenoisean and Azilian tools are found together in the same archaeological layer; the two cultures are therefore contemporary. In fact they are often grouped together as the Azilio-Tardenoisean culture. At the Grotte des Enfants, near Mentone, occur many feet of archaeological deposits which show an Aurignacian culture steadily developing, undisturbed by Solutrean and Magdalenian invasions. It is interesting to note that almost insensibly the Aurignacian tools diminish in size and change their form, until in the top layers the student is surprised to find himself in the presence of an Azilio-Tardenoisean industry.

A Tardenoisean burial under a tumulus in the vicinity of Vittoria, Spain, has been described by Obermaier. At Ofnet, in Bavaria, Tardenoisean as well as Azilian tools have been collected, and in England Tardenoisean industries are found, notably at Hastings and on the Pennine hills near Huddersfield.

The Asturian Culture.—The Asturian industries occur chiefly in the north Spanish province of Asturias, where they were first brought to light by the Count de la Vega del Sella. They have been recognized also near Biarritz, and as far east as Catalonia; perhaps, too, traces of the culture occur farther north in France. The industries are found in veritable kitchen midden refuse heaps which consist largely of sea shells that have been thrown into the caves, these having served seemingly as dustbins for the inhabitants. From stratigraphical evidence the Asturian culture is post-Azilian, for deposits containing Asturian industries are found resting on others containing typical Azilian tools.

Asturian implements are very crude, but there is one characteristic tool, the pick, which is manufactured from a more or less oval river pebble by chipping one end of it so as to leave a rough point. There are also some poorly made bone tools. Among the enormous quantity of the remains of shell-fish that have been found is the species *trochus*. This fact is important as it indicates that the mean annual temperature of the district must have been slightly higher than it is to-day.

Maglemosean Culture.—This culture is essentially north European, and industries belonging to it have been found in districts stretching from Poland to the Baltic; they are especially common in the latter region. Isolated Maglemosean tools have been found as far west as eastern England, and a site has been discovered in north-east France, near Bologne.

Of great interest is the correlation of the Maglemosean culture with the earth movements that have taken place in the Baltic area since Quaternary times. At the end of the great ice age the whole area lay at a lower level than it does to-day and to the north of the Baltic sea there was a wide open channel connecting it with the Arctic ocean. The whole was known as the Yoldia sea, and in time this period corresponded with the post-glacial Bühl oscillation. There followed an uplift of the land when the Baltic became a lake known, from a small shellfish then common, as the Ancylus lake. At this period the pines which preceded the growth of oak-woods were predominant and it was now that the Maglemosean culture flourished.

Later a second depression of the land occurred, but this time it was not on a large enough scale to produce a connection with the Arctic ocean. However in place of the "Belts" a wide opening to the North sea existed, and the increased Ancylus lake is now known as the Littorina sea because of the common occurrence in it of the shells of *Littorina litorea*. We find the pines were now largely replaced by oaks and the Maglemosean culture by that of the Kitchen Middens. In Finland, however, Maglemosean industries are found associated with oak trees, which indicates that in this district they were of rather later date than in Denmark and were contemporary with the Kitchen Midden culture there. Finally a slight uplift occurred inaugurating conditions similar to those which prevail to-day, and at the same time the oaks gave way to the beech and the birch.

Since the Magdalenian culture in France probably coincided with the Biihl oscillation, the Maglemosean culture, which is post-Buhl and therefore post-Magdalenian, is thus seen to be truly mesolithic. It was in all probability contemporary with the Azilio-Tardenoisean culture farther south, but was earlier in time than the culture of the Kitchen Middens with which however it is linked by many ties and from which it cannot be sharply separated except in age. For this reason then, if for no other, the Kitchen Midden culture too must be classed as mesolithic.

Maglemosean industries were first recognized under the "great heath" near Mullerup on the west coast of Zealand. Since then many other sites have been discovered in Denmark. The industries consist of stone and antler tools. The former comprise scrapers—both end scrapers and core scrapers—awls and a few pygmies. The latter include pierced axes, or more frequently adzes, as well as a characteristic type of harpoon having a single row of barbs. There are also pierced antler sleeves in which stone implements were affixed to give a sharp working edge, while the sleeves themselves were hafted on to a stick; the directions of the holes through which the sticks must have passed relative to the direction of the flint working edges show that these tools were usually adzes and not axes.

The Kitchen Midden Culture.—The position of the Kitchen Midden culture relative to the Maglemosean culture and to the post-glacial earth movements in Scandinavia has been already given. As regards its distribution—it is found near the coasts of south Scandinavia and round the southern shores of the Baltic—it is in fact again an essentially Baltic culture. It remains to say a few words about the industries themselves and their occurrence. The Kitchen Middens form low mounds a yard or more in height and sometimes covering an area of as much as 100yds. by 50 yards. They occur close to the coast and are composed almost entirely of the remains of shellfish thrown aside by man. In these rubbish heaps are often rough stone and bone implements, and sometimes primitive burials. The remains of the dog are found and also a primitive pottery, the pots having a pointed bottom and a rough decoration just below the rim. The characteristic tool is a sort of chisel formed from a piece of flint or split stone pebble by squaring the sides, removing a large flake at one end and so obtaining a sharp edge by the intersection of this flake surface with the flat under-surface of the material. This tool also occurs commonly in the next culture to be considered. The same kind of antler tools and sleeves that were common in the Maglemosean culture persist, but now in the case of the sleeves it is noticeable that axes were the tools generally required. Tools made by a grinding or polishing technique are absent. There are indications that the climate must have been slightly warmer than it is to-day—may we for this reason suggest a contemporaneity for the Kitchen Midden and Asturian cultures?

The Arctic culture, perhaps connected with the Maglemosean culture, survived and developed undisturbed in the hinterlands where the Kitchen Midden folk do not seem to have penetrated. This culture is found in Scandinavia and Finland and may occur even farther eastwards; to it belongs, in all probability, the well known rock engraving art group of western Norway and northern and central Sweden, as well as some characteristically decorated pottery.

The Campignian Culture.—The Campignian culture is similar in many respects to that of the Kitchen Middens, but it is found in more southern areas distant from the coast-line. The type station is near Blangy-sur-Bresle (Seine Inférieure, France). Here are found a number of pit dwellings, oval in shape and varying in size, being sometimes as much as five yards in the longer diameter and several feet deep. Over these hollows there were doubtless roofs formed of rough beams with an infilling of twigs and mud. At Campigny several of these pit dwellings had been sunk in mammoth-bearing gravels of Quaternary age and the following section is vouched for by M. Capitan. At the bottom was found a hearth with cinders and charcoal. Above these cinders was a yellow sandy loam containing Campignian tools. On the top was a modern humus which yielded, in one instance, a few polished stone tools. The industries from the sandy loam included

the typical Campignian axe already described in connection with the Kitchen Midden industries, rough awls, scrapers, etc., and a coarse kind of pottery. The distribution of the culture is restricted to the northern part of western Europe, more especially to the north of France and Belgium.

The folk belonging to these various mesolithic cultures must have been in a primitive stage of civilization and must have eked out a somewhat precarious existence in the various parts of Europe. Nothing suggesting artistic tendencies in them has been found with the exception of a few more or less geometrically decorated objects of Maglemosean and Kitchen Midden age. Their story is very different from that of their immediate palaeolithic forbears; yet it is these people, in all probability, who very largely formed the basal stock of the later neolithic peoples of western Europe, absorbing the new knowledge introduced with the neolithic civilization, influences of which they began to feel both from the east and from the south at the end of mesolithic times.

NEOLITHIC

Civilization is the right word to use for this stage of man's history, for the mode of life and general outlook of the folk of the new stone age was profoundly different from that of their palaeolithic and mesolithic forerunners. For this change four new discoveries or practices were mainly responsible; viz., (1) agriculture, (3) domestication of animals, (3) manufacture of pottery, (4) tool-making by a grinding and polishing technique. The first two of these enabled man to lead a far less precarious existence than formerly, for he could by means of them store food against times of dearth. Further, a given area of country can support a far larger population under these conditions than it can when hunting and food collecting are the sole means of subsistence of the people. Again—and this particularly applies to the crop-growers—more settled communities developed, involving communal existence and therefore to a large extent specialization in work.

The manufacture of pottery played a not unimportant part in the refinement of the home. The surface of an unbaked pot simply calls for decoration and it is not too much to say that art for art's sake is in large measure coincident with the discovery of pottery making. A grinding and polishing technique enabled man to obtain a sharp and tough edge on fine-grained igneous rocks, a result unobtainable by chipping methods alone. In the case of flint a chipped edge is very sharp, but extremely brittle. A sharp, tough edge is essential for the carpenter, and any kind of woodwork had been impossible except on a very small scale before neolithic times.

Agriculture.— Information under this head has largely been gained from investigations in Switzerland where, for protection against wild animals and the like, neolithic man often built villages on piles above the marshy margins and indeed sometimes stretching quite a long way out above the surfaces of lakes. He threw his rubbish down from the pile-supported platforms of the huts and it has often been preserved for us in the accuinulations of mud and peat which have been deposited on the floor of the lake below. Examining these it has been found that amongst the earliest and most important of the various farinaceous groups cultivated by man there appears a small six-rowed barley (Hordeum *hexastichum sanctum*) and small wheat (*Triticum* vulgare antiquorum); after this comes the beardless compact wheat (*Triticum* vulgnre *compactum muticum*) and the larger six-rowed barley (*Hordeum hexastichum densum*) with occasionally its two-rowed relative. Two kinds of millet also appear, as well as Egyptian wheat (*Triticum* turgidum) which is, however, a rarity. Oats, spelt and rye have not yet been found. Apples, pears and the poppy have been collected, and the parsnip, pigweed, walnut and grape were certainly eaten, as well as raspberries and blackberries. But most of these species doubtless occurred wild. Flax was used for cloth-making and in the manufacture of fishing nets, etc. For cultivating and preparing such crops as those indicated above ploughs or hoes would be needed to break up the ground. sickles to reap the crop, and some form of handmill to powder the grain. All these have been discovered in neolithic industries.

The first must often have been made of wood, and ploughs of this nature can still be seen in out of the way districts in Spain and elsewhere, but it was soon found that an unprotected share is rapidly destroyed. It has been suggested that in all likelihood many of the roughly chipped and pointed bars of quartzite and other tough materials that are found may have been attached to the share in such a way as to protect it from rough usage. Doubtless too the land was often prepared for agricultural purposes by means of hoes, and polished tools suitable for hafting as such have been found, especially in the eastern, Danubian, area. The celt—the characteristic tool in neolithic industries (see FLINTS)—may itself have been sometimes hafted and used for this purpose.

Sickles consisted, as a rule, of a curved wooden haft, into a groove in the inner side of which long flint blades were fixed, their working edges being frequently denticulated. The constant friction of these edges against the straw while reaping has produced on them a polish which is very characteristic, although it is not unlike the sand polish found on flints in desert regions. The handmills were of the nature of pestles and mortars, or more frequently a sort of polished stone rolling pin and slightly concave slab of fine-grained sandstone.

The Domestication **of Animals.**—Palaeolithic man may have occasionally tamed wild animals and these may have been made to work for him, but true domestication involves breeding in captivity, a custom which does not appear before the neolithic civilization developed. The first animals to be domesticated were dogs, sheep and goats, cattle and pigs. The horse was not mastered until a later date. Bones of dogs have been found in one or two instances in mesolithic industries, and already in neolithic times there were two distinct varieties; one, derived from the jackal, being a housedog variety; another derived from the wolf, being a sheepdog. There are four basal stocks from which all sheep are derived: (1) the Mouflon, (2) the Urial, (3) the Argali, (4) the American Bighorn. The Mouflon existed wild in western Europe in Quaternary times, but the species seems to have become extinct before mesolithic times and the first domestic sheep known in Europe—the so-called "turbary" sheep of the Swiss lake dwellings—was of Urial stock, probably introduced from central Asia. Later there appears in Europe a hybrid of this with the Mouflon. Hybrids with the Argali stock are only found at a much later period. Wild cattle (Bos *primigenius*) existed in palaeolithic times. They were of large size and had immense spreading horns. The first cattle to be domesticated had, however, short horns, and were also probably introduced into Europe from central Asia. They are named Bos *longifrons* (formerly known as Bos *brachyceros*). Later the Bos *primigenius* itself was domesticated and hybrids developed. The wild pig existed in late palaeolithic times and was painted on the walls of caves by Magdalenian man. But the "turbary" pig found in a domestic state in neolithic settlements was a much smaller animal with comparatively long legs. Central Asia was probably its place of origin.

Pottery.— In one or two instances fragments of what has been described as pottery have been found in palaeolithic industries, but no finished article has been yet unearthed. True pottery (*q.v.*) is made by moulding carefully prepared clay into the required shape and scientifically firing it after it has been mixed with something, sand or other micaceous material, or charcoal made from burnt wood or bones, to render it porous so that the steam when formed may readily escape. Most clays contain a small quantity of iron salts, and if firing takes place in the presence of air, these oxidize and produce a red colour. If, however, the air is absent when the clay is fired, the colour is usually black or grey. Man soon learnt the use of "slip." The pot was moulded out of quite coarse material and then, just before firing, was dipped into a mixture made of a fine clay and water. A thin veneer of this mixture thus covered the pot and formed a smooth outer surface over the inner coarser material from which the main body of the pot was made.

Even in mesolithic times a crude attempt at decoration is found, generally made with a piece of stick or impresses of the finger. In later neolithic times pottery decoration included both engraved and painted vessels, and in the case of the former the

engraved lines were sometimes filled in with a white or coloured material, often giving a striking and beautiful effect.

The Grinding and Polishing of Tools.—Hitherto in Europe practically all stone tools had been made from flint or flinty material; but now in neolithic times, with the invention of the processes of grinding and polishing, any fine-grained compact rock could be used and could be given an edge both sharp and tough. For this purpose however slabs of fine-grained sandstone were needed to form the grindstones. In such areas as East Anglia. where sandstone suitable for this purpose does not occur, the chipping technique continued to be employed for everything far longer than elsewhere, as did also the use of flint. In fact, frequently a polished tool—no doubt a rare treasure—had to be resharpened by chipping. Flint itself can be ground and polished also, and the edge so produced is distinctly tougher than that formed when it is merely chipped.

Fine-grained igneous rocks occur in many places, especially in the west of England, but flint, which was still preferred for many purposes, has a more capricious distribution. It occurs in bands in limestone deposits, and primitive man frequently obtained his raw material by mining it. Many of these mines are known both in England and on the Continent. One of the most famous is Grimes Graves near Brandon in Suffolk. There a number of shafts were sunk which struck the flint-bearing strata at a depth of about 40 feet. From the bottom of the shaft passages radiated in all directions, along them the raw material was brought to the bottom of the shaft and thence hoisted to the surface. It would seem probable that mining in a simple way was started at Grimes Graves as early as late mesolithic times, but its importance grew throughout the neolithic period and it was, in all probability, still flourishing during the earlier part of the bronze age.

Throughout mesolithic and neolithic times the climate of Europe played an important part in the history of the cultures we are considering. Climatic changes show themselves in variations of both temperature and humidity. With the former of these we are but little concerned after the end of the great ice age. There were no startling temperature changes in mesolithic and neolithic times comparable to those of the old stone age, but there were alternately warm-dry and warm-damp periods, and these have profoundly affected humanity because during warm-damp periods forests increased and flourished, while in times of greater dryness they retreated and dwindled. Not until the days of the road-making Romans was man able to withstand the growth of forests and in consequence he had to retreat and migrate elsewhere. It is a fact that the many movements of peoples which took place in pre-Roman times were largely the result of forest growths and therefore of climatic changes. During most of the mesolithic period the climate was warm and dry, except near the Atlantic seaboard where damp conditions prevailed. But at the end of this time, warm, damp conditions set in with the result that forests flourished and in fact covered the whole of central Europe. For this reason the neolithic civilization in these districts was unable to spread over the continent and as a result there developed three more or less distinct cultural areas; an eastern including the basin of the Danube, a northern comprising the lands round the Baltic sea and north Germany, and a western which includes Britain, France, Belgium, parts of Holland, Switzerland, etc. Interchange or commerce between them was of course always possible up river valleys and over loess lands, where dense forests did not readily extend even under favourable climatic conditions, but between the northern and western areas communication was made specially difficult, as much of what is now north Holland was then under the sea.

At the end of neolithic times the climate again became warm and dry with the result that the primaeval forests dwindled and the people of all the three areas pushed in to occupy the now forest-free lands of central Germany. Naturally the contact with each other engendered a large number of hybrid cultures and the examination of these has developed into an exceedingly difficult and complex study.

Whence did the neolithic civilization penetrate into Europe? Probably to a great extent from those regions of central Asia which lie to the east of the Caspian sea. Though to-day these are desert lands, at the end of Quaternary times quite other conditions prevailed; large areas of country were covered by an immense inland ocean, of which the Caspian sea, Lake Aral and Lake Balkash, etc., are the dwindled remains, and the regions round about it were highly fertile. Neolithic influences too probably reached the western area from Spain and the Mediterranean regions.

Tombs.—In the northern and western areas one common feature is the development of a series of very interesting tombs constructed with immense roughly dressed stones, which in some cases weigh many tons. How these blocks of rock were moved into position remains a mystery. The simplest form of tomb, called a "dolmen," consists essentially of a large more or less flat slab of rock supported on three or more uprights. The whole was sometimes left open, sometimes covered with a mound of earth, forming a tumulus. Dolmens appear first and continue well into the bronze age. Somewhat later than their first appearance the passage-grave, corridor-grave or *allée couverte* was made. This consists of a small chamber of upright stones with a lid upon the top, access to which is obtained by means of a corridor, itself composed of upright stones upon which roofing flags are laid. The whole construction is usually covered by a mound of earth and there is often a sort of threshold where the end of the passage emerges from the tumulus. Several varieties of this grave type are known. Sometimes in France, more rarely in England, there is a division made between the passage and the chamber consisting of a large flag pierced by a round hole just large enough to admit a person. These are called "port-hole entrance" corridor-graves. Passage-graves are frequently of immense size. At the Cueva Menga, for example, near Antequera in the south of Spain, there is a chamber, over 25 metres long by rather more than 6 metres wide and nearly 3 metres high, completely covered by only five lid stones.

Finally there appears the "stone-kist." This consists of a small chamber, sometimes so small in size as to be a mere coffin, buried under a tumulus, there being no passage to the exterior. Stone-kists continued to be used in the bronze age. Excavations in these megalithic monuments have often yielded a rich funeral furniture consisting of pottery, implements and objects of decoration. The occurrence of animal bones may suggest the practice of sacrificial meals. Sometimes the human body or bodies were buried at once in the tomb; sometimes, however, the tombs seem to have been merely ossuaries where the bones were preserved after decomposition of the body had taken place elsewhere. Inhumation, not cremation, seems almost entirely to have been the rule in neolithic times. In some cases the stones composing the tomb have been roughly sculptured, it being possible to recognize poorly drawn animals, conventionalized figures of men, signs and the like.

Besides these tombs single standing stones marking a burial below are often found. These are sometimes of enormous height and may or may not be dressed; they are known as menhirs. Circles of small menhirs are known as cromlechs. Occasionally a single menhir is found in the centre of such a stone circle. Sometimes they are arranged in parallel lines forming a series of avenues. These are known as alignments. The most important yet discovered are those at Carnac (*q.v.*) in Brittany where there are ten such avenues stretching for more than a quarter of a mile and leading down from a large cromlech. The reasons for building these cromlechs and alignments and the uses to which they were put are not known.

The place of origin and the distribution of the practice of burial under megalithic constructions, as they are in general termed, is of great interest. One view is that the practice originated in Egypt and spread thence over parts of Europe. It is difficult, however, to find enough connecting links to support this theory. In southern Spain, megalithic tomb construction was practised throughout the new stone age, which was of very short duration there and early developed into a copper-using culture, owing to the occurrence locally of suitable ores. The various methods of building there employed and the great size to which the construc-

tions attained suggest that southern Spain *(see* SPAIN; Archaeology) may have been an actual cradle of the megalithic tomb culture, and this seems more than likely when we consider the geographical situation of Spain and how easily influences from the east would be felt there, tending to contribute to the early growth of a rich native culture.

The motives lying behind the construction of these megalithic tombs remain obscure. Undoubtedly they involve the conception of some sort of cult of the dead. If a dead body is just thrown on one side it becomes a prey of wild beasts. Again, if a heap of stones or earth, sufficient to protect the dead body from such wild animals, is heaped over the corpse, the weight crushes the body out of recognition. It may be that, in the first instance, the difficulty was got over by the creation of a small chamber in which the body could lie secure, and that later these chambers grew in size and the cult, whatever it was, developed. Exactly what the builders of the megalithic tombs believed about their dead or whether the details of the buildings were the result of any particular belief we cannot tell.

Dwellings. — Neolithic man lived in huts which were often grouped together in clusters or villages. Not infrequently these were fortified and on the tops of hills. The simplest form of hut is the pit dwelling, such as that described in connection with the Campignian culture, circular, oval or occasionally in the form of a trench with a fireplace in the bottom and a roof above it. In dry areas this kind of home has obvious advantages; it is warm, fairly draught-proof and the roof is easy to construct as it can spring directly from the level of the ground.. In late neolithic times, wooden houses, often well made, with two or even more compartments and occasionally two storeys, occur. In certain areas, especially in Switzerland and the countries bordering the Alps both on the northern and southern sides, villages were built on piles driven into the floors of lakes. The piles were sometimes 30ft. in length and gin. thick, and as many as 50,000 have been counted in a single village. Beams laid horizontally on the tops of the piles formed platforms on which the houses were constructed. Access to the shore was assured either by rafts or sometimes by a narrow causeway. This type of village had the obvious advantages of security and rubbish could be easily disposed of. *(See* LAKE DWELLINGS.)

The Western Area. — In all probability the neolithic people of the western area were in a large measure of the same stock as their mesolithic predecessors. The old folk adopted, and adapted themselves to, the new neolithic civilization, which enabled a larger population to exist in the same areas. This mesolithic background explains a certain monotony which is apparent in the neolithic industries of the western area. Indeed it was not till the end of neolithic times that western Europe began seriously to forge ahead. The new civilization seems to have been introduced partly from intercourse with the Danubians of the eastern area, which could take place by way of the Danube and the Rhine, following the forest-free lands of southern Germany, and partly from south Spain. In Belgium there appears what is known as the Omalian culture which on stratigraphical grounds seems to occur very early in a neolithic sequence. Omalian pottery shows undoubted connections with that of the eastern area. In a similar manner connections with south Spain can be demonstrated and the megalithic constructions penetrated northwards from that region.

The most typical tool in neolithic industries is the ground and polished celt. *(See* FLINTS.) The development of this tool in the western area is different from that in the northern area; the stumpy massive basal type becomes finer, longer and flatter and develops into an almost chisel-like tool. Another type of tool common in these industries is the so-called neolithic pick which consists essentially of a roughly chipped bar of flint or other material, blunted at one end and having a sharp cutting edge at the other. It varies considerably in length. A smaller variety, much more neatly made and sometimes ending in a rounded rather than a sharp working edge, is known as a fabricator. Awls also occur, as well as beautifully chipped flint arrow heads, but these latter only develop at the very end of neolithic times and during the earliest metal age. The pottery of the western area is largely made from coarse material and is but roughly decorated. Various types of pots, including cups, spoon-like objects and so on, have been found.

A number of special industries have been found in the lake dwellings of Switzerland and northern Italy. In the first place these areas seem to have been occupied by folk from the eastern area. Later, however, there was a change of climate; the lakes rose and the early villages were submerged. Then the level of the lakes again rank and the area was repopulated, but it is now rather to the West than to the East that we must look for the revival of the lake dwelling culture. Small, very beautifully made polished celts are found, often fashioned from a carefully selected green stone, and these were often hafted into antler sleeves. Bone awls, needles and harpoons were made. They are often well made but somewhat larger and quite different in appearance from their palaeolithic precursors. The pottery, too, is good and shows various characteristic forms and decorations. At the end of neolithic times quite a commerce in a special fine, honey-coloured flint found in France at Grand Pressigny grew up. Tools made from this material are found in Switzerland, as well as in Belgium and elsewhere.

The Northern Area. — In the northern area the development is not quite the same as in the western area and there seems to have been an admixture of peoples, a theory which is confirmed by the occurrence of several different types of skeletons. The basal stock was probably also mesolithic and it may be assumed that it was connected with that of the Kitchen Midden folk. The second influence was of a totally new people who introduced a characteristic type of stone tool, bored for hafting and known as the Battle Axe. Their dead were buried singly in flat graves, not several together in megalithic tombs. These single graves first appear in Jutland in early neolithic times. Some authorities consider that this culture developed around the shores of the Baltic, others that it arrived as an invasion, having been evolved originally in southern Russia. However this may be, the Battle Axe folk proved themselves to be the dominant strain and later, when the climate became dryer and the forests dwindled, we find large areas of the northern part of central Europe, hitherto scarcely inhabited, occupied by these people of the northern area.

The industries of the northern area comprise the celt, chisel, gouge, battle axe, etc., and the pottery both in form and decoration is more varied and better made than it was in the western area. The characteristic feature of the decoration consists of a series of close deep zigzags running round the body of the vessel, quite different from the shallower poorly engraved lines of the western area decorations. Scandinavian authorities have shown that the dolmen preceded the passage-grave which, in turn, appeared before the stone-kist. If we consider the evolution of the stone celt in the northern area (see FLINTS), the evolutionary series of this family will be found to agree with this determination, the final development being only found in the stone-kist, an earlier form in the passage-grave, and the first development from the original type in the simple dolmen. It is thus possible to divide the neolithic period of the northern area into three periods.

The neolithic civilization continued far longer in these northern regions than it did elsewhere, especially where natural copper was easily obtainable. In such areas the pure neolithic civilization was of short duration and it is probable, for example, that in south Spain copper was in use throughout most of the period contemporary with neolithic times farther north.

Owing to its geographical situation the problems connected with the neolithic civilization in England are not always easy to unravel. The country was undoubtedly influenced both from the northern and western areas. This can be shown from a study of the pottery, which falls readily into two groups. The distribution of one of these groups covers all the north of England and stretches down as far as Dorset, while the distribution of the other is centred farther south and only extends as far north as Yorkshire. All three kinds of megalithic tomb occur; the passage-grave is usually covered by an oval or pear-shaped tumulus (long barrow), that covering the later stone-kist (which in England already belonged to the bronze age) being circular (round barrow). The industries

are rich but vary considerably in different parts of the country and it is not always easy to assign them with certainty to a purely neolithic culture; thus the surface finds in East Anglia, which include arrow heads, awls, chisels etc., belong in part, at any rate, to the culture of the "Bealier" folk who reached East Anglia at the end of neolithic times, probably bringing with them the knowledge and practice of copper working together with characteristically shaped and decorated pottery vessels called "bell beakers." On the surface of the do ns in southern England, however, rough flint implements seem to have been in use until comparatively recent times, and Kipling's story of the stone worker going down into the woods to get the metal knife is by no means too fanciful. That flint was in use for certain purposes in the bronze age and even in the iron age is attested by the fact that flint implements are found in villages and settlements belonging to these periods.

With the change of climate at the end of neolithic times and the setting in of warm dry conditions it became possible to cross the Alps by way of the Brenner pass. The first people who seem to have penetrated by this route into northern Europe were the "Beaker" folk. From the cradle of their culture in south Spain they passed into Italy and thence into northern Europe, whence, turning westwards, they eventually arrived in England via the Rhine valley. Another branch of the same people reached Brittany, but there seems to have been no connection between that country and England as the types of pottery developed in the two areas are dissimilar. The "Beaker" folk introduced the use of copper to the northern peoples, but very soon afterwards the manufacture of bronze was evolved and a close contact with the more developed peoples of the Mediterranean was assured by the growth in the north of an export trade in metal ores, especially in tin from Bohemia.

See J. M. Tyler, The New Stone Age in Northern Europe (1921); *H.* Reiuerth, *Chronologie der Tungeren Steinzeit in Suddeutschland* (Augsburg, 1923); V. G. Childe, *The Dawn* of *European Civilization* (1925); M. C. Burkitt, *Our Early Ancestors* (1926); and the *Cambridge Ancient History,* vol. i. (M. C. B.)

2. BRONZE AGE

The Bronze Age is the name commonly applied to that stage of human culture during which the alloying of copper with tin in regular proportions became a widespread practice, and the material thus obtained was used for tools and weapons as a supplement to or a substitute for stone. Its end begins when iron was first used for these purposes. The term has no absolute chronological value, but marks a period of civilization through which the peoples of Europe, Egypt, many parts of Asia, as well as some parts of Central America, passed at one time or another. At the beginning of the bronze age metal was relatively scarce, though more so in some places than in others, so stone tools were used for many purposes, while the poorer folk had to be content with the cheaper material for all their needs, and those who had bronze implements apparently remelted old ones to get material for new ones. Thus it happens that in many regions, especially in the north-west of Europe, flint tools and weapons were for a time made in imitation of those of bronze, and only sporadic finds of early bronze implements occur during the earlier phase of the bronze age. It is considered, however, that a region had entered the bronze age as soon as that metal had made its appearance there, however rare its use may have been. Thus the overlap of the different materials is considerable. Stone was used throughout the bronze age, and hoes and other flint implements were not uncommon during the earlier centuries of the iron age.

It is generally believed that bronze was first used about 2000 B.C., or perhaps a little earlier, and that the knowledge of this alloy spread rapidly to most parts of Europe and the adjacent parts of Asia and Africa. Some of the outlying areas, however, and those remote from trade routes, remained ignorant of the new material for several centuries, or, if aware of its existence, were too poor to obtain supplies. This seems to have been true for parts of south and central France, for Norway and for the north-east of Europe, while bronze did not appear in Switzerland until it arrived from Italy several centuries after it had been known in most of the coastal lands of Europe.

Use **of** Copper. — Copper had been known and freely used in the Near East from a very early date, and the knowledge of this metal spread thence to Crete, Greece and other parts of south-east Europe, as well as along the Mediterranean sea to south Italy, Sicily, Spain and Portugal. Thence it may have spread to Brittany and perhaps to Denmark, but whether it then reached the British Isles is uncertain. Copper tools of an early type have been found in Britain and more commonly in Ireland, but it is uncertain at present whether it is safe to speak of a British copper age. It seems, on the evidence available at the moment, that bronze was the first metal to reach these shores. It was difficult to obtain tin in Ireland, and bronze tools may well have been copied in copper in that island.

Small traces of tin, probably due to the accidental presence of impurities in the ore, have been found in a few copper objects of very early date found in Mesopotamia, but there is no evidence that true bronze, intentionally alloyed, occurs there earlier than elsewhere. A fine adze-head, with a hole perforated to receive the shaft, has recently been found at Ur some feet beneath buildings of the 1st dynasty of that city. It is composed of an alloy of gold, silver and copper, with a trace of tin. It has been stated that the statue of Pepi I., a king of the 5th dynasty in Egypt, was made of bronze; this has recently been shown to be erroneous, for the statue is of copper, though a band added much later is of bronze. Again a rod of bronze was found in a tomb of the 6th dynasty at Medhm, but, since this is the only example of bronze for which so early a date has been claimed, most authorities now believe that, owing to the carelessness of a workman, it must have fallen in from a higher layer. It has been claimed that the earliest tools and weapons found in Crete were of bronze, but recent analyses have shown that most of these were of copper, and the earliest daggers, proved to be of bronze, came from tombs that were in use as late as the first middle Minoan period. (See AEGEAN CIVILIZATION.)

Hissarlik Finds. — The earliest specimens of undoubted bronze were obtained by Schliemann from the second city at Hissarlik; they formed part of the famous hoard L. This city was twice rebuilt and the period of its existence may thus be divided into three phases. It seems clear that hoard L belonged to the third of these phases, which is roughly contemporary with the first middle Minoan period in Crete and with the 11th and 12th dynasties in Egypt. This phase may thus be dated roughly as having lasted from about 2200 to about 1900 B.C.

It has been pointed out recently that objects, some clearly made at the second city at Hissarlik and others that are imitations of such objects, have been found at various sites throughout the central portion of the Danube basin, in the Moravian gap, and still farther north in Silesia and Saxony. A line of trade seems to have existed along this route at that time, and it has been suggested that traders from Hissarlik came hither in search of metal ores. It is believed that ultimately they found and worked the copper deposits of the Erzgebirge and later on the tin lodes in the same region. As a result of this, it would seem, the discovery was made that a certain percentage of tin, added to the copper, increased its hardness and made it possible to make castings in a closed mould. How early this discovery was made, and whether by the Hissarlik traders or by the Bohemian miners, is uncertain; it seems likely, however, that bronze, hardened by the addition of about 6 to 10% of tin, was being made and used at Hissarlik as early as the beginning of the third phase of the second city, if not earlier. Thus we may believe, with a fair measure of certainty, that bronze was known" in the Aegean about 2200 B C. This date accords well with the available evidence from Crete, Egypt and other fields of archaeological activity.

Not long after the discovery of bronze we find a considerable development of metallurgy arising in Bohemia and Saxony. The civilization in which this first arose is known as the Aunjetitz culture, from the site at which this industry was first noted, a village some miles south of Prague. All the evidence available at the moment suggests that it was from these two centres, Hissarlik and Bohemia, that the knowledge of bronze became dispersed throughout Europe and the adjacent regions.

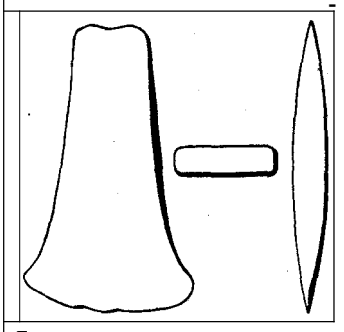
Trade Routes.—For some centuries preceding the discovery of bronze, Hissarlik had been in touch with Syria and Mesopotamia, probably by an overland route connecting it with the settlement of Sumerian traders at Kara Euyuk in the Halys basin, and thence also, through the Cilician gorge, with Cyprus. Hissarlik had sea connections with the Cyclades, the inhabitants of which were carrying on a trade with the people of south Russia and the northern slopes of the Caucasus; also with the Cretans, who had for long traded with Egypt. A further line of connection has been traced between Hissarlik and Euboea, and it is suspected that another trade route crossed the Balkan peninsula, perhaps by the line afterwards followed by the Via Egnatia, to the shores of the Adriatic. By some such routes the products of Hissarlik had already reached a line of trade, which, starting from the neighbourhood of Corinth, passed the island of Leucas to the eastern shore of Italy, and thence by sea to the south-east coast of Sicily, where the most important trading post was at the spot where Megara Hyblaea afterwards arose. From Sicily there are indications of trade in various directions; to the Ligurian coast, the mouth of the Rhone, to Sardinia and the Balearic islands, and as far as the coasts of Spain and Portugal. There is even reason for believing that from Portugal a further line of coastal trade ran to Brittany and the Channel islands, and ultimately to Ireland and the west of Britain, as well as to the amber coast of Denmark.

With the discovery of bronze, a few centuries before 2000 B.C., this trade increased, and we find objects, bearing unmistakable affinities to metal tools found at Hissarlik, Crete and Cyprus, at all the places mentioned as far as Portugal. In the Iberian peninsula various centres of metallurgy arose, and there can be little doubt but that the supplies of Cassiterite, found in that peninsula, were worked very early in the bronze age. The need for tin supplied an added impetus to this trade, and we find evidence of greater activity along the coastal regions.

In the Iberian peninsula there arose several metallurgical centres, of which two are the most important; one in the copper bearing region of south-east Spain, the other in south Portugal. The latter seems to have traded mainly with the west of Brittany, Ireland and the west of Britain, while the route from Spain passed by land along the coast to the neighbourhood of Narbonne, through the Carcassonne gap, down the Garonne valley and along the Atlantic coast to the Morbihan; thence it passed across Brittany, probably up the Cotentin peninsula, and thence to various points on the south coast of England. At an early date some of the traders who followed this route landed near St. Austell. and doubtless discovered the tin deposits of Cornwall. For a time, at least, the route to Denmark was discontinued.

The Aunjetitz culture arose in Bohemia out of a copper culture, in which a few objects of poor bronze are occasionally found. This copper culture is known as the Marschwitz culture, from the village of that name, near Ohlau in Silesia, where the culture was first noted. A few bronze axes, similar in shape to some found at Hissarlik II., found their way to Bohemia and farther north in Germany before the beginning of the true Aunjetitz culture, and their distribution north of the Elbe gap suggests the existence of trade routes to various places on the southern shore of the Baltic between Jutland and Danzig. It was not, however, until the latter half of the first period of the bronze age that the Aunjetitz culture, which received influences from Italy, and perhaps indirectly from Spain, was fully developed. The culture then spread rapidly to Silesia, Saxony, Moravia and Bavaria, and even as far as Lower Austria and Hungary. Though the people responsible for this culture did not spread north of a line running through Magdeburg from Glogau to Brunswick, their bronze wares were carried almost all over north Germany, especially in the region lying between the Ems and the Oder, while some found their way still farther to the north-east. Only along the shores of the Baltic are they lacking, except in the Province of Holstein. Thus we find two groups of implements, the one starting from the Aegean and spreading coastwise to Normandy, the British Isles, and, later, to Scandinavia, while the other radiates from the Erzgebirge region, spreading chiefly to the north and reaching Scandinavia mainly through Schleswig and Jutland.

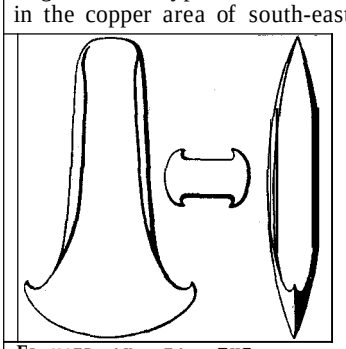
Since bronze, unlike copper, could be cast in closed moulds, it was possible to make a great variety of forms, and the bronze age is essentially a period of metallurgical experiments As regards tools and weapons, the bronze age exhibits far more types than are met with during the much longer period in which iron and steel have been in use. This is especially true for axes, spearheads, daggers and swords. The types show a steady development from the primitive shapes, formerly made in copper, based as they were in most cases upon stone models. There are, however, several parallel lines of development, which pursued their courses simultaneously in different regions. This is especially true of the axe-heads, which, owing to the many phases exhibited by their evolution, form the best series by which we can build up a relative and, to some extent, a positive chronology.



FLAT AXE-HEAD. THE EARLIEST TYPE OF BRONZE AXE

Axe-head Types.—The axe-heads found in the second city of Hissarlik are plain flat blades, with slightly expanded edges and the butts usually rectangular, though in a few cases they are semicircular; a few are long and narrow, with rectangular butts, and more nearly resemble the blades of chisels. This long and narrow type was most commonly used in the Aegean region, and, under the influence of the double axes of stone that had already developed in south Russia, these soon acquired a thickness at the centre, which was perforated for a haft, thus forming a long and slender double axe. As time went on the two blades became wider and shorter and the edges more extended. In Cyprus the axe-heads with the semicircular butts acquired narrower and more pointed butts, until the blade became triangular. Those with rectangular and with semicircular butts were carried to the Iberian peninsula, where the former became more commonly used in Portugal and the latter in south-east Spain. The Portuguese type was carried to the west of Brittany, to Ireland and the west of Britain, while the Spanish type seems to have travelled through the Carcassone gap and over land to the Cotentin and thence to England.

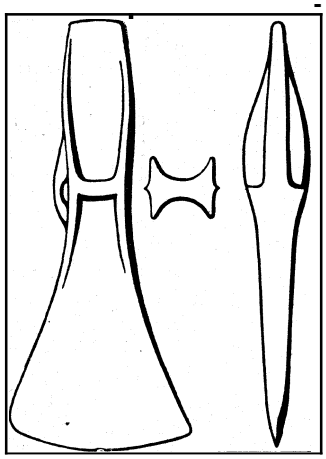
It was this latter type that acquired a thickness at the sides, due to blows designed to keep the blade in place, thus forming slight flanges. These were then cast and developed in depth until what is known as the flanged axe-head appeared. The place of origin of this type is uncertain, but it seems likely that it arose in the copper area of south-east Spain. Thence it travelled, not only to England by the route already traced, but along the shores of the Mediterranean, across the Rhone valley and the pass of Mt. Genevre into north Italy, where it assumed a more elongated form, with a more developed edge, sometimes spatulate in shape, and with a small notch in the butt. From Italy this last type of axe-head spread in many directions, across the Alps into Switzerland, into many parts of France, across the Brenner pass, down the valley of the Inn, and so through Bohemia into Saxony. Ultimately some form of flanged axe-head spread into most parts of Europe.



FLANGED AXE-HEAD. THE SECOND TYPE OF BRONZE AXE

The advantage of the flanges was that the axe-head could not now slip sideways from the cleft stick that formed the haft, but constant use of this tool caused the haft to split farther with every blow until it became useless. To avoid this, a ridge was cast across the middle of the blade. to receive the impact of the blow and thus to avoid the farther splitting of the haft; this is known as a stop-ridge. Thus was developed the form of axe-head, known as a palstave, with flanges or wings on the upper

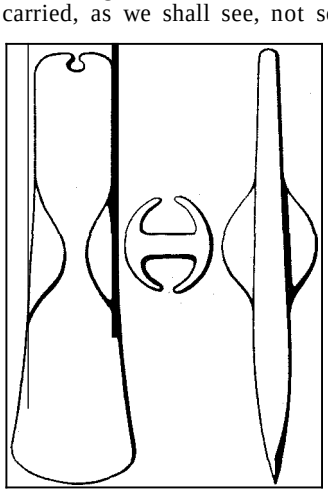
half of the blade and a pronounced stop-ridge. What appear to be the primitive forms of this palstave have been found in Schleswig, and the early development of the palstave took place principally in north Germany. The use of this type of axe-head spread widely in north Europe and ultimately down the west of the continent as far as Portugal, in which land flanged axes had been unknown. It remained in use for many centuries, during which at least six successive variants can be traced.



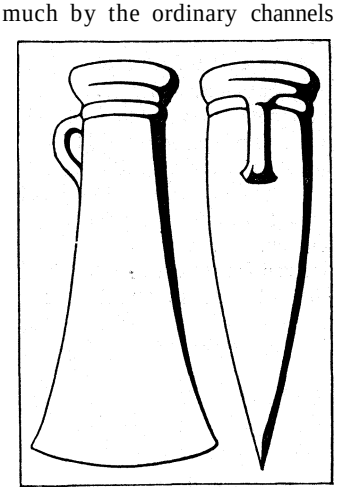
PALSTAVE, A LATER TYPE THAT DEVELOPED IN THE NORTH

In the south, however, the flanges developed in size, though they were confined, sometimes to the centre, but more often to the butt end of the blade. These flanges, or wings as they are called, were hammered round the haft until they almost met, and later were cast in this form. This last type, the winged axe-head, was the prevailing form in the south of Europe and in the southern part of central Europe, especially in Bavaria, and remained in use there until long after iron had become the material employed for most cutting tools and weapons. Towards the close of the bronze age this type was occasionally carried still farther north, for it occurs, though rarely, in England and Denmark.

In Saxony axe-heads like other tools took on forms peculiar to that area, though they were carried thence to most of the adjoining regions. It seems probable that it was in this area that there developed a new type of axe-head, known as the socketed axe-head, in which the haft fitted into a hollow socket in the blade, though how this form arose is still uncertain. The advantage of this form was that the end of the haft could not split, while every blow fixed it more firmly into the socket. This type of axe-head spread over most parts of Europe except the south, and has been found in great numbers in the Cotentin; it seems to have been carried, as we shall see, not so much by the ordinary channels of trade as by considerable movements of peoples, which took place in the centuries immediately preceding 1000 B.C.

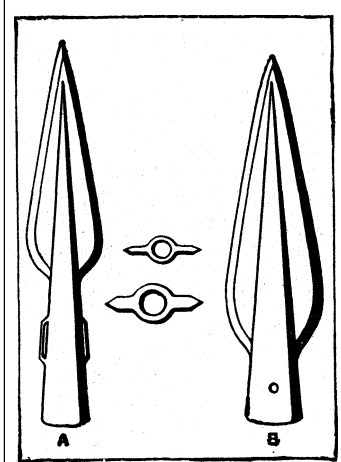


WINGED AXE-HEAD, A LATER TYPE THAT DEVELOPED IN THE SOUTH



SOCKETED AXE-HEAD, A TYPE THAT DEVELOPED IN CENTRAL EUROPE

Dagger **Types.**—We must now turn to another implement, which was in general use from the beginning of the bronze age, and had been made in considerable quantities during the preceding copper age. This was the dagger, often used, no doubt, as a knife. The earliest copper daggers found in Crete and the Aegean are roughly triangular, with broad butts to which the handles were attached by rivets. Similar daggers have been found in Sicily and south Italy. Before the close of the copper age the blades had become longer and the butts narrower, and these changes are still more marked in the first daggers of bronze, which cannot with certainty be dated earlier than the first middle Minoan period. Daggers of this type, often with their sides slightly concave, are found distributed over the Mediterranean region, especially in the Iberian peninsula. They did not, however, at the beginning of the bronze age reach the British Isles, where there occurs during the earliest period a type of flat dagger, with convex sides, the origin of which is obscure. Daggers of the Spanish type arrived first in Britain with flanged axe-heads. As time went on the daggers with concave sides became longer and with narrower butts, until these became trapezoidal in shape and attached to the handles with four rivets. This type is often called the dirk. These dirks continued to be made with longer and longer blades, until they became sword-like in length, when they are often known as rapiers. These rapiers were used all over the west of Europe, from Spain to Britain, until the introduction of the leaf-shaped sword, which arrived with the socketed axe-head under circumstances that will be described later. Another variant of the Aegean dagger seems to have developed in north Italy. This was absolutely triangular, with straight sides, parallel to which were two or three straight grooves. These were carried to France and more rarely to Britain; they have also been found in Switzerland, and more commonly in Bohemia.



SPEAR HEADS
A. Of middle Bronze Age
B. Of late Bronze Age

Daggers of the Spanish type were often attached to long poles by being inserted in a cleft and riveted; the blade was usually attached at right angles to the pole or nearly so. Daggers that have been so attached are known as halberds, and they are found abundantly in Spain and Portugal, also in Ireland. They occur more rarely in France and England and one has been found in Holland; they found their way, too, into the region of the Saale and the Elbe, whither the Aunjetitz culture had already penetrated, and here the shaft and blade were cast in one piece in bronze.

In Britain flat daggers, not unlike those of the Spanish type, but with a long tang, were attached upright at the ends of staves, and used as spear-heads. As the tang tended to split the staff, this was enclosed in a bronze ferrule, which was attached by rivets to the staff. Then blade and ferrule, including the rivet-heads, were cast in one piece, thus producing the first socketed spear-head. These at first had loops at their sides, and later at the base of the blade, through which leather thongs could be passed for strengthening the attachment. Finally this was achieved by passing a long rivet through socket and shaft.

During the pre-copper and copper ages there had been great movements of peoples across Europe and in some places a mingling of peoples of diverse origins and customs. During the earlier half of the bronze age the population seems to have been fairly stationary, and each group continued to develop its civilization in its own way. Trade, however, received an impetus from having a new commodity to carry, and from the need felt by manufacturers of procuring the raw material for their industry, namely copper and tin.

The Beaker Folk.—It was at one time believed that bronze was introduced into Britain by a people who buried their dead in round barrows accompanied by an earthenware drinking cup, of a type now known as a beaker. These people were fairly tall and very robust, with fairly broad and square heads and marked supraorbital ridges. They were known formerly as the bronze age invaders of Britain or the Round Barrow men. Since many of these skeletons have been found in Britain, and a few only were buried with implements of bronze, it has been doubted whether they introduced this alloy or whether they were even

users of it when they first arrived, and since the great majority of round barrows were erected to cover the cremated remains of another people at a later date, it has been suggested that both these names should be abandoned, and they are now usually known as the Beaker folk or the Beaker makers. Beakers, closely resembling the British types, have been found in a zone lying between the Rhine and the Elbe, stretching northwards from Bohemia and ending in Denmark and Holland. In Denmark the graves containing the beakers are known as single graves, and the earliest of these contain little if any metal; since metal, though already known, was scarce in that country before their arrival, it is impossible to decide whether they were acquainted with its use before they reached Jutland. No skeletons from the single graves have been sufficiently well preserved to enable anatomists to describe the skulls. In Holland bronze has been found only with one beaker interment; this has been described as a dagger, but it is in reality a halberd of Iberian type, and may well have reached that country by coastwise traffic from Spain or Portugal. The skeletons buried with the beakers in Holland, owing to the nature of the soil, have perished, but fragmentary remains of one have been preserved, and, though it is impossible to measure its skull, owing to its imperfect condition, the well-marked supraorbital ridges, characteristic of the British Beaker-makers, can be detected. It is said that some of the beakers found in Germany were accompanied by knives of Spanish type; it is possible, however, that these reached these people, as in the case of the Dutch example, by a sea route. Some Dutch archaeologists believe that these people came across Europe from the steppes of south Russia, and have pointed out that their manner of burial resembles that found in many of the Russian kurgans.

Bell-beakers. — It has been asserted by most archaeologists, though it is not universally agreed, that a form of beaker, known as the bell-beaker, developed in Spain, probably in imitation of baskets woven with esparto grass. These beakers had wide globular bodies, with hemispherical bases, and widely expanding mouths. They were decorated by zonal bands of geometric ornament. Smaller beakers of the same type, usually without the characteristic decoration, were carried northwards to Brittany and thence to the Channel Islands, but failed to reach the British coast.

The bell-beakers have been found very widely distributed over the greater part of Spain and Portugal, though they are relatively scarcer in the north-west of that peninsula. They have been found also in Sardinia, Sicily, in north Italy and some parts of France, pointing it is thought, to a route through the Belfort gap. Either by the latter route or by the Brenner pass they are said to have reached Bohemia, where their makers came into contact with those who used the cord-ornamented vases, which during the neolithic age had had a wide range over north Germany. These cord-ornamented vases had long cylindrical necks, and it has been conjectured that it was the influence of these that led to the development of the northern beaker, consisting of a globular body with a long, though slightly expanding cylindrical neck and a flat base. Be this as it may, the beakers that have been found north of Bohemia are many of them of the latter type, and the few bell-beakers discovered in that region have to some extent lost their resemblance to the Spanish form. The zonal decoration has often degenerated into a succession of parallel horizontal rings, often of true cord-ornament. Others would bring this ware from the Ukraine, believing that it passed from central Europe to Spain, where its characteristic zonal decoration was more fully developed. The beaker culture spread over the whole of England, though it has less commonly been found in the western counties; it is found sparingly in Wales, and is abundant in the eastern half of Scotland as far north as the Moray Firth, though rarely in the west. It has not yet been found in Ireland, though hemispherical bowls, which occur with beakers in Spain, have been fouhd in County Down. This culture lasted for some centuries in Jutland, Holland and Great Britain, and in the former country three distinct periods have been recognized.

Greece. — During the bronze age the mainland of Greece formed two cultural provinces, Thessaly and the Peloponnese, while the intervening region, central Greece, oscillated between the two Before the close of the copper age Cycladic mariners had made settlements in the Argolid, where their culture is known as Helladic; before the introduction of bronze they had penetrated northwards as far as the Spercheios valley, to some extent displacing Thessalian peasants, who had preceded them in this area. These Thessalian peasants had, at an earlier date, been ousted from eastern Thessaly by people coming, it is believed, from the Black Earth lands of south Russia, who had introduced the painted pottery known as Dhimini ware. Some centuries before the introduction of bronze this painted pottery deteriorated, and its place was taken by encrusted ware, decorated by the application of pink and white colour to the surface of grey-black or reddish pots, Finally the decoration was abandoned and plain pottery came into general use. It was while this degeneration of the pottery was taking place that bronze came gradually into use. After 2000 B C. a new type of pottery is found there; this is known as Minyan ware. It was wheel-made and of a silver-grey colour. The origin of this ware is unknown. Some authorities believe that it came from Asia Minor, others that it developed from the plain wares of Thessaly. It is found gradually superseding the previous wares in that province, and was introduced forcibly into central Greece by invaders, who destroyed the second city of Orchomenos. The makers of the Minyan ware, who were armed with daggers, halberds and spears of bronze, soon made themselves masters of central Greece, and extended their dominions to include the Peloponnese. Here their culture lasted until about 1625 B.C., when the whole mainland of Greece. except Thessaly, came under the control of Cretan lords, who introduced many elements of late Minoan culture.

Central Europe. — During the copper age Hungary and the middle Danube basin had been invaded from the east; it has been suggested that the invaders came from the south-east Russian steppes. About the time that the discovery of bronze was made, this region seems to have been subjected to two fresh invasions, one from the north by people using cord-ornamented pottery, and another from the east by men armed with battle-axes of copper. It seems likely that both groups of invaders had come earlier from the Russian steppes. Though bronze implements, imported from Hissarlik, were known, the metal most generally used was copper.

Aunjetitz Culture.—It was after the arrival of the Beaker folk that there arose in Silesia a civilization, known as the Marschwitz culture, in which bronze of a poor quality was sparingly used. This suggests that the people living north of the Erzgebirge were learning the use of bronze. About 1900 B.C. this culture developed into that known as the Aunjetitz culture, which spread from Silesia into Saxony, Moravia, Bohemia and Bavaria. The earlier implements from the Aunjetitz graves are clearly derived from north Italy, and in some cases indirectly from Spain, but with the raw materials of the industry close at hand the people of this part soon developed their own forms and exported them northwards to the plain of Germany and south-eastwards to Hungary, where, however, copper was still used for many purposes. Rather later special centres of distribution arose at various places in north Germany, notably to the east of Halle, around Bremen and Hamburg, and in Schleswig. At these centres various types of palstaves were developed and traded to the north and west. In Hungary, as before, many other influences came in from south Russia and Asia Minor.

Lausitz Culture. — Towards the close of the middle bronze age a new culture, with a more developed metal industry, arose in the south-west of Saxony and the adjacent part of Silesia. This is known as the Lausitz culture. The people responsible for this civilization burned their dead and deposited the ashes in biconical urns, over which they erected round barrows This culture spread into east Bohemia and Moravia, where it displaced the Aunjetitz culture; it was carried also eastward across Poland to the confines of Russia. The Lausitz culture was fertile in developing new types of implements, and it has been suggested that it was here that the socket axe-head was invented. Ulti-

mately, in conjunction with other culture influences from the plain of Hungary, the Lausitz burial customs and types of implements spread over the greater part of Europe.

Cremation. — It has often been stated that the dead were buried in the neolithic age and that cremation was introduced in the bronze age, some would say in the late bronze age. Such statements are, however, not strictly accurate. It seems probable that cremation was very generally practised in central Europe in the neolithic age, for, though a few cases of inhumation have been found, they are relatively rare in regions in which villages of this date are common. Cremated remains have recently been found in Belgium in a neolithic settlement, and burnt bones have been met with in long barrows in Yorkshire. Cremation was also practised at an early date in many parts of Germany. Still it is true that these cases of cremation were to some extent confined to limited regions, while in others both practices prevailed at the same time. The almost universal practice of cremating the dead and placing the charred remains in an urn, to be buried in a round barrow or in an urn-field, seems to have spread from central Europe, probably from the Lausitz region, at the beginning of the late bronze age, to almost every part of Europe.

Hungary. — It is believed that the plain of Hungary was twice invaded, for the first time in the middle of the third millennium and again at its close, and that these invaders had come, directly or indirectly, from the grassy steppes of south-east Russia. It is believed, too, that these invaders established themselves as war-lords over the peasants, who had for long occupied that region. Be that as it may, about **1500** B.C. the inhabitants of Hungary developed very efficient weapons of a larger size than were used elsewhere. In this region the dagger, originally of west European type, was made much larger, until the strain on the rivets, by which the hilt was attached to the blade, became insupportable. At length an experiment was made of casting with the blade a flanged tang, to which plates of bone or wood could be riveted to form the hilt, and afterwards of adding to this a hilt cast in bronze. The experiment was successful and the blades became longer and frequently expanded in the middle. Thus arose the leaf-shaped sword, the most formidable weapon yet invented.

It would seem that about this time the Lausitz people, with their improved art of bronze working, coalesced with the people of the Hungarian plain, and together they began to spread in almost every direction. The first move seems to have been to the north, in the direction of Jutland, and their arrival in these parts may have accounted for the growth of the bronze industry in the neighbourhood of Bremen and Hamburg. Later they reached the west of Schleswig, where more than three thousand round barrows have been noted. Up till then metal had been relatively scarce in the Baltic region, and such early specimens as have been found, many of copper, are of types that arrived by sea traffic from the west. The chief warlike implement was the perforated battle-axe of stone. After the arrival of the invaders from central Europe bronze became abundant and the conspicuous weapon was the bronze sword. There is reason for believing that about 1250 B.C. a movement was made towards the south, for several swords of central European type have been found in Greek lands, two at Mycenae, two at Muliana in Crete, and one at Levadia in Boeotia; besides these two have been found in Egypt, on one of which was engraved the cartouch of Seti II. It has been suggested that the presence of these swords in Greek lands betokens the arrival of northern invaders; these have been identified with the Homeric Achaeans and the Akaiwasha, who attacked Egypt in the reign of Meneptah. Others, however, think that the swords passed southwards by way of trade, or were loot taken by the Mycenaean inhabitants of Greece in some northern foray. Swords of similar type found their way into Italy, probably across the Adriatic, for the majority have been found in the neighbourhood of Lake Fucino.

The leaf-shaped swords found in western Europe are of a still later type, and the bearers of these cannot have left central Europe long before **1200** B.C., while some seem to have set out considerably later. These swords reached Switzerland fairly early, but were later in their arrival in France, where they have been found over the eastern half of the country, from the valley of the Seine to the mouth of the Rhone. It was not until a much later time that a still later form reached Brittany, probably by sea, and later still that they were carried across the Pyrenees into Spain. About 1100 B.C. the bearers of these swords seem to have passed down the Rhine into Holland, and then to have crossed the North Sea to the east coast of England, where they are thought to have arrived rather before 1000 B.C. There is also some evidence that at a slightly earlier date a few of them penetrated south Russia, though the evidence of their presence there is slight.

Wherever they went the bearers of the leaf-shaped swords carried with them socketed axe-heads, which seem to have been invented in the Lausitz region, socketed gouges and a great variety of tools. They also used spear-heads with a leaf-shaped blade and a single rivet through the socket. The shafts of these spears had their ends cased in bronze ferrules. The sudden arrival in most parts of Europe of a civilization, which had its origin in Saxony, Moravia and Hungary, seems to indicate that these new tools and weapons of bronze were carried, not by the ordinary channels of trade, but by invading hordes. It appears safe to attribute to these people the universal custom of cremation, which was adopted in the late bronze age, and we may with good reason attribute to them also the use of those cinerary urns that have been found in many of the round barrows and in the urn-fields, but without associated tools or weapons. A few settlements of these people have been noted and some of them excavated with care; little study has yet, however, been made of their domestic pottery, though large numbers of their cinerary urns have been studied. This culture, which was fairly uniform over most of Europe, lasted with but little change until the introduction of iron weapons.

Life in the Bronze Age. — Though much is known of the tools and weapons used at this time, and many examples of the domestic pottery of the earlier phases of the bronze age have been found in graves, as well as of cinerary urns used during the latest phase, relatively little is known of the way in which these people lived. No settlements, dating from the first phases, have been explored, while at the close of this age some of the people lived in villages, defended by a rectangular ditch and bank, and others seem to have made settlements in the low lands by the sides of lakes and rivers. Since the knowledge of agriculture had reached most parts of Europe earlier than implements of bronze, we may assume that the people of the bronze age cultivated grain, while remains of domesticated animals have been found in their later settlements. Of their clothing we know little by direct evidence, though the complete outfit of a man of this period has been found at Treenhol and that of a woman at Borum-Eskoi, in Jutland. These garments, of simple cut, were made of a woven woollen material. The man had worn a tunic and a mantle, stockings or some other woollen covering on his legs, and a high cap. The woman had worn a long skirt and a short jacket, and upon her head a bonnet made of a net-work of woollen threads. The ornaments worn were relatively few. Bracelets of bronze, more rarely of gold, have been found, dating from all parts of the bronze age; these are usually plain circlets of metal, though during the last phase they are sometimes decorated with geometrical designs; towards the end of the bronze age oval penannular bracelets sometimes occur, especially in central Europe. Metal ear-rings were also worn, sometimes of considerable size; these were often made of gold. The most important ornament, however, was the torque, usually made of a twisted band of bronze or gold. Torques have been found in several forms, characteristic of this age. The most curious ornament was the gold crescent or *lunula*, which has been found abundantly in Ireland, as well as in England, the north of France, north-east Germany, and Denmark. These *lunulae* are large thin plates of gold, shaped like crescents, with the points almost joining, and profusely decorated with incised geometric designs. How they were worn has not been explained. The people who carried the leaf-shaped swords throughout Europe seem to have worn over their shoulders a plaid or some similar garment; this they fastened with a long bronze pin. As this pin tended to

slip out, various devices were designed to keep it in place. At length, about 1400 B.C., it was bent, with a coil, into a simple brooch or fibula, like a safety-pin, and during the latest phase of the bronze age these fibulae began to pass through that series of changes which continued throughout the iron age.

Quest for Gold.—As has already been pointed out, the bronze age was especially a period of invention and active trade, more particularly during its earliest and latest phases. The need for a greater supply of copper and still more for tin, a much scarcer metal, caused traders to explore many parts of Europe, especially those easily accessible from the sea. Here they found many sources of supply, and had, apparently discovered the tin ores of Cornwall before flat axe-heads had given way to flanged. There was, however, another metal, sought for with much greater eagerness; this was gold. From a very remote antiquity gold has been prized, and numerous objects of the goldsmith's art have been recovered from graves lying many feet below the foundations of buildings that date from the 1st dynasty at Ur. The richest gold-field in Europe was in Transylvania, where the mines were worked under the Roman emperors. Gold from Transylvania seems to have reached Egypt before the close of the and dynasty, and this region seems for long to have supplied the needs of the Near East.

There is no part of Europe that has furnished so large a number of gold objects of prehistoric date as Ireland, and the great majority of these can be shown by their decoration or associations to have been made in the bronze age. Reference has already been made to the *lunulae* or crescents, found so commonly in Ireland, and it is generally agreed that these, wherever found, are of Irish gold, showing that the precious metal was at that time exported in many directions. The fact that two such crescents were found in a barrow near Harlyn bay, in association with a flat axe-head of bronze, shows us that this gold trade was well developed long before the close of the early bronze age. It has been pointed out that alluvial gold deposits were worked in the Wicklow hills in the 18th century, and there is little doubt that it was these deposits that attracted traders quite early in the bronze age. These deposits and the tin lodes of Cornwall, as well as certain copper and, perhaps, gold deposits in Wales, were the lures that tempted the first bronze traders to these countries. Thus it was that, within a very few centuries after the first use of this alloy, bronze was brought to the British Isles.

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3. IRON AGE

Definition.—Care must be taken, in discussing the period known as the early iron age of Europe, to distinguish between the first appearance of wrought iron in any locality and the beginning of the local iron age. The period in question belongs to the history or prehistory of the European continent and islands; and with due qualifications for various countries, covers the thousand years immediately preceding the birth of Christ. It normally follows the bronze age, when that metal (an alloy of copper and tin) was used not only for objects of luxury, as it is to-day, but also for household and agricultural implements; but in most parts of Africa it seems to have succeeded the stone age, bronze being almost unknown there in prehistoric times. Egypt, however, is an exception to the rule in Africa, and has a chronological system which helps to establish the limits of the iron age in other countries.

Iron in Egypt.—Though the early iron age of Egypt did not begin till about 800 B.C. (between the 22nd and 25th dynasties), when the metal was produced locally and passed into general use, there are many iron objects preserved from much earlier dates, and the question has been raised whether they were of meteoric or telluric origin—that is, whether made from metallic masses which reached this planet from space and contained a large percentage of nickel; or from local iron ores reduced in some kind of furnace. A recent analysis of the lump found with copper implements and a mirror of the 6th dynasty at Abydos (now in the British Museum) shows that no nickel is present in the rusted surface, and only minute traces of it in the black crystalline core, which contained also traces of phosphate, sulphur, carbon and a notable quantity of copper. The inference is that even at that early date (2700–2500 B.C.) iron was being obtained from the local ores by primitive metallurgical processes, and not from meteoric sources. The earliest known example in Egypt is the group of oxidized iron beads found by Wainwright at El Gerzeh, dated about 4000 B.C.; and there is documentary evidence of the authenticity and early date of the iron tool found inside the great pyramid of Khufu at Gizeh, dating from the 4th dynasty (about 3100 B.C.). Other early specimens are quoted by J. N. Friend, who gives evidence that hard rocks can be chiselled with soft metals, provided due perseverance and patience are exercised: this in view of the contention that the stone of the pyramids cannot have been shaped without iron or steel tools. It should be observed that the earliest iron objects in Egypt and elsewhere are chiefly weapons and ornaments, not tools which had to wait for the iron age properly so called.

Iron in the Bible.—Biblical references to iron are of interest in connection with the view that the Philistines (1 Samuel, xvii. j) were connected with Crete and found a refuge in Palestine when Crete lost command of the sea and gave way to the Mycenaeans and Greeks of the Eastern Mediterranean. The iron chariots of Sisera in the days of the Judges gave the Canaanites an enormous advantage over the Israelites (Joshua, xvii. 16; Judges i. 19); but Lebanon soon became an industrial centre, and David collected iron in abundance for Solomon's temple, which was, however, for ritual reasons, erected without the use of iron tools. From the time of Amos (middle of the 8th century, B.C.) iron was in general use amongst the Hebrews as well as the Syrians, and smelting furnaces were known to the later Hebrew writers. It may be added that the passage in 1 Samuel, xiii. 19—"Now there was no smith found throughout all the land of Israel, for the Philistines said, Lest the Hebrews make them swords and spears"—is regarded by Cheyne and Black (Encyc. **Bibl.** under Samuel, Books, col. 4,27 j) as an incredibie statement, and merely a later interpolation in the text.

Crete and Greece.—Researches in Crete during the last 30 years have given a chronological standard only inferior to Egypt for dating the prehistoric finds of Europe; and it is generally admitted that the iron age began in the island about 1100 B.C. Iron was certainly known locally before that date, but was regarded as a precious metal, and in 1927 a cube of it was found by E. J. Forsdyke in a sealed tomb-deposit at Knossos dating from about 1800 B.C. Another stage in its adoption is marked by mention of it in Homer, *e.g.* Iliad, xxiii., 834, the poem no doubt dating from the full iron age of Greece but referring to the period about 1200 B.C. It was given as an athletic prize, but clearly for the production of tools and implements rather than weapons. Both Crete and Greece are noticed in separate articles, and it is only in connection with the iron age of Central Europe that they are mentioned here, in order to fix the route and period of the introduction of iron into Europe. The theory that the Achaeans (*q.v.*) brought the new culture from the Danube into the Bronze Age areas of Greece and the islands has not been widely accepted, but there is little doubt that the Dorian (*q.v.*) invasion played that rôle and put an end to the Mycenaean dominion, at least on

the mainland. The Greeks called it the Return of the Heraclids or sons of Hercules, and dated the event about 1104 B.C., approximately 80 years after the fall of Troy. That the newcomers were of alien race is indicated by their practice of cremation, the dead having been buried unburnt as a rule during the bronze age. Their civilization was evidently on a low level compared with that of the people they conquered; and the change from the Mycenaean to the Geometric style of pottery was contemporary with, even if not due to, their arrival from the barbarian north about 1050 B.C. Novel types of the sword and brooch are seen in late Mycenaean association, and specially striking are the brooches of spiral wire (as fig. 5) discovered at Sparta, as these are obviously connected with those of the Hallstatt (*q.v.*) area and period in Central Europe. The name is derived from a salt-mining site in the Salzkammergut, Upper Austria, and the period marks the first appearance of the Celts or at least of peoples speaking the Celtic language.

Recent excavations have thus given precision to prehistoric chronology in an area for which no written documents exist, and link up the bringers of iron into Central Europe with personages in Greek history. Whether the Dorians were Celt in origin is a secondary question of terminology; but the Greek connection may be expected to throw light on the nationality and tongue of the Hallstatt invaders who are often credited with the introduction of iron.

Celtic Culture.—With all due caution regarding the differences between Celtic blood-relationship and the use of the Celtic idiom, it is generally agreed that the Celts were located in Central Europe (the upper Rhine valley and the later Roman provinces of Rhaetia and Noricum) at the time when the use of iron spread from that very region, and they are known to have migrated in force to distant parts of Europe where their former presence can be traced in place-names and historical allusions. The Hallstatt culture may not have been Celtic at first, but in any case no people of Celtic speech can be traced on the map before the Hallstatt period, though the language was closely allied to Latin and was apparently the last to break off from the Aryan stem. Philologists no longer allow a Celtic population (whether by blood or language) in Britain, for example, during the Bronze Age, and insist that the Celtic connection cannot be earlier than the 7th century B.C. This agrees fairly well with recent archaeological evidence, but does not give an upper limit of date for the Celtic occupation of Central Europe.

Origin of Iron Working.—The legendary home of iron is North-east Asia Minor where the Chalybes (mentioned by Aeschylus in the 6th century B.C.) once had a kind of monopoly; but about 200 miles to the south was Commagene (*ubi ferrum nascitur,* the birthplace of iron), which also has serious claims to priority. Prof. Gowland mentioned two important districts in Western Asia where iron ores are very extensive and remains of early iron manufacture are found; but he preferred the south-east angle of the Black sea (ancient Paphlagonia and Pontus), which includes iron deposits along the slopes and foot-hills of mountains near the coast. At the north-eastern end of this area as well as north of the Caucasus, Ernest Chantre excavated cemeteries which yielded weapons and other iron objects closely allied to the Hallstatt products of Europe.

Though recognizing the prevailing uncertainty as to the beginnings of metallurgy, the late Jacques de Morgan was in favour of an oriental origin for iron, and thought that the art would have reached the Ligurians of Central Europe through some Continental trade-current as well as by way of the Mediterranean. "The Celts and the Dorians must have been the principal propagators of the iron industry . . . it is generally agreed that the Celts came from the east by the valley of the Danube." Apart from striking analogies in weapons and ornaments, in brooches and pottery found in Russian Armenia and the Hallstatt area of Europe, he insisted rather on the introduction of naturalism into the geometric art of the bronze age. Both in South-east Russia and in Persia products of the early Iron Age are characterized by representations of men and animals "of which both technique and style seem to derive entirely from the Geometric." This points to a development in *situ* of a civilization that was destined to spread to the Atlantic, and appeared suddenly in Central Europe as a new and independent creation. It is of interest to note in this connection Prof. J. L. Myres' theory that the Sigynnae, mentioned by Herodotus (v. 9) as living beyond the Danube and north of Thrace, may be identified with Strabo's Siginni of the Caucasus, and possibly the Sequani of the Jura, who extended later to the neighbourhood of Paris. The first two are said to have worn Median costume (trousers, like the Gaulish braccae, breeches), and to have driven shaggy ponies attached to carts. Herodotus adds that the Ligurians called the Sigynnae pedlars; and there is reason to associate a particular form of iron spear like the Gaulish *gaesum* and the Roman *pilum* with these people. Their extensive wanderings might account for its occurrence even in Cyprus, and it may be recalled that the Galates who dominated Gaul in the early iron age had settlements as distant as Galatia in Asia Minor.

Celts and Galates.—A new view of the Galates has been put forward by Dr. Jules Guiart, who distinguishes them from the three recognized human types of Western Europe—(i.) the tall, blond, long-headed (dolichocephalic) Nordics; (ii.) the short, dark, short-headed (brachycephalic) Celts of Central Europe, the Alpine race; and (iii.) the short, dark, long-headed Mediterranean race. In his opinion the Galates (Galatians, Gaulois) were tall, blond and short-headed people who in 1500 B.C. were still roaming over the steppes of South Russia and eventually passed westward to the north of the Hercynian forest (Taunus to Carpathians), settling for a time near the North sea coast west of the Elbe, whence they proceeded to occupy most of the northern half of France in the Hallstatt period, thrusting the native Celtic population almost to Marseilles and the Auvergne (to judge by the physical characteristics of the modern departments). It should be added that Celts and Galates were regarded as distinct peoples by Bertrand, whose arguments were amplified by Piroutet in 1920 (*L'Anthropologie,* xxx., 51). The latter sees in the Marne inhumations in trenches a Galatian population distinct from the true Celts, the latter being responsible for the barrows (grave-mounds, tumuli) over cremated burials in East and North-east France, as well as in South Germany. There is, in his view, no authority for the Celts before the second stage of the Hallstatt period (say 700 B.C.). Their arrival is put much later by Schliz (Hoops, Reallexikon, under Rassenfragen), who regards the Flachgraber (flat-graves, without barrows) of La Tène II. (about 400 B.C.) as the earliest traces of the Celts, who came from Gaul, the chief centre of brachycephaly in Western Europe; but he is careful to add that these Celts represent a blend of blond long-heads (Nordic) and dark short-heads (Alpine), and correspond to the classical description of the Celtic warrior: they are brachycephalic blonds.

Hallstatt Culture.—Whether lineally descended frotn it or not, the Hallstatt culture succeeds the bronze age of Central Europe; and, with Austria and South Germany as a centre, radiates in several directions. Intercourse with the south was by this time active, and there was a close connection with the Bologna area, where early iron age finds are abundant and are grouped under the name of Villanova (*q.v.*) (a suburb of Bologna). The contact with Thrace and the Caucasus is not so clear as with Illyria and the neighbourhood of Venice or with Eastern Germany (the Lausitz or Lusatian area); but it was mainly westward that the new culture spread via Switzerland and the Vosges to Eastern France, and later to the Atlantic coast as well as to Spain and Britain. This last movement is attributed to the Celts, a mobile and a conquering people; but most authorities attribute the Hallstatt culture of Central Europe to the Illyrians, who may have influenced the Germans on the north-east of what has been called the Celtic cradle. Hut-urns (sepulchral vessels of pottery made in the form of contemporary dwellings) are of frequent occurrence in Mecklenburg and near the mouth of the Vistula, and suggest some connection in the 7th century B.C. with Italy, though the type is also found from time to time in widely separated parts of South-eastern Europe, and in Italy (Alba Longa) is hardly later than 900 B.C.

CHRONOLOGY OF THE EARLY IRON AGE

HALLSTATT PERIOD

Celtic Europe			Italy.	Greek Pottery.
Hallstatt A,	1000–800 B.C.	Early Hallstatt, Geometric style.	Hut-urns: Biconical urns. Pit-graves: Early Villanova.	Sub-Mycenaean, 11th and 10th centuries B.C.
Hallstatt B,	800–700 B.C.	Middle Hallstatt, Orientalizing style,	Villanova period, Bologna district.	Geometric, 10th–8th century B.C.
Hallstatt C,	700–600 B.C.		Chamber-tombs, Proto-Etruscan.	Proto-Corinthian, 750–600 B.C. Corinthian, 7th century B.C. Black-figure ware, 6th century B.C.
Hallstatt D,	600–500 B.C.	Late Hallstatt, Early Greek style.	Certosa (Bologna), Etruscan period.	Early red-figure, late 6th century B.C

LA TÈNE PERIOD

Germany.	France.	*Switzerland.*
Reinecke's La Tène A, 5th century B.C.	Dbchelette's La Tène I., 500–300, B.C.	Viollier's La Tène I., 450–250, B.C.
" " " B, 4th century B.C.	" " " II., 300–100, B.C.	" " " II., 250–50, B.C.
" " " C, 3rd and 2nd centuries B.C.	" " " III., 100–1, B.C.	" " " III., Roman period.
" " " D, 1st century B.C.	La Tène IV. (only in Britain), 50 B.C.–A.D. 50.	

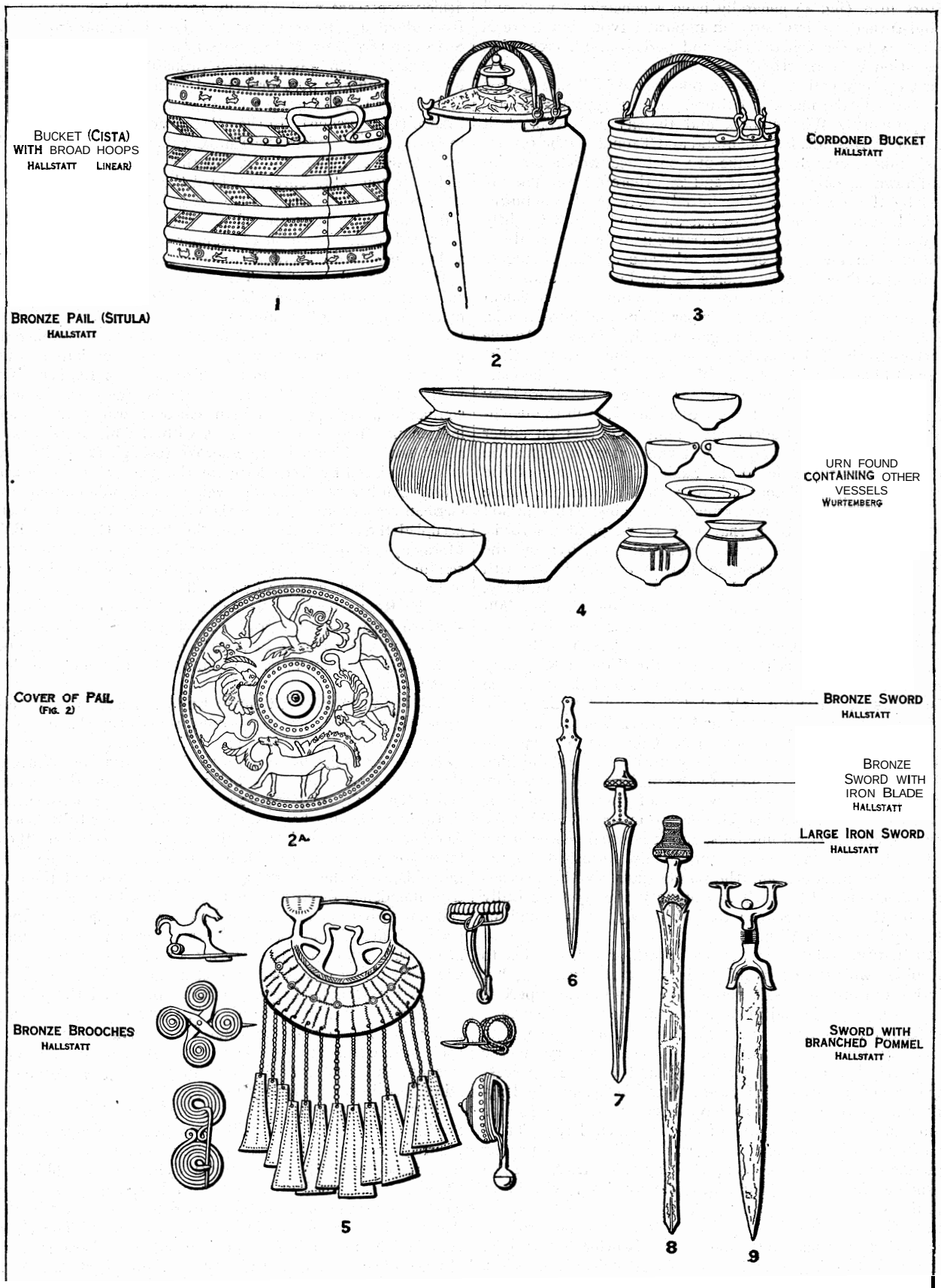
Iron in Italy. — The iron age of Italy forms part of the history of the peninsula, and need only be summarized here in connection with Central Europe. The terramara (*q.v.*) culture, spreading from the lakes to the Apennines, really belongs to the bronze age; but this is attributed by some to the Italici, who were later responsible for the Villanova culture, with their headquarters at Bologna, and are also credited with the foundation of Rome in 753 B.C. Villanova is five miles east of Bologna, and the district contained ancient cemeteries named after their modern proprietors (Benacci and Arnoaldi) and the local Charterhouse (Certosa, one mile west of Bologna). The last dated from the Etruscan conquest (late 6th century), when the name was changed to Felsina, and there was a Gaulish period (under the Boii) before the Romans colonized it in 189 B.C. under the name of Bononia. The Etruscans (immigrants from Asia Minor) first came into contact with the Villanovans about 850 B.C. in Etruria and Latium, where they soon asserted their supremacy, and buried their dead unburnt in oriental style, using in succession the shaft, trench, corridor and chamber; whereas the early Villanovans practised cremation, which gradually gave way to inhumation as at Hallstatt. Their civilization was of a high order, now fully represented at Bologna; and the bronzes at least were largely due to Greek traffic with the Etruscan coast. The pails (situlae) are conical (figs. 2, 2a) with lids and zones embossed with figure subjects representing contemporary life; and they have been regarded as the nearest approach to the shield of Achilles. An orientalizing tendency has been noticed in bronzes and other artistic products of Central Europe dating from the middle Hallstatt period (about 700–600 B.C.), contrasting with the earlier geometric and later classical styles (see HALLSTATT and VILLANOVANS).

Iron **Age** Burials. — In the Hallstatt period inhumation (burial of the dead unburnt) below a tumulus (grave-mound, barrow) was the rule in South Germany and in Eastern Gaul; and in the succeeding period (La Tène I.) the practice continued, with occasional cremation, in districts profoundly affected by the Hallstatt civilization. Old barrows re-used, or newly-constructed mounds of this period are found in Haute Marne, Burgundy, Franche-Comté, South Germany and South-west Bohemia. On the other hand, cemeteries without mounds, containing the unburnt body, are found on the outer fringe, in Gaul and Bohemia; and Déchelette concluded that barrows marked the original Celtic area in Europe, settled ever since the bronze age; whereas the vast cemeteries without mounds, as in Champagne, North Bohemia and Cisalpine Gaul, belonged to conquering tribes who originally came from the Celtic area. Déchelette considered the barrow area and the adjacent right bank of the Rhine as the primitive home of the Celts.

In a recent study of the upper Rhine population who burnt their dead and buried them in cemeteries called urn-fields without surface indications (unlike their bronze age predecessors of the *Hügelgräber,* the Grave-mound or Barrow people), Georg Kraft traces some elements in their pottery and bronze types to the south-east, others to the north-east, others again to the indigenous population that became subject to these invaders. The most likely people seem to be Illyrians moving from east to west, and participating in the great migrations which account for the passage of Thracians, Phrygians and Armenians into Asia Minor via the Bosporus and Dardanelles about 1180 B.C.; the Dorian invasion of Greece about 1100 B.C.; the entry of certain Balkan peoples into Italy, and the western extension of the Lausitz (Lusatian) culture of Eastern Germany. It is still an open question whether the urn-field people were Illyrians or a blend of Illyrians, Celts and other races, but the invasion of South-west Germany at this time is generally accepted, and archaeologically it coincides with the beginnings of the Hallstatt culture, though grave-mounds are still found in the Gündlingen area and period (Hallstatt B).

The urn-fields have yielded an unexpected variety of pottery and bronze, the most typical being urns with cylindrical neck and bulging body, and bronze armlets tapering at both ends, with spiral wire terminals. Schumacher dates the early urn-fields about 1200–1000 B.C. and regards the people as coming into South-west Germany from the south-east, much as the Ribbonware (*Band*-keramik) folk had done centuries before. They spread northward down the Rhine to the Saar and Eifel, and betray in their house-building and burial rites a close connection with the Italici of upper Italy; though this may be explained either by original contiguity or by blood relationship. They were good agriculturists, living in imposing villages established in the most prolific areas. The later urn-fields (about 1000–800 B.C.) mark the opening of the early iron age (Hallstatt A), when the indigenous population was pressed northwards into the mountains and side valleys of the Rhine by invaders provided with a certain amount of iron and addicted to agriculture. The pottery is made without the wheel, and includes urns, bowls and platters apparently copied from metal patterns; of bronze are small cups with handles, long pins with globular heads, brooches made of twisted wire, and sets of pendants designed to jingle (fig. 5).

Hallstatt Period. — The leading authorities on the iron age of Germany allow two centuries of overlap with the bronze age, and begin the second stage about 800 B.C., Gdndlingen near Freiburg (Baden) being the typical site for the 8th century (Hallstatt B). The contemporary swords (figs. 6–8) were either of bronze in imitation of the late bronze age type, with exaggerated chapes (scabbard-ends) of winged form; or of iron, emanatting from Noricum (the modern Styria and Carinthia, with parts of Austria, Bavaria and Salzburg — the chief European centre of the industry) and attaining huge proportions, with a two-edged blade for cutting and a broad point not suitable for thrusting.



FIGS. 1-2 FROM "GUIDE TO THE EARLY IRON AGE ANTIQUITIES" BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

FIGS. 1–9 — ARTICLES OF COMMON USE BELONGING TO THE HALSTATT CULTURE. 1000–800 B.C.

The name Halstatt is generally applied to articles of form and decoration like those found at Halstatt, in Upper Austria, during the excavations made between 1847 and 1864. The period of the Halstatt culture marks the first appearance of the Celts

The pottery urns (fig. 4) generally have a constricted neck and sharply out-turned lip, evidently an imported type; but there is some doubt as to the funeral rite, and perhaps both cremation and inhumation were practised.

The next century (7th B.C.), corresponding to Hallstatt C, saw certain changes in the material culture, and the typical sites are Salem (representing Wiirttemberg and Baden) and Koberstadt (Langen near Darmstadt, for Odenwald and Taunus). The former is about six miles north of the Lake of Constance, which in antiquity was known as *Lacus Venetus* and was therefore presumably controlled by the Venetians. The burials were mostly unburnt, and besides long iron swords there was an abundance of brightly coloured pottery, with panels and zones including geometrical designs, the urns having more open mouths and bulging shoulders than in the preceding century. Some of the burial mounds certainly contained unburnt skeletons. The Giindlingen and Salem groups have been traced across the upper Rhine and into Alsatia, entering France by the Burgundian gate and the Meurthe-Moselle valley; whereas the Koberstadt people kept more to the right bank of the Rhine, crossing later at Worms and Mainz. The Germans then lay to the north and Ligurians to the west, where they are noticed by Herodotus about 450 B.C., at any rate in the neighbourhood of Marseilles. Rademacher points out that on either side of the Rhine between Mainz and Bonn, extending from the Saar to the Fulda and again to the Saale, Celtic graves of the 6th century contained skeletons, whereas further down the Rhine barrows were raised over the cremated remains. This period (Hallstatt D) is marked by a change to short, pointed swords, generally with forked or "horseshoe" pommels (fig. 9); and the scabbard of one well-known example shows a cavalry leader with a sword, but spears only in the hands of troopers and infantry. The helmet, shield and cuirass are almost unknown in the Hallstatt area of Germany though common further east; and it was on their occurrence in such places as Glasinač (a plateau in Bosnia) and in the Homeric poems that the late Sir William Ridgeway chiefly based his theory that the Achaeans were a Hallstatt people from the Danube, but ultimately of Celtic and Nordic origin. Many of the hill-forts in Central and Western Europe are now attributed to the Hallstatt people, who (like the Normans in England) kept down the countries they invaded by establishing fortified posts in strong positions. In the majority of cases they burnt their dead and used cinerary urns of pottery; but it is remarkable that at Hallstatt itself burnt and unburnt burials have been found in almost equal numbers, and it is usual to assign the cremated burials, which are the more richly furnished, to the dominant race of invaders, and the poorer graves with skeletons to their indigenous subjects. The cemetery was systematically excavated by Ramsauer between 1846 and 1863, and the bulk of the finds may be seen in Vienna.

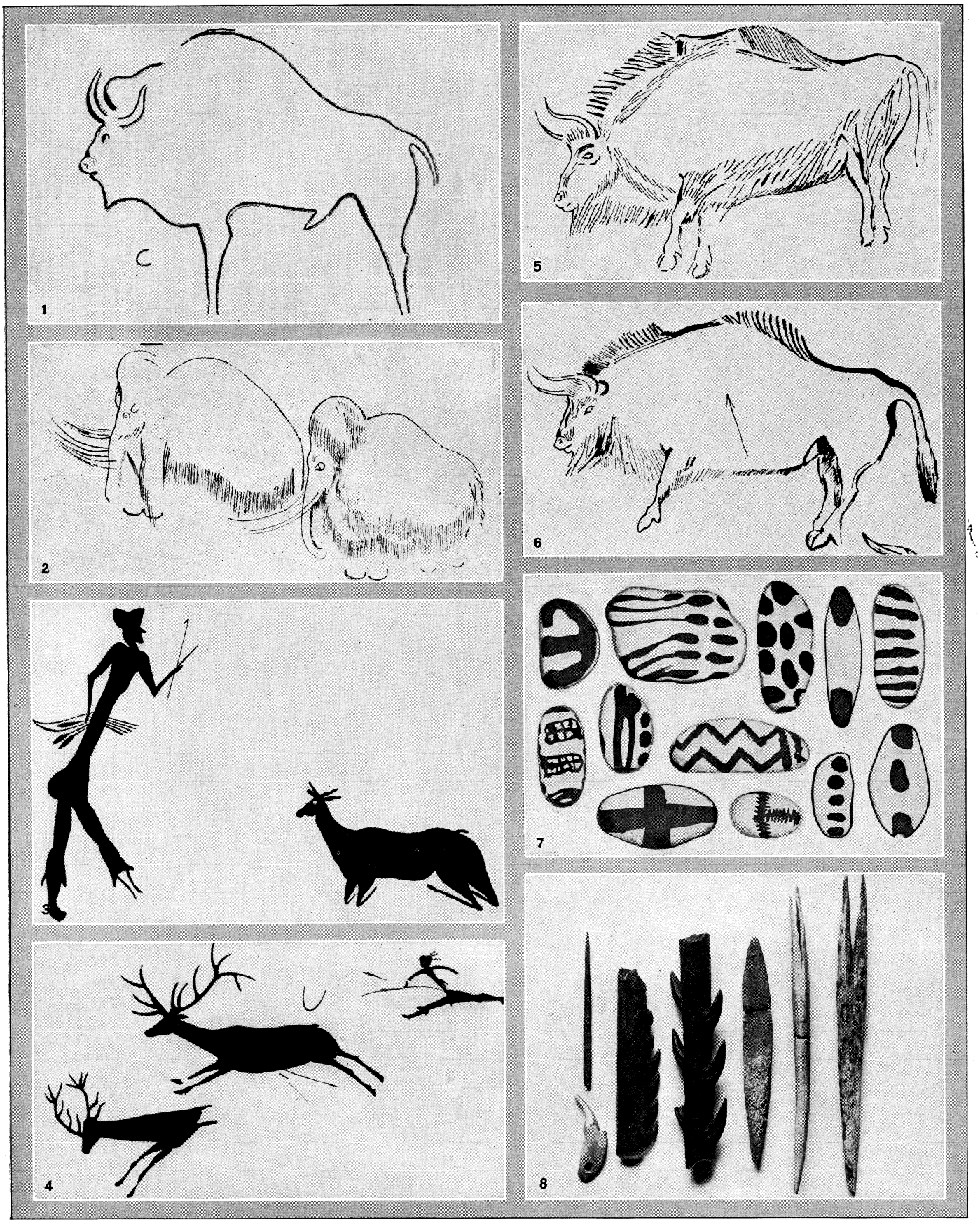
Salt Industry. — The site owed its wealth and distinction to the salt mines which were exploited in the early iron age, but other methods of obtaining salt were practised in the same period. Brine-springs near Halle and in the valley of the Saale (Saxony) and near Marsal in the Seille Valley (Lorraine), for instance, were evaporated by running the liquid over heated pottery of the coarsest description (called briquetage); and a similar process was employed on the coasts of Belgium and Brittany. In England salt mines do not seem to have been worked till Roman times, but the coastal Redhills of Essex which have yielded pottery of the early iron age, may be the debris of a process for extracting salt from sea-water; and Pliny (*Nat. Hist.* xxxi., 7) records such an industry in Gaul and Germany (see also Tacitus, Annals, xiii., 57).

La Tène Culture. — The change in the main armament of the Hallstatt period may have been due to the growing influence of North Italy on the Alpine and sub-Alpine districts, but Greek influence manifests itself in the second half of the early iron age (La Tène period). It is clear that the leading "barbarians" (non-classical peoples) from the 5th century B.C. down to the Roman empire were Celts, or at least spoke a dialect or dialects of the Celtic language; and the new sword pattern may mark the advent or the emergence of the Celts, whose martial and artistic achievements are now generally recognized. The period extends from about 450 to 50 B.C. and derives its name from a famous Swiss site (La Tène, the Shallows) (*q.v.*) at the east end of Lake Neuchâtel, which was occupied probably between 250 and 100 B.C. as a military post or arsenal; but the richest and earliest finds of this Celtic culture are on the middle Rhine and in Eastern France (Champagne). In the 6th century these people are known to have been settled in the Rhone valley and round the lakes of Switzerland and North Italy, but their earlier home is unknown, and their conquests unrecorded till the sack of Rome in 390 B.C. A plausible view is that they were Nordic warriors from the Baltic, marching in command of Alpine soldiery through Europe from end to end in search of plunder, rich lands to settle on, and a share in the luxuries of Mediterranean life.

In the first phase of La Tène culture (La Tène I.) burials on either side of the upper Rhine were richly furnished, but those of La Tène II. are less pretentious, and cemeteries of flat or surface graves (Flachgraber) came into fashion, containing the unburnt body, though there were numerous exceptions to this rule. The spread of cremation in the third phase of La Tène is attributed to the growing influence and the southern extension of the Germanic peoples of Northern Europe, where cremation was indigenous. This is in agreement with the historical record, for about 100 B.C. Teutonic tribes broke through the Celtic frontier, which is placed by Déchelette for the 3rd and 4th centuries B.C. a little south-west of Leipzig (where Celtic inhumations met the German cremations). Before the German advance, the Celts had occupied the middle Rhine and South-west Germany, Bohemia, Moravia, part of Silesia and lower Austria, not to mention successful expeditions to Italy, Greece and Asia Minor. In the period of La Tène, trade was almost as well organized as in Roman times, and the Rhone became the principal highway of commerce for Western Europe, Greek products being distributed through Marseilles and the colonies in North-eastern Spain, in competition with Northern Italy which had enjoyed a monopoly in the Hallstatt period.

Celtic Coinage. — In Central European unburnt burials of La Tène II. and III. are sometimes found cup-shaped pieces of electrum (gold with silver) called "little rainbow dishes" (Regenbogenschiisselchen), mostly in Bavaria and Wiirttemberg, the German name probably being derived from the superstitious belief that they may be found where the rainbow meets the earth, many having been washed out of the earth by heavy rain. Another explanation is that the device on some of them was taken for a rainbow, though it is more like the rising sun. Any resemblance to the original types was soon lost, but the comparative abundance of money in Gaul points to considerable trade and intertribal communication before the conquest of the country by Julius Caesar (50 B.C.). In the south silver copies were made, with more or less dexterity, of coins struck at Marseilles and other Greek colonies on the coast or in North-eastern Spain; and on the Danube Celtic moneyers preferred the silver stater of Philip II. of Macedon to his gold stater (fig. 14), which served as a model in the centre and north of France as in Britain. The gold stater was a little heavier than the British sovereign or pound sterling; and Gaulish copies were subject to progressive deterioration both in weight and artistic merit.

Iron Age in Spain. — The oldest historical inhabitants of the Spanish peninsula were the Iberians, but there is a possibility of Ligurians in the north about 500 B.C., and Herodotus (484–425, B.C.) records that the westernmost Celts were neighbours of the Cynetes, who inhabited the south of Portugal. This agrees well enough with the archaeological evidence of a Celtic invasion, flanking the Pyrenees, early in the 6th century. The Celtiberian name testifies to a mixed population, and there is a marked absence of any early Hallstatt types, the earliest swords, for example, being derivatives of the type with horse-shoe (antennae) pommel (fig. 9). Cremation was the funeral rite among the Celtic invaders, who reached the middle course of the Tagus and Guadiana; and the Hsllstatt pottery in their graves is not associated with Greek wares, the influence of the Greek settlements on the coast (Rhoda, Emporiae) not being felt till the



BY COURTESY OF (1, 2) H. BREUIL, (4) THE HISPANIC SOCIETY OF AMERICA, FROM OBERMAIER, "FOSSIL MAN IN SPAIN" (OXFORD UNIVERSITY PRESS), (5, 6) MASSON AND COMPANY, FROM "L'ANTHROPOLOGIE," 1912, (7) MASSON AND COMPANY AND THE HISPANIC SOCIETY OF AMERICA, FROM PIETTE, "LES GALETS COLORIES DU MAS D'AZIL" IN "L'ANTHROPOLOGIE"

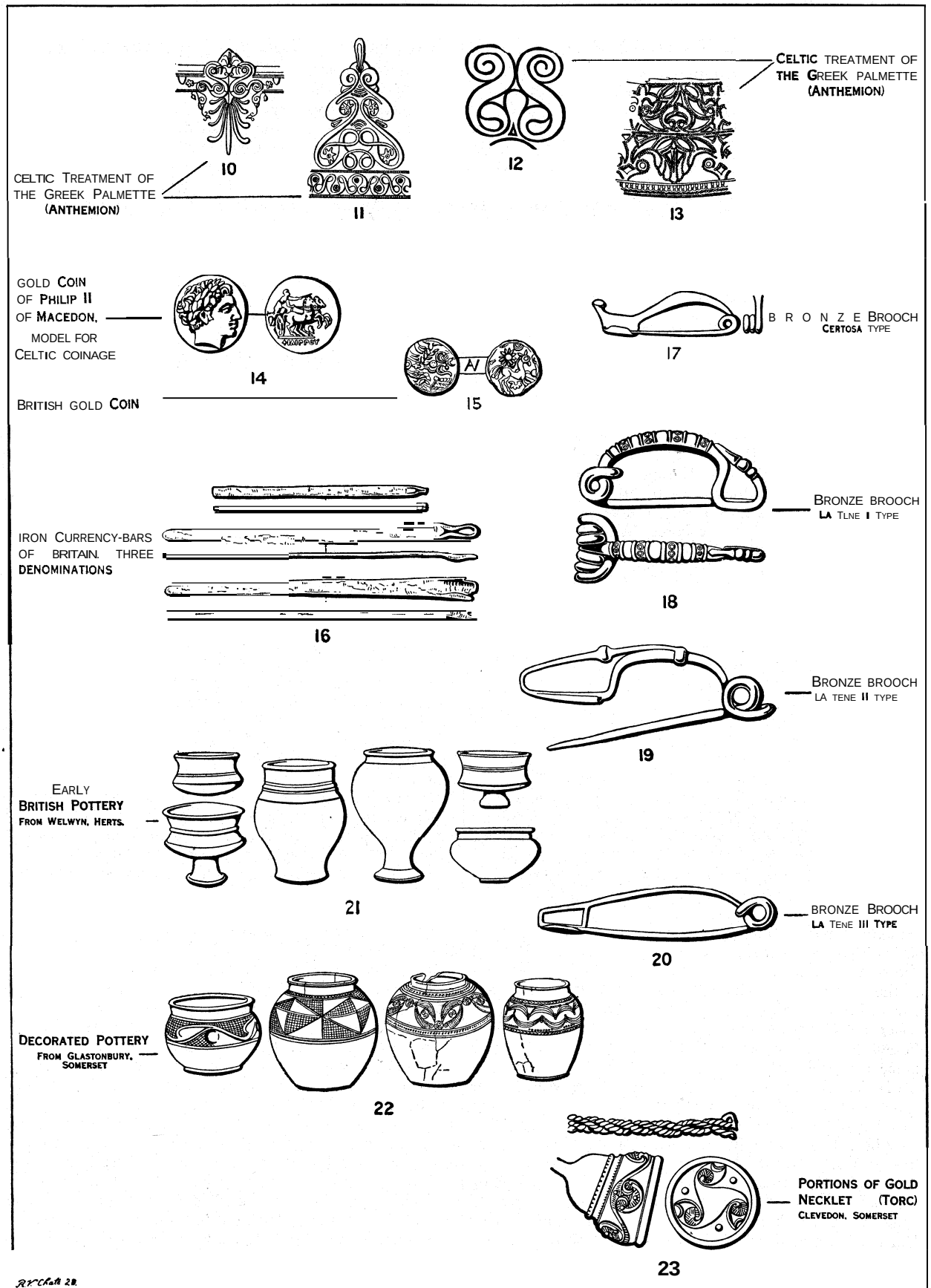
PALAEOLITHIC ART AND HANDICRAFT

1. Engraved bison, from La **Grèze,** near Les Eyzies, Dordogne, France (Aurignacian). 2. Palaeolithic paintings of mammoths, from Font-de-**Gaume** near Les Eyzies, Dordogne (Upper **Magdalenian).** 3. Palaeolithic drawing of hunter and chamois, from **Tortosilla,** Spain (after Breuil). 4. The Stag Hunt, Valltorta, **Castellón,** Spain. 5, 6. Two bisons from Niaux, **Ariège,** France, painted in black (after Breuil). 7. Painted pebbles from Mas **d'Azil,** France. 8. Stone age handicraft: (left to right) **(1) upper,** eyed needle, lower, pierced tooth used as ornament, (2) Single barbed harpoon, (3) Double barbed harpoon. (4) Lance point. **(5)** Split bone point, **(6)** Forked base bone point. **Magdalenian** Age except **(5)** Aurignacian

(2, 3) BY COURTESY OF THE CONTROLLER OF H.M. STATIONERY OFFICE

AERIAL SURVEYS OF ARCHAEOLOGICAL RESEARCH

1. A hilltop camp about 300 feet above the surrounding country on Hambledon Hill, Dorset, England
2. Celtic fields on Windmill Hill, near Crawley, Hampshire, England; the plan of the enclosures is visible beneath the modern cultivation
3. Mediaeval strip-cultivation on Middle Hill, near Norton Bavant, Wilts. The old English strip-system was introduced by the Saxons



FROM "GUIDE TO THE EARLY IRON AGE ANTIQUITIES," BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

FIGS. 10–23. — ARTICLES OF COMMON USE BELONGING TO THE LA TÈNE CULTURE, 450–50 B.C.

The "La Tène" culture derives its name from a famous Swiss site at the east end of Lake Neuchâtel. It covers the second half of the early Bronze Age, and shows Greek influence on this early Celtic Culture

period of La Tène, when the cultural development ran parallel to that of Gaul, but produced some peculiar local forms, especially brooches and weapons. Coinage began in the 3rd century B.C., Greek and Sicilian types being imitated, but the Carthaginians supervened (232–219); and the Roman conquest, which culminated in the fall of Numantia (133 B.C.), may be considered the end of the Early Iron Age in the peninsula.

Austria and Germany.—The occurrence of a few brooches (fig. 17) of Certosa type (named after the Charterhouse outside Bologna) gives a limiting date for the Hallstatt cemetery and period, the site being within 40m. of Noreia, which gave its name to Noricum and is generally considered one of the earliest centres of iron-working in Europe. In Austria generally the bronze age culture gradually gave way to iron, and in late Hallstatt times there was a local revival in bronze-working, no doubt stimulated by trade with Northern Italy. Nearly all the local burials of that date were under grave-mounds (*tumuli*), and the dead were cremated. In the succeeding period (La Tène) the polychrome pottery characteristic of the Hallstatt period disappears and gives place to wheel-made ware, the first proof of the potter's wheel in this area. The embossed bronzes show an orientalizing tendency, and scrolls and palmettes indicate contact with Greek civilization. Italian influence did not, however, cease till the next stage (La Tène B), when the country became predominantly Celtic, and dependent on Western Europe. The Celts had extended their control to the Alpine area before they were finally incorporated in Roman provinces during the reign of Augustus. In the north-east they spread to Silesia and Western Galicia, and brought the culture of La Tène to East Germany and Poland, where Hallstatt survivals have been recognized but where the new civilization was firmly established only towards the end of the 2nd century B.C. Iron was then copiously used for weapons and ornaments; and while cremation with cinerary urns was common in the south, the northern tribes (perhaps the original Burgundians) buried all that remained of the funeral pyre without urns (Brandgrubengriiber), a custom that may have spread from the island of Bornholm.

Denmark and Sweden.—In the absence of a purely Roman period, the early iron age of Denmark runs on till the Migration period (5th century A.D.), and the date of its commencement falls in the 4th century B.C. when La Tène elements reached the Cimbric peninsula (Jutland). This phase is best represented in the moor (peat-bed) finds of Nydam and Thorsbjerg, including boats and iron weapons which were the predecessors of those brought to Britain by the Anglo-Saxons. Bronze swords of Hallstatt type found in Denmark cannot be taken as proof of a local iron age before La Tène, as Jutland was at one end of the amber trade-route across Europe and naturally received a larger share of southern metal-work in exchange for the amber of its coasts during the last centuries of its bronze age. Sweden, at least in the south, was at much the same stage of culture as Denmark, but the island of Gotland in the Baltic, as a trading centre, seems to have been somewhat in advance of the mainland.

Iron Age in Norway.—Physical and economic conditions were different in Norway, where the bronze age is little more than a name and the early iron age is comparatively late. Indeed there is little of the iron age till some of the best Roman products were introduced about A.D. 100 though it is generally assumed that Montelius' classification holds good. Another line has recently been taken by A. W. Brøgger of Oslo, who contends that in the pre-Roman period Norway had no bronze or iron for industrial or domestic purposes, and only became independent of foreign supplies about A.D. 350 when the Roman period elsewhere was drawing to a close, there being no period of Roman occupation in Norway, though the term is conveniently borrowed. According to this theory the stone age only came to an end with the general use of the iron axe, which enabled the population to clear the woodlands and bring something more than a coastal strip under cultivation. This was a turning-point as important as the introduction of domestic animals and agriculture; and after some tribal movements occasioned by the great migrations of the 4th and 5th centuries, the country entered on its later iron age, culminating in the splendid achievements and barbaric luxury of the Vikings. It is remarkable that there is hardly a trace of Celtic civilization in Norway—none of the characteristic weapons or artistic creations which were distributed over large areas of Europe in the last two or three centuries before Christ. Though cunning workers in metal themselves, the Celtic tribes, who were warriors first and last, did not communicate the craft to the Germans of the Continent or the related tribes of the Scandinavian peninsula. Norway owed its knowledge of iron and its first supply of weapons to the Romans, whose nearest depôts were on the western frontier of Germany; but soon learnt the method of reducing its native ores, and with home-made implements turned eagerly to boat-building, an art which contributed largely to local prosperity in the Viking period.

Britain.—In the second half of the bronze age it was the custom in Britain to burn the dead and erect funeral mounds of circular form (round barrows) over the ashes, with or without cinerary urns. Cemeteries of cremated remains in or under urns, without any superficial indications (urn-fields), have also been found, presumably late in the bronze age, though here and there containing objects of iron; and this association has led O. G. S. Crawford to attribute these graves to Celtic invaders, preferably of Goidelic (Gaelic) language and armed with the leaf-shaped sword of bronze (Antiquaries Journal, ii., 27). It should, however, be pointed out that according to philologists there are no traces of a Goidelic occupation of England, and the Gael only reached Scotland in the 5th century A.D. The very scarcity of iron objects in these urn-fields suggests their inclusion in the bronze age, as an iron age cannot be said to begin till the metal has passed into common use and is no longer an article of luxury. The varieties of the leaf-shaped sword referred to do not include the specific Hallstatt bronze sword, which has a spade-shaped prolongation of the hilt for a heavy pommel; and it is the latter type which characterizes the earliest Hallstatt phase abroad as well as in England: the inference is that other types are of the pure bronze age. All have been illustrated by Harold J. E. Peake who suspects that pottery with finger-tip ornament on raised bands was earlier than the bronze swords of Hallstatt type, and therefore contemporary with swords of the recognized bronze age patterns. Both pottery and swords represent in his opinion an earlier invasion from the Continent; and the Hallstatt type of bronze sword was brought by people retreating before the sword of iron. In support of this he points out that the Sequani (dwellers on the Sequana, Seine), who belonged to the Q Celts (Goidelic), had bronze swords and were not disturbed by wielders of the iron weapon, who apparently spoke a Brythonic language (P Celts). He sees a corresponding association of sword-pattern and dialect in Italy.

Hallstatt Period in Britain.—Till quite recently Britain has been denied a Hallstatt period, though in 1906 various Italian and Hallstatt types of brooches in the country were interpreted to mean at least commercial relations with Central Europe, and the argument was strengthened by the discovery of a cordoned bucket like fig. 3 (made in North Italy) at Brooklands, Surrey, in the following year. Brooches of La Tène I. type are common in certain parts of England (especially Wiltshire and neighbouring counties), and that stage has been generally recognized as the beginning of the British iron age, but recent discoveries tend to demonstrate not only trade but occupation by people of Hallstatt culture. Though most of the leaf-shaped swords must be referred to the bronze age, a few of the peculiar Hallstatt type have been found, and pottery is still better evidence of a new wave of population, for some distorted fragments found with a kiln at Eastbourne are not only of Hallstatt ware but were evidently made on the spot, as wasters would not be imported. Earlier discoveries at Hengistbury Head, Hampshire, included fragments attributed to the same period but not so easily recognizable; and these have been followed by a large number of typical fragments at All Cannings Farm near Devizes (Wiltshire), Scarborough (Yorkshire) and Park Brow near Worthing (Sussex). From these associations it may be possible to assign certain burials without mounds, in cinerary urns of cylindrical

form with finger-nail impressions. to the first part of the early iron age, though it is not clear at what stage of the Hallstatt period these newcomers arrived, as the finds are at present few and sporadic. Unburnt burials of early La Tkne date have been found (some with chariots) in Yorkshire, but more familiar are the urn-fields with cinerary urns of the pedestal type in South-eastern England (as at Aylesford and Swarling in Kent, Welwyn in Hertfordshire, and on several sites in Essex).

The artistic productions of this early iron age in Britain (as figs. 21–23) were at their best in the period between the invasions of Julius Caesar and the conquest under Claudius (roughly 50 B.C.–A.D. 50, known as La Tkne IV.); but the subject is discussed elsewhere (under La Tkne), and the examples given in the plate must here suffice. The coinage (fig. 1j) was at first borrowed from Gaul, and later struck by the local tribes at Colchester, St. Albans, Silchester and other centres, the first inscriptions being in Roman characters. There had, however, been a currency here before coins were introduced, and in 1905 the iron bars adjusted to a certain weight standard, as Caesar relates, were recognized in a number of flat blades with roughly shaped handles (fig. 16) found chiefly in British earth-works and evidently conforming to a standard of 4,770 grains (309.7 grammes or about 11oz. avoirdupois), no less than six denominations (fractions or multiples) being now recorded. They are almost confined to a square with its angles at Leominster, Northampton, Bridport and Portsmouth.

Ireland.— There are undoubted Hallstatt types in Ireland. E. C. R. Armstrong enumerated two dozen bronze swords with trapezium (or spade-shaped) pommels, one iron sword, seven winged chapes (end of sword-scabbards), seven pails (situlae) and other objects which, however, do not include bronze razors, cordoned buckets, swords with horse-shoe pommels (late Hallstatt), swan-necked pins or coloured pottery; but further excavation may fill some or all of these gaps, and the succeeding period of La Tkne is better represented, though mostly in its later phases. The ancient Irish population seems to have consisted of two main types: a short, dark, long-headed group of Mediterranean affinities (locally pre-Celtic), and a tall, fair, long-headed people of Nordic type, reprtsenting a Celtic invasion a few centuries before Christ. The earliest traces of La Tène culture date about 300 B.c., and burials of the period seem to have been after cremation. Ireland is comparatively rich in stone monuments of La Tène character, from Turoe (Galway), Castlestrang (Roscommon) and Mullaghmast (Kildare); but on the other hand there are no coins or even a bar-currency of the period in the country. The artistic tendencies of the Celt may be seen in the local treatment of the brooch, sword-scabbards and enamel work, but only a few specimens can be dated by comparison with Continental types, and it was in Ireland that the Celtic artist took refuge and maintained the traditional style uninfluenced by the Roman empire which included the rest of Western Europe.

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4. AIR SURVEY

Long before aeroplanes were invented it was confidently hoped that vertical photographs would some day be taken, and it was felt certain that, if so, they would greatly assist archaeology. Maj. Elsdale was the pioneer of air-photography in the British army. Between about 1880 and 1887 he carried out many experiments from free balloons; but ballooning was not much in favour then and, although some progress was made, he received little or no official support in his experiments. During several years preceding the World War, Henry S. Wellcome successfully used large box-kites, with specially devised automatic control cameras, for photographing his archaeological sites and excavations in the upper Nile regions of the Anglo-Egyptian Sudan.

During the World War, when aeroplane photographs first became common, it was expected that archaeological features would be observed; but in the British sector in France none were seen. The photographs were often taken at a great height, over country which is archaeologically barren, or which was too rankly overgrown to show results. Only on other fronts was time found for archaeology in the air. Col. Beazeley observed and photographed in 'Iraq, in 1917, cities whose ruins were unintelligible on the ground. On an air-photograph these ruins were seen as an orderly arrangement of streets and houses. This definitely proved that air-photography could add to kno ledge, and that it would be an invaluable aid to excavation. To Col. Beazeley, therefore, is due the credit for the first actual application of aeroplane photography to archaeology.

The birth of the new study in England, however, dates from 1922 when Air Commodore Clark Hall observed certain curious marks on R.A.F. air-photos taken in Hampshire. With him must be mentioned Flight-lieut. Haslam, who took a number of photographs near Winchester showing what turned out to be prehistoric fields. Air Commodore Clark Hall showed these photographs to Dr. Williams-Freeman and O. G. S. Crawford, archaeology officer of the Ordnance Survey, who saw that their expectations were fulfilled, and even surpassed, by what was revealed. It was possible from these photographs to make a map of the prehistoric field-system near Winchester. Popular interest was first aroused by O. G. S. Crawford's discovery and publication of negatives showing, for the first time, the complete course of the Stonehenge avenue (eastern branch). The photographs were taken in the dry year of 1921 by the Old Sarum squadron; but their archaeological importance was not recognized until two years later, in 1923. The most important archaeological air-photographs obtained are those taken during 1924 by O. G. S. Crawford and Alexander Keiller. An aeroplane was specially hired, and about 300 photographs of archaeological sites were taken.

Outside England little has been done except in 'Iraq, Palestine, Transjordan and Egypt. In Palestine many sites have been photographed by the Royal Air Force, at the suggestion of the Department of Antiquities. A photograph of Masada on the Dead sea is described in Antiquity. Remarkable remains were revealed in the Amman region (Transjordan) by R.A.F. air-photographs. These show an elaborate system of stone walls and enclosures designed probably for the rapid herding of animals when threatened by a raiding party. A preliminary report on these was published by Flight-lieut. P. E. Maitland in 1927; further results have been obtained in the same area by Group-captain L. W. B. Rees, V.C. In Egypt valuable archaeological results were secured as a by-product of the third Nile aerial survey (1922). Oblique photographs have been taken of Numantia in Spain, but obliques are always inferior to verticals in archaeological value.

It is usually imagined that the camera, when fixed in an aeroplane, records marks on the ground which are invisible to the eye of an observer. That is not so. The observer can see these marks more plainly than the camera records them, for he sees them in colour. The most remarkable discoveries that have been made are due to plants, which are sensitive to slight differences of soil and moisture. For example, if a ditch has been dug on a chalk down and the down has afterwards been ploughed flat and sown with corn, for ever afterwards the subsoil filling (or silt) of that ditch differs from the adjacent never-disturbed soil. Nothing can ever restore chalk once dug to its former state. Archaeologists have long known this, for one of the principal needs in excavation is to distinguish between disturbed and undisturbed soil. But one cannot dig up a whole field or several fields to find a ditch which, after all, may not exist. Here it is that a vertical view helps; for the effect of this moister and more fertile silt upon a crop of corn is to promote its growth and deepen its colour. Thus from above one sees, and can photograph, a belt of darker green corn following the line of the vanished ditch. These lines are sometimes visible on the ground, from across a valley, or even at closer quarters. Sometimes (as in parts of the Stonehenge avenue) they are quite invisible. But always, when more than a single ditch is concerned, the distant view is necessary to convert chaos into order. The reason for this necessity can best be explained by means of a comparison. If one looks through a magnifying-glass at a half-tone illustration made through a coarse screen, it ceases to be seen as a picture and becomes a meaningless maze of blurred dots. If one holds it some distance off and looks at it with the naked eye it becomes a picture again. The observer on the ground is like the user of the magnifying-glass; the observer (or camera) in the air resembles him who looks at the picture from a distance. *(See* SURVEYING.)

The majority of British prehistoric sites, and many later ones, were a maze of ditches and pits, dug for drainage, storage, habitation, defence or boundary purposes. Many still exist on the downs, undisturbed and turf covered; many more have been flattened by cultivation. All of the latter can be re-discovered by air-photography, provided only that the arable has not been allowed to revert to grass. Even then traces of the ditches are sometimes visible, especially on poor soils and in dry summers, by a belt of darker green. Air observation, however, is most fruitful when young crops are growing; then discovery is easy and rapid, and every flight is productive. Such sites may afterwards be seen to exist by an observer on the ground; but few of them could ever have been discovered except from the air. Chalk is not the only soil that produces these streak-sites; they have been observed on oolitic limestone near Bath and gravel near Exbury.

Other factors enable air-photography to record ancient sites. Prehistoric cultivation-banks are revealed because they either throw slight shadows or because when ploughed they appear as belts of lighter soil, from the chalk grains mixed with them *(see* plate). From photographs the prehistoric field-system of a district can be accurately mapped. Again, rabbits work in the looser silt or filled-up ditches (as well as in the soil of the lynchets), and if there are many rabbits a white line, or row of white patches, is visible from the air. Daisies and poppies grow from choice above these ditches, and barrows and hill-top camps have thus been revealed by white and scarlet circles. Lastly, the low shadows at sunrise and sunset etch the slopes of low banks in deep black. That is the time to photograph lynchets. On a June morning before breakfast the greater part of Salisbury plain is seen to be covered with the banks of abandoned Celtic fields; but afterwards they "fade into the common light of day." The great ramparts of hill-top camps throw a shadow even at mid-day, but are best photographed when the sun is low, for then not only do the ramparts stand out best, but also the banks and pits of the habitations within.

Hambledon Hill, Dorset, England (see fig. 1 on plate), one of the finest hill-top camps, is on an isolated hill about 300ft. above the surrounding country. The entrance of the camp is protected by a hook-like prolongation of an outer rampart; from it led a pathway within the camp, passing between oblong and circular pits, the site of huts. Those, especially in the middle portion of the camp, are very clearly seen, and beside them is a long barrow, far older of course than the camp, which was probably made in the early iron age. Across the narrow ridge connecting the hill of the camp with the next hill, was built a formidable double scarp-to-scarp rampart; and beyond this can be seen the faint outline of a probably older camp (only partially included). The hill must have been permanently inhabited. A scattered flock of sheep in the inner portion of the camp will give some idea of the scale of the photograph.

Oakley Down, Dorset, England, another noted site, is between Salisbury and Blandford, on chalk soil now covered with turf. The principal features are: (1) The raised causeway of the Roman road running diagonally across the district; (2) a group of round barrows, or burial mounds of the early bronze age, older than the Roman road, which cuts its way through two disc-barrows; (3) a network of Celtic fields, particularly noticeable in one corner of the photograph. In the valley below is the remains of a contemporary pond (very large, but now dry), and there are signs of Celtic ploughing on both sides of the Roman road.

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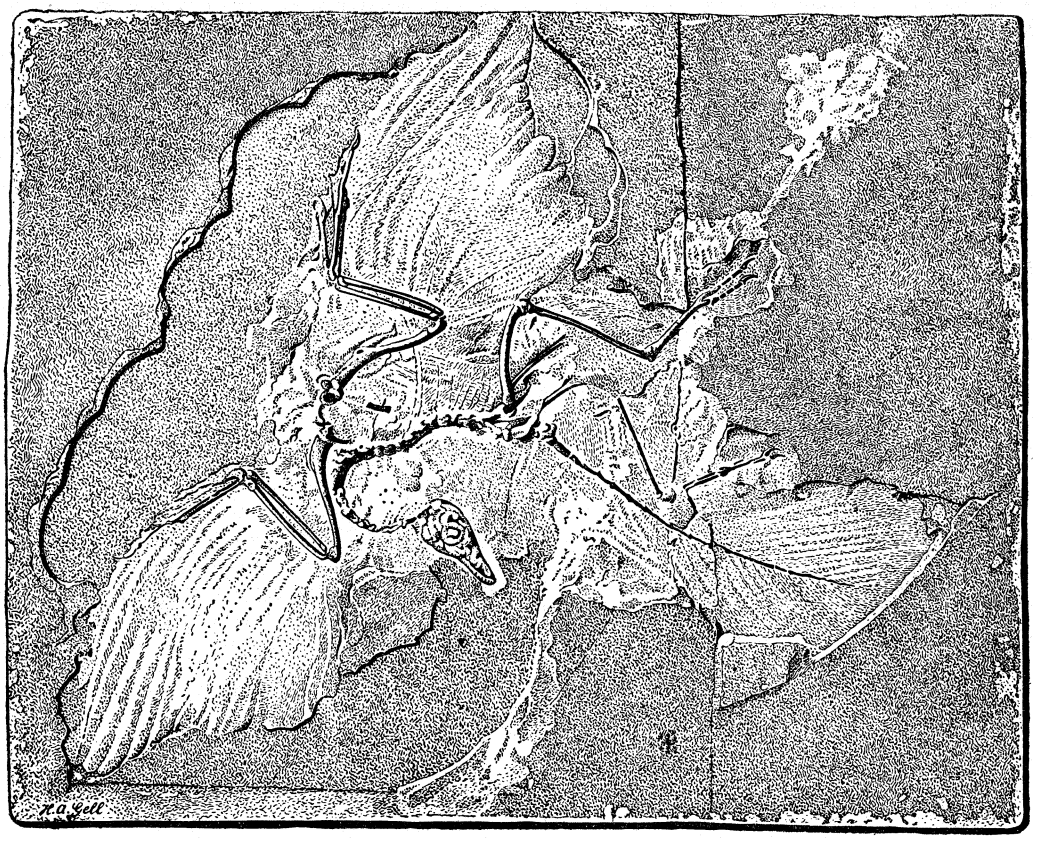
ARCHAEOPTERYX. The discovery of the impression of a feather in the lithographic limestone of Solenhofen, Bavaria, has enabled us to trace back the descent of birds of Jurassic times; though it afforded no clue as to the type of bird to which it belonged. This feather was named *Archaeopteryx lithographica,* by Hermann von Meyer, so far back as 1861. Later in the same year, and from the same quarry, a very imperfect skeleton was found, together with the "flight-feathers" of the wings and the feathers of the tail. These remains, it is of importance to notice, were those of a "perching-bird," though of a vastly more primitive type than any now existing. This specimen is now in the British Museum of Natural History, and was described by Owen under the name *Archaeopteryx macroura.*

In 1872 a second and nearly perfect specimen was found—again in the same quarry—and is now in the Berlin Museum. That it represents a distinct species of the genus *Archaeopteryx* is generally admitted. The adjoining text-cut (fig. 1) seems to justify the assumption that it fell to the bottom of some shallow lake, and was slowly covered with a deposit of fine mud, so that the bones, after the disintegration of the flesh, remained undisturbed. The interest and importance of these two specimens cannot easily be exaggerated. They have formed the theme of endless discussion by men of science; though from a lack of familiarity with avian anatomy the conclusions at which they have arrived are sometimes surprising.

That birds and reptiles are derivatives from the same common stock is convincingly demonstrated in the structure of living birds; but in *Arclzaeopteryx* we find what the evolutionist would



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

FIG. 1.—THE ARCHAEOPTERYX, THE EARLIEST OF KNOWN BIRDS. AFTER A CAST OF THE ORIGINAL IN THE BERLIN MUSEUM
Skeletal remains show that the Archaeopteryx forms a deflnita link between reptiles and birds

expect: stages in the transformation from reptile to bird, to be seen in modern birds only during embryonic and early post-embryonic life. The jaws were armed with teeth, as were those of *Ichthyornis* and *Hesperornis* of the later Cretaceous epoch. These teeth are reptilian heritages. The tail furnishes still more important evidence. In *Archaeopteryx*, as in the reptiles, this was formed of a long chain of vertebrae. The last 12 bore each a pair of stiff-shafted feathers, shown in fig. 2, directed backwards and outwards. In modern birds the tail-feathers, precisely similar in character, are arranged fan-wise, and fixed by their bases to a median lamina of bone, the "pygostyle." When this lamina is examined in the embryo it is found to be composed of a number of separate elements, answering to from six to seven originally separate vertebrae. In other words, the tail of modern birds has been derived by a process of "telescoping" the vertebrae, so that the pairs of feathers they originally supported have come to lie within a semicircle embracing what is now a "pygostyle," but what was once a number of vertebrae in linear series, as seen in fig. 2.

The wing is no less remarkable in this connection. In its essential features it agrees with the late embryonic and early post-embryonic stages of living birds. Thus, in modern birds the three metacarpal bones, answering to the bones of the palm of the hand, can be separated only during the early stages of development. In *Archaeopteryx* they never became welded together. In living birds the first and sometimes the second digit may terminate in a claw, but the third digit has been found to possess a claw only in one or two cases of embryos of the ostrich. The distal, or second row of wrist-bones in *Archaeopteryx* were welded together to form a semi-circular nodule of bone closely applied to the bases of the metacarpals. In modern birds a precisely similar welding together of the wrist-bones is found, but very early in post-embryonic life, and sometimes before, the fused mass comes to form one common bony tissue with the metacarpals. That the wing of *Archaeopteryx* was evolved *pari passu* with the feathers in response to the movements peculiar to the requirements of flight scarcely admits of doubt; though quite different functions have been claimed for it. The problem of the evolution of the skeleton of the wing cannot be divorced from the study of the indubitable "flight-feathers" which it supported. These, as in living birds, are divisible into the outermost, or "primaries," borne by the hand, and the "secondaries," borne by the fore-arm. They are as sharply defined as in modern birds, and this could not have come about save as a response to the same stimuli. In other words, they have the same form and arrangement because they served the same function. In one particular the wing of *Archaeopteryx* seems to differ from that of living birds, and this has proved a stumbling-block to many who have discussed this theme after no more than a very desultory survey of the facts. This differencelies in the fact that the second and third digits projected beyond the outermost primaries and terminated each in a claw—a condition that has been interpreted to show that the wing was used rather for climbing than as an organ of flight. We have a parallel in the wing of the nestling Hoatzin, and also in the wings of nestling Gallinaceous birds. In the Hoatzin the thumb and first finger, which is very long, are armed with claws which enable the wing to be used for climbing along the branches supporting the nest. Soon the "flight-feathers" of the hand begin to grow, but the development of the outermost primaries is inhibited till the inner feathers have provided a wing-surface sufficient to break the force of a fall. Not till then do the outer primaries make their appearance, and at the same time the claw at the tip of the second digit disappears, while by

changes in the rate of growth the hand becomes greatly shortened relatively to the fore-arm. The condition of the wing at the time of the inhibition of the primaries answers to the adult condition of the wing of *Archaeopteryx,* and suggests that the projecting'second and third digits, and their claws, were used as climbing-hooks during the annual moult when all the quills were shed at once, as in the *Anatidae,* for example, to-day.

The shoulder-girdle of *Archaeopteryx* is very "reptilian," especially in regard to the coracoid—the shaft projecting from the

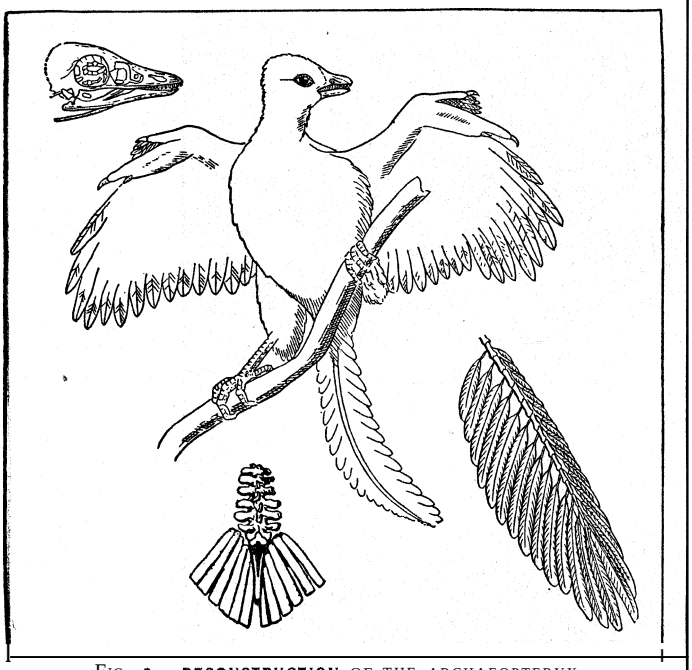


FIG. 2.—RECONSTRUCTION OF THE ARCHAEOPTERYX
The outstanding features are the long reptilian tail and the teeth, 13 in the upper jaw and 3 in the lower, all in distinct sockets. The Archaeopteryx was about the size of a rook

sternum for the support of the wing. Of the sternum we know nothing. The absence of a median keel to the sternal plate has been postulated on what is, at present, mere guesswork. The pelvis, though emphatically avian in type, presents many peculiar and interesting features. Of these one of the most striking is seen in the pubes, which met towards their hinder ends to form an elongated, triangular plate; restorations which have been made of the pelvic-girdle have left out of account the probable cartilaginous areas of the hinder border of the ilium and ischium, seen in the late embryonic and early post-embryonic pelves of modern birds. When these are added, a much more familiar look is given to the whole structure. The foot of *Archaeopteryx* is profoundly interesting, since, had it alone been found, it would have been regarded as that of a small Corvine bird. This means that it had already become transformed into the typical "Passerine" type of foot adapted both for perching and walking.

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ARCHAISM, an old-fashioned usage, or the deliberate employment of an out-of-date and ancient mode of expression. Examples will be found in English in the forgeries of Chatterton and in the prose romances of William Morris.

ARCHANGEL. (1.) A nonautonomous region of the Russian S.E.S.R., decidedly smaller than the former Archangel province. Its boundaries are, north, the White sea; east, the autonomous Komi (Zyrian) area; south, the Vologda nonautonomous region, and west, the Karelian A.S.S R The area is 450,770 square kilometers. The province is divided into the following districts: —Archangel, Mezensk (the pop. of the town of Mezen is 70% greater in summer than in winter), Onega. Petchora, Shenkursky, the islands of the Arctic ocean (Novaya Zemlya, Vaigach, Kolguev, Franz Josef Land). The climate is severe. the Kanin peninsula and the Timan coast area lying in the Arctic zone. Archangel gulf freezes at the end of October on the average of 140 days, and the port of Archangel is blocked for 190 days, though the Gulf Stream influence is sufficiently felt to make the winter no more severe than that of Onega bay 200 mi. south. The heaviest precipitation is in autumn. At Archangel, the average rainfall is 15·3in.; January temperature 7·3°F., July 60·4F. In the north the land remains frozen all the year, since spring and autumn are moist, with frosty nights, and summer is foggy; therefore the north is in the tundra zone, chiefly sand and reindeer moss; the south is pine forest. The chief occupation on the coast is fishing (especially cod and herring) and in the forest, salmon fishing and hunting (brown bear, glutton, lynx. elk, fox, wolf), collecting cranberries and mushrooms to be dried and sent to the towns. The Kanin peninsula is inhabited by nomad Samoyedes, following the tundra limit with their reindeer, from which they get food, clothing and tent covers; in winter they visit the Russian and Zyrian towns and exchange their reindeer products for flour and ammunition. Barley, winter rye, oats, hemp and flax are grown in the south, but birch bark has often to be used for flour. Potatoes are grown south of latitude 65°. Pitch, tar and timber are obtained from the forests, and shipbuilding is carried on on the coast.

Cattle are raised in Kholmogory, west of the North Dvina river, and veal is sent to Leningrad. Naphtha and salt are produced in the Pinega area and lignite in Mezen. Mica is mined. Shenkursk and Kholmogory have sulphur springs.

(2). A town and port, the administrative centre of the region, on the right bank of the North Dvina river at the head of the delta, 64° 33' N. and 40° 50' E. The shortest day is 3hr. 12min., the longest 21 hr. 48 min. Pop. (1933) 194,302. Of the White sea trade, about 82% passes through Archangel. The harbour is immense, and can accommodate hundreds of ocean-going steamers. It has six sections, the depth of water being 24–25 feet. It is ice bound from November to May. It is linked by river, canal and rail with the south, and the railway line was converted from single to double up to Vologda in 1916. Its main exports are timber, tar, flax, linseed, skins, but timber forms 80%. Its chief industry is sawmilling. Others are fishing, sail and rope making, shipbuilding, cod curing, cod-liver oil preparation, skins and blubber. English and Norwegian vessels ordinarily use the port.

It was visited by Norsemen in the 10th century (Ottar or Othere 880–900 is best known), but the town dates from R. Chancellor's expedition, 1553, when an English factory was built. It was long the only seaport of Muscovy and was opened to all nations by Boris Godunov (1598–1605). Its bazaar and trading hall were built by Tatar prisoners (1668–84). It declined after the building of St. Petersburg (later Leningrad) in 1702, but when equal trading facilities were granted in 1762 it gradually recovered. It has a cathedral (1709–43), a museum, the monastery of the Archangel Michael (hence the name) and a school of navigation.

ARCHBALD, a borough of Lackawanna county, Pa., U.S.A., in the anthracite fields, 10 mi. N.E. of Scranton, about 900 ft. above sea-level. It is served by the Delaware and Hudson and the New York, Ontario and Western railways. The population in 1930 was 9,587; 8,296 in 1940 by federal census. Coal mining is the principal industry of the borough. Within its limits is a large glacial "pot-hole," about 20 ft. in diameter and 40 ft. deep. Archbald was named after James Archbald, formerly chief engineer of the Delaware and Hudson. It was incorporated in 1877.

ARCHBISHOP (Gr. ἀρχιεπίσκοπος) in the Christian church, the title of a bishop of superior rank, implying usually jurisdiction over other bishops, but no superiority of order over them. The functions of the archbishop, as at present exercised, developed out of those of the metropolitan (*q.v.*); though the title of archbishop when it first appeared, implied no metro-

politan jurisdiction. Nor are the terms interchangeable now; for not all metropolitans are archbishops, nor all archbishops metropolitans. The title seems to have been introduced first in the East, in the 4th century, as an honorary distinction implying no superiority of jurisdiction. Its first recorded use is by Athanasius, bishop of Alexandria, who applied it to his predecessor Alexander as a mark of respect. In the next century its use seems to have been more common; for several archbishops are stated to have been present at the council of Chalcedon in 451.

In the Western Church the title was hardly known before the 7th century, and did not become common until the Carolingian emperors revived the right of the metropolitans to summon provincial synods. The metropolitans now commonly assumed the title of archbishop to mark their pre-eminence over the other bishops; at the same time the obligation imposed upon them, mainly at the instance of St. Boniface, to receive the *pallium* (q.v.) from Rome, marked the defeat of their claim to exercise metropolitan jurisdiction independently of the Pope.

At the present day, the title of archbishop is retained in the Roman Catholic Church, the Orthodox and other Churches of the East, the Anglican Church, and certain branches of the Lutheran (Evangelical) Church.

Roman Catholic Church. — In the Roman Catholic Church the powers of the archbishop are considerably less extensive than they were in the middle ages, their rights having been greatly curtailed by the council of Trent. The confirmation and consecration of bishops (see BISHOP) is now reserved to the Holy See. The disciplinary powers once exercised by the archbishop can scarcely be said to survive. The right to hold a visitation of a suffragan's diocese or to issue censures against him was made by the council of Trent dependent upon the consent of the provincial synod after cause shown, and the only two powers left to the archbishop in this respect are to watch over the diocesan seminaries and to compel the residence of the bishop in his diocese.

Besides archbishops who are metropolitans there are in the Roman Catholic Church others who have no metropolitan jurisdiction; *e.g.,* certain archbishops of Italian sees who have no bishops under them. Archbishops rank immediately after patriarchs and have the same precedence as primates. The right to wear the *pallium* is confined to those archbishops who are not merely titular. The special ensign of the archbishop's office is the cross, *crux* erccta or gestatoria, carried before him on solemn occasions (*see* CROSS).

Eastern Church. — In the Orthodox and other churches of the East the title of archbishop is of far more common occurrence than in the West, and is less consistently associated with metropolitan functions.

Lutheran Church. — In the Protestant churches of continental Europe the title of archbishop has fallen into almost complete disuse. It is, however, still borne by the Lutheran bishop of Uppsala, who is metropolitan of Sweden, and by the Lutheran bishop of Abo in Finland.

Church of England. — In the Church of England and its sister and daughter churches the position of the archbishop is defined by the mediaeval canon law as confirmed or modified by statute since the Reformation.

The ecclesiastical government of the Church of England is divided between two archbishops — the Archbishop of Canterbury, who is "primate of all England" and metropolitan of the province of Canterbury, and the Archbishop of York, who is "primate of England" and metropolitan of the province of York. The jurisdiction of the Archbishop of Canterbury as primate of all England extends in certain matters into the province of York. He exercised the jurisdiction of *legatus natus* of the Pope throughout all England before the Reformation, and since that event he has been empowered, by 25 Hen. VIII. c. 21, to exercise certain powers of dispensation in cases formerly sued for in the court of Rome. Under this statute the archbishop continues to grant special licences to marry, which are valid in both provinces; he appoints notaries public, who may practise in both provinces; and he grants dispensations to clerics to hold more than one benefice, subject to certain restrictions which have been imposed by later statutes. The archbishop also continues to grant degrees in the faculties of theology, music and law, which are known as Lambeth degrees.

The Archbishop of Canterbury exercises the twofold jurisdiction of a metropolitan and a diocesan bishop. As metropolitan he is the guardian of the spiritualities of every vacant see within the province, he presents to all benefices which fall vacant during the vacancy of the see, and through his special commissary exercises the ordinary jurisdiction of a bishop within the vacant diocese. He exercises also an appellate jurisdiction over each bishop, which, in cases of licensed curates, he exercises personally under the pluralities act 1838; but his ordinary appellate jurisdiction is exercised by the judge of the Arches court (see ARCHES, COURT OF). The vicar-general exercises jurisdiction in matters of ordinary marriage licences and of institutions to benefices. The master of the faculties regulates the appointment of notaries public, and all dispensations which fall under 25 Hen, VIII. c. 21.

A right very rarely exercised by the Archbishop of Canterbury, but one of great importance, is that of the visitation and deprivation of inferior bishops (see LINCOLN JUDGMENT).

It is the privilege of the Archbishop of Canterbury to crown the Kings and Queens of England. He is entitled to consecrate all the bishops within his province. He takes precedence immediately after Princes of the blood royal and over every peer of Parliament, including the lord chancellor.

The Archbishop of York has immediate spiritual jurisdiction as metropolitan in the case of all vacant sees within the province of York, analogous to that which is exercised by the Archbishop of Canterbury within the province of Canterbury. He has also an appellate jurisdiction of an analogous character, which he exercises through his provincial court, whilst his diocesan jurisdiction is exercised through his consistorial court, the judges of both courts being nominated by the archbishop. It is the privilege of the Archbishop of York to crown the Queen Consort and to be her perpetual chaplain. The Archbishop of York takes precedence over all subjects of the Crown not of royal blood, but after the lord high chancellor of England (see further, ENGLAND, CHURCH OF).

The Church of Ireland had at the time of the act of union four archbishops, who took their titles from Armagh, Dublin, Cashel and Tuam. By acts of 1833 and 1834, the metropolitans of Cashel and of Tuam were reduced to the status of diocesan bishops. The two archbishops of Armagh and Dublin are maintained in the disestablished church of Ireland.

The title archbishop has been used in certain of the colonial churches; *e.g.,* Australia, South Africa, Canada, and the West Indies, since 1893, when it was assumed by the metropolitans of Canada and Rupert's Land (see ANGLICAN COMMUNION). Archbishops have the title of His (or Your) Grace and Most Reverend Father in God.

BIBLIOGRAPHY. — See Hinschius, *System des katholischen Kirchenrechts* (1869), also article "Erzbischof," in Hauck, *Realencyklopadie* (1898); Phillimore, *The Ecclesiastical Law of the Church of England,* and authorities there cited.

ARCHCHANCELLOR, or chief chancellor, a title given to the highest dignitary of the Holy Roman empire, and also used occasionally during the middle ages to denote an official who supervised the work of chancellors or notaries. A charter of the emperor Lothair I. dated 844 refers to Agilmar, archbishop of Vienne, as archchancellor, and there are several other references to archchancellors in various chronicles. This office existed in the German kingdom of Otto the Great, and about this time it appears to have become an appanage of the archbishopric of Mainz. When the empire was restored by Otto in 962, a separate chancery seems to have been organized for Italian affairs, and early in the 11th century the office of archchancellor for the kingdom of Italy was in the hands of the archbishop of Cologne. The theory was that all the imperial business in Germany was supervised by the elector of Mainz, and in Italy by the elector of Cologne. However, the duties of archchancellor for Italy

were generally discharged by deputy, and after the virtual separation of Italy and Germany, the title alone was retained by the elector. During the 12th century the elector of Trier took the title of archchancellor for the kingdom of Arles, although it is doubtful if he ever performed any duties in connection with this office. This threefold division of the office of imperial archchancellor was acknowledged in 1356 by the Golden Bull of the Emperor Charles IV., but the duties of the office were performed by the elector of Mainz. The office in this form was part of the constitution of the empire until 1803 when the archbishopric of Mainz was secularized. The last elector, Karl Theodor von Dalberg, however, retained the title of archchancellor until the dissolution of the empire in 1806.

ARCHDEACON, a high official of the Christian Church. The office of archdeacon is of great antiquity. Originally the archdeacon was, as the name implies, the chief of the deacons attached to the bishop's cathedral, his duty being, besides preaching, to supervise the deacons and their work. His close relation to the bishop gave him, though only in deacon's orders, great importance, which continually developed. In the East, in the 5th century, the archdeacons were already charged with the proof of the qualifications of candidates for ordination; they attended the bishops at ecclesiastical synods, and sometimes acted as their representatives; they shared in the administration of sees during a vacancy. In the West, in the 6th and 7th centuries, archdeacons had in addition certain well-defined rights of visitation and supervision, being responsible for the good order of the lower clergy, the upkeep of ecclesiastical buildings, and the safeguarding of the church furniture. During the 8th and 9th centuries the office tended to become more exclusively administrative, the archdeacon relieving the bishop of the details of government and keeping him informed of the condition of his diocese. The archdeacon had thus become the *oculus episcopi,* "the bishop's eye," but, empowered as he was to impose penance and even to excommunicate offenders, his power tended to grow at the bishop's expense. This process received a great impulse from the erection in the 8th to 12th centuries of defined territorial jurisdictions for the archdeacons. The dioceses were now mapped out into several archdeaconries, and these defined spheres gradually came to be regarded as independent centres of jurisdiction. The bishops, now increasingly absorbed in secular affairs, were content with a somewhat theoretical power of control, while the archdeacons rigorously asserted an independent position which implied great power and possibilities of wealth.

The power of the archdeacon reached its zenith at the outset of the 13th century. He possessed in his own right the powers of visitation, of holding courts and imposing penalties, of deciding in matrimonial causes and cases of disputed jurisdiction, of testing candidates for orders, of inducting into benefices; and these powers he might exercise through delegated *oficiales.* His jurisdiction had become, in fact, co-ordinate with that of the bishop.

From the 13th century onward a reaction set in. The bishops began to circumvent the power of the archdeacons by appointing new officials to exercise in their name the rights to which they laid claim. These were the *oficiales foranei,* whose jurisdiction was parallel with that of the archdeacons, and the *oficiales principales* and vicars-general, who presided over the courts of appeal. The clergy having thus another authority to appeal to, the power of the archdeacons declined; and, so far as the Roman Catholic Church is concerned, it received its death-blow from the Council of Trent (1564), which confined the power of the archdeacons to holding visitations in connection with those of the bishop and with his consent. In the Roman Church to-day the office of archdeacon, where it exists, is merely titular, his sole function being to present the candidates for ordination to the bishop. His ancient functions are exercised by the vicar-general.

In the Church of England the office, which occurs in 803, but did not become general until the Conquest, survives, with many ancient prerogatives. The archdeacons are appointed by their respective bishops, and they are, by an act of 1840, required to have been six full years in priest's orders. Their functions are ancillary to those of the bishop of the diocese. They inspect the churches to see that the fabrics are kept in repair, and hold annual visitations of the clergy and churchwardens of each parish, for the purpose of ascertaining that the clergy are in residence, of admitting the newly elected churchwardens into office, and of receiving the presentments of the outgoing churchwardens. They present all candidates for ordination to the bishop of the diocese. It is their duty also to induct the clergy into the temporalities of their benefices. Every archdeacon is entitled to appoint an official to preside over his archidiaconal court, from which there is an appeal to the consistory court of the bishop. The archdeacons are *ex officio* members of the convocations of their respective provinces.

In the Dominions the functions of archdeacons correspond to those of English archdeacons. In the Episcopal Church of America the office of archdeacon exists in only one or two dioceses.

See Hinschius, Kirchenrecht, ii. §§ 86, 87; Wetzer and Welte, Kirchenlexikon (1882–1901); Schroder, Die Entwicklung des *Archi*diakonats *bis sum* 11 Jahrhundert (1890); Herzog-Hauck, *Realency*klopadie (ed. 1896); Phillimore, Ecclesiastical Law, part ii. chap. v. (1895).

ARCHDUKE, a title peculiar in modern times to the Austrian royal family (Lat. *archidux,* Ger. *Erzherzog*). The designation was exceedingly rare during the Middle Ages. The title of "archduke palatine" (*Pfalz-Erzherzog*) was assumed first by Duke Rudolph IV. (died 1365). Rudolph IV. used the title on his seals and charters till he was compelled to desist by the Emperor Charles IV. The title did not legally belong to the house of Habsburg until 1453, when the Emperor Frederick III. conferred the title of archduke of Austria on his son Maximilian and his heirs.

ARCHELAUS, received the kingdom of Judaea by the last will of his father, Herod the Great, though a previous will had bequeathed it to his brother Antipas. He was proclaimed king by the army, but declined to assume the title until he had submitted his claims to Augustus. Before setting out, he quelled with the utmost cruelty a sedition of the Pharisees, slaying nearly 3,000 of them. At Rome he was opposed by Antipas and by many of the Jews, but Augustus allotted to him the greater part of the kingdom (Judaea, Samaria, Ituraea) with the title of Ethnarch. He married Glaphyra, the widow of his brother Alexander, though his wife and her second husband, Juba, king of Mauretania, were alive. This violation of the Mosaic law and his continued cruelty roused the Jews, who complained to Augustus. Archelaus was deposed (A.D. 7) and banished to Vienne. The date of his death is unknown. He is mentioned in Matt. ii. 22, and the parable of Luke xix. 11 *seq.* may refer to his journey to Rome.

ARCHELAUS, king of Macedonia (413–399 B.C.), was the son of Perdiccas and a slave mother. He obtained the throne by murdering his uncle, his cousin and his half-brother the legitimate heir. He fortified cities, constructed roads and organized the army. He endeavoured to spread Greek civilization among his people and invited to his court, which he removed from Aegae to Pella, many celebrated men, amongst them Zeuxis, Timotheus, Euripides and Agathon. In 399 he was killed while hunting; according to another account he was the victim of a conspiracy.

BIBLIOGRAPHY.—*See* Diodorus Siculus xiii. 49, xiv. 37; Thucydides ii. 100.

ARCHELAUS OF CAPPADOCIA (1st century B.C.), general of Mithridates the Great in the war against Rome. In 87 B.C. he was sent to Greece with a large army and fleet, and occupied the Peiraeus after three days' fighting with Bruttius Sura, prefect of Macedonia. There he was besieged by Sulla, compelled to withdraw into Boeotia, and completely defeated at Chaeroneia (86). A fresh army was sent by Mithridates, but Archelaus was again defeated at Orchomenus (85). On the conclusion of peace, Archelaus, finding that he had incurred the suspicion of Mithridates, deserted to the Romans, by whom he was well received. Nothing further is known of him.

Appian, Mithrid. 30, 49, 56, 64; Plutarch, *Sulla,* 11, 16–19, 20, 23; *Lucullus,* 8.

ARCHELAUS, king of Egypt, was his son. In 56 B.C. he married Berenice, daughter of Ptolemy Auletes, queen of Egypt, but

his reign only lasted six months. He was defeated by Aulus Gabinius and slain (55).

See Strabo xii., p. 558, xvii. p. 796; Dio Cassius xxxix. 57–58; Cicero, Pro *Rabirio,* 8; Hirtius (?), *Bell. Alex.* 66; also PTOLEMIES.

ARCHELAUS, king of Cappadocia, was grandson of the last named. In 41 B.C. (according to others, 34), he was made king of Cappadocia by Antony, whom, however, he deserted after the battle of Actium. Octavian enlarged his kingdom by the addition of part of Cilicia and Lesser Armenia. He was accused by Tiberius, when emperor, of stirring up a revolution, and died in confinement at Rome (A.D. 17). Cappadocia was then made a Roman province.

Strabo xii., p. 540; Suetonius, *Tiberius,* 37, *Caligula,* 1.; Dio Cassius xlix. 32–51; Tacitus, *Ann.,* ii. 42.

ARCWELAUS OF MILETUS, Greek philosopher, 5th century B.C., born probably at Athens, though Diogenes Laërtius (ii. 16) says at Miletus. He was a pupil of Anaxagoras and is said by Ion of Chios (*ap.* Diog. Laërt. ii. 23) to have been the teacher of Socrates. Some argue that this is probably only an attempt to connect Socrates with the Ionian school; others (*e.g.,* Gomperz, Greek Thinkers) uphold the story. In general, he followed Anaxagoras, but in his cosmology he went back to the earlier Ionians, postulating primitive matter, mingled with mind, which produces fire and water. From these spring animal life. No fragments of Archelaus remain; his doctrines have to be extracted from Diogenes Laërtius, Simplicius, Plutarch and Hippolytus.

See IONIAN SCHOOL; for his ethical theories *see* T. Gomperz, *Greek Thinkers* (Eng. trans., 1901), vol. i. p. 402.

ARCHENHOLZ, JOHANN WILHELM VON (1743–1812), German historian, was born at Langfuhr, a suburb of Danzig, on Sept. 3, 1743, and died at Oyendorf, near Hamburg, on Feb. 28, 1812. He served in the Seven Years' War, and then retired from the army. He then spent a long period abroad, living in England from 1769 to 1779, and returned to Germany in 1780. His England *und Italien* (1785) gave a good picture of English political and social life. But his best known work is the history of the Seven Years' War, Geschichte des *siebenjährigen Krieges* (first published in the Berliner historisches *Taschenbuch* of 1787, and later in 2 vols., Berlin, 1793; 13th ed., Leipzig, 1892). This book is still a useful source of information.

ARCHENTERON, the term used in embryology (*q.v.*) to denote the primary body-cavity of the embryo which, in higher forms (Coelomata, *q.v.*), divides into alimentary canal and coelom (*q.v.*), in lower is retained as the coelenteron.

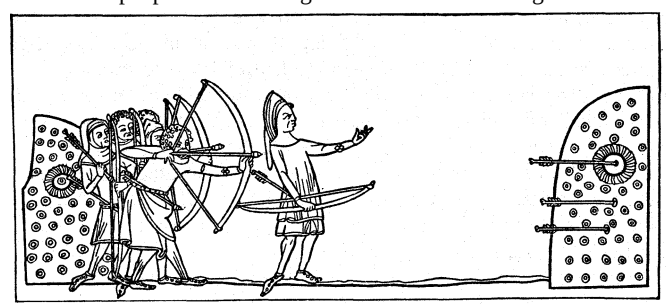
ARCHER, WILLIAM (1856–1924), English critic, was born at Perth, Sept. 23 1856, and was educated at Edinburgh University. He became a leader-writer on the Edinburgh *Evening* News in 1875, and after a year in Australia returned to England and became dramatic critic of various newspapers. Archer introduced Ibsen to the English play-going public by his translation of The Pillars of *Society,* produced at the Gaiety Theatre, London, in 1880. He translated, alone or in collaboration, other Scandinavian plays: Ibsen's *A* Doll's *House* (1889); Edvard Brandes's *A* Visit (1892), Ibsen's Peer Gynt (1892), *Master* Builder (1893), Little Eyolf (1895), and *John Gabriel Borkman* (1897). He also edited a collected edition of Henrik *Ibsen's* Prose Dramas (1890–91). Many of his dramatic criticisms were collected in book form. Archer's critical work exercised a real influence upon the English stage; but in most people's minds his work was associated almost exclusively with the more serious side of life and letters. Great was the surprise of his friends and of the general public when he produced (1921) an excellent but melodramatic piece, *The* Green Goddess, which was a popular success. He died Dec. 27, 1924. His death was a great loss to the English theatre.

ARCHER-FISH, the name given to several small fish of the Chaetodontidae on account of their habit of projecting water from their mouths, thus wetting insects and knocking them into the water. The best-known species, *Toxotes jaculator,* inhabits the fresh waters of Java and other Indo-Malayan islands. It reaches a length of 6 to 7in. and can throw a jet of water 5 or 6ft. An other species, *Chelmon* rostratus, also inhabits Java.

ARCHERMUS, a Chian sculptor of the middle of the 6th century B.C., is said by a scholiast (on Aristophanes' Birds, v. 573) to have been the first to represent Victory and Love with wings. This statement gives especial interest to a discovery made at Delos of a basis signed by Micciades and Archermus which was connected with a winged female figure in rapid motion (see GREEK ART), a figure first regarded as the Victory of Archermus. Unfortunately further investigation has discredited the notion that the statue belongs to the basis, which seems rather to have supported a sphinx.

ARCHERY, the art and practice of shooting with the bow and arrow. Nearly every country except Australia has the bow and its origin is lost in the uncertainties of the old Stone age. Excellent drawings of archers are found in the Palaeolithic carvings at Castellón (Spain), and elsewhere, which show a high development of tackle and shooting technique. Flint arrow-heads of Aurignacian culture date back, according to different anthropologists, from 25,000 to 50,000 years, and probably arrows without stone points were used for unknown ages before that.

Savage bows of to-day vary in size and strength from the feeble 3ft. stick of the African pigmy to the 8ft. long but moderate-weight bow of the Siriono Indian, or the heavy weapon of the African Wasukuma with a draw of 80lb. and a cast of 250 yards. The weight of a bow indicates the force required fully to draw its arrow. Primitive arrows differ according to the bow they fit. The pigmy shoots a sharpened twig of 80 grains, with or without an iron point, and the Siriono an arrow more than 8ft. long and an inch thick. The average, taken the world over, might show bows about 5ft. in length, weighing from 30 to 50lb., according to their thickness and the kind of wood. (The "weight" of a bow is the number of pounds required, when appended to the string, to draw to the head an arrow of 28in. for a man's bow and 25in. for a woman's.) The arrows, usually with three feathers and iron tips, are from 2ft. to 30 inches. Bows are generally made of wood, but in Asia, from very early times, a composite bow of horn, wood and sinew, in order from front to back, has been used by the great military nations, such as the Greeks, Assyrians, Hindus, Scythians, Turks and Chinese, and has been a potent factor in establishing their power. It is short and strong, weighing up to 100lb., and so resilient and elastic as to allow great reflexion, or bending frontwards when unstrung. This reflexed shape puts the strung bow in a state of high stress even



AFTER THE LOUTERELL PSALTER

ENGLISH ARCHERS OF THE 14TH CENTURY SHOOTING AT THE BUTTS
The long bow, with its arrow a cloth-yard long, was for centuries the principal weapon of English soldiers, and was used with memorable effect at Crecy, Poitiers and Agincourt. It continued in use until 1590

before the arrow is drawn and thus increases its quickness or casting power.

The interest of English-speaking people centres in the wooden, 6-ft. long bow which was, for more than a millennium, practically the only projectile weapon of Great Britain. It seems to have been developed by the Scandinavian races and carried by them into England at an early date. About 40 such bows of the 5th century, dug up at Nydam, Denmark, and much other evidence, support this view. Probably the preceding Celtic bow was a short, sturdy weapon, used chiefly at short range, of a type which persisted in Ireland. At Stamford Bridge the English archers were a formidable portion of the troops. William the Conqueror won the battle of Hastings largely through his Norman archers, who shot high in the air and dropped their arrows behind the English

wall of shields. From this fact it is often said, though erroneously, that he introduced the bow into England. The highest development of military archery was in the Hundred Years' War and in the Wars of the Roses, where it was the deciding factor at Creçy, Poitiers, Agincourt and elsewhere, in France, and, to a great extent, on several battle-fields in England.

With the improvement of fire-arms the use of the bow in English warfare rapidly declined, the forces of Elizabeth being the last in which it played an important rôle, although it was employed occasionally thereafter in such remote districts as the Scottish highlands. Archery then almost died. In fact, of all the myriads of bows that were made in old England only four are known to exist and two of these were recovered from a wreck which sunk in the Thames during the reign of Henry VIII. However, archery had been widely enjoyed as a sport during the middle ages. In fact, all men between 16 and 60 years were forced by law to practise it. It therefore survived among its amateurs, though comparatively feebly, in this form. A silver arrow, dated 1603, is still competed for in Scotland, and many other threads of continuity can be followed.

The old English archers shot in two ways; at a small prick or white spot, on a butt of turf, standing at a distance varying from 100ft. to a moderate, but uncertain, yardage, or at marks set from 150 to 300yd. away, which tried the full cast of the bow. If, at long range, the target were a white cloth stretched on a hoop, it was called a clout. Thus Shakespeare says:—"A' would have clapped i' the clout at twelve score, and carried you a forehand shaft a fourteen and fourteen and a half." This extreme is 290yd., but a forehand shaft is one aimed no higher than can be sighted over by the eye, which might suggest an even greater cast for an underhand shaft at 45° elevation. If a succession of marks, like posts, were installed, as in the Finsbury Fields near London, the game was called shooting at rovers, and possibly was a forerunner of golf.

Toward the end of the 18th century the formation of the Royal Toxophilite Society, of London, and the participation in the sport by the Prince of Wales, established modern archery as we know it. In 1844 the Grand National Meeting, which, ever since, has determined the championships of England, was held for the first time. Standards then adopted, which are still in force, were the four-foot target, coloured gold, red, blue, black and white and counting 9, 7, 5, 3, 1; the York Round, for men, of 72 arrows at 100yds., 48 at 80 and 24 at 60; and the National Round, for women, of 48 arrows at 60 and 24 at 50 yards. Usually these rounds are shot "double," or repeated, and the scores combined. The best English archer of all the years since then, probably the best of all time, was Horace Alford Ford, who shot from 1848 to 1867. His Single York of 137 hits—809 score, in private practice, and Double York of 245–1,251, in a public meeting, stand as world's records. The best woman archer was Miss Legh. Her magnificent Double National of 143–841, at the Grand National Meeting of 1904, is the world's record.

A small and curious meeting to shoot for a little silver dart called the Ancient Scorton Arrow has been held in Yorkshire since 1673 and is one of the oldest sporting events, with practically unbroken annual records, in the world. In Scotland archery is splendidly upheld by the King's Bodyguard for that country, called the Royal Company of Archers. The recorded minutes of this society date from 1676, its membership comprises Scotland's highest nobility, and it perpetuates the best traditions of shooting, both at 100ft. butts within doors and at 180 and 200yd. ranges without. The only other society which shoots over similar long distances is the Woodmen of Arden, of Meriden, England. On the Continent, archery is practically confined to Belgium and the parts of Holland and France that lie near it, including Paris. It is a sport of the working classes, not of the leisured as in England. Some *compagnies* are of great antiquity, that of Soissons claiming to have been formed in the Roman times of 471. The *Compagnie de St. Sebastien* at Bruges, with a fine mediaeval hall, includes Charles II. and Victoria of England among its former members.

Continental shooting is much like the old English butt-practice, In a typical *jardin des archers,* two open sheds face each other at 50 metres, one for a straw butt and small target and the other for the archers, who file in singly and shoot only one arrow apiece. *Le tir à la perche* (popinjay shooting) is widely and elaborately done, each village having its *mât,* or mast about 100ft. high, with a *grille,* of cross-bars, on which from 1 to 60 *oiseaux* and a *coq* (feathered, wooden birds) are placed. The archer knocks them off, while holding one foot against the pole, with a *maquet,* or heavy arrow with a blunt horn end.

In the Olympic games of 1908, against an English team and the best American archers of that time, and in more than half a dozen less formal matches in other years between English and French, the latter were always victorious at the distances to which they were accustomed. At one of the latter contests, at Le Touquet in 1914, Ingo Simon, a naturalized Englishman, shot 462yd. 9in. with an 80lb. Turkish composite bow. This modern performance rendered credible an authenticated shot of 482yd. made in 1795, at London, with the same sort of weapon, by Mahmoud Effendi, secretary to the Turkish ambassador.

In America the bow was the chief weapon of the aboriginal Indians, but their skill was not so great as story books would lead us to believe. They usually shot animals at very short ranges after skilfully stalking them. In many contests between Indians and white experts, the latter have always won by scores two or three times as great. Organized archery, on the English pattern, was initiated in 1828 by the United Bowmen of Philadelphia, a club of about 25 young men who shot regularly in that city for 30 years and whose handsome trophies are preserved in the Pennsylvania Historical Society. Dying out in the Civil War period, it was revived in 1878 by the formation of the National Archery Association, following a wave of enthusiasm produced by the writings of Maurice Thompson, a Confederate veteran, who, with his brother Will, had lived by the bow in the forests of the far south. Tournaments to determine the championships for both sexes have been held by this body annually, beginning in 1879, except for two years during the World War. At these tournaments the York and National Rounds are shot, as in England, but the hasty American temperament has added two shorter rounds called the American, for men, of 30 arrows at 60, 50 and 40yd. (go in all), and the Columbia, for women, of 24 arrows at 50, 40 and 30yd. (72 in all). The American championships, since 1915, have been computed on the sum of the hits and scores of both double rounds, for each sex. At other meetings various rounds may be shot, most of which are associated with English archery societies and carry their names. The best of American origin which tests a man's skill at all favourite distances is the Metropolitan, originated at New York in 1926, of 30 arrows at 100, 80, 60, 50 and 40yd., or 150 in all.

There is an important difference in the customs of the two countries, which makes the exact comparison of scores difficult, in that the English place targets at both ends of the range, shooting in two directions, while the Americans shoot in only one. How much this affects the score, if at all, has never been accurately determined. Among American archers, a few have affixed to their bows adjustable sights, usually of metal, to facilitate aiming. As this is a radical departure from the unassisted methods of the past, many feel that scores made with their aid should be classified separately from those made without it, although, as yet, no official action has been taken. The leading American archer is Paul Webb Crouch, of Boston. His best scores are:—in practice, Single York, 132–732, Single American, 90–684, Single Metropolitan, 148–932, the last being one of the world's outstanding feats in any sport; in tournament, Double York, 232–1,132, Double American, 180–1,232, Single Metropolitan, 134–810. Crouch is one of those who use the sight. The best woman archer was Mrs. M. C. Howell, of Cincinnati, O., whose Double National of 132–756, made in 1895, is still the record.

Flight-shooting in America is done with wooden bows only. In England, Rawson and Troward, in the 18th century, made unofficial shots of 360 and 340yd. As 290yd. by Maxson of Washington, D.C. (1891), remained the American record for 25 years, some scepticism regarding those figures existed until

Curtis, of Pembina, N.D., testing their possibility, shot 366yd. (1927), by lying down and drawing a bow against his feet. On New Year's day, 1928, Howard Hill, of Opa-Locka, Fla., a magnificently built man with a strain of Cherokee blood, set a new record by shooting, in the ordinary standing position, a 5-ft. osage-orange bow with the astounding weight of 172lb., sending a 22in. birch arrow 391yd. and 23 inches.

Hunting wild game with the bow is, from necessity, practised by all savages. Among civilized nations it was a sport of royalty until the bow was replaced by the gun. In modern times, although the Thompsons lived on small game shot with arrows, it was really left for the late Saxton T. Pope, with his close friend and pupil in archery, Arthur Young, both of San Francisco, to revive, after the Great War, the mediaeval broad-headed arrow and yew bow as instruments of death. These skilled hunters and great archers have killed specimens of practically every game animal in North America, from squirrels to the Kodiak bear, and from birds, fish, rabbits, deer, pumas, black-bears and grizzlies to the wary mountain sheep. In 1926 they hunted lions near Nairobi, Africa, but, while they did kill seven with the arrow only, they also proved that a charging lion must be stopped by some other defence. such as a shelter or a rifle.

The equipment for modern archery consists of a bow, with its string, arrows, a bracer or arm-guard, finger-tips or shooting glove, a quiver and a target. The standard English bow is divided by a handle, of plush, tape or leather, into upper and lower limbs. These taper gradually and are nearly flat on the back and half-round on the belly, or face. Nocks may be cut near the ends to receive the string, or curved tips of horn also nocked, may be added. Bows for men are from 5ft. 8in. to 6ft. in length and weigh from 36 to 80 pounds. Thirty-six to 40lb. is weak and of little use beyond 60 yards. Forty-six to 50 is about right for most men. Fifty-five to 60 is excellent at 100yd. when in strong hands. Greater weights are chiefly used in hunting, roving and flight-shooting. Women's bows are from 5ft. to 5ft. 6in. and weigh from 18 to 35lb., with 25 as an average. Because of their convenience in transportation, jointed bows, with separate limbs connected by metallic sleeves like a fishing rod, have long been used in continental Europe and, more recently, in America. Crouch made all of his big scores with them. In England they are not favoured. Owing to the rigid centre they have less wood to bend and, therefore, are very quick but rather more liable to break. Backed bows have a strip of tough wood, like hickory, glued to a more fragile belly. The backing is often of rawhide or hard fibre. A thin strip of steel has been used, but as yet this has been inadequately tested. Since 1927, jointed steel bows have been made in the United States which, at least in the writer's opinion, are fully equal to the best wooden ones. They are formed of either tapered seamless tubing or tapered U-bar, the latter being possibly the better. The best wood for bows is probably yew, some still coming from Italy and Spain, but most from the northern Pacific slope of the United States. It is light in hand, quickly resilient and divided into heart and sapwoods which must be properly proportioned in the making. Close rivals are osage orange, from the United States, and lemon wood and lancewood, from the tropics. Osage is so elastic that it may be shortened to 5ft. or less, with improved cast. Lemon and lance bows are more slender than yew but are equally strong and shoot just as far.

The parts of an arrow are the shaft, tip, feathers, nock and crest or painted rings. The woods most often used are spruce, Norway pine and Port Orford cedar. A self-arrow is made of a single stick of wood, sometimes with a short core of steel set in its end, while a footed-arrow has a piece of hardwood spliced on it to give balance and strength. The restless ingenuity of America has also brought into use hollow metal arrows made of seamless tubing of both duralumin and steel. The former were introduced in 1927 and the Double American Round was won with them at the tournament of the National Archery Association. The latter were not perfected until the following year. The steel is plated with cadmium to prevent rust and the feathers are affixed to both kinds by the medium of a coating of celluloid. The best strings, of hemp, are professionally made in Belgium, where the trade has come down from the middle ages, but excellent substitutes may be made of twisted coarse linen thread. One end is laid to form an eye and the other is tied in a timber-hitch. The centre is whipped with fine thread to prevent abrasion by the arrow-nock.

When shooting repeatedly at the targets it is necessary to protect the first three fingers of the drawing-hand and the inside of the wrist of the bow-arm from being injured by the string. For the former purpose a glove may be worn which is reinforced on the palmar surface of the fingers by an extra thickness of leather, or separate tips may be used which, in general, are patterned like long thimbles. For the wrist of the bow-arm a device is a strip or cuff of leather, laced with elastic to prevent slipping. In the occasional shots of hunting and rovers these adjuncts are frequently dispensed with. The standard target-back is made of straw rope, tightly compressed and sewn in a spiral. On permanent ranges stationary butts may be constructed of baled straw.

(R. P. E.)

See R. Ascham, *Toxophilus* (1545); Roberts, *The English Bowman* (1801); *The Archer's Register* (a year book, 1865–1914); Walrond, *Archery* (Badminton library, 1894); S. T. Pope, *Hunting with the Bow and Arrow* (1923); R. P. Elmer, *Archery* (1925); Henri Stein, *Archers* (1925, in French); and S. T. Pope, *The Adventurous Bowmen* (1926).

ARCHES, COURT OF, the English ecclesiastical court of appeal of the archbishop of Canterbury, as metropolitan of the province of Canterbury, from all the consistory and commissary courts in the province. It derives its name from its ancient place of judicature, which was in the church of *Beata Maria de Arcubus*—St. Mary-le-Bow or St. Mary of the Arches, "by reason of the steeple thereof raised at the top with stone pillars in fashion like a bow bent archwise." This parish was the chief of thirteen locally situated within the diocese of London but exempt from the bishop's jurisdiction, and it was no doubt owing to this circumstance that it was selected originally as the place of judicature for the archbishop's court. The proper designation of the judge is official principal of the Arches court, but by custom he came to be styled the dean of the Arches. The judge of the Arches court was until 1874 appointed by the archbishop of Canterbury by patent which, when confirmed by the dean and chapter of Canterbury, conferred the office for the life of the holder. But by the Public Worship Regulation Act 1874 the two archbishops were empowered, subject to the approval of the sovereign by sign-manual, from time to time to appoint a practising barrister of ten years' standing, or a person who had been a judge of one of the superior courts (being a member of the Church of England), to be, during good behaviour, a judge for the purpose of exercising jurisdiction under that act, and it was enacted (sec. 7) that on a vacancy occurring in the office of official principal of the Arches court the judge should become *ex officio* such official principal. In this way the late Lord Penzance became dean on the retirement of Sir Robert Phillimore in 1875. Lord Penzance received in 1878 a supplemental patent as dean from Archbishop Tait, but did not otherwise fulfill the conditions observed on the appointment of his predecessors. On Lord Penzance's retirement in 1899, his successor, Sir Arthur Charles, received a patent from the archbishop of Canterbury as official principal of the Arches court, and he took the oaths of office according to the practice before the Public Worship Regulation Act. He was subsequently and separately appointed judge under that act. Sir A. Charles resigned in 1903 and was succeeded by Sir L. T. Dibdin, who was succeeded in 1934 by Sir Philip Baker-Wilbraham. The official principal of the Arches court is the only ecclesiastical judge who is empowered to pass a sentence of deprivation against a clerk in holy orders. The appeals from the decisions of the Arches court were formerly made to the king in chancery, but they are now by statute addressed to the king in council, and they are heard before the judicial committee of the privy council. For many years past there has been but little business in the Arches court, mainly owing to the unwillingness of a large number of the clergy to recognize the jurisdiction of what they deny to be any longer a spiritual court, and the consistent use by the

bishops of their right of veto in the case of prosecutions under the Public Worship Regulation Act. On the rare occasions when a sitting of the court is necessary, it is held in the library of Lambeth Palace, or at the Church House, Westminster.

ARCHESTRATUS, of Syracuse or Gela, a Greek poet, who flourished about 330 B.C. After travelling in search of foreign delicacies for the table, he embodied the result in a humorous poem called Ἡδυπάθεια, afterwards freely translated by Ennius under the title *Heduphagetica*. About 300 lines of his poem, which parodies the style of the old gnomic poets, are preserved in Athenaeus.

See Ribbeck, *Archestrati Reliquiae* (1877); Brandt, *Corpusculum Poesis Epicae Graecae ludibundae,* i. 1888; Schmid, *De Archestrati Gelensis Fragmentis* (1896).

ARCHIAC, ETIENNE JULES ADOLPHE DESMIER DE SAINT SIMON, VICOMTE D' (1802–68), French geologist, was born at Reims Sept. 24 1802, and died Dec. 24 1868. He wrote a *Histoire des progrès de la géologie 1834–59* (Paris, 1847–60). He was appointed (1861) professor of palaeontology in the Museum of Natural History in Paris. He made important contributions to Tchihatcheff's *Asie mineure* (1866).

ARCHIANNELIDA, the most primitive of the classes of the Annelida (*q.v.*), or segmented worms.

ARCHIAS, AULUS LICINIUS, Greek poet, was born at Antioch in Syria 120 B.C. In 102 B.C. be came to Rome, where he obtained the patronage of Lucullus, whose gentile name he assumed. In 93 he received the citizenship of Heracleia, one of the federate towns, and indirectly, by the provisions of the lex Plautia Papiria, that of Rome. In 61 he was accused of having assumed the citizenship illegally; and Cicero successfully defended him in his speech Pro *Archia*. This speech, which furnishes nearly all the information concerning Archias, states that he had celebrated the deeds of Marius and Lucullus, and that he was engaged upon a poem on the events of Cicero's consulship. The Greek Anthology contains 35 epigrams under the name of Archias, but it is doubtful how many of these (if any) are the work of the poet of Antioch.

BIBLIOGRAPHY.—Cicero, *Pro Archia;* T. Reinach, ***De*** *Archia Poeta* (1890).

ARCHIBALD, RAYMOND CLARE (187 j–), American mathematician, was born in Colchester (N.S.), Canada, on Oct. 7, 1875. He graduated at the University of Mt. Allison college, New Brunswick, in 1894, and from Harvard university in 1896. Following two years' graduate work at Harvard, he studied at the University of Berlin in 1898–99 and at the University of Strasbourg in 1899–1900, from the latter receiving the degree of doctor of philosophy. Returning to Canada, he taught mathematics in Mt. Allison Ladies' college, Sackville, N.B., in 1900–07 and in Acadia university, Wolfville, N.S., in 1907–08. He then entered the faculty of Brown university, Providence, R.I., where he served successively as instructor, assistant professor, and associate professor in mathematics until 1923, when he was made professor. In 1918 he became a member of the council of the Matheinatical Society of America, of which in 1921 he was made librarian. He has contributed extensively to mathematical journals and edited important scientific publications.

Among his published writings are: *The Cardioid and Some of Its Related Curves* (1900); *Bibliography of Life and Works of Simon Newcomb* (1905, 1924); *Carlyle's First Love, Margaret Gordon, Lady Bannerman* (1910); *Mathematical Instruction in France* (1910); *Euclid's Book on Divisions of Figures with a Restoration* (1915); *The Training of Teachers of Mathematics* (1918); and *Benjamin Peirce, 1809–1880* (1925).

ARCHIDAMIAN WAR, the war between Athens and Sparta, with their respective allies, which began in 431 B.C. with the surprise attack of Thebes on Plataea. The name is taken from Archidamus, king of Sparta, who on the outbreak of the war led the first invasion of Attica. Over the victims of this raid Pericles delivered his famous funeral speech (Thuc. ii. 34, seq.). The war was marked by the great plague and the campaign of Brasidas in the north. It was ended by the peace of Nicias (421). It is generally, and with reason, considered as merely the earlier part of the Peloponnesian War. *(See* GREECE: ***History.)***

ARCHIDAMUS, the name of five kings of Sparta, of the Eurypontid house.

(1). The son and successor of Anaxidamus. His reign, which began soon after the close of the second Messenian War, is said to have been quiet and uneventful (Pausanias iii. 7. 6).

(2). The son of Zeuxidamus, reigned 476–427 B.C. (but *see* LEOTYCHIDES). He succeeded his grandfather, Leotychides upon the banishment of the latter, his father having already died. He was a friend of Pericles and a man of prudence and moderation. During the negotiations which preceded the Peloponnesian War he did his best to prevent, or at least to postpone, the inevitable struggle, but was overruled by the war party. He invaded Attica at the head of the Peloponnesian forces in the summers of 431, 430, and 428, and in 429 conducted operations against Plataea. He died probably in 427, certainly before the summer of 426, when we find his son Agis on the throne.

Herod, vi. 71; Thuc. i. 79-iii. 1; Plut. *Pericles,* 29. 33; Diodorus, xi. 48-xii. 52.

(3). The son and successor of Agesiiaus II., reigned 360–338 B.C. In 371 he led the relief force which was sent to aid the survivors of the battle of Leuctra. Four years later he captured Caryae, ravaged the territory of the Parrhasii and defeated the Arcadians, Argives and Messenians in the "tearless battle," so called because the victory did not cost the Spartans a single life. In 364, however, he sustained a severe reverse in attempting to relieve a besieged Spartan garrison at Cromnus in south-western Arcadia. He showed great heroism in the defence of Sparta against Epameinondas immediately before the battle of Mantineia (362). He supported the Phocians during the Sacred War (355–346), moved, no doubt, largely by the hatred of Thebes, which he had inherited from his father; he also led the Spartan forces in the conflicts with the Thebans and their allies which arose out of the Spartan attempt to break up the city of Megalopolis. Finally he was sent with a mercenary army to Italy to protect the Tarentines against the attacks of Lucanians or Messapians; he fell, together with the greater part of his force, at Mandonion[1], on the same day as that on which the battle of Chaeronea was fought.

Xen. *Hell.* v. 4, vi. 4, vii. 1. 4. 5; Plut. *Agis,* 3, *Camillus,* 19; *Agesilaus,* 25, 33, 34, 40; Pausanias iii. 10, vi. 4; Diodorus, xv. 54, 72, xvi. 24, 39, 59, 62, 88.

(4). The son of Eudamidas I., grandson of Archidamus III. The dates of his accession and death are unknown. In 294 B.C. he ,was defeated at Mantineia by Demetrius Poliorcetes, who invaded Laconia, gained a second victory close to Sparta, and was on the point of taking the city itself when he was called away by the news of the successes of Lysimachus and Ptolemy in Asia Minor and Cyprus.

Plut. *Agis,* 3, *Demetrius,* 35; Pausanias, i. 13. 6, vii. 8, 5; Niese, *Gesch. der griech. u. makedon. Staaten,* i. 363.

(5). The son of Eudamidas II., grandson of Archidamus IV., brother of Agis IV. On his brother's murder he fled to Messenia (241 B.C.). In 227 he was recalled by Cleomenes III., who was then reigning without a colleague, but shortly after his return he was assassinated. Polybius accuses Cleomenes of the murder, but Plutarch is probably right in saying that it was the work of those who had caused the death of Agis and feared his brother's vengeance.

Plutarch, *Cleomenes,* i. 5; Polybius, v. 37, viii. 1; Niese, *op. cit.* ii. 304, 311. (M. N. T.)

ARCHIL, a purple dye obtained from various species of lichens. Archil can be extracted from many species of the genera *Roccella, Lecanora, Umbilicaria, Parmelia* and others, but in practice two species of *Roccella*—*R. tinctoria* and *R. fuciformis* —are almost exclusively used. These, under the name of "orchella weed" or "dyer's moss," are obtained from Angola, where the most valuable kinds are gathered; from Cape Verde Islands; from Lima; and from the Malabar coast of India. The colouring properties are developed by special treatment. Archil is prepared for the dyer's use in the form of a liquor (archil) and a paste (persis), and the latter, when dried and finely powdered. forms

[1]So Plut. *Agis,* 3 (all mss.). Following Cellarius, some authorities read Manduria or Mandyrium.

the "cudbear" of commerce, a dye formerly manufactured in Scotland from a native lichen, Lecanora *tartarea*. The manufacturing process consists in washing the weeds, which are then ground up with water to a thick paste. If archil paste is to be made this paste is mixed with a strong ammoniacal solution, and agitated in an iron cylinder heated by steam to about 140°F. till the desired shade is developed—a process which occupies several days. In the preparation of archil liquor the principles which yield the dye are separated from the ligneous tissue of the lichens, agitated with a hot ammoniacal solution, and exposed to the action of air. When potassium or sodium carbonate is added, a blue dye known as litmus, much used as an "indicator," is produced. French purple or lime lake is a lichen dye prepared by a modification of the archil process, and is a more brilliant and durable colour than the other. The dyeing of worsted and home-spun cloth with lichen dyes was formerly a very common domestic employment in Scotland; and to this day, in some of the outer islands, worsted continues to be dyed with "crottle," the name given to the lichens employed.

ARCHILOCHUS, Greek lyric poet and writer of lampoons, was born at Paros, one of the Cyclades islands. The date of his birth is uncertain, but he probably flourished about 650 B.C.; according to some, about forty years earlier but certainly not before the reign of Gyges (687–652), which he mentions in a well-known fragment. His father, Telesicles, who was of noble family, had conducted a colony to Thasos, whither Archilochus afterwards removed, hard pressed by poverty, and indignant because Lycambes refused him his daughter in marriage. At Thasos the poet passed some unhappy years; his hopes of wealth were disappointed; according to him, Thasos was the meeting-place of the calamities of all Hellas. The inhabitants were frequently involved in quarrels with their neighbours, and in a war against the Saians—a Thracian tribe—he threw away his shield and fled. After leaving Thasos, he is said to have visited Sparta, but to have been at once banished from that city on account of his cowardice and the licentious character of his works (Valerius Maximus vi. 3, *externa* 1). He next visited Siris, in lower Italy. He then returned to his native place, and was slain in a battle against the Naxians by one Calondas or Corax, who was cursed by the oracle for having slain a servant of the Muses.

The writings of Archilochus consisted of elegies, hymns—one of which used to be sung by the victors in the Olympic games (Pindar, Olympia, ix. I.)—and of poems in the iambic and trochaic measures. To him certainly we owe the invention of iambic poetry and its application to the purposes of satire. The only previous measures in Greek poetry had been the epic hexameter, and its offshoot the elegiac metre; but the slow measured structure of hexameter verse was utterly unsuited to express the quick, light motions of satire. Archilochus made use of the iambus and the trochee, and organized them into the two forms of metre known as the iambic trimeter and the trochaic tetrameter. The trochaic metre he generally used for subjects of a serious nature, the iambic for satires. He was also the first to make use of the arrangement of verses called the epode. Horace in his metres to a great extent follows Archilochus (Epistles, i. 19. 23–25). All ancient authorities unite in praising the poems of Archilochus. (Longinus xiii. 3; Dio Chrysostom, *Orationes,* xxxiii.; Quintilian x. i. 60; Cicero, Orator, i.). Horace (Ars *Poetica,* 79) speaks of the "rage" of Archilochus, and Hadrian calls his verses "raging iambics."

His poems were written in the old Ionic dialect. Fragments in Bergk, Poetae Lyrici *Graeci;* Liebel, *Archilochi* Reliquiae (1818); A. Hauvette-Besnault, *Archiloque, sa* vie et ses *poésies* (1905).

ARCHIMANDRITE, in the Greek Church a superior abbot who has the supervision of several monasteries, or the abbot of some specially important monastery, the superior of an ordinary monastery being called hegumenos. The title is also conferred as an honorary distinction.

See the *Dictionnaire* d'arcbdologie *chrétienne* et ***de*** *liturgie.*

ARCHIMEDES (c. 287–212 B.C.), Greek mathematician and inventor, was born at Syracuse, in Sicily. He was the son of Pheidias, an astronomer, and was on intimate terms with, if not related to, Hieron, king of Syracuse, and Gelon his son. He studied at Alexandria and doubtless met there Conon of Samos, whom he admired as a mathematician and cherished as a friend. On his return to his native city he devoted himself to mathematical research. He himself set no value on the ingenious mechanical contrivances which made him famous, regarding them as beneath the dignity of pure science and even declining to leave any written record of them except in the case of the σφαιροποιΐα (*sphere-making*), as to which see below. As, however, these machines impressed the popular imagination, they naturally figure largely in the traditions about him. Thus he devised for Hieron engines of war which almost terrified the Romans, and which protracted the siege of Syracuse for three years. There is a story that he constructed a burning mirror which set the Roman ships on fire when they were within a bow-shot of the wall. It is probable that Archimedes had constructed some such burning instrument, though the connection of it with the destruction of the Roman fleet is more than doubtful. More important is the story of Hieron's reference to him of the question whether a crown made for him and purporting to be of gold, did not actually contain a proportion of silver. According to one story, Archimedes was puzzled till one day, as he was stepping into a bath and observed the water running over, it occurred to him that the excess of bulk occasioned by the introduction of alloy could be measured by putting the crown and equal weights of gold and of silver separately into a vessel of water, and noting the differences of overflow. He was so overjoyed when this happy thought struck him that he ran home without his clothes, shouting εὕρηκα, εὕρηκα (generally anglicized as Eureka—"I have found it, I have found it"). Similarly his pioneer work in mechanics is illustrated by the story df his having said 66s μοι ποῦ στῶ καὶ κινῶ τὴν γῆν (or as another version has it in his dialect, πᾶ βῶ καὶ κινῶ τὰν γᾶν, "give me a place to stand and I (will) move the earth"). Hieron asked him to give an illustration of his contention that a very great weight could be moved by a very small force. He is said to have fixed on a large and fully laden ship and to have used a mechanical device by which Hieron was enabled to move it by himself; but accounts differ as to the particular mechanical powers employed. The water-screw which he invented (see below) was probably devised in Egypt for the purpose of irrigating fields.

Archimedes died at the capture of Syracuse by Marcellus, 212 B.C. In the general massacre which followed the fall of the city, Archimedes, while engaged in drawing a mathematical figure on the sand, was run through the body by a Roman soldier. No blame attaches to the Roman general, Marcellus, since he had given orders to his men to spare the house and person of the sage, and, in the midst of his triumph he lamented the death of so illustrious a person, directed an honourable burial to be given him, and befriended his surviving relatives. In accordance with the expressed desire of the philosopher, his tomb was marked by a sphere inscribed in a cylinder, the discovery of the relation between the surface and volume of a sphere and its circumscribing cylinder being regarded by him as his most valuable achievement. When Cicero was quaestor in Sicily (75 B.C.), he found the tomb of Archimedes, near the Agrigentine gate, overgrown with thorns snd briers. "Thus," says Cicero (Tusc. *Disp.* v. c. 23, §64), "would this most famous and once most learned city of Greece have remained a stranger to the tomb of one of its most ingenious citizens, had it not been discovered by a man of Arpinum."

Works.—The range and importance of the scientific labours of Archimedes will be best understood from a brief account of those writings which have come down to us; and it need only be added that his greatest work was in geometry, where he so extended the method of *exhaustion* as originated by Eudoxus, and followed by Euclid, that it became in his hands, though purely geometrical in form, actually equivalent in several cases to *integration,* as expounded in the first chapters of our text-books on the integral calculus. This remark applies to the finding of the area of a parabolic segment (mechanical solution) and of a spiral, the surface and volume of a sphere and of a segment thereof, and the volume of any segments of the solids of revolution of the second degree.

The extant treatises are as follows:

(1) *On the Sphere and Cylinder* (Περὶ σφαίρας καὶ κυλίνδρου). This treatise is in two books, dedicated to Dositheus, and deals with the dimensions of spheres, cones, "solid rhombi" and cylinders, all demonstrated in a strictly geometrical method.

(2) *The Measurement of the Circle* (Κύκλου μέτρησις) is a short book of three propositions, the main result being obtained in Prop. 2, which shows that the circumference of a circle is less than $3\frac{1}{7}$ and greater than $3\frac{10}{71}$ times its diameter.

(3) *On Conoids and Spheroids* (Περὶ κωνοειδέων καὶ σφαιροειδέων) is a treatise in 32 propositions, on the solids generated by the revolution of the conic sections about their axes, the main results being the comparisons of the volume of any segment cut off by a plane with that of a cone having the same base and axis (Props. 21, 22 for the paraboloid, 25, 26 for the hyperboloid, and 27–32 for the spheroid).

(4) *On Spirals* (Περὶ ἑλίκων) is a book of 28 propositions. Propositions 1–11 are preliminary, 13–20 contain tangential properties of the curve now known as the spiral of Archimedes, and 21–28 show how to express the area included between any portion of the curve and the radii vectores to its extremities.

(5) *On Plane Equilibria or Centres of Gravity of Planes* (Περὶ ἐπιπέδων ἰσορροιῶν ἢ κέντρα βαρῶν ἐπιπέδων.) This consists of two books, and may be called the foundation of theoretical mechanics, for the previous contributions of Aristotle were comparatively vague and unscientific. In the first book there are 15 propositions, with seven postulates; and demonstrations are given, much the same as those still employed, of the centres of gravity (1) of any two weights, (2) of any parallelogram, (3) of any triangle, (4) of any trapezium. The second book in 10 propositions is devoted to the finding the centres of gravity (1) of a parabolic segment, (2) of the area included between any two parallel chords and the portions of the curve intercepted by them.

(6) *The Qzradrature of the Parabola* (Τετραγωνισμὸς παραβολῆς) is a book in 24 propositions, containing two demonstrations that the area of any segment of a parabola is $\frac{4}{3}$ of the triangle which has the same base as the segment and equal height.

(7) *On Floating Bodies* (Περὶ ὀχουμένων) is a treatise in two books, the first of which establishes the general principle of hydrostatics, and the second discusses with the greatest completeness the positions of rest and stability of a right segment of a paraboloid of revolution floating in a fluid.

(8) *The Psammites* (Ψαμμίτης, Lat. *Arenarius,* or sand reckoner), a small treatise addressed to Gelon, the eldest son of Hieron, expounding, as applied to reckoning the number of grains of sand that could be contained in a sphere of the size of our "universe," a system of naming large numbers according to "orders" and "periods" which would enable any number to be expressed up to that which we should write with 1 followed by 80,000 ciphers!

(9) The *Method,* addressed to Eratosthenes, is a treatise of vital interest, since in it Archimedes explains how he first arrived at many of his important results by means of mechanical considerations, namely, by weighing an indefinite number of elements of one figure against similar elements of another. This treatise, formerly supposed to be lost, was discovered in 1906 by J. L. Heiberg in a palimpsest at Constantinople, and now forms part of Heiberg's Greek text of Archimedes.

(10) *A Collection of Lemmas,* consisting of 15 propositions in plane geometry. This has come down to us through a Latin version of an Arabic manuscript; it cannot, however, have been written by Archimedes in its present form, as his name is quoted in it more than once.

Lastly, Archimedes is credited with the famous *Cattle-Problem* enunciated in the epigram edited by G. E. Lessing in 1773, which purports to have been sent by Archimedes to the mathematicians at Alexandria in a letter to Eratosthenes. Of lost works by Archimedes we find references to six: (1) investigations on *polyhedra* mentioned by Pappus; (2) Ἀρχαί, *Principles,* a book addressed to Zeuxippus and dealing with the *naming of numbers* on the system explained in the *Sand Reckoner;* (3) Περὶ ζυγῶν, *On balances or levers;* (4) Κεντροβαρικά *On centres of gravity;* (5) Κατοπτρικά, an optical work from which Theon of Alexandria quotes a remark about refraction; (6) Περὶ Σφαιροποΐας, *On Sphere-making,* in which Archimedes explained the construction of the sphere which he made to imitate the motions of the sun, the moon and the five planets in the heavens. Cicero actually saw this contrivance and describes it *(De Rep.* i. c. 14 §§ 21–22).

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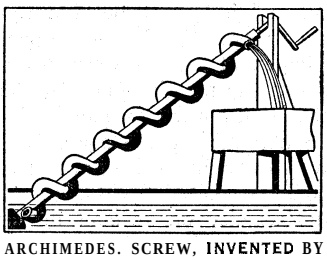
ior *a* possible though by no means certain portrait. (T. L. H.)



ARCHIMEDES. SCREW, INVENTED BY THE GREEK MATHEMATICIAN (c. 287-212 B.C.)
The screw was first used to remove water from the hold of a large ship.
The same principle is sometimes employed in machines for handling wheat

ARCHIMEDES, SCREW OF, a machine for raising water, said to have been invented by Archimedes for the purpose of removing water from the hold of a large ship that had been built by King Hiero II. of Syracuse. It consists of a water-tight cylinder which encloses a helix, and has its lower open end placed a half turn in the water. The water is therefore lifted mechanically by the turning of the machine. Other forms have the helix revolving free in a fixed cylinder, or consist simply of a tube wound-helically about a cylindrical axis. The same principle is sometimes used in machines for handling wheat, etc. *(see* CONVEYORS IN MASS PRODUCTION).

ARCHIPELAGO, a name now applied to (1) any island-studded sea, and (2) by transference, to a group of islands, but it was originally the distinctive designation of what is now generally known as the Aegean Sea (Αἰγαῖον πέλαγος), its ancient name having been revived. The word archipelago does not occur in ancient and mediaeval Greek. Ἀρχιπέλαγος in modern Greek has been introduced from Western languages. Several etymologies have been proposed: *e.g.* (1) a corruption of the ancient name, *Egeopelago;* (2) from the modern Greek: Ἅγιο πέλαγο, the Holy Sea; (3) it arose at the time of the Latin empire, and means the Sea of the Kingdom *(Arch.?).*

ARCHIPPUS, an Athenian poet of the Old Comedy, who flourished towards the end of the 5th century B.C. His most famous play was the *Fishes,* in which he satirized the fondness of the Athenian epicures for fish. The Alexandrian critics attributed to him four plays previously assigned to Aristophanes.

Titles and fragments of six plays are preserved, for which *see* T. Kock, *Comicorum Atticorum Fragmenta,* i. (1880); or A. Meineke, *Poetarum Comicorum Graecorum Fragmenta* (1855).

ARCHITECT, one who, skilled in the art of architecture *(q.v.),* designs buildings, determining the disposition of both their interior spaces and exterior masses, together with the structural embellishments of each, and generally supervises their erection. Formerly, the architect was often active in all phases of erecting a building, from the project to the various details of construction. To-day, with the growing tendency toward specialization and the increasing size of buildings, his designs are executed by various agencies—engineers, contractors, manufacturers, machines, etc.—

and his success, to a large extent, depends on the proper co-ordination of these elements. For a discussion of the architect's problems and methods *see* ARCHITECTURE; for a treatment of his training *see* ARCHITECTURAL EDUCATION.

Naval architect, one who designs ships and supervises their construction.

ARCHITECTURAL ARTICLES. Architecture is treated in this work under various headings, an account of which will help the reader to consult any part of the subject.

For a definition of architecture, a general survey of its evolution and a discussion of contemporary practice and theory, reference should be made to the article ARCHITECTURE.

The historic styles, being those divisions into which occidental architecture from the earliest times through the 19th century may generally be said to fall, will be found treated under EGYPTIAN ARCHITECTURE; WESTERN ASIATIC ARCHITECTURE (after Egypt to Archaic Greece); GREEK ARCHITECTURE; ROMAN ARCHITECTURE; BYZANTINE AND ROMANESQUE ARCHITECTURE; GOTHIC ARCHITECTURE; RENAISSANCE ARCHITECTURE; BAROQUE ARCHITECTURE; MODERN ARCHITECTURE: *18th* and *19th Centuries*. The important sub-divisions of these styles, while discussed in these articles, also appear under their own headings, as EMPIRE STYLE, GEOMETRIC PERIOD, COLONIAL STYLE, PERPENDICULAR PERIOD, etc.

Contemporary Architecture, being more affected by science and by social and economic influences than by tradition or national characteristics, is treated under headings whose significance is explained in the article ARCHITECTURE; for the articles themselves *see:* INDUSTRIAL ARCHITECTURE; SOCIAL ARCHITECTURE; HOUSE PLANNING; THEATRE: *Architecture;* HOSPITAL PLANNING; SCHOOL ARCHITECTURE; UNIVERSITY ARCHITECTURE; LIBRARY ARCHITECTURE; MUSEUM ARCHITECTURE; EXHIBITION ARCHITECTURE; GOVERNMENTAL ARCHITECTURE; RELIGIOUS AND MEMORIAL ARCHITECTURE. Wherever it has been deemed necessary to a proper understanding of these subjects, an historical introduction has been given.

Separate articles describe CHINESE ARCHITECTURE; INDIAN ARCHITECTURE; JAPANESE ARCHITECTURE; MOHAMMEDAN ARCHITECTURE; RUSSIAN ARCHITECTURE.

For a concise treatment of the important periods in the history of art throughout the world, the reader may well consult PERIODS OF ART.

A summary of the training available for a prospective architect to-day is given under ARCHITECTURAL EDUCATION.

LANDSCAPE ARCHITECTURE is fully treated under its own heading as is also TOWN AND CITY PLANNING. Other special articles are also given to COLOUR IN ARCHITECTURE; ORNAMENT, ARCHITECTURAL; RENDERING, ARCHITECTURAL; SCULPTURE: *Architectural;* SHOP FRONT DESIGN; ZONING. A large number of architectural subjects, such as BASILICA, DOME, FOUNTAIN, HOUSE, MOSQUE, PARTHENON, etc., and technical terms as, for instance, ARCHITRAVE, BASE, CAPITAL, COLUMN, GAINE and ORDER, are treated independently.

Finally, in the articles on many cities the reader will find descriptions of important buildings.

ARCHITECTURAL DRAWING: *see* DRAWING, ENGINEERING.

ARCHITECTURAL EDUCATION. The functions of the architect to-day are manifold and of a highly technical nature. He must first of all be expert in the actual planning of buildings, that is, he must be acquainted with the practical requirements of the accommodation of various kinds of structures, often of a complex order, such as factories and commercial buildings, hotels, theatres, hospitals and schools.

He must know how to arrange the several parts of these buildings in the most economical and convenient manner, for the art of planning is the very basis of the art of architecture.

He must have a thorough understanding of the ordinary methods of building construction, and sufficient knowledge of the principles of steel and ferro-concrete work to enable him to employ those modern structural resources as an artist.

A considerable body of applied science is now involved in architectural practice, but it is always part of the means and never the end of architecture. The architect must be instructed how to make the technical sciences the servants of his art. Not only methods of construction, but surveying, sanitation, hygiene, heating, lighting, ventilation and acoustics come within this category, as also do such ancillary subjects as the law and finance of building.

It is necessary too, that the training of the architect shall include the study of perspective, sciagraphy, rendering *(see* RENDERING, ARCHITECTURAL) and the preparation of working drawings *(see* DRAWING, ENGINEERING).

In addition, a knowledge of materials, their practical characteristics and the effects which can be obtained from them, is an essential element in the architect's education, since they determine the durability of the fabric and its appearance. The application of all this varied knowledge is implied in *design* in architecture.

And it is with design that the architect is primarily and ultimately concerned.

Architectural design involves thinking simultaneously in three dimensions, visualizing the work in plan, section and elevation in such a way that the resultant composition is expressive and beautiful. For this, efficient creative ability of a special order is required and no system of training can generate that ability. But training can make possible its fullest development, can direct it along the most profitable lines and can place at its disposal, in the best manner, the accumulated experience of the past. These are the objects with which the present systems of architectural education are chiefly concerned.

It is generally agreed that the study of architecture should be preceded by a liberal education. As one of the fine arts, historically associated with the arts of painting and sculpture, and as the background of civilized society, it demands both for its practice and its appreciation some measure of general culture. The tendency to-day is, therefore, for schools of architecture in Europe, the British Empire and America to require from candidates for admission evidence of a broad non-technical education; and in a number of cases liberal studies are pursued during at least the earlier portion of the professional course. A general survey of architectural education at the present time shows that it is principally administered in America by universities, and in Europe and the British Empire, either by universities or by institutions virtually of university rank, such as the *École des Beaux Arts* in Paris, the High School of Architecture in Rome and the Viennese academy. Sometimes the teaching of architecture has the advantage of being conducted under academic auspices in association with painting and sculpture. In certain schools the curriculum has a strong mathematical bias, whilst in others, emphasis is laid on preserving and developing traditional methods of design. Such differences are due to national and local influences. They do not materially affect the broad cosmopolitan character of modern architectural education. That education, it is now more and more realized, is the proper responsibility of the practising profession in each country. In France the fact has always been recognized, and, since academic education was instituted in Paris in the 17th century, the most eminent architects have themselves undertaken educational obligations. The result has been that in no other country has the practice and teaching of architecture been so completely and successfully related. Elsewhere in the early days of the scholastic system the attempt was made to divide the architectural profession into two classes—theoretic non-practising teachers, and architects who practised and did not teach. But architecture could not be taught by theorists any more than medicine and the experiment has been definitely abandoned. To-day architectural education in all countries is in the hands of practising teachers. Direct connection between the instruction given in the school and the experience of actual practice is thereby assured; the world of the school is not isolated from the world of the architect's studio or office. At the same time scholastic training cannot of itself complete the education of the architect. The conditions of practice must inevitably differ from those of theoretic training. For this reason, to effect a transition between the two, most systems of architectural education now in operation provide for some part of the school course being devoted to gaining actual experi-

ence of practice.

Italy. — The emergence of Italy as a unified nation in the 19th century finally closed that phase of architectural development in which the training of architects was undertaken by the independent academies founded during and after the Renaissance. Henceforth the State itself assumed the responsibility and established two types of institutions to discharge it — schools of civil engineering and institutes of fine arts. Architecture was taught in the first as a structural science and in the second as an art of design associated with painting and sculpture. The inherent defects of this arrangement were not long in showing themselves. By divorcing the study of modern constructional methods from that of composition, two separate classes of experts were created, structural engineers and architectural decorators. The former were well equipped in the scientific technique of building, but could not use their knowledge as artists; the latter, insufficiently trained in the material and practical aspects of their subject, were accomplished as a rule only in superficial design. As was inevitable in an age which exalted applied science and mechanical skill, the profession of structural engineers soon acquired a superior authority to that of the architects, with consequences unfortunate both for the latter and their work. To remedy this state of affairs a number of proposals and tentative experiments were made in the latter half of the century. The final outcome of these was the establishment in 1919 of the High School of Architecture in Rome, a school of university rank, which requires from entrants a liberal education and previous artistic training. It is the central institution for architectural education in Italy. Its professional course extends over five years and the curriculum provides for a properly adjusted balance of scientific and aesthetic studies. In the provinces, other institutions modelled on the Roman High school, are in process of being established or developed at Milan, Florence and Venice. Special provisions have recently been made by the State further affecting architectural education in Italy. An official qualification has been introduced which is awarded on examination after a certain period has been spent in acquiring practical experience subsequent to the completion of the school course. In addition, a carefully worked out scheme has been devised to secure candidates for the profession from as wide a field as possible and to ensure that their previous education is of the most suitable kind.

France. — The State control of French architectural education dates from the foundation under Colbert of the Royal Academy of Architecture in 1670. This control, temporarily interrupted by the Revolution, was resumed in 1795, when in the newly created *Institut de France* an academy of fine arts, embracing architecture, was included. The private school of architecture, set up by Leroi during the Revolution, was then taken under the protection of the *Institut,* incorporated with the other art schools administered by that body, and finally, in 1816, accommodated on the site which it now occupies, under the name, famous throughout the world, of *École des Beaux Arts*. Under Napoleon III., a decree was issued in 1863 which, drastically altering the organization of the school, restricted the authority of the Academy of Fine Arts over it, and introduced the régime which is in operation to-day. The school became directly a State institution, with a director at its head appointed by the minister of fine arts. Its professors were nominated by the educational council and its courses extended and increased in number. In addition to the professors who lectured, *patrons* or heads of *ateliers,* were officially appointed to the staff. The problem of style, which the dissensions of the Romanticists and Classicists had made an acute issue, was solved by eliminating it. There were no longer any prescribed or proscribed periods. All designs were judged by logical standards and matters of taste were permitted to remain matters of taste. Compositions might be submitted in any style or in no style at all; their value would be assessed upon grounds that had nothing to do with the question of architectural idiom. By thus adopting an attitude of the most complete catholicity the school was able to stabilize its position and to emerge from the trials of the 19th century with increased rather than diminished prestige.

To-day the teaching of architecture in France is still centralized in the *École des Beaux Arts* in Paris; although the influence of leading modern architects opposing the *École des Beaux Arts* is spreading fast among the younger generation. So far, the regional schools in Lille, Rouen, Rennes, Lyons, Marseille, Strasbourg, and other provincial cities are still branches of the Paris *École,* working on the same programs and conducting simultaneously the same competitions amongst their students. All of this work is sent to Paris and judged there side by side with that executed in the capital, on the same terms of anonymity. Thereafter the best designs are exhibited in the provincial schools, which in this way are acquainted with the general standards required and are stimulated to maintain and surpass them.

The course of studies leading to the government diploma in architecture is elaborate and difficult. There is first of all the preliminary training for admission to the *École* itself. Students are prepared for the entrance examination either in certain special ateliers which devote themselves exclusively to this task or in the large ateliers mainly concerned with the subsequent design work of the course. The examination comprises tests in design, drawing and modelling, mathematics, descriptive geometry, science and the history of art. Normally the number of entrants is about 450; 60 only, including 15 foreigners, are passed. After admission to the *École* the work falls into three sections — second class, first class and the great prize competitions, of which the most important is that for the *Grand Prix de Rome*. Before promotion from the second to the first class further tests must be passed in science, mathematics. geometry, perspective (*q.v.*), construction and design. Concluding the studies in the first class there are final examinations in physics, chemistry, building laws, regulations and design.

On the results of these the diploma is awarded after a course which, from the time of admission to the second class, usually extends over at least four to five years.

Great Britain and Dominions. — So long as English architects followed, as they did throughout the 17th and most'of the 18th centuries, a single architectural tradition, and were content simply to develop it; and so long as the technical requirements of building were relatively simple — the pupilage system was adequate for the education of the profession. But the foundations of this world of commonly shared artistic convictions and practice began to be undermined when architects ceased to be satisfied with giving to the style of the Italian Renaissance a national character, and sought their inspiration in the antique origins of that style. The re-study of Roman forms was followed by the discovery and copying of Greek, with the result that by the end of the 18th century the architectural student had already lost his certainty of outlook. The variety of the prospects opened up to him was further extended by the Romantic movement. This, finding its architectural expression in the Gothic revival, completed the confusion which had been initiated by archaeological research. The orderly development of English architecture was lost in a "battle of the styles," and the offices of practising architects, which had formerly served as the instruments of a common professional education, were reduced to dissociated units, each of them the vehicle of a personal concept of architecture. Finally, by the latter half of the 19th century, the practical requirements of building and the methods of construction employed had greatly increased in range and complexity, so that the technical equipment required for their mastery alone had become more than could be supplied by the normal office. All these factors combined to render the pupilage system no longer a satisfactory method of education for the profession. Institutional training had to take its place, and during the last 50 years considerable progress has been made in establishing and developing schools of architecture devoted to giving systematic courses of instruction in the whole technique of building, and endeavouring to replace the lost traditions of design by teaching based on rational principles.

There are to-day in Great Britain four types of institutions giving instruction in architecture: technical schools, schools of art, independent professional schools and universities. With few exceptions the first two offer courses of not more than three

years' duration, and the classes are in many cases held at night. The main function of schools of this order, which are usually under municipal control, is to supplement the pupilage system in those parts of the country, still of considerable extent, in which it yet survives. But the real qualifying work is undertaken by schools whose course is a full day-time one, extending over five or more years.

The full five year course was formally introduced at the Liverpool University School in 1920, when the Architectural Association school in London adopted one of similar character. Such courses, when taken at a university by matriculated students, lead to a degree; when taken at an institutioq of non-academic rank, to a diploma similar to that granted by the universities to graduates who have not matriculated.

At the present time the largest school of architecture in England is that of the Architectural Association and the next largest that of Liverpool university. Both these schools show definite tendencies away from the ***Beaux Arts*** influence and towards contemporary architecture, period design having been dropped almost entirely. In Scotland the Glasgow school has the greatest number of students. Through its affiliation with the University of Glasgow it has, since 1925, been able to offer a B.Sc. degree with honours in architecture. In Ireland a single school has been established, that of University college, Dublin. Here a course of three years in the school, followed by two spent in gaining practical experience, leads to the degree of Bachelor of Architecture. In the overseas dominions of the British empire — Canada, South Africa, Australia and New Zealand — university schools of architecture have been founded which conduct courses of study varying from three to five years in length. Particularly in the case of Canada and Australia, English influence in architectural education is accompanied by American, with the result that the complete transition from pupilage to training under university auspices seems likely to be more rapid in these countries.

The normal curriculum of the larger qualifying schools in Great Britain provides for the study of design and construction throughout five years. In addition to the work done in the school studios, courses of lectures are given on the theory of design and construction, history of architecture, descriptive geometry, sciagraphy, perspective, sanitation, hygiene, surveying, specification, estimates, contracts, professional practice and other cognate subjects. Provision is sometimes made for specialization during the last two years, the course being then taken with honours in either design or construction to meet the demand for advanced qualifications in both these spheres. In certain of the academic schools the first year's programme of study includes such liberal subjects as languages, social history and literature. A portion of the concluding part of the course is always spent by the students in gaining practical office experience. The Liverpool school, having established connection with offices of American architects, each year sends over a number of selected students to acquire such experience in the United States. Town planning (see TOWN AND CITY PLANNING) is now a recognized subject in most schools of architecture. Two of them, Liverpool and London university, have departments of civic design with professorships established respectively in 1912 and 1914, and both award certificates and diplomas in civic design.

From its foundation in 1835 the Royal Institute of British Architects has been the supreme controlling authority of the profession throughout the empire. At no time, however, has the R.I.B.A. itself undertaken the teaching of architecture. But by setting up, in the latter half of the last century, a centralized system of examinations when no professional tests existed in the country, it performed a notable service in raising the general level of professional knowledge. Through its board of architectural education it has now delegated to certain approved schools the task of qualifying candidates for admission to the institute, only maintaining its own centralized examinations for students not seeking entry through scholastic channels.

The following schools of architecture are now recognized for exemption from the R.I.B.A. final examination (except in the subject of "Professional Practice"): Robert Gordon's colleges, Aberdeen; Edinburgh College of Art; Royal Technical college, Glasgow; University of Liverpool; Architectural association, London; University of London; University of Manchester; McGill university, Montreal, Canada; University of Sydney, Australia. The schools of architecture in the following institutions are recognized for purposes of exemption from the R.I.B.A. intermediate examination: School of Art, Birmingham; Royal West of England academy, Bristol; University of Cambridge; Technical college, Cardiff; Leeds College of Arts; Leicester College of Arts and Crafts; Northern Polytechnic, London; Armstrong college, Newcastle-on-Tyne; University of Sheffield; Municipal School of Arts and Crafts, Southend-on-Sea; University of Toronto; Sir J. J. School of Art, Bombay. In both classes the maintenance of the requisite standard is assured by the periodic inspection of a visiting board, appointed by the R.I.B.A. board of architectural education, which reports to the institute on the work of the various schools granted or applying for exemption. The institute further requires to be satisfied as to the preliminary general education of students, and evidence has now to be submitted upon this point in each individual case. As scholasti'c training in architecture has tended to become increasingly lengthy and expensive, it has been feared that a certain proportion of potential talent might be excluded from the profession on that account. To meet this contingency the R.I.B.A., with its provincial allied societies, has instituted a scheme of maintenance scholarships which are competed for annually and are tenable at schools of architecture "recognized" by the institute. A number of valuable prizes and studentships are offered by the R.I.B.A. each year for competition amongst architectural students throughout the empire. Further open to students who are British subjects is the Rome Scholarship in Architecture, established in 1913 by the royal commissioners of the exhibition of 1851. The annual competitions for this scholarship are conducted under the direction of the faculty of architecture of the British school at Rome and the scholarship itself is tenable at that school for three years.

Germany, Holland, Switzerland, and Other European Countries. — Architectural education in Germany, Holland, Switzerland and the former Czechoslovakia is given by a variety of institutions — technical institutes of university rank, colleges, and schools of applied art. After the World War, modern European architects turned the educational system, particularly in these countries, toward more functional design and toward closer contact with contemporary productive methods. In Germany the Staatliches *Bauhaus* in Weimar (and later in Dessau) had started the combining of artistic training in modern design with practical training in crafts and building — a method which has since influenced various architectural curricula. As far as other European countries are concerned it may be said that the tendency is generally to make architectural education the business of specially organized schools. Belgium provides for the training of architects in municipal academies of fine arts and in the professional schools known as the St. Luc academies. At present the Royal Academy of Art is the only institution that provides a complete training for architects in Denmark. Norway has made architectural education a State responsibility and, in the Technical university established at Drontheim, a four years' course leading to a diploma is in force. The organized training of Swedish architects is divided between two institutions, the Architects' Professional school of the Technical High school and the Building school of the High School of Art. A period of six years covers the total course, four being spent in the Professional school. The technical colleges of Austria are of university rank and two of them, those of Vienna and Graz, give technical and artistic training in architecture. In addition, the Viennese Academy of Plastic Arts comprises two "master colleges" for architecture, which carry the education of students to a higher stage. State examinations are held, and for those who qualify there is legal protection for the title of architect. A special faculty of architecture in the Royal Joseph Technical university at Budapest is responsible for the professional education of Hungarian architects. A diploma is awarded on the successful conclusion of the course and, as in Austria, the title of architect is legally protected. In Spain architectural training is

given at the High School of Architecture at Madrid, which is affiliated with the university, and at the Barcelona school.

United States.—Organized architectural instruction in the United States was first given in the schools of technology, where design was taught as early as 1860 as a part of the science of building. Prior to 1860 the English pupilage system had been the only method of qualifying for practice. The first independent courses in architecture were established by the Massachusetts Institute of Technology in 1866, by the department of engineering of the University of Illinois in 1870, and by Cornell university in 1871. From the beginning these schools and others established at Columbia university and Harvard university in 1881 and 1890, took an active part in fostering the development of classic architecture. At a time when most architects in America were under the influence of English romanticism, the schools taught a system of design based upon the formulae of Vignola. The precision of this system no doubt appealed to the practical minds of the engineers in charge of them; but an impetus was given to more liberal teaching by the growing number of architects returning from study at the *École des Beaux Arts* in Paris. These architects introduced into the American schools the methods of the *École*, gradually eliminating the control of the engineering faculties. To further establish their system they brought French professors of design to America. The success of the latter. who were among the most brilliant teachers in the American schools, completed the supremacy of the *Beaux Arts* methods in the United States. And finally, a society of *Beaux Arts* architects was formed which supports the Beaux Arts Institute of Design, an organization that by the regular issue of programs and judgments intends to complement the work of the collegiate schools. However, corresponding to the new scope of architectural education abroad. the influence of the *École des Beaux Arts* is now fading. Reaction against the former separation of practice in building from academic learning is growing, and emphasis on training in functional contemporary design and construction is gradually displacing that on period design and decorative design. The main representatives of these modern methods of training are: The Graduate School of Design, Harvard university, Cambridge, Mass.; Armour Institute of Technology, Chicago, Ill.; Cranbrook Academy of Art, Bloomfield Hills, Mich. Other important schools are: University of California, Berkeley, Calif.; Carnegie Institute of Technology, Pittsburgh, Pa.; Columbia university, New York city; Cornell university, Ithaca, N. Y.; Georgia School of Technology, Atlanta, Ga.; University of Illinois, Urbana, Ill.; Massachusetts Institute of Technology, Boston, Mass.; University of Michigan, Ann Arbor, Mich.; University of Minnesota, Minneapolis, Minn.; Ohio State university. Columbus, O.; University of Pennsylvania, Philadelphia, Pa.; Princeton university, Princeton, N. J.; Yale university, New Haven, Conn.; University of Virginia, Charlottesville, Va.

Mexico.—The training of architects in Mexico is now, after passing successively through Spanish and Italian phases, being conducted on French lines by the Mexican National Academy of Fine Arts, an institution recognized as of university rank. The Academy course is a four years' one, modelled essentially upon that of the *Beaux Arts* and largely administered by professors who have had direct or indirect experience of the French system.

Japan.—Since 1873 Japanese architectural education has been organized in the Western manner. It is entrusted to high technical schools and to universities. Both have three year courses in which chief attention is paid to the constructional aspect of architecture. There are three universities with architectural departments in the faculties of engineering, the Tokyo and Kyoto Imperial universities and the Waseda university. In the imperial universities two years of post-graduate research may lead to the conferment of a degree.

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ARCHITECTURAL RENDERING: *see* RENDERING, ARCHITECTURAL.

ARCHITECTURE, the art of so building as to apply both beauty and utility. The end of architecture is to arrange the plan, masses and enrichments of a structure in such a way as to impart to it interest, beauty, grandeur, unity and power without sacrificing convenience. Architecture thus necessitates the possession by the designer of creative imagination as well as technical skill, and in all works of architecture properly so called these elements must exist, and be harmoniously combined.

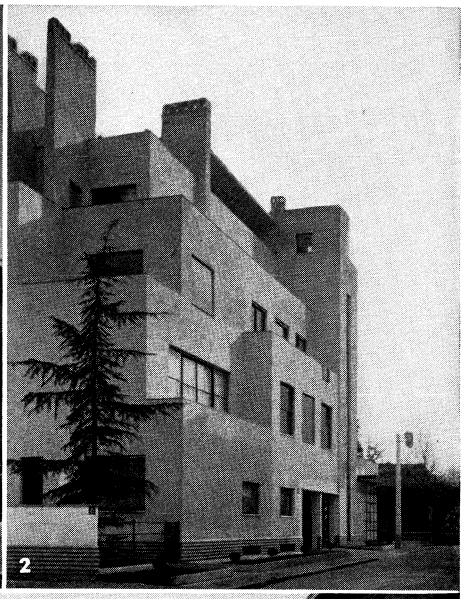
The pages immediately following are devoted to an editorial survey of architecture since it began. Any general survey that treats architecture only chronologically, however, burdens the reader with facts, interesting, but to-day of relatively small importance, for the new forms produced by steel have revolutionized the art. Modern architecture is therefore treated first; an historical survey of the influences on and the peaks of architectural evolution is appended. Elsewhere in this work the various manifestations of the art, as explained in this main article, and many architectural subjects and terms are discussed under their own headings *(see* ARCHITECTURAL ARTICLES).

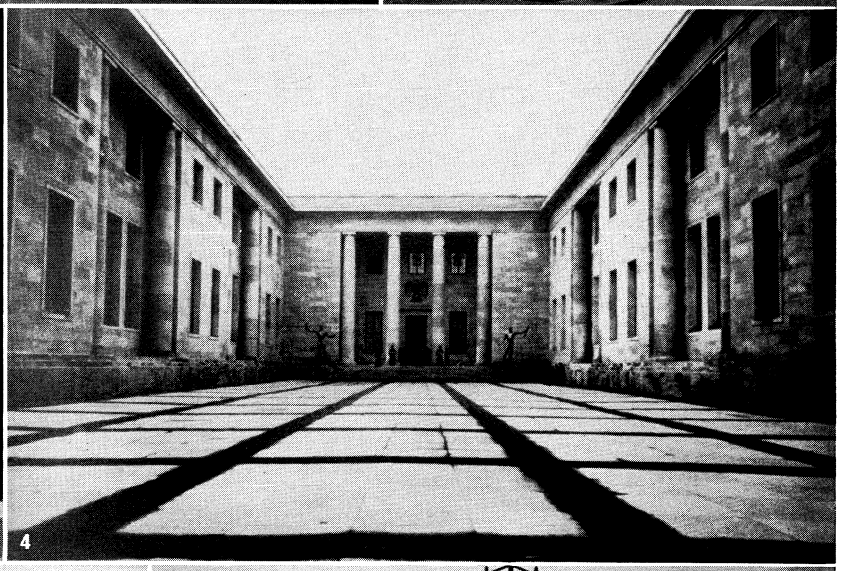
INTRODUCTION

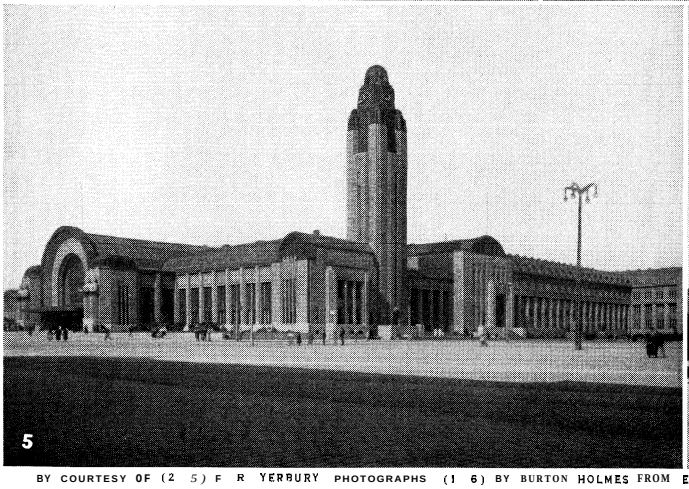
The problem that architecture sets itself to solve is how best to enclose space for human occupancy. For the earliest attempts at a solution *see* ARCHAEOLOGY, for architecture is recorded only in those buildings whose materials have endured. All building of a permanent character has been governed by four basic structural principles—the post and lintel, the wooden truss, the masonry arch and the modern steel skeleton—each of which, in evolving, gave the art new impetus. The post and lintel, the wooden truss and the masonry arch, however, all developed in periods mainly devoted to religion, agriculture, barter in the market-place and war. Industrialism created a new set of social and economic relationships. It made commerce the chief human activity. It introduced large-scale merchandising, calling for large and individual places in which to transact business. New types of enclosed spaces rose to meet the changed conditions. Steel appeared at the beginning of this new period; speed became possible; building acquired an entirely new element.

The transition of steel from merely strengthening stone to carrying the masonry load at each floor was the most momentous step in the history of architecture since the days of Rome. In a single bound architecture was freed from the shackles of stone-weight and made flexible beyond belief. Suddenly architecture gained a new dimension, the possibility of almost unlimited verticality. The extent to which steel has liberated architecture from the burdens of past building methods may be observed in its current use in every type of structure. It is now the accepted method of construction. It saves space and makes for economy and speed in building. Walls can be made thinner without sacrificing strength. Construction goes forward on many floors at once, much more rapidly and yet at less expense.

The historic architectural styles came from distinct nations isolated by difficult and limited means of transit and communication. Each was evolved by a segregated people, each had individual qualities, each in itself represented truly the society that bore it. But during the last 100 years architecture progressed so rapidly that the designer, impelled by an unprecedented demand for buildings, and with knowledge at his elbow of everything the world had yet produced, turned for embellishment to the historic styles, copying and adapting rather than creating. Consequently, many





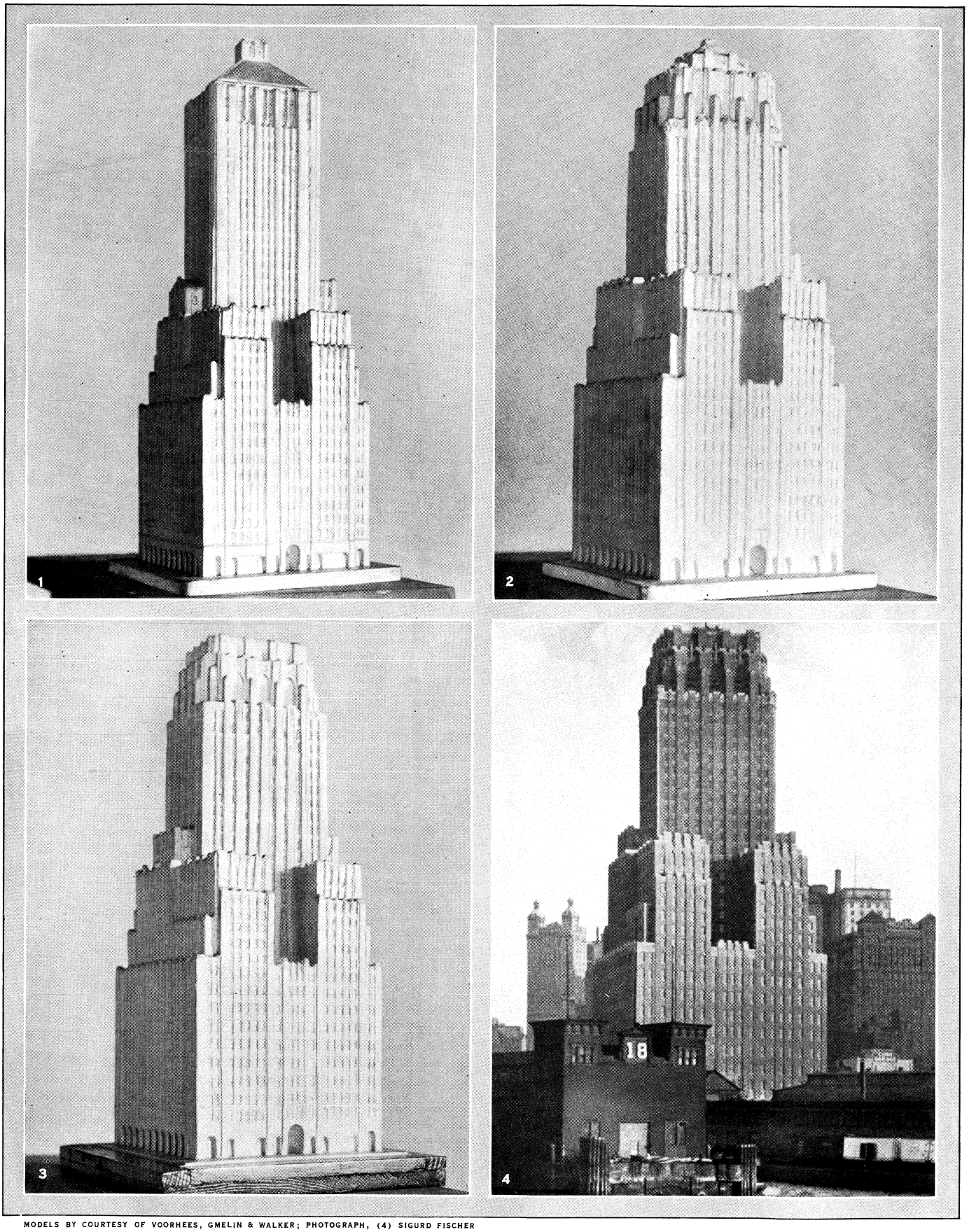


BY COURTESY OF (2 5) F R YERBURY PHOTOGRAPHS (1 6) BY BURTON HOLMES FROM EWING GALLOWAY, (3) SOVFOTO, (4) ACME

MODERN BUILDINGS SHOWING ARCHITECTURAL TRENDS IN EUROPEAN COUNTRIES

1. Main building of the University of Rome. Large reliefs provide the principal decoration in a façade of simple vertical lines
2. Concrete modern houses in the Rue Mallet-Stevens, Paris; Mallet-Stevens, architect
3. Model of the Palace of the Soviets, Moscow, topped by a gigantic statue of Lenin
4. German Chancellery, Berlin. Massiveness and severity are dominant architectural motifs of the Nazi régime
5. Railway station, Helsingfors, Finland; E. Saarinen, architect. This building has modern detail but does not deviate notably from conventional forms
6. Railway station, Florence, Italy. Space and lighting problems solved in a modern manner

ARCHITECTURE



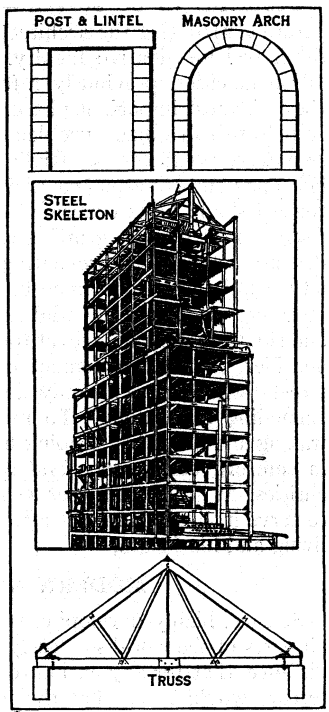
MODELS BY COURTESY OF VOORHEES, GMELIN & WALKER; PHOTOGRAPH, (4) SIGURD FISCHER

TRIAL MODELS AND COMPLETED STRUCTURE OF THE N. Y. TELEPHONE COMPANY BUILDING

1. First trial model, which, taking advantage of all the bulk possible under the restrictions of the zoning law, carried the tower higher than was finally deemed necessary
2. Second trial model, showing tower reduced in height, thus forming a pleasanter relation to the general mass of the supporting building
3. Final model. The top of the tower has been simplified
4. The completed building, at Barclay and Vesey streets, from the Hudson river side. Such an exceptional view, showing the apportionment of the tower to the building mass, cannot be obtained of most New York towers, because of lack of suffioient space in front

buildings to-day express neither contemporary nor any other culture. Architects have begun to realize the falseness of thus slavishly adhering to stylistic forms, and the new industrial and commercial architecture of Germany and America, for example, has issued directly from this fresh desire for logical design.

Building Activity.—In the United States of America the sustained demand for quantities of building is enormous; old buildings give way to new, new buildings seem almost to rise over night; and Europe, whose tendency has been to retain and use what exists, shows a marked trend in the same direction, as in the development of Kingsway and Regent street in London and in the Continental cutting of boulevards in Paris and in Rome. Anything that so enormously increases both the size and number of buildings must be accounted a potent factor in all kinds of architectural developments.



STRUCTURAL PRINCIPLES IN BUILDING

A prime cause of building activity is the concentration of population in and near the larger cities. Since about 1885 machinery had radically changed human relationships. Men and women released from the farms by traction ploughs and harvesters have flocked to the cities to produce manufactured articles. The production and use of more and more articles, both necessities and luxuries, require more buildings in which to make them, more buildings from which to sell them, more buildings in which to transact the business arising from their manufacture and sale, and more homes to house the workers. With this concentration of population have come the corporation, the trust and the super-trust. Great buildings, great at least in bulk and cost, are required to house vast numbers of workers. Formerly, only religious or governmental agencies could build large structures; to-day private enterprise, through control of capital in large amounts, builds on a greater scale and more expensively than either. This evident and rapid change influences every walk of life and each new building.

The New Architecture.—Artistically, architecture is the result of a search and struggle for beauty under restrictions imposed by the structural requirements of the plan problem and the aesthetic possibilities of the materials available. Strictly speaking, it is concerned only with those buildings that embody elements of beauty, or that at least vary from strict utilitarian necessities for the sake of better appearance. In the past, building was a slow, leisurely proceeding, expensive in terms of human energy, but now changes in style, which are nothing more or less than period changes in the life of the people, occur more rapidly. Undoubtedly the outstanding feature of the new period is a growing interest in, and enthusiasm for, the architectural improvement and embellishment of all types of buildings. Whether it be homes, workshops or playhouses, improvement in appearance is demanded. The need for more buildings, the will to have them beautiful, and steel with speed in building appeared almost simultaneously as the invigorating influences that started the new architecture off and determined its course.

The architect to-day is a sculptor in building masses. His forms are limited by the practical requirements of the plan problem, *i.e.*, the interrelation of the spaces to be enclosed and the legal restrictions on building, by the materials out of which his building must be made, the machines that shape these materials and the labour available for putting them into place. This has always been essentially true, but the recent and tremendous improvements in construction methods, the new materials and new machines used for building, and the modern type of workmen employed have given the oldest art a thoroughly new aspect. Steel and speed have completely altered human relationships and, therefore, changed architecture more than any factors that preceded them. The present-day architect has to consider not only how best to enclose space for human occupancy, but many tendencies of contemporary life as well.

The art of architecture is in constant flux, for it is an ever-changing medium of expression, incapable of being static. It results from human needs and conceptions of beauty determined by the way in which the ideas of a period happen to be associated. The new art, so-called, which is evolving in both Europe and America, in fact in every nation claiming cultural advancement, can in no sense be considered strange, exotic. It does what architecture has always done: it expresses faithfully its time. When it appears strange, it is likely that the architect, under the pressure of getting out work, has not had time to study the true feeling of his art as properly as he has its physical requirements. Formerly, his knowledge of building construction, and the capacity of workmen to execute his ideas, limited the architect. So they do now; but with this difference: the machine is everywhere supplanting handicraft, and the modern architect has ta design for it.

Machines Mastered.—At first, the ease and rapidity with which machines accurately repeat processes and designs resulted in many ugly forms being turned out. This caused the gingerbread decoration that blighted the 19th century. New materials as they appeared were disguised. Metal was used for objects previously made of wood, and, by means of a photographic process, very carefully surfaced with an enamel texture that simulated the grain of wood so perfectly that only an expert could distinguish it as false. Similarly, rubber was transformed into imitation marble floors and walls. Here again the designer, pressed by the necessity of producing, demanded that the new materials imitate the old in order to design with the old forms as the basis of his design problem. Submission to machine power passed, however; mastery replaced it. For the first time in history the economic problem became not how to produce enough to live, but how to market everything produced. To sell their goods manufacturers had to make them more attractive. The basis of the new art is not to use materials as substitutes, but rather to refine their characteristic qualities. By so taking advantage of them, and by learning the capacities of machines employed to shape them, the designer evolves new surfaces in colour and texture, and new combinations in form and line, with the machine as the most important factor in the process. The machines themselves have provided the wealth that carries on such work.

Wealth and Art.—There is little demand for art among a people crushed and poor, or during the rise of a nation. The essentials of life and the provision needed for its immediate future always come first. It is only after these essentials are assured and a demand has arisen for comfort and refinement that art becomes alive. But the quality of art produced by a people cannot be measured by its wealth. On the contrary, history contains many examples of peoples who have acquired great wealth and whose art has become flamboyant and debased. Art in its highest form is produced by peoples of culture who possess high ideals; artists can only be developed by a demand for art.

Meanwhile, there has developed in modern art a new and revolutionary factor. To the new art which is evolving, this factor—the machine—is becoming a most valuable slave. Supported by machines, the possibilities for modern art are boundless, for it can be enjoyed and partaken of, not only by a limited group, but by all mankind. Significantly, the machine has first manifested itself in architecture, the parent art. Each building is regarded as a machine planned, designed, constructed for a special purpose, a machine to be scrapped when need for its peculiar type of service ends. Post-war architecture, and art generally, tends to express itself in mass and form, in efficient essentials refined and made beautiful, in simplicity. Called on to enclose new forms of spaces, the architect has developed new methods of construction and is achieving new results.

Skeleton Construction. — The structural principle responsible for these new forms is the skeleton, of structural steel or of ferro-concrete (*q.v.*), which carries the building load. Steel takes up all the stresses to which a building is subjected; compressive, tensile and shear. Reinforced concrete acts similarly save that the tensile strain is cared for by the steel imbedded in the concrete and the compressive by the concrete itself. Steel, for protection from fire and corrosion, must always be faced by some material, such as stone or brick. Reinforced concrete can only be used in comparatively low buildings; while it gives a finished surface as well as a supporting structure, its surface is difficult to decorate; but concrete is cheap, for it eliminates highly technical labour, and effects are secured by carefully studied proportion and massing. Steel can be used in any type of building; reinforced concrete is most valuable for factories, aeroplane and airship hangars, hydraulic works, power plants and other similar purposes.

Logical Design. — The designs first used in facing the new structures were drawn from old masonry forms. Conventional styles are always slow to disappear; wooden forms influenced masonry design until the days of Rome; even rock-hewn tombs, as at Corneto, had feigned roof beams. Heretofore, Gothic (*q.v.*), which was applied to churches to point them heavenward, was the only style with any verticality, and when tall buildings appeared, architects, naturally enough, turned to it for their inspiration. The Woolworth building, New York (Cass Gilbert, Architect), was the first great example of its use. But as tall buildings became more common, architects began to develop their inherent stylistic qualities. Steel frame structures permit such height, and their interior requirements bring such unusual plan arrangements, that it'grows less and less logical for masonry to inspire the designer.

The steel frame is rectangular, neither curved nor arched. Its most expressive covering, therefore, is designed in straight lines and right angles. The best American work has a real "lift" that carries the eye upward in each line of construction, by emphasizing everywhere the vertical, by subordinating the aesthetically less pleasing horizontal, and by pyramiding the masses that support the central tower. Such designing assures suitable facing for the skeleton, and the minimum of wasted material and space. The jacket of the building is then true to the underlying structure, which bears the load.

In the Telephone building, New York (McKenzie, Voorhees and Gmelin, architects), the effect is one of proportional masses, and impressively simple. The architects approached their problem from the point of view of designing something with respect for this present "machine age"; they thought in terms of what could be done with the labour of to-day, with the construction of to-day and with the machinery that would shape the materials; an entirely new and thoroughly modern feeling is expressed. In matters of detail, the old-fashioned cornice, which is meaningless when raised to a height of 20 or 40 storeys, disappeared entirely. The vertical accent is never lost, however, even when the building reaches its climax; instead of crossing it with a horizontal band, the band is ornamented by inserts that give a proper finish to the wall composition without interrupting its verticality; the same holds true for the interior. All embellishments, and these, in keeping with modern simplicity, are few, were designed for manufacture by machines. The marble work, instead of being cut in pilasters with flutes carefully chiselled out, was designed for machine production. By so using machines as a basis, architects can evolve designs characteristic of this period. Notable results have already been reached.

Colour.—In view of the many new building materials that modern machinery has made available, colour, which was used extensively in ancient architecture, particularly in Egypt, western Asia and Greece, may again become an important factor in design. A few attempts of questionable success have been made, but most modern cities, in both Europe and America, are rather drab. Where used, colour has soon been lost under the smudge of dirt and soot that reduces everything to grey. But it is not unreasonable to suppose that improved methods of fuel consumption, electric transmission and city management may eventually eliminate soot and dust from city atmosphere. New materials, especially in the field of glazed tile of enduring colour, may then be used to advantage in giving modern cities the brilliance characteristic of antiquity. We are not here suggesting a mere plastering of colour in spots like postage stamps on otherwise drab buildings, but rather colour used as an inherent part of a building's composition, like, for example, shadow bricks, accentuating its line, form and proportion. (See COLOUR IN ARCHITECTURE.)

Problems to be Solved. — The problems of the immediate future confronting the architect demand a well-trained and highly developed imaginative faculty. With the concentration of population in cities, previously referred to, city architecture became the art's most important phase, and the architect is now called on to help to solve many problems not properly his own (see TOWN AND CITY PLANNING). Right concentration multiplies business efficiency and convenience, and the drift of building developments toward single units covering entire squares has an enormous influence on design. A growing tendency to bring business and residence together, thus preventing the present waste of transporting city populations from home to office twice daily, may well lead to structures with a residential zone on top, a business zone below and sidewalks at a high level for the residents. The architect must consider, too, the movement of traffic through the now crowded streets, whose capacity only double-decking, arcaded sidewalks or tunnelling can extend. To modern man, spending most of his waking and all of his sleeping hours indoors, buildings mean more in comfort, convenience and well-being than any other material entities. If architecture serves his purpose, life is good; if it fails to serve it, life is harsh; it affects his thought, his art, his mode of living and his future.

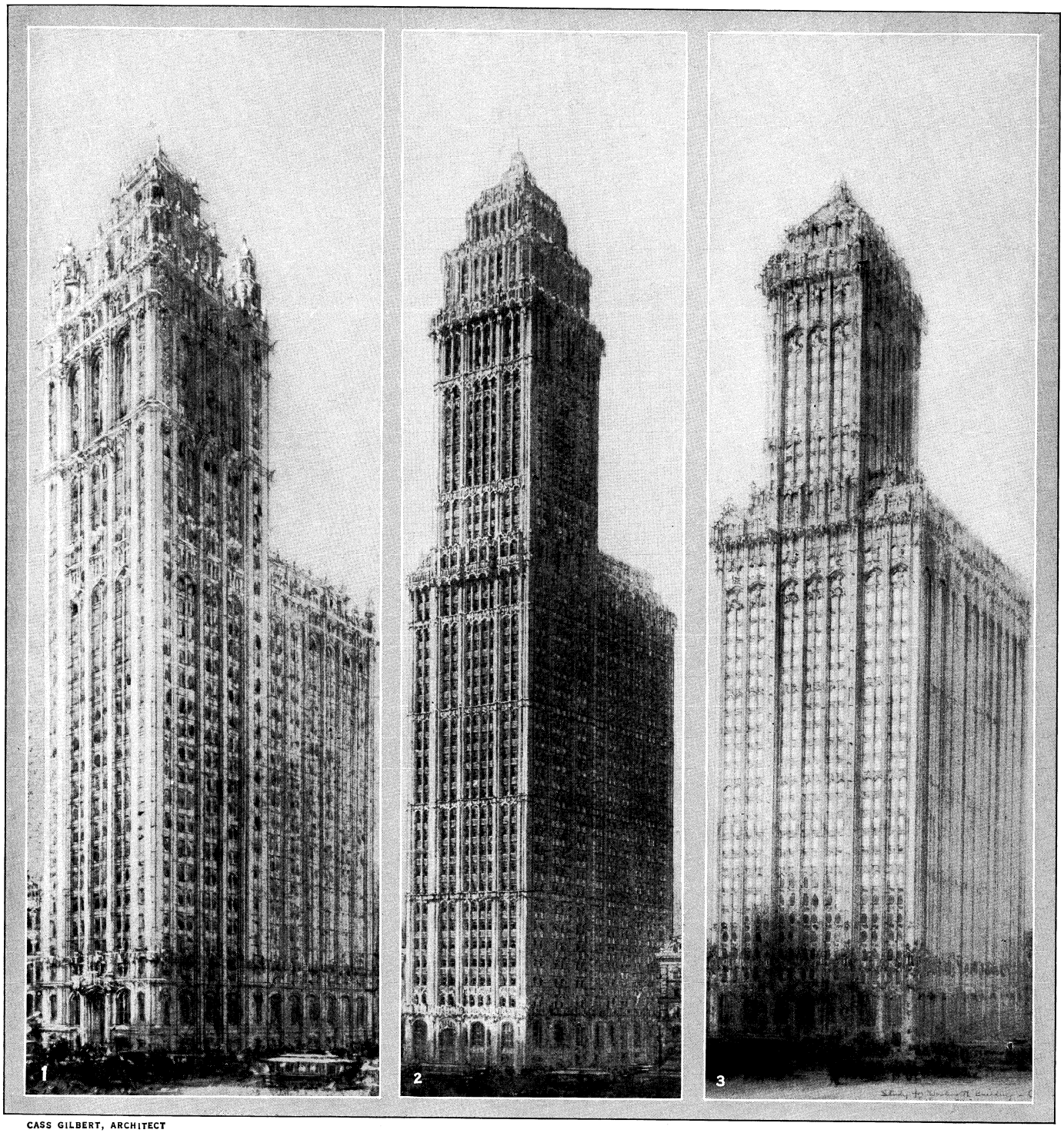
MODERN ARCHITECTURE

Science, highly developing transit and communication, has knit all parts of the world so closely together, and so reduced time and distance, that for any nation to develop a purely indigenous architecture would mean that the material and spiritual status of its people had been untouched by modern inventions. Modern architecture therefore will be discussed not by geographical boundaries, but according to those influences — industrial, social, educational, governmental, and religious and memorial — that are the basic causes of all building development, and common to all nations. They have been placed in the order of their importance, considered in terms of capital investment and the number of people involved.

I. INDUSTRIAL ARCHITECTURE

Under this classification are included all buildings in which manufacture, purchase, sale, exchange and transport of commodities are carried on, and in which the financing of business enterprises is negotiated. Industrial architecture has now peculiar significance, because the present period of civilization is normally neither an age of war nor an age of art, but a scientific and industrial age. It constitutes by far the most important architectural development since 1900, not alone as measured in terms of quantity, but in terms of actual progress as well. Industry and commerce, through combination and absorption, have grown far beyond the wildest imaginings of the '80s of the last century, and their necessities have developed a striking and significantly new architecture, highly expressive of the present age. The trend is toward larger and larger units — larger office buildings, larger department stores, larger banks, larger railway stations, larger industrial plants.

The increase in the height and mass of office buildings is perhaps the most phenomenal feature of this development. Many misapprehensions exist as to its cause. One of the most persistent is that in New York, where the so-called sky-scraper has received its chief development, the long, narrow shape of the island forced growth upward. This is far from the truth. There is still plenty of room for lateral expansion on Manhattan island. The tall buildings form a narrow ridge through the centre, following the general course of Broadway. Should all the buildings on the island proper be reduced to an average height, they would probably not exceed

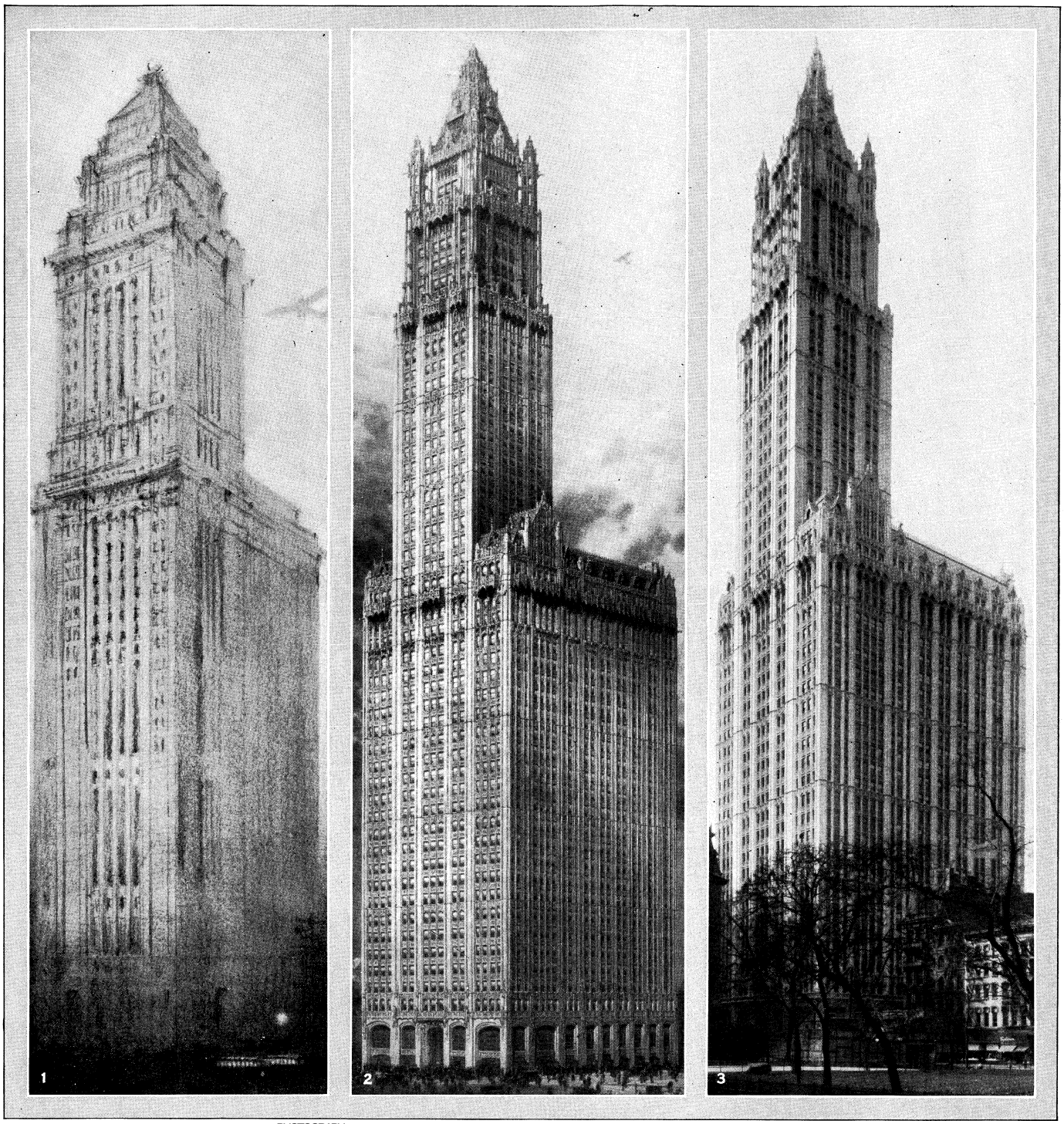


CASS GILBERT, ARCHITECT

THREE RENDERED STUDIES IN PREPARATION FOR PLANS OF THE WOOLWORTH BUILDING

1. Design showing high portion of building carried over the entire property front several storeys lower than as finally erected
2. Design showing initial developments of the tower idea, to meet the conditions of additional property to the south which had been acquired
3. First study, showing tower in centre of Broadway front but not yet carried to height of final building

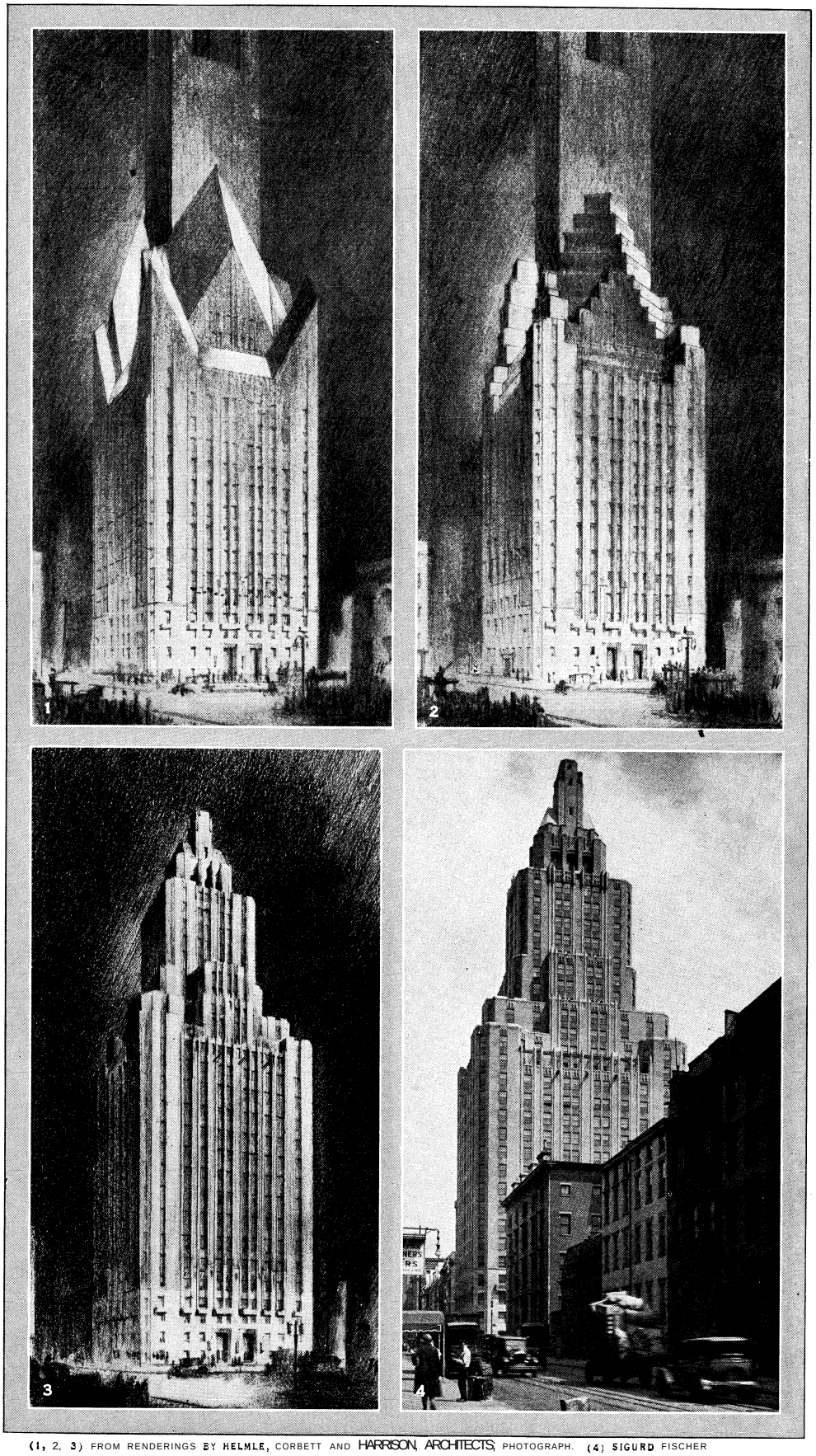
ARCHITECTURE



(1, 2) FROM RENDERINGS BY CASS GILBERT; PHOTOGRAPH, (3) (COPR.) WURTS BROTHERS

TWO ADDITIONAL RENDERINGS OF WOOLWORTH TOWER AND FINAL BUILDING AS ERECTED

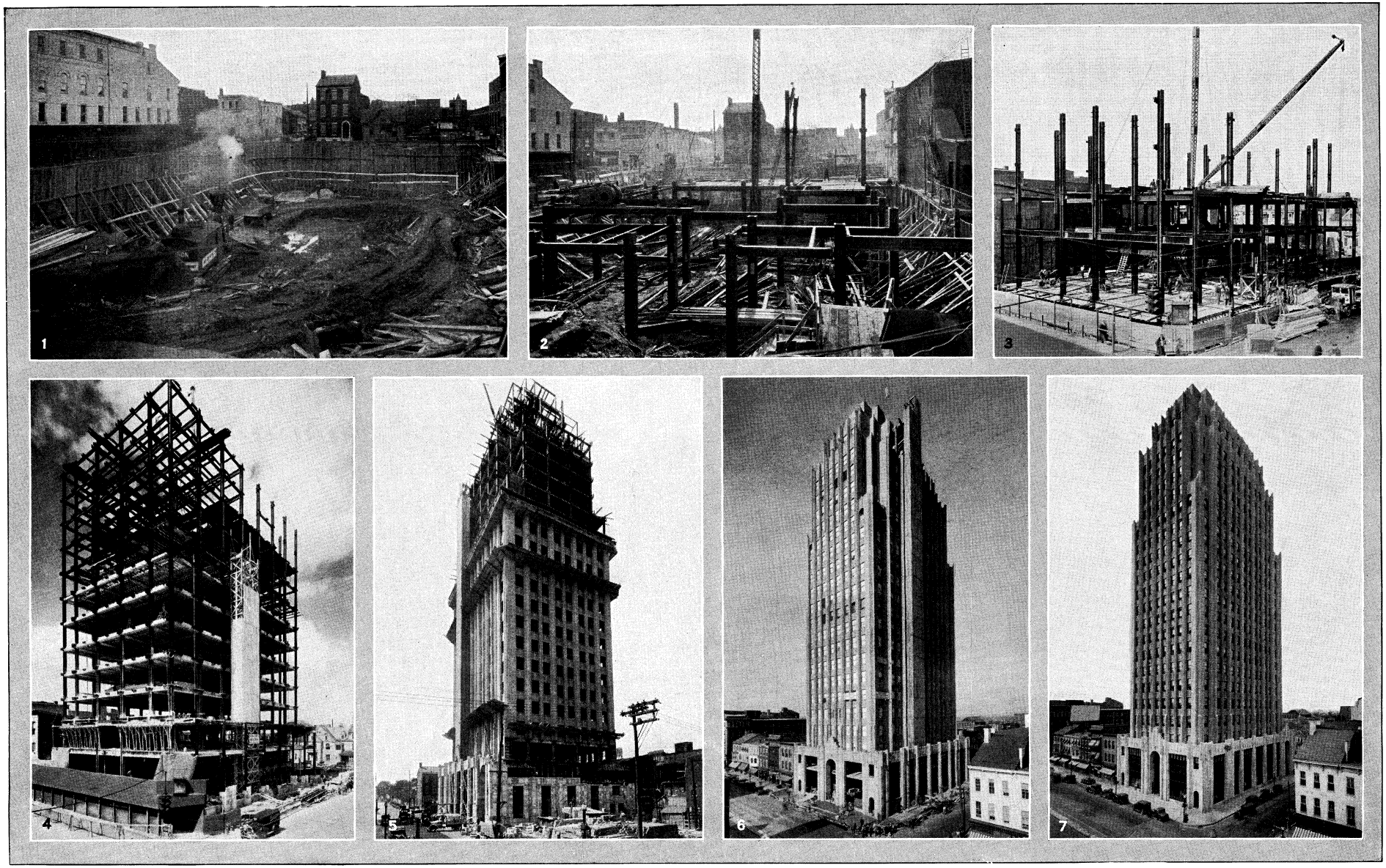
1. A rough study, prepared as a "tryout" to gauge the possibilities of a Renaissance treatment as compared with Gothic, which was abandoned because of the conflict between the adherent vertical mass of the building and the horizontality of the Renaissance forms
2. Architectural rendering of perspective as the building would look from City Hall park, with all the details worked out as finally shown in the erected building in fig. 3. This drawing was made before building actually began
3. Photograph of the building as erected, at approximately same angle as shown in the second drawing



(1, 2, 3) FROM RENDERINGS BY HELMLE, CORBETT AND HARRISON, ARCHITECTS; PHOTOGRAPH. (4) SIGURD FISCHER

STUDIES AND PHOTOGRAPH OF FINISHED APARTMENT HOTEL

1. Preliminary sketch
2. Second study, substituting vertical surfaces and setbacks for the inclined plane
3. Final building mass as determined by adjusting setbacks to normal spacing of steel frame and reducing tower
4. View of finished building, at No. 1 Fifth avenue. New York city



PROGRESSIVE STEPS IN THE CONSTRUCTION OF A MODERN SKYSCRAPER

1. Excavation work for the Pennsylvania Light and Power building, at Allentown, Pennsylvania (Helmle, Corbett and Harrison, Architects), begun on Nov. 27, 1926. The soft limestone formation of the subsurface soil necessitated an excavation of 90 feet before a firm foundation was reached
2. Steel erection under way. All the steal work had been prepared in advance ready for shipment. so that each piece arrived at the exact time when it was needed
3. Steel work raised above grade level as it appeared on Feb. 10, 1927. A floor construction of steel had been installed for each floor, providing working surfaces for the mechanics
4. The steel work about half-finished nine weeks later. The brick exterior had been started at the second floor, and a service lift shaft was erected at the side of the building
5. The steel work shown completed, six weeks later, with the stone and brick exterior three-quarters finished
6. The enclosed building with the exterior finished, three months later
7. The finished building is shown ready for occupancy 16 months and 3 days after the excavation work in Fig. 1 was begun. The temporary service shaft had been removed, and all furniture and necessary eauiprnent was installed by means of a passenger and service lift in the centre of the building

six or seven storeys. This contention is proved by the rapid appearance of groups of tall buildings in many other cities where the special topographical conditions of New York do not exist.

The truth is that increased concentration makes for increased efficiency in commercial operations. It is probable that the tall building originated in the desire of real estate owners to exploit small and heavily taxed property holdings. Increased revenue could be obtained from a small area of land by building upward. But the sky-scraper has proved invaluable to efficiency in business, for, in the final analysis, all important business affairs are negotiated through personal contact, in spite of telephone, telegraph and other means of communication.

The City Factory.—The factory in cities is beginning to take on city dress. The open labour market commonly causes a large industrial plant, especially in such work as garment-making, to build in the heart of a city. Such a plant should not be a blot among fine buildings, but should be in harmony with its surroundings. The plan problem is as varied as the nature of the work carried on, but industrial plants may be divided into three types, depending on the different kinds of enclosed spaces: (1) plants of large area, of only one floor; (2) plants of large spaces for great machines, travelling cranes, etc., in conjunction with smaller spaces of the ordinary type; (3) plants of ordinary spaces, many-storeyed and dependent on light from the sides. The first type furnishes simply a problem of building over large areas and with "saw tooth" skylight construction; the second involves engineering for broad spaces, but both clerestory and top lighting are possible; the third type does not differ from the many-storeyed office building in which a conventional upper floor plan is developed as a series of typical office units along both sides of a corridor. The line of vertical circulation (lifts or elevators) is fixed at a central point on this corridor, utility spaces are added, and the ground floor is devoted to special purposes.

Importance of the Architect.--Only in the 20th century have such problems as steel plants, mining hoists, automobile works, etc., been considered in any sense architectural. Generally handled by engineers with practical considerations only in view, the architect had no essential part, but was called in, if at all, to add a bit of "dressing" to a predetermined structure. To-day, however, the large corporations are realizing more and more that beauty in its broadest sense is a commercial asset, and that thoughtful planning with consideration for the human occupants of buildings has utility.

The architect, by training and experience, has a more comprehensive sense of arrangement than the engineer or the contractor. A certain distinctive appearance, a certain completeness of design, a more perfect interior arrangement and a general suitability seem more likely to prevail when the largest industrial buildings are handled through an architect's office than when an architect is not in the picture. The architect is consulted to advantage from the outset of the problem; choice of site, plan arrangement, types of construction, fire prevention, natural lighting, welfare provisions, plumbing, heating, ventilation and artificial illumination are all matters of consideration in the design of any building. (See also INDUSTRIAL ARCHITECTURE.)

II. SOCIAL ARCHITECTURE

Social architecture comprises all buildings for human residence, recreation, entertainment and health. Not long ago, the home provided for all these activities. To-day they are more highly specialized, and are more and more taken care of in specially designed buildings. The theatre, picture house, stadium, athletic club, etc., provide recreation. The sick and dependent are ministered to in public and private hospitals, sanatoria, orphanages, etc. This custom is growing to such an extent that many people, particularly in cities, do little more at home than sleep and entertain their friends.

Private Dwellings.--A tendency to provide co-operatively for domestic drudgery has had fairly steady growth since 1885. The factory has increasingly taken over the work of the home: food is supplied in ready-cooked form; clothes are washed in quantity; heat and light are automatically provided. Even small dwellings are now being brought into groups. The construction of homes by individual owners has diminished steadily since the World War, not only due to these new methods, or to the burdens laid upon wealth, but to the difficulty of obtaining competent domestic servants also. The large house is dependent on this class of worker which, drawn away by the war, was unwilling to return to domestic duties at its close. (See also SOCIAL ARCHITECTURE; HOUSE PLANNING.)

Apartments (Flats), Hotels.—Apartment or flat building, especially in America, is not confined to cities and towns where the concentrated population might furnish an excuse; it has an increasing vogue even in small villages. The apartment building is simply a combination of compact homes one above the other. The plan problem consists of making a series of such home units, each comprising a living-room, dining-room, kitchen, and one or more bedrooms and baths. A foyer or entrance hall, library and study may be added to the living-room; a breakfast-room, pantry and servants' hall may be added to the kitchen and dining-room; and a nursery and servants' rooms to the bedrooms. These, however, are merely supplementary to the basic unit. The popular apartment hotel is simply an apartment house in which the kitchens and the servants' sections of all the apartments are concentrated in one place and conducted under hotel management. In the hotel proper improvement in mechanical arrangements is more manifest than any change in basic planning principle. As in most other types of buildings, the tendency is toward increased size. The heavy overhead expense of a modern hotel, giving complete service of every kind, makes it difficult to operate successfully with less than 1,000 rooms. The plan problem starts with a typical bedroom floor which is repeated many times and is the basis of income. The lower floors, the least in demand as bedrooms (for the public seems to have lost its fear of fire in modern structures and prefers to be high for light, air and freedom from noise), are used for the essential hotel offices, lounging spaces, parlours, dining-rooms, banquet-halls, restaurants, cafeterias, etc. (See also SOCIAL ARCHITECTURE.)

Specialized Buildings.—Theatre design has markedly progressed, and the picture house has added a new problem. In old theatres, stage and auditorium formed two nearly balancing elements. Improved mechanical equipment has somewhat reduced the size of the stage, and the different seating arrangements of the auditorium have increased proportionately the ground area of this part. The cinema requires almost no stage, and in many cases the auditorium has been enlarged almost beyond the reach of the human voice. In both types the cross section shows the use of but one balcony, and no supporting posts to interrupt the view. Architecturally most theatres of both types are problems in interior design. Being commercial enterprises, and requiring no natural light, they occupy spaces away from the street and have at most only a small street frontage. Of course the government-owned and municipal theatres are generally free standing, and, like the Paris Opera House, have an architectural treatment in keeping with their location.

For open-air entertainment, the most significant structure that has appeared is the great stadium (*q.v.*) rivalling in size, and in some cases in architectural embellishment, those of old. These are of three general classes: those completely elliptical in form and built on banked-up earth as at Yale university; those built up from the level of the ground like the Colosseum of Rome but open at one end as at Princeton university; and those built only at one side of the play-held. (See also THEATRE ARCHITECTURE.)

Care of the sick has received particular attention (see HOSPITAL PLANNING). The World War gave medicine and surgery opportunities for study and experiment that brought about great strides in both fields and many new features in hospital design. Two types of plans may be noted: the open scheme with few storeys where ample space is available, and the compact many-storeyed type required in cities. The open plans show a more orderly arrangement of building units, central administration, kitchen facilities and power plants; general orientation is a very important factor, and lines of communication unite the various elements in a direct and simple plan-scheme.

III. EDUCATIONAL ARCHITECTURE

Under this heading are included all buildings in which knowledge is imparted and acquired, either directly, by contact between teacher and pupil, as in schools, colleges and universities; or indirectly, as in museums, libraries and exhibition buildings. Compulsory elementary education prevails in most civilized countries, and government-directed institutions are on the increase. The one-time high school group which represented merely the finishing touches of an English education has become subdivided into many different forms. Modern education, which prepares the pupil for a later status in life, has divers schools where the pupil is trained in whatever vocation he selects, and is launched successfully on a career.

Schools. — The development of architecture in school buildings has been one of the most remarkable phases of architectural progress during the present century. The architect who specializes in schoolhouse construction must be a student of educational methods, and, moreover, he must know how to conserve the physical wellbeing of the pupil during school hours by surrounding him with every element of safety that will protect his health, his eyesight and his general physical condition. The tendency toward larger and larger units that runs through commerce and industry manifests itself again in educational buildings. The large institution is the only adequate means of meeting the demand for instruction, but there is a distinct limit to the number of students that a single teacher can handle. Much study and experiment on the part of experts in this field have evolved a classroom of fairly definite size and shape. The school plan revolves around this unit classroom. Unilateral lighting is preferred; wide corridors, leading to the exits, stairways, assembly hall, gymnasium and other special spaces, adjoin all rooms; ceiling heights are ample for ventilation purposes, and when there is 15ft. or more from floor to floor above, stairways can be doubled, thus securing two separate stair exits in the space formerly occupied by one. (See also SCHOOL ARCHITECTURE.)

Universities. — The most interesting feature of the newer colleges and universities is the comprehensive plan lay-out, permitting future expansion, upon which they are being built. The older universities of Europe grew through the centuries by successive accretions, and they possess, of course, the charm and interest of historical background and precedent. Certain modern universities, notably in America, have endeavoured to recapture this atmosphere by imitating the semi-monastic architecture of those older institutions — Harkness Memorial hall at Yale and the Graduate school at Princeton, to mention only two. On the other hand, there is a growing tendency to accept frankly the changed conditions of the time and build in the modern idiom. The University of Pittsburgh plans to build a sky-scraper to house its halls of learning. (See also UNIVERSITY ARCHITECTURE.)

Libraries. — Libraries are keeping step with the general increase in public education. Many large cities have a central building, extensive in scope and impressive in design, and one or more branches at convenient points in the populous districts. The general plan consists of a central public room, where books are loaned and returned, where card catalogues are convenient for consultation and where information is given. Together with the stack rooms, this forms the hub of the plan, around which are disposed other special spaces, such as children's rooms, periodical rooms, reference rooms, special exhibits, etc., as the scope of the work demands. (See also LIBRARY ARCHITECTURE.)

Museums. — Public museums constantly take a more important place in modern life as a means of indirect education. The addition of many commercial, industrial, mechanical, horticultural and other museums to the traditional art museum is proof of this. Here the plan is comparatively simple, consisting of large well-lighted spaces through which visitors pass from room to room. Good modern practice provides one entrance with control, and a disposition of rooms that permits of any given space being temporarily closed for rearrangement or installation of exhibits without shutting off other rooms from public access. The growing tendency of the modern museum to combine educational courses open to the public with its more traditional activities freauently calls for the addition of lecture-rooms, reference-rooms and even auditoriums to the usual plan. (See also MUSEUM ARCHITECTURE.)

Expositions. — Expositions are generally housed in temporary buildings constructed for the purpose. The plan problem is of special interest to the architect, because it gives him an opportunity to make experiments on a large scale which he might not care to risk in more permanent buildings. The Columbian exposition in Chicago in 1893 changed the whole tendency of architecture in America, creating a veritable renaissance of classic styles. The Paris Exposition Universelle in 1900 experimented with the flowing line and naturalistic ornament, but with no permanent effect on architecture in general. The Wembley exhibition near London revealed certain possibilities in the use of permanent concrete construction, but lost much effectiveness through lack of distinction in setting and approach. The French, on the other hand, made the most of their Exposition des Arts Décoratifs in Paris in 1925, and many of the temporary buildings displayed architectural forms of unusual interest: the straight line, the post and lintel, sculpture in low relief panels, strong contrasting colours; classical mouldings, capitals and cornices were conspicuous by their absence. The influence of the Paris exposition can be seen in certain commercial buildings in America, and will doubtless have a lasting effect, because the style so readily adapts itself to modern forms of machine-made construction. (See EXPOSITION ARCHITECTURE.)

IV. GOVERNMENTAL ARCHITECTURE

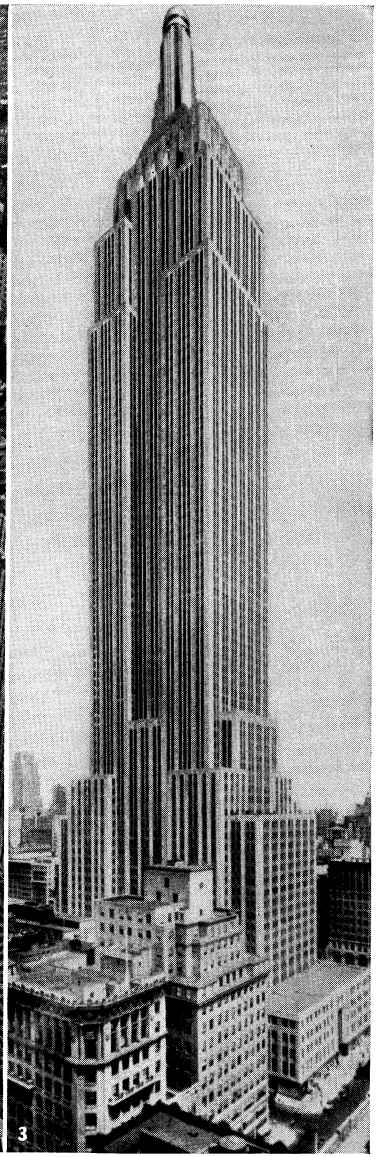
Many municipalities in Europe have erected new and imposing buildings to house local administrations. State governments in the United States have undertaken new capitols. New, modernized post-offices, custom-houses, town-halls, etc., have been built in many places.

The plan problem of modern administrative buildings is somewhat similar to that of the commercial office building except for two features: (1) the plan includes large and specially designed rooms for the assembly of boards, councils, delegates or gatherings of representatives, which dominate the plan and are surrounded by offices for government workers and permanent staffs; (2) architecturally, both exterior and interior are treated more extravagantly, with liberal provisions for landscaped settings (see LANDSCAPE ARCHITECTURE), all very properly done to impress the community with the power and authority of the State. The architectural problem is new only in so far as the tendency for the State to assume ownership of certain public utilities has considerably increased the space needed for government work. The London County Council hall, near the Houses of Parliament, the fine building of the Port of London Authority, the Town Hall of Stockholm and the State Capitol of Nebraska in the United States are conspicuous examples. (See also GOVERNMENTAL ARCHITECTURE.)

V. RELIGIOUS AND MEMORIAL ARCHITECTURE

Religious architecture, which includes all buildings erected for spiritual or commemorative purposes, appears to be in a transitional stage. In the endeavour to adapt itself to changing conditions, the Church is faced on one hand with the necessity of broadening its activities, and on the other with the problem of effecting a physical compromise with other forms of building. Architecturally this involves two distinct problems: (1) enlarging or modifying the church to house new activities; (2) combining it with commercial structures, a course adopted to some extent in the United States.

In the past, the church was a refuge for the poor and afflicted, a seat of learning and a centre of social life. One after another these functions began to be assumed by independent agencies. Education, except in the spiritual sense, fell chiefly under secular supervision; separate institutions began to care for the sick and the poor; the increased number of diversions weakened the church's social hold on the people. There seems to be, however, a tendency to resume some of these functions in the form of welfare work and community service. This has added to the necessary equipment of the church proper such spaces as small



BY COURTESY OF (1) ROCKEFELLER CENTER INC., PHOTO BY WIDE WORLD, (2) ROCKEFELLER CENTER INC., PHOTO BY THOMAS AIRVIEWS, (3) EMPIRE STATE, INC., OWNERS AND OPERATORS OF THE EMPIRE STATE BUILDING

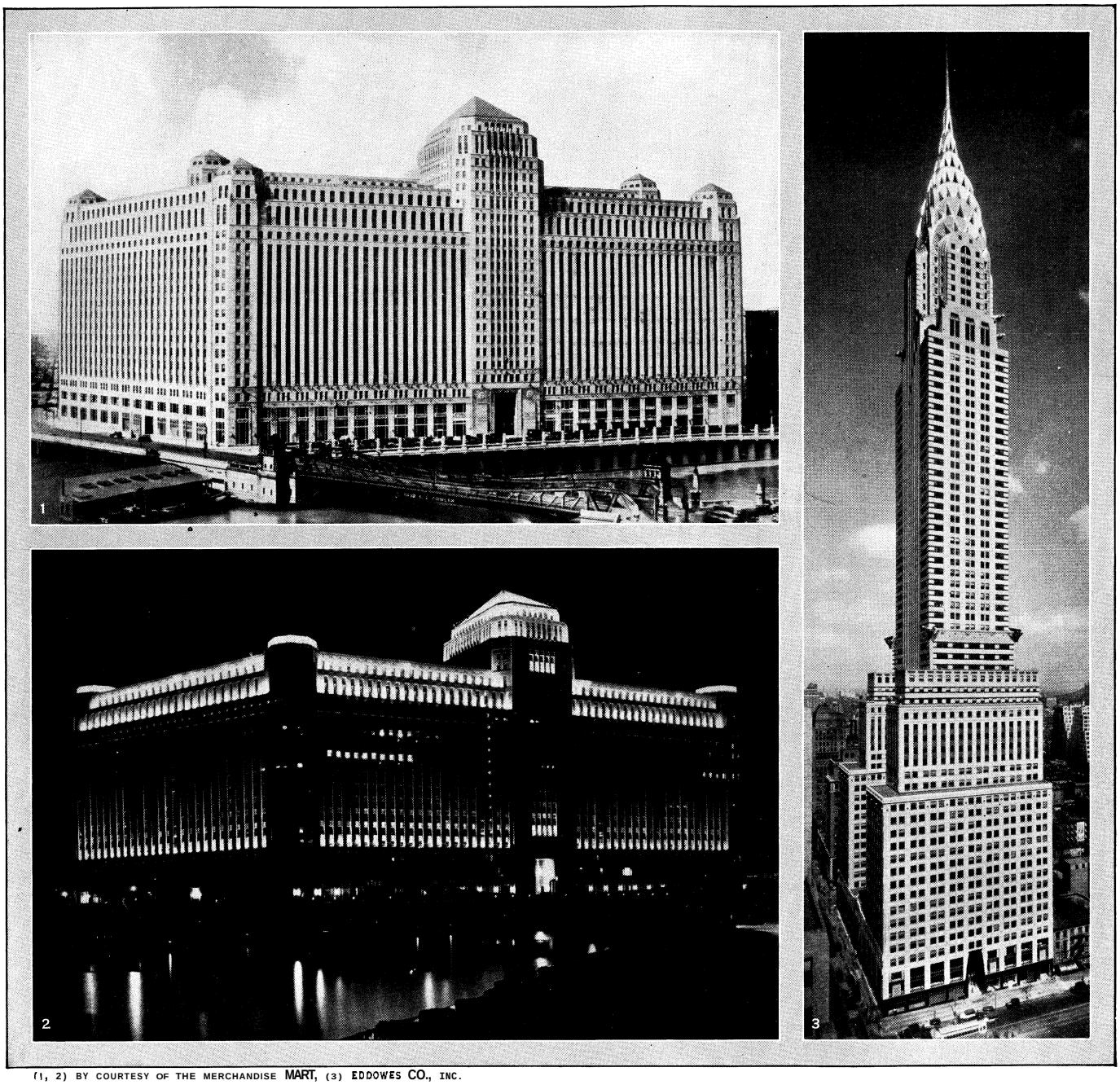
ROCKEFELLER CENTER AND THE EMPIRE STATE BUILDING

1. Rockefeller Center, New York city, completed in 1940, as viewed from Fifth avenue. The 70-story RCA building is in the centre. At the left is the 36-story Time & Life building; at the right, the 41-story International building. The smaller buildings in the foreground are La Maison Française (left) and the British Empire building

2. Rockefeller Center as viewed from the south-west, with the 14 units grouped around the RCA building. In the left centre is the RKO building. Reading counter-clockwise from this structure, the larger buildings visible are the RCA Building West, the U.S. Rubber Company building (lower left-hand corner), the Eastern Air Lines building, and a corner of the Time & Life building (right). Part of the International building projects beyond the RCA building

3. Empire State building, New York, the tallest structure of any kind in the world. It is 102 stories above the street, 2 stories below grade. The observatory roof is at the 86th floor

ARCHITECTURE



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MODERN OFFICE BUILDINGS

1. The Great Central Market of Chicago, the massive, impressive Merchandise Mart. Two city blocks long, one city block deep, 93 acres of floor space
2. Merchandise Mart, Chicago, illuminated
3. Chrysler Building, New York

auditoriums, Sunday-school rooms, gymnasia, committee-rooms, restaurants, etc. The modern church, excepting the ritualistic type, which has not materially changed in plan arrangement or source of design, tends more and more to assume the form of an auditorium in which the important consideration is to see and hear adequately.

The enormous growth of large cities has left many churches stranded in business or financial sections, miles from their parishioners, so that their very existence as buildings is jeopardized. In both London and New York there are many such churches which are preserved only for their architectural interest or historic associations. With a few exceptions, these will eventually have to give way. Even in newly developed residential communities, the small church finds it difficult to retain a fixed or stable congregation. Localities are no longer local. The automobile, the railway, the telephone and the radio have all conspired to diffuse and diversify public attention.

New Churches. — The most startling and essentially modern feature of religious architecture is the "sky-scraper church." In order to retain a position in the crowded, highly taxed business centres, certain churches in America have combined with office buildings. This enables them to carry on their social and community service without depending entirely on voluntary contributions for maintenance. The architectural problem is a commercial sky-scraper with an auditorium on the ground floor; one building is superimposed on another of quite different character.

In spite of adverse conditions, many impressive churches are being built; for instance, the cathedral at Washington, the great cathedral in Liverpool, and the cathedral of Saint John the Divine in New York. France tried a novel experiment in building the church of Notre Dame at le Raincy; this structure, built of reinforced concrete, is of rigidly simple modernistic design but of dubious aesthetic value.

Memorials. — As a problem, memorials have a peculiar fascination for the architect, because they are usually untrammelled by the practical restrictions of ordinary buildings and frequently offer the best opportunity for combination with the allied arts of sculpture and painting. The difficulties of the problem lie principally in the lack of limitations, for the freedom of choice makes selection of the appropriate mode of expression harder.

War memorials, which abound in every country, frequently employ weapons and military costumes as a basis of design. The most successful, however, stress abstract conceptions such as bravery and sacrifice, rather than the paraphernalia of war. An indication of the universal trend toward democracy since the World War is apparent in numerous memorials to the Unknown Soldier. War memorials range from simple wall tablets to buildings of impressive proportions. The latter sometimes take the form of memorial hospitals, soldiers' homes, assembly halls, stadiums, etc., in which case their inclusion under memorial architecture is merely nominal. Public interest in war memorials has brought about a recrudescence of other commemorative monuments. The monument of Vittorio Emanuele II., Rome, is one of the most impressive ever erected to one man. The Lincoln memorial at Washington, D.C., and the George Washington Masonic memorial at Alexandria, Va., overlooking the Potomac river, are other examples on impressive scales. (*See* also RELIGIOUS AND MEMORIAL ARCHITECTURE.)

HISTORICAL ARCHITECTURE

History furnishes the architectural designer with opportunities to study buildings in such mass and detail that new forms can be based on accurate knowledge of the old as they exist or existed, full size and in position, with their natural environment of light, shade, play of colour and variety of line. It gives him knowledge of the materials, the craftsmanship and the allied arts that have determined the form and character of buildings, and of the social, political and religious changes that affected nations in the past and were reflected in their buildings. Architectural history differs substantially from archaeology (*q.v.*) with which, nevertheless, it is too often confused. The archaeologist unearths and studies the forms, materials and embellishments of ancient buildings. The architectural historian relates the information gleaned by such scientific research and develops a record of past architectural styles together with the underlying human relationships that brought them into being.

To understand the evolution of the art of architecture intelligently one must first understand the mental processes by which man creates architectural works. Such procedure has not materially changed since ancient Egypt which, as far as is known, was the first western nation to establish a civilization with a fixed cultural background to leave enduring records of its achievements. The architect called on to enclose space, whether it be a tomb, shrine or simple dwelling, first looks about to see how it has been done before. If facilities are available, he travels to other lands to study foreign methods. If documents concerning ancient works exist, he turns to them also for enlightenment. From all such information as a background, from the practical requirements of his problem and from the materials and methods of construction at hand, he creates his work.

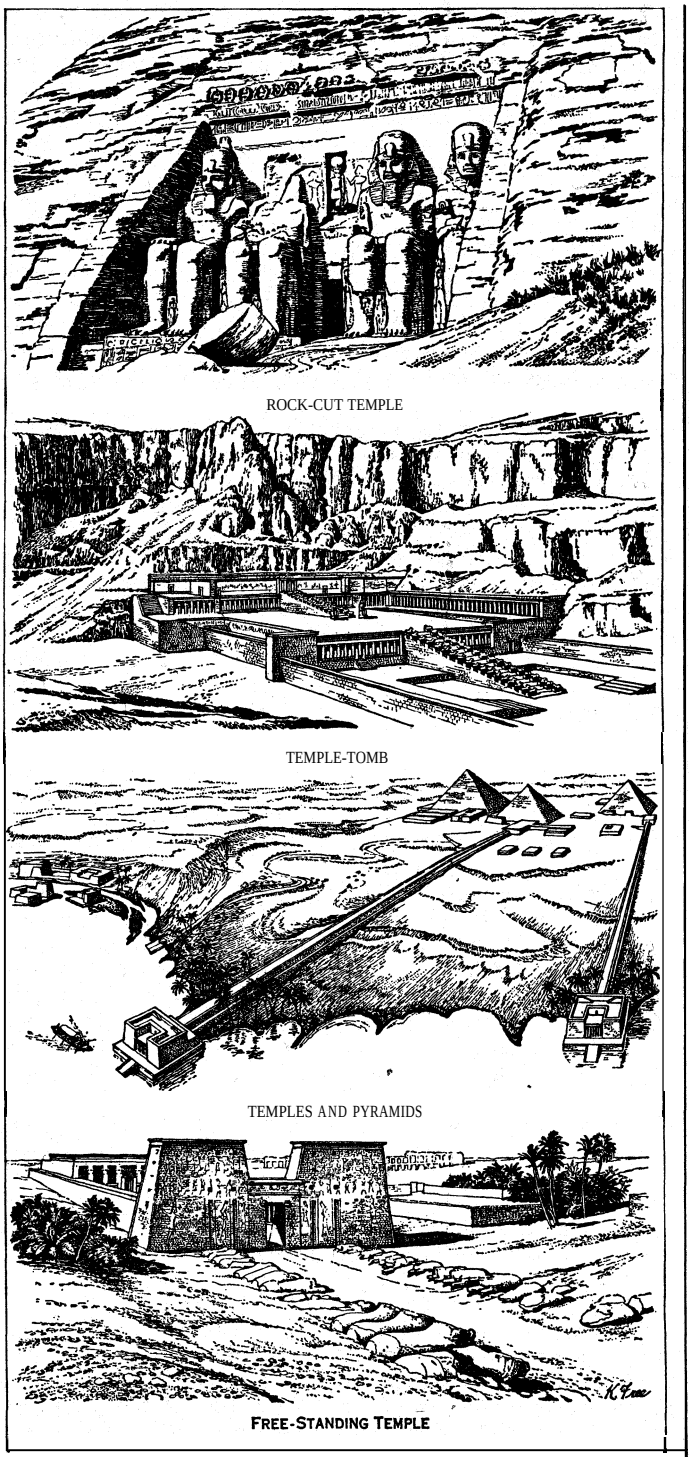
The lay mind frequently mistakes the origin of architectural styles. There are no strict demarcations between periods. Only the extent of centuries of history makes seeming divisions, because the high spot in each period is the determining factor, obscuring the transitional periods between. The present occidental art has been influenced more strongly by the ancient western countries, beginning with Egypt, than by India, China or Japan (*q.v.*); but the growing present-day connections between Far East and West may affect it more materially than past centuries of separated civilizations. The following outline is designed to relate the special articles, on such predominant periods as those of Egypt, Greece, Rome and the Gothic, which appear in this work under their own headings, with the general trend of the world's architectural development from the earliest recorded efforts. (*See* INDIAN ARCHITECTURE; CHINESE ARCHITECTURE; JAPANESE ARCHITECTURE.)

Unlike the other arts, architecture rose from a primary requirement of human life—the need for shelter. In the earliest days, the cave, the hut and the tent may have sheltered people devoted to hunting and fishing, to agriculture, to pastoral and nomadic lives. Architecture originated in more permanent dwellings in which wood was used less and less, and in which bricks, made of sun-dried alluvial clay as in the early work in Chaldaea and Egypt, became the basis of construction for walls that supported trunks of palm trees as lintels for doorheads and roofs. Some of the earliest rock-hewn tombs at Giza reproduce old wooden forms in stone, and so record the construction of periods whose buildings have long since disappeared (*see* ARCHAEOLOGY). The sun-dried bricks could not resist much pressure and required walls of great thickness with a batter, or raking side, which is even employed in the present-day huts of the fellahs.

I. EGYPTIAN ARCHITECTURE

Although structures discovered in Chaldaea, at Tello and Nippur, seem to date back to the fifth millennium B.C., the best examples of architecture prior to Greece exist in the monumental works of the Egyptians. The culture of the period was confined to a small ruling class, made up of priests and nobles. The desert relentlessly opposed man's struggle for existence, and the common people had to rely on their rulers for sustenance and protection, and on life after death to abolish cruelty and fear. During the seasons when the flooded Nile valley made agriculture impossible, the energy of the large slave population was directed to building vast tombs, temples and palaces for a reigning family of fixed position, unchanging religion and supreme power. Although stones had to be brought from distant quarries, the Egyptians achieved the most lasting architectural forms yet attempted by any civilization.

The three best-known pyramids are situated about seven miles south-west of Cairo, and were built by the second, third and fourth kings of the fourth dynasty — Khufu (c. 3969–3908 B.C.), Khafra (c. 3908–3845 B.C.), and Menkaura (*c.* 3845–3784 B.C.), who are better known as Cheops, Cephren and Mycerinus; their major interest to present-day civilization is more historic than



TYPES OF EGYPTIAN TEMPLES SHOWING THE PERSISTENCE OF THE OLD CONCEPTIONS OF TOMBS AND TEMPLES CONSTRUCTED IN CAVES

architectural (see PYRAMID). Many temples were also constructed, as that of the Sphinx, attributed to Cephren, and tombs, such as the Serapeum at Sakkara, in which the sacred bulls were embalmed and buried, and those of the kings and queens of Thebes.

We have already referred to the probable origin of the peculiar batter or raking side given to the walls of the pylons and temples, with the Torus moulding surrounding the same and crowned with the cavetto cornice. What is more remarkable is the fact that once accepted as an important and characteristic feature it should never have been departed from, and that down to and during the Roman occupation the same batter is found in all temples. Particularly notable is the strong influence of early methods of construction in wood and clay on the form and outline of the more permanent stone construction, in which no such thickness of wall or such extreme batter was necessary constructively. But their mass gives these structures a magnificent repose and an air of lasting through eternity.

A dominant will to do in each new work what had been done before seems to have been exerted in all Egyptian architecture. Variations were slight and in the direction of more extensive size and more impressive scale. One would suppose that the spirit moving Egyptian architects was always so to impress the people with the overpowering, almost supernatural, dominance of their rulers and deities that they might never think for themselves or entertain the possibility of changing their social status, a condition still existing among many of the peoples of the Far East. It is difficult for modern men and women, living in an ever-changing civilization, to realize that for so many thousands of years an entire civilization remained static, as the architecture of Egypt proves it must have done. An examination of the plan scheme of these temples shows a monotonous repetition of form, arrangement and general conception, varying only in extent. Although the high degree of conventionalization of ornament and sculpture has some value to the modern designer in his efforts to break away from purely naturalistic forms, the position that Egyptian architecture occupies as an influence on modern architecture is more historic and archaeological than otherwise, because its extreme stylistic quality is out of place in any of the later civilizations.

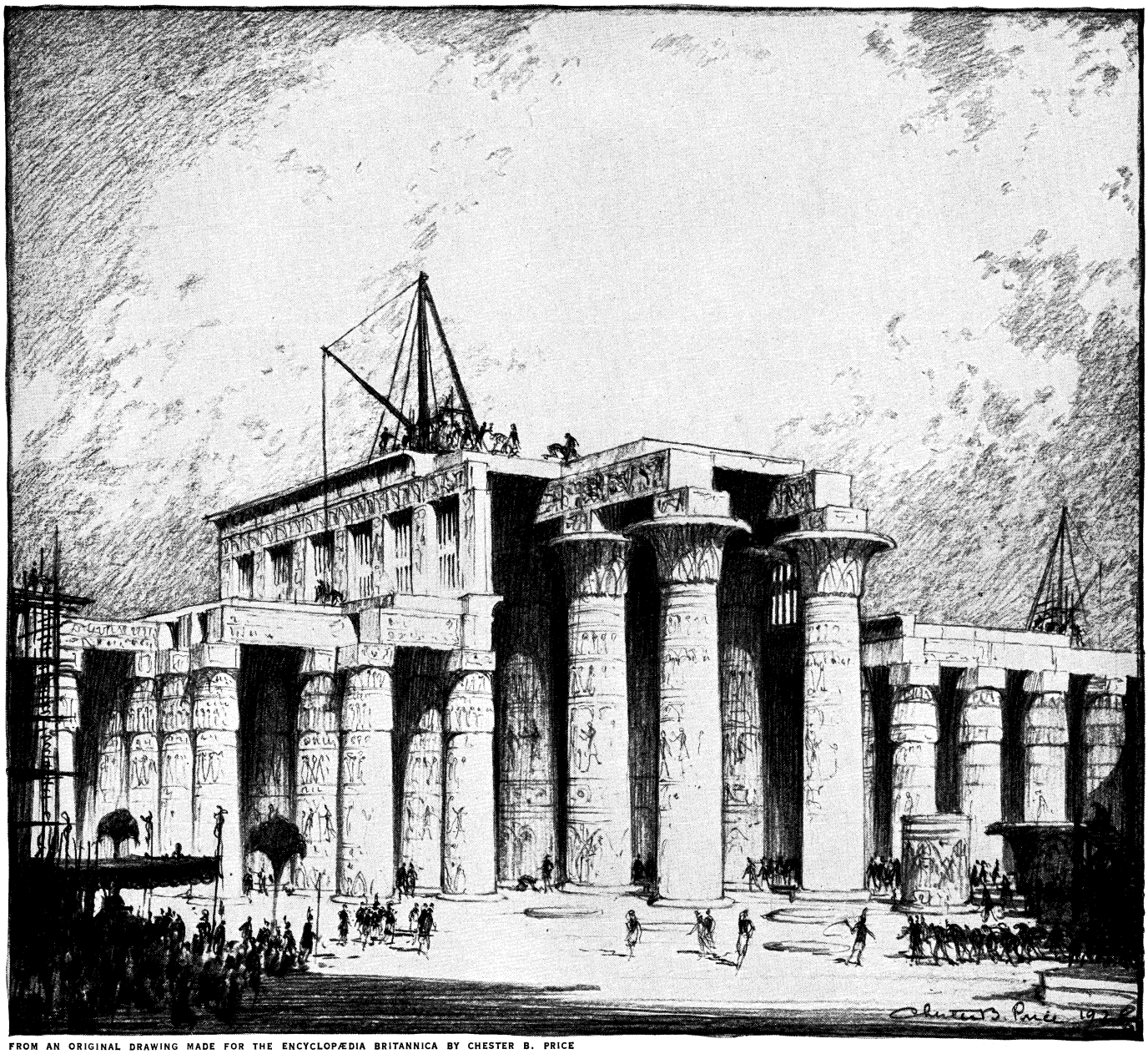
Only the one structural idea of the post and lintel was used; consequently all enclosed spaces of any size became a forest of columns. Flat roofs of massive stone slabs spanning outer walls and closely spaced internal columns were the most logical form of coverings. Central aisles of columns were of greater height than those elsewhere, giving a clerestory with a perforated stone screen through which a subdued light filtered. The wall surfaces were extensively decorated with carvings, paintings and hieroglyphics.

Each temple was planned on a long axis with regard for extreme and perfect symmetry, not only within its walls but outside them too, where the axis was extended forward in an avenue of great length flanked by sphinxes. They seem to have been designed for imperial pageants and other ceremonials, staged further to impress the masses with the power of their rulers, who were often their deities also. Probably no architectural period more visibly demonstrates how true an expression of life architecture is. Definite religious beliefs, consistent and lasting cultural habits, and limited and unchanging social relationships, must result in just such uniformity as Egypt showed. (See also EGYPTIAN ARCHITECTURE.)

II. WESTERN ASIATIC ARCHITECTURE

Many architectural records are to be found in the countries north-east of Egypt, where archaeologists have unearthed the remains of Assyrian and Persian structures. A great deal of historic value in explaining the movements of people in the development of dominant monarchies has come to light. About 800 B C. the Assyrians seem to have begun to build the magnificent series of palaces from which were brought the winged man-headed bulls and the sculptured slabs now in the British Museum. A type of architecture different from that of Egypt was developed, on account of disparate religious forms, dynasties less firmly established, less durable building materials and flat country subject to inundations which required erection of platforms to build on.

Structurally, the masonry arch, the barrel vault and even the dome were new factors, although records of the last are only preserved in bas-reliefs, not in *situ*. Excavations recently undertaken by the University of Pennsylvania have revealed indications of the same piling up of one culture on the ruins of a preceding one that is characteristic of many great cities of modern Europe. Such researches are of intense historic interest, and many beautiful objects of art, both in metals and tiles, have been discovered. But the existing remains of the palaces, even those giving fairly definite clues, are not sufficiently intact to permit restoration, or to have had any marked influence on recent architectural progress.

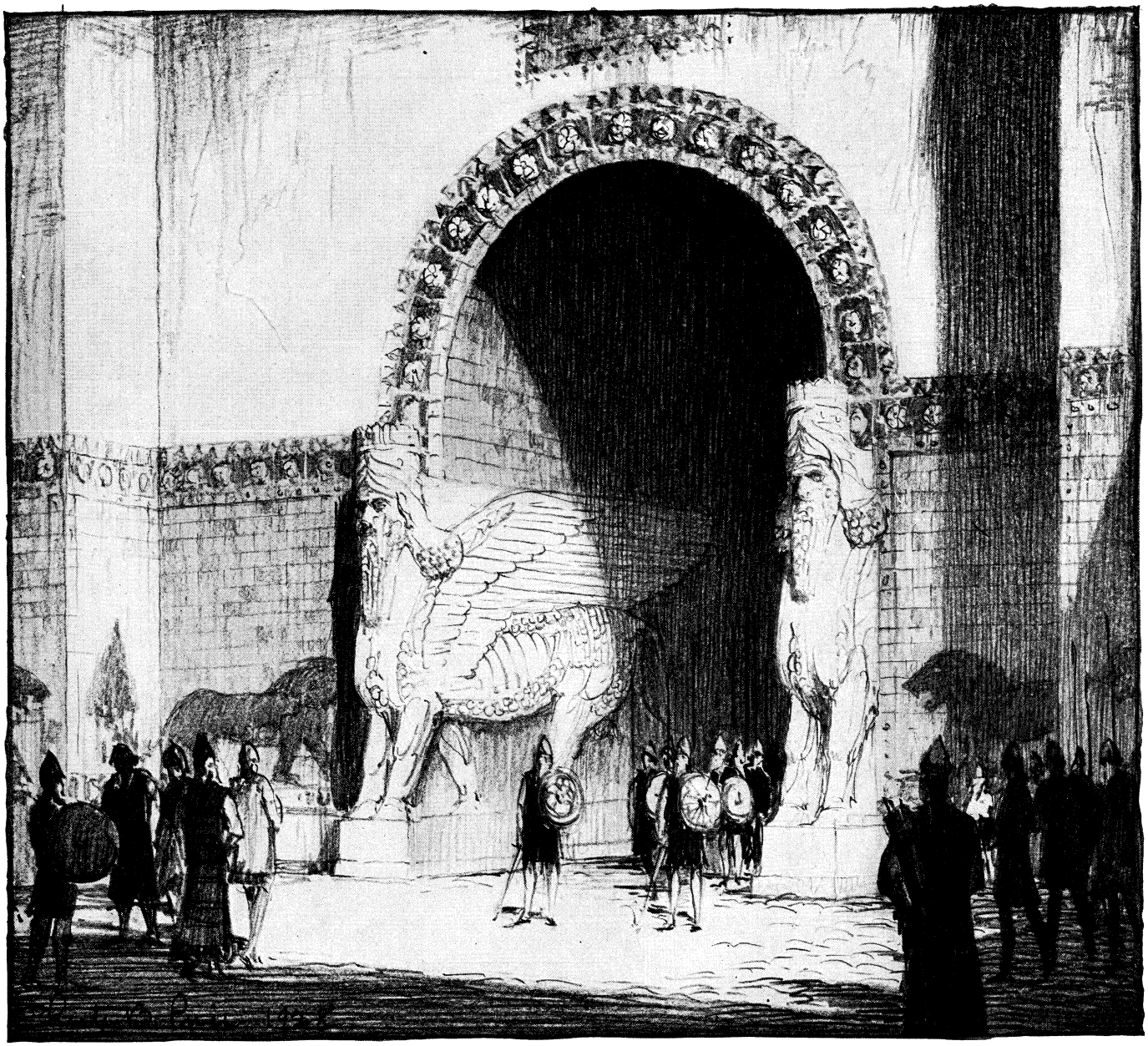


FROM AN ORIGINAL DRAWING MADE FOR THE ENCYCLOPÆDIA BRITANNICA BY CHESTER B. PRICE

BUILDING THE GREAT HYPOSTYLE HALL AT KARNAK

The great hypostyle hall at Karnak as it may have appeared during its construction, 1313–1225 B.C. The immense scale, characteristic of much Egyptian work, may be realized from the fact that the ceiling of the central portion of the hall is more than 76 ft. above the floor and the central columns are 10 ft. 7 in. in diameter. The whole structure is roofed with slabs of stone, sufficiently wide to span from beam to beam over the columns. The central portion was lighted by the clerestorey windows, visible in this sketch, occupying the height between the roof of the lower portion and that of the central, higher portion. In order to give scale to the tremendous size of the building the surfaces of the columns are decorated with band on band of figure sculpture in low relief, with sunk outlines. These were, originally, richly coloured. The mechanical means by which the great stones were moved and set in place, has long been a subject for conjecture. It is generally considered that mounds of sand, occasionally faced with brick, and with inclined planes leading up to them, were used. These, and wooden frameworks known as rockers, combined with levers and blocking, would enable large stones to be raised slowly

ARCHITECTURE



FROM AN ORIGINAL DRAWING MADE FOR THE ENCYCLOPÆDIA BRITANNICA BY CHESTER B. PRICE

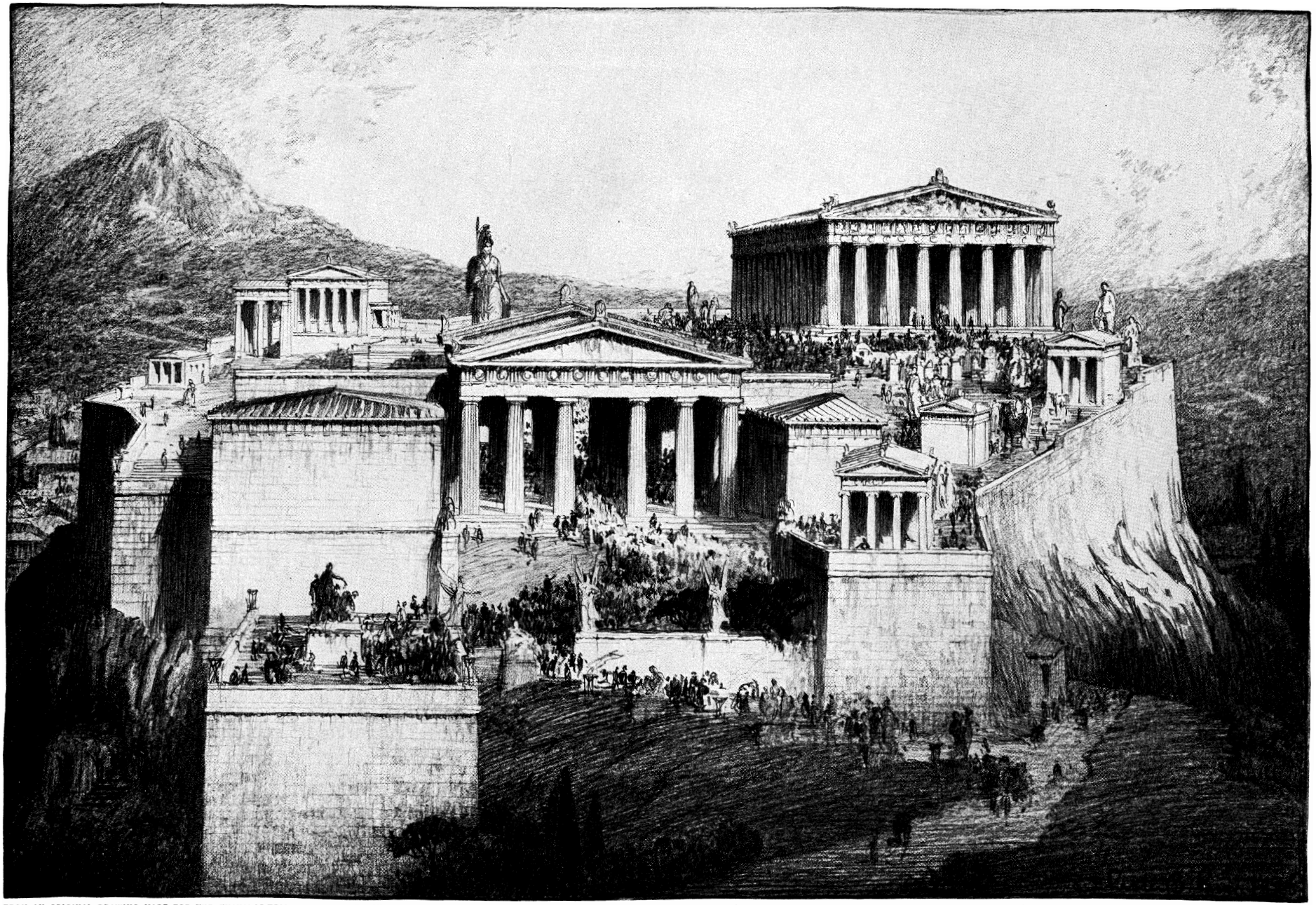
CONJECTURAL RECONSTRUCTION OF AN ASSYRIAN GATEWAY

This conjectural reconstruction of the gateway to an Assyrian palace shows the characteristic architectural forms in the Tigris-Euphrates valley during the 9th and 8th centuries B.C. It is built of sun-dried brick, protected from the weather by a plaster of stucco coating on the upper parts of the walls and burned clay wainscots below. The form of the arch is not only a practical means of covering the gate opening, but also is made an opportunity for decorative embellishment. The two flanking man-headed bulls are characteristic Assyrian features. Besides serving as decoration, they had a religious significance, probably symbolizing the guardians of the gateway and the protectors of ail that was within. It is typical of the naïveté of the designers that each of the bulls was given five legs, for in no other way could the problem of full representation from both front and side be solved. The use of bands of rosettes to cap the wainscot and form the archivolt is another typical Assyrian decorative element. The restoration, as a whole, is intended to express the autocratic spirit that made its mark on Assyrian architecture

FROM AN ORIGINAL DRAWING MADE FOR THE ENCYCLOPÆDIA BRITANNICA BY CHESTER B. PRICE

RECONSTRUCTION OF THE GREAT TEMPLE AT PAESTUM

The great temple at Paestum or Poseidonia, in south Italy, is the largest of a group of several buildings and probably dates from the beginning of the 5th century B.C. It is presumably the temple of Poseidon, the patron god of the city. Its construction shows the transition from the extreme heaviness of the earlier, archaic style to the later, thoroughly developed Doric style of the Periclean period. The subtle spacing of the columns, with those at the corners closer together than those between, the beauty of the curved taper or entasis of the columns themselves, and the simple, sweeping strength of the capitals are all characteristic of the Greek genius. No mere black-and-white drawing, however, can convey an adequate picture of a Greek temple in the days of its glory. Richness of colour was everywhere. Mouldings were painted with intricate patterns, and the frieze was brilliant with the alternation of rich red and blue. The temple of Poseidon is in a remarkable state of preservation: both pediments and the epistyle at the sides are still standing



FROM AN ORIGINAL DRAWING MADE FOR THE ENCYCLOPÆDIA BRITANNICA BY CHESTER B. PRICE

RECONSTRUCTION OF THE ACROPOLIS AT ATHENS

A general view of the Acropolis as it may have appeared at the time of Pericles on a day of ceremony. Crowds throng the approaches to the Parthenon (upper right). which was the chief temple of Athene, the patron goddess of Athens. Both this building and the Propylaea (in the centre) show the perfected Doric order of the Periclean period

Plans of these palaces show long lines of parallel walls, evidently carrying vaults, and a general absence of columns, which were a dominant characteristic of the Egyptian work. The symmetry of the Egyptian temple is absent; while such features as entrance doors, interior courts and special rooms were symmetrical, the plans as a whole seem to have. been evolved without the preconceived and broad conception evident in Egyptian work. The restorations show stylistic treatment of distinctive designs. The buildings themselves did not stand long enough to have much bearing on later architecture.

Designers of modern high buildings have turned with interest to existing restorations of ziggurat towers. Probably the ziggurats, representing an early effort of man to rise to any considerable height above the flat alluvial plains, were the most striking architectural feature of the ancient Assyrian cities. The Tower of Babel, of Biblical renown, was undoubtedly a construction of the ziggurat type. Ziggurats were built in several storeys set back one behind the other with a winding ramp carried round the rectangular tower; or the set-backs of each storey formed terraces extending around the structure. At the great temple of Borsippa at Birs Nimrud the ground storey was 272ft. square, and it is known from a description on a cylinder found on the site that there were seven storeys, dedicated to the planets, each coloured with the special tint prescribed; the total probable height was 160ft., and on the top was a shrine dedicated to the god Nebo. Such towers are a marked illustration of how forms of religious worship have expressed themselves in architecture. Scarcely any records remain of the habitations of the common people; they were probably simple huts of sun-dried brick roofed with vaults of the same material. Only the ruling forces of religion and monarchy remain architecturally recorded.

Persian architecture, which had its origin in the Assyrian and Median dynasties, to whose empire the Persian monarch succeeded by conquest in 560 B.C., borrowed from the earlier types many features, such as the raised platform on which their palaces were built, the broad flights of steps leading up to them and the winged human-headed bulls flanking the entrance portals. The point of architectural interest is the reappearance, probably from Media, of the great halls of columns; but while in plan scheme they recall Egyptian practice, in detail they bear no resemblance to Egyptian form; these columns probably derived their form from the wooden ones at Ecbatana described by Polybius; the capitals are formed by twin bulls ingeniously arranged to carry the stone architraves that supported the roof. The plans of these palaces were symmetrically arranged and strikingly similar, with open porticos on at least one and sometimes three sides. But they lacked the preconceived Egyptian balance as was shown clearly when new palaces were added to the great platform on which earlier ones had been built, as at Persepolis.

In these new architectural forms we begin to see evidence of a less dominant ruling class, a freer population, more extensive forays into neighbouring countries, increasing intercommunication between nations and the consequent influence on architectural design. *(See* also WESTERN ASIATIC ARCHITECTURE, *from* Egypt to *Archaic Greece.)*

III. GREEK ARCHITECTURE

Coincident with this movement of civilization through western Asia the people of Greece were evolving a new culture and with it a new architecture that was destined to become the most influential, and still remains an ever recurring factor, in the art. Of the prehistoric period, much that is archaeologically interesting has been written; the extant remains, notably in the palace of Cnossus in Crete and the beehive tombs at Mycenae and in other parts of Greece, owe less to Egyptian and Chaldaean architecture than was at one time supposed; although there is evidence of commercial exchange between the several countries, it affected matters of detail and decoration more than the plan scheme of the palace referred to, or of the tombs. The point of architectural interest is the Greek freedom from the too binding and established precedent in design so characteristic of Egypt. A freer people in a mountainous country deeply cut by the sea required imagination to meet their peculiar problems, which gave their art more rapid and effective development than that in other lands of the same period.

About 2,000 B.C. the Achaeans began to migrate southward and, apparently, to mingle with the earlier Mycenaean civilization. This culture ultimately succumbed before Dorian invaders from still farther north. Before a new culture appeared some centuries passed; in the meanwhile, the invaders intermarried with the native population forming, in the mixture of the clear, cool, hardy northerner and the dark, gayer southerner, the ideal racial combination. The Greeks colonized the Aegean islands, Asia Minor, southern Italy and even Sicily. The prosperity of the colonies as well as the states proper is vouched for by splendid stone temples, the remains of many of which have lasted to this day.

For centuries Greek architecture evolved by a consistent progression. The very contour of the country must have engendered the freedom of thought, unique in the then-known world, which was expressed with equal force in philosophy, literature and architecture. Everything on this comparatively small area of land conspired to the development of a vigorous creative art. Nature herself was no small contributor. The temperate, invigorating climate, the clear atmosphere, the rich blue of the Mediterranean sea, and the mountains silhouetted against a sunny southern sky formed an ideal setting for buildings of refined lines and proportions; while the abundance of unrivalled marble, found in the mountains of Hymettus and Pentelicus near Athens and in the islands of Paros and Naxos, provided a finely textured building material that facilitated the exactness for which the Greeks are famous. Handicapped at the start by the established precedents of other countries, they were, nevertheless, too segregated by their geographical situation to be restrained in the development of their own peculiar talent.

In spite of the comparatively small area of Greece, no single group seems to have been able to control the peninsula and thereby dominate its art. Yet a common religion and love of music, the drama and the fine arts bound the peoples of the various states together. Nature was kinder than in Egypt, and life pleasanter; the fearful gods of former civilizations were abandoned; the deities worshipped were of human form idealized. Beauty of form, colour, mass, silhouette, texture and proportion became high considerations in the lives of the people as well as of the workers in the field of art. The Greeks loved beauty for itself and idealized their conceptions of everything. Just as the Greek philosophers loved thought for its own sake, the artists must have loved beauty for itself. A study of the progress of architectural forms shows consistent refinement, each step being made after careful study of what had preceded, and each modification of conventional style marking an improvement in beauty of form and delicacy of proportion. There is neither abject adherence to precedent nor a searching for the new merely to be different, but that gradual change for the better that so eminently characterizes a nation of great culture, in which beauty and truth are the ultimate goal.

The Parthenon (*q.v.*) at Athens represents the most perfect composition and its realization, and for centuries it has remained the ideal combination of building and setting. There is no sham or flamboyance in either structure or embellishments. In accuracy and delicacy the workmanship surpasses anything that even the modern machine can produce. Its studied refinements of line—such as the very slight curving of linesintended to appear straight, the slight tilting in of corner columns to correct the appearance of tilting outward that such vertical columns have, the spacing of the columns so as to produce a span at the centre slightly larger than that at the ends—these with the complete symmetry of the plan as viewed from each side and the use of only one structural principle, the post and lintel, all combined to give this building a simple and impressive dignity that has never been equalled. Philosophers, mathematicians, archaeologists and architects have attempted with infinite research and study to discover some mathematical rule by which the Greeks worked to produce this great masterpiece of architecture. Enthusiasm for their own theories has led many astray, but, judging from the literature on

all the theories, it may well be that the Greeks did develop some principle since lost.

It has already been seen that in Egypt the only form of popular entertainment was that of seeing the king or priests parade. In Greece, a freer people, actually participating in the government, demanded opportunities to enjoy and take part in the achievements of the time, and the open air theatre for the production of dramas and the staging of festivals appeared. In selecting the sites for their theatres, the Greeks always utilized the slope of a hill, which they could cut out, thus saving the expense of raising a structure to carry seats and at the same time obtaining a beautiful prospect for the background. These theatres went through a natural evolution of being first a gathering place formed by the natural contour of the ground, then being furnished in some regularity with wooden seats, and finally refitted with stone seats. To-day there are remains of the theatre of Dionysus at Athens and of others at Epidaurus, Eretria, Delos, Sicyon and Orobus.

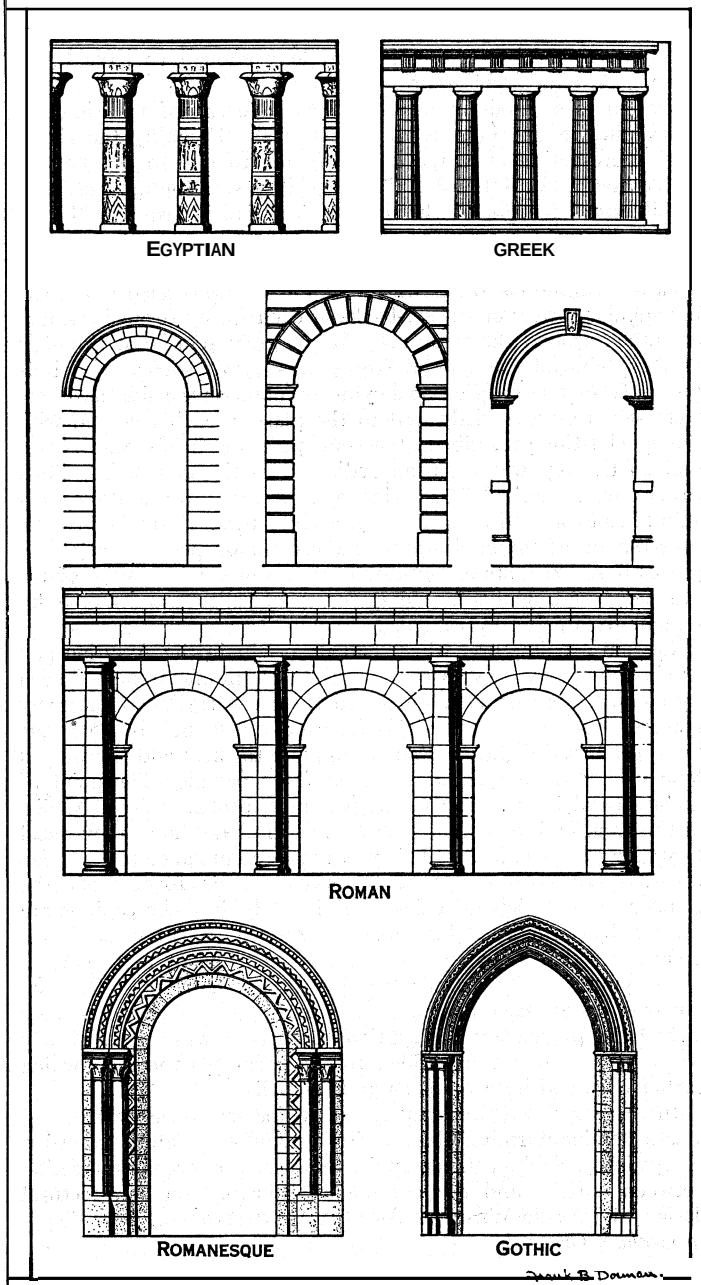
The point of architectural interest is the front row of seats, which were designed for dignitaries, and some of which still remain in *situ* in the theatre of Dionysus, Athens. The centre seat was made the most imposing and elaborate, but many others were inscribed, each with the name of its regular occupant. They were most graceful in line and proportion, they were embellished with exquisite detail and they are still an inspiration to the designer of seats in monuments and other places of importance.

Probably the most significant element in Greek architecture is the perfect correlation of architecture, sculpture and painting. We can speak with less assurance of painting, for while we know that colour was sec extensively in buildings, t ravages) time have left few defin exa d it is difficult tc le how much of the colour that has been found was part of the original conceptions. But of the sculpture there can be no question; when used it was an inherent part of the building's design and perfectly composed for its position with respect to scale, relief and the play of light and shade upon it. In fact, purely architectural form, such as appeared profusely in later periods, notably in Rome, was significantly simple in Greek work. Sculpture gave the necessary embellishment to their buildings, effecting desirable contrasts between plain surfaces and those in which light and shade were required. In every case the sculpture symbolized the purpose of the building, told the story of its function and became a coherent and truthful element of its composition. (*See* SCULPTURE, ARCHITECTURE.)

The temperate Greek climate, with its scant rainfall, encouraged open-air activities and most political and social ceremonies were so held. Consequently Greek architecture is largely devoted to temples whose deities symbolized natural phenomena. The most important temples were built in the 50 years following the battles of Salamis (480 B.C.) and Plataea (479 B.C.) in exultation at the complete defeat of the invading Persians. Athenian prosperity excited Sparta to jealousy, however, and the Peloponnesian War (431–404 B.C.) resulted, after which the leadership passed to Sparta, Thebes and Macedonia successively. Greek states disputing among themselves were easy prey for conquerors, and Rome's power in Greece steadily increased until in 146 B.C. the once proudly independent nation, whose art and thought were to remain fresh always, became a Roman province. (See also GREEK ARCHITECTURE.)

IV. ROMAN ARCHITECTURE

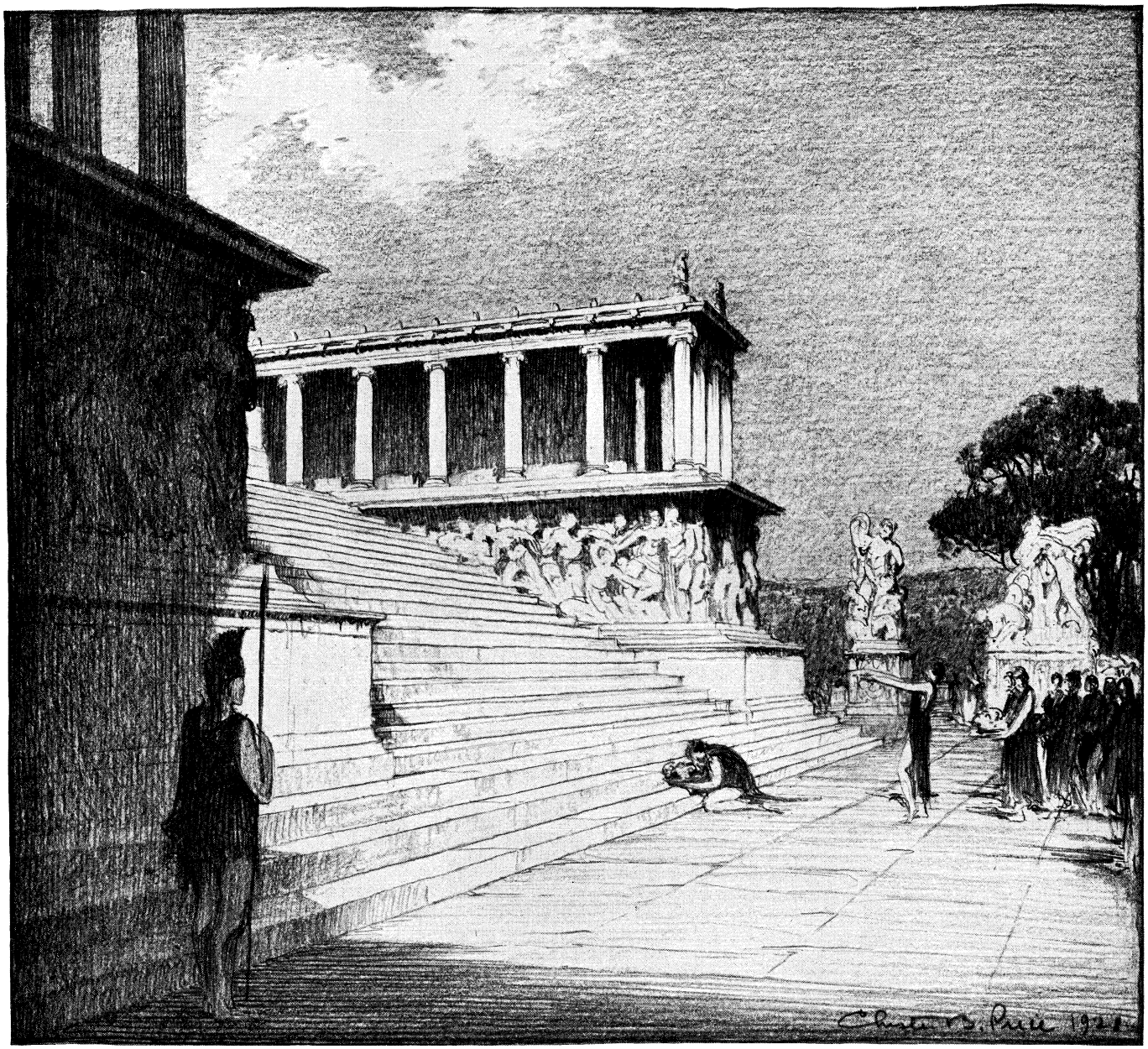
Roman architecture owes its historical importance as much to the quantity produced as to any inherent merit of the work itself. The Etruscans, who were the early inhabitants of central Italy, were great builders and employed the arched vault in their structures. Rome complicated architecture by combining this form with that of the Greeks which, as we have seen, was based only on the post and lintel. It is readily evident that when such a simple form of construction as the post and lintel is combined with one as radically different as the arch and dome, far greater spaces without supporting columns, and a more striking impression of pomp and wealth, can be secured; but neither a finer nor a greater art necessarily results. Everywhere Roman designers worked for enrichment. Since the great Roman empire included all of the then-known world, extending over all of the ancient Mediterranean countries and northward across Gaul and even Britain, and since the Roman conquerors always built in the image of the Imperial City, the Roman love of ornamental grandeur



TRANSITION FROM THE POSTS AND LINTEL TO THE POINTED ARCH. THE ARCH MADE POSSIBLE A GREATER CLEAR OPENING AND THEREFORE BECAME AN IMPORTANT AND IMPOSING FEATURE OF ENTRANCES AND PORTICOS

irrespective of underlying structural principles made an enduring impression on nearly all of the peoples of Europe.

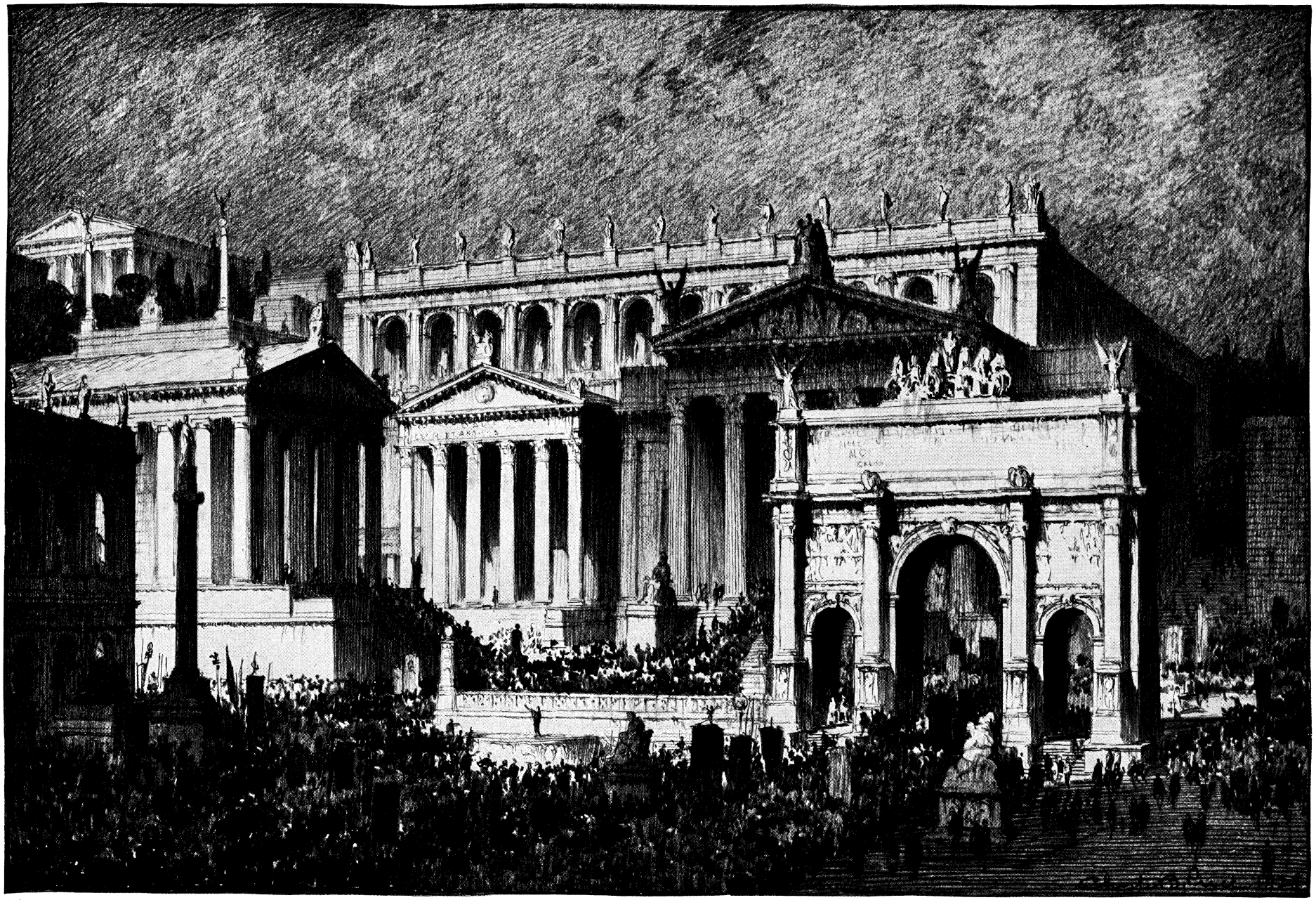
The topography of Italy, unlike that of Greece, was sufficiently open to encourage unification of the early kingdoms in a republic. As the power of the state spread, Greece being conquered in 146 B.C., Gaul in 59 B.C., and Egypt in 30 B.C., the need for centralized government of distant provinces brought about the formation of the empire. Caius Octavius (31 B.C.–A.D. 14), later known as Augustus, which became the surname of all the Roman emperors, boasted that he found Rome a city of brick and left it a city of marble. His boast is true in a sense, for in his reign the sun of Imperial Rome was at full noon and building flourished; but as



FROM AN ORIGINAL DRAWING MADE FOR THE ENCYCLOPEDIA BRITANNICA BY CHESTER B PRICE

RECONSTRUCTION OF THE GREAT ALTAR AT PERGAMUM

The great altar of Zeus, erected by Eumenes II., 180 B.C., was the central feature of the acropolis of Pergamum. It consisted of a large terrace bordered on three sides by a colonnade and approached by a flight of steps between the ends of the flanking colonnades. In the centre of the terrace stood the altar proper. Around the retaining wall and acting as a pedestal for the outside columns of the colonnade was a great frieze, sculptured in high relief, representing the battle of the gods and the giants, the finest example of the Pergamum school of sculpture that survives. The architectural forms are Greek in origin, but the whole displays a feeling of luxury and dramatic climax that suggests the spirit of the earlier military monarchies of the near east. It is typically Hellenistic, rather than Hellenic. It is probably this altar which caused the writer of the Apocalypse to refer to Pergamum as "Satan's seat" (Rev. ii. 13) The remains of the altar and its surrounding buildings were excavated during the last quarter of the 19th century and taken to Berlin, where they are now set up in the Kaiser Friedrich Museum



FROM AN ORIGINAL DRAWING MADE FOR THE ENCYCLOPÆDIA BRITANNICA BY CHESTER B. PRICE

RECONSTRUCTION OF THE ROMAN FORUM

This view shows the Roman forum as it probably appeared under the later empire about the middle of the third century, A.D. In the background rise the arcades of the Tabularium, the national archives building. In front of it are the three temples of Saturn, Vespasian and Peace, and in the foreground at the right, the triumphal arch of Septimius Severus. The whole group, magnificent and rich as it is, lacks the subtlety and perfection of Greek work

a rule marble was used only as a facing, the core of the walls being formed by rubble, bricks or concrete. The rebuilding of Rome begun by Augustus was carried even farther by his immediate successors, and most of the earliest work was destroyed in the process.

The life of this victorious, self-honouring people is clearly depicted by their great forums, their law courts, their magnificent thermae or public baths, amphitheatres, bridges, triumphal arches, aqueducts and expensive town and country residences. The Romans were more practical men of the world than the Greeks, and their tastes more sophisticated, less fresh. Religion had begun to lose its grasp on the popular mind, and while it was adopted from the Greeks and kept up officially by the State, it centred more and more in a worship of imperial glory and the home, every house having an altar to its family gods.

One of the delights of Greek architecture is its perfect masonry form, marble blocks being accurately fitted together without mortar or cement by means of unequalled craftsmanship. Marble was practically the only building material Greece had. The quarries near Rome yielded a variety of stones, but the material that made structural innovation possible was pozzolana, a volcanic earth which, mixed with lime, formed an hydraulic cement of great cohesion. The Romans do not seem to have realized the tenacious properties of this pozzolana cement which in foundations formed a solid mass capable of bearing as much weight as the rock itself. They feared also the thrust of the immense vaults over their halls, to counteract which they always provided cross-walls, But when they had once covered large spaces with a permanent casing indestructible by fire, it not only gave an impetus to work in Rome, but led to a new type of plan which spread all through the Empire, and which only the differences in available materials and labour varied.

The studied and appropriate decoration of the Greeks, like their structural sincerity, disappeared in Roman architecture. The Roman legions brought home spoils from all the countries of the ancient world; niches and pedestals in Roman buildings supported alien statues. Owing to their cement, Roman builders required fewer columns to span greater spaces, and they could erect structures of several storeys, like the Colosseum. The column began to lose its structural significance; the engaged column and the pilaster were introduced and employed decoratively; in buildings of more than one storey the orders were superimposed; the composite order (*q.v.*), a combination of the Corinthian and the Ionic orders, was developed. The facings of the walls were highly polished, sometimes painted.

Rome was laid out in a series of splendid forums, or public squares, surrounded by public buildings, temples, basilicas, shops, porticos and colonnades, and containing arches and other monuments in honour of victorious emperors. The forums were the vital organs of the city. In them, commerce centred, generals were acclaimed and captives were paraded. They formed the nucleus of cities and towns even on the outskirts of the empire, and are early instances of good municipal planning.

Of the ancient Roman buildings, the Pantheon (*q.v.*) is best preserved. Now, shorn of its once splendid embellishments, it is a Christian church known as S. Maria Rotunda. It was built by Hadrian (A.D. 120–124) and originally consisted of an immense rotunda (142ft. in diameter) covered with a hemispherical dome (140ft. high); a portico was added later. Its walls are 20ft. thick and contain alternately semicircular and rectangular recesses, which probably once held statues of gods. Architecturally, its most interesting feature is its only, yet ample, source of light, a circular opening (30ft. in diameter) in the centre of the dome. The famous Colosseum (*q.v.*) is four storeys high, a sky-scraper for its day, though the topmost storey was not added until the first part of the 3rd century; it is notable for the excellent use of materials to accomplish desired structural effects; it records the love of entertainment that must have impelled the creation of such a vast structure solely for gladiatorial and similar exhibitions. Palaces were of a scale not conceived before or since. The villa of Hadrian extended over seven miles, and, in addition to numerous halls, courts, libraries, etc., Hadrian attempted to reproduce in it some of the most remarkable monuments that he had seen in his travels.

The influence of Roman architecture may be divided according to its effect on (1) the world of Roman times, (2) the world immediately following the decline of Rome, and **(3)** the world that came with the Renaissance (*q.v.*) in the 16th century. Jn Rome, quantity production and standardization tended to kill initiative, just as they do to-day; love of power, wealth and comfort, and lack of spiritual incentive produced art magnificently impressive but barren of truly emotional significance. The very grossness of life ultimately turned men's thoughts to spiritual matters, and the architecture that followed Rome's decline still inspires designers of religious buildings. When antiquity became the model for Renaissance artists, Rome had so many classical monuments that its style was dominant. No other period in history has received the study and research given to the Roman, and this, too, has helped to impress its spirit on modern architecture. Finally, science and machines excluded, the civilization of imperial Rome differed but slightly from ours; the seeming appropriateness of the Roman spirit to-day is therefore easily understood. (*See* ROMAN ARCHITECTURE.)

V. BYZANTINE ARCHITECTURE

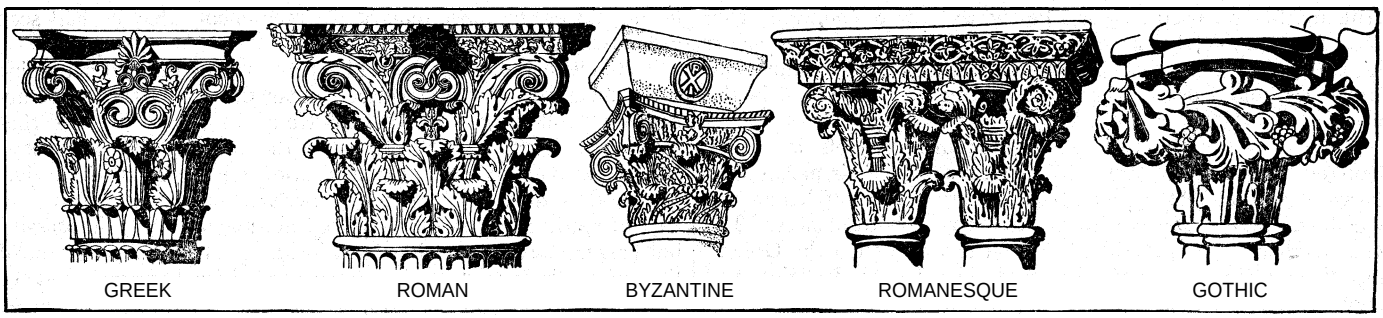
The decline of Roman imperialism was automatically accompanied by that of Roman architecture and its influence. To govern the empire from a more central location, Constantine, in A.D. 324, moved his capital from Rome to Byzantium, an ancient Greek city, to be known thenceforth as Constantinople. The same emperor had already established Christianity as the State religion, and when Byzantium was rebuilt on Roman lines the new form of worship made itself felt architecturally. As the power of Rome decreased, that of Christianity, which was destined to become the new unifying world force on which later civilizations would be built and later architecture developed, grew steadily.

Byzantine is the term applied to the style of architecture evolved in the new capital of the Roman empire. Constantine erected many churches, law courts and other buildings, practically all of which contained columns and slabs taken bodily from Roman buildings. These structures were neither indigenous to the country nor of durable form, and little or nothing of them remains. The architecture of the period had scant significance until Rome's influence diminished and what was built became more expressive of the new country, the new government and the new faith.

Passing to Justinian's time (A.D. 527–565) we find St. Sophia built between A.D. 532 and A.D. 537. It marks the highest development of the Byzantine style. In it the arch and vault, which, as explained in the section on Western Asia, probably originated in the East, were extensively developed. Christianity appealed to the mass of the population and required buildings that could accommodate congregations; it was devoted to one God instead of many; consequently it produced large churches rather than numerous small temples for various deities as earlier religions had.

St. Sophia affords one of the most perfect examples of high development of vault and dome. The great central space was acquired by means of the vast central dome which rests on pendentives (*q.v.*) leading down to four massive piers. The lateral thrust is cared for by secondary and much lower arches equally reinforced; the longitudinal thrust by two half domes each divided again into three semi-domes. The architects, Anthemius of Tralles and Isodorus of Miletus showed extraordinary skill in solving their problem. It is doubtful if modern engineers would attempt to reproduce such construction without employing the principle of the steel skeleton. In fact, the dome fell in A.D. jjj, and when rebuilt it was raised higher and pierced round its lower part with 40 circular-headed windows, which give an effect of extraordinary lightness to the structure. When considered in terms of its great span and comparatively great height, the main dome is a mere shell of unbelievable thinness.

The structure is of brick, and its being built of small elements bound together by a strong lime cement—an art developed highly by the Romans---explains the seeming mystery of its stability.



BY PERMISSION FROM SIR BANISTER FLETCPER, "HISTORY OF ARCHITECTURE ON THE COMPARATIVE METHOD." 8TH EDN. 1928 (BATSFORD)
THE DEVELOPMENT OF THE CAPITAL FROM THE GREEK TO THE GOTHIC INDICATES THE TREND OF DESIGN: IN SPITE OF THE TRANSITION IN FORM, THE RELATION OF EACH EXAMPLE TO THE OTHER IS EVIDENT

The binding nature of the cement actually absorbs the tensile strains to which it is subjected. The building measures 260ft. from entrance door to eastern apse; in width, including the aisles, 238ft.; and 175ft. from floor to the apex of the central dome. The Roman idea of surface decoration is carried to extremes; the Greek idea of structural expression in architecture disappears totally. The walls and vault above were covered with mosaics on a gold ground. The columns of the whole church on the ground floor are of porphyry, and on the upper storey of verd antique. The columns and arches give scale to the small apses, the small apses to the larger ones, and the latter to the dome, so that its immense size is grasped from the first. The lighting is admirably distributed, and the rich decoration of the marble slabs, the monolith columns, the elaborate carving of the capitals, the beautiful marble inlays of the spandrils above the arches, and the glimpses here and there of some of the mosaic showing through the stucco, all give a magnificent effect to the interior. Although often debased into a purely decorative feature, the column was used with real structural significance throughout the Roman work, in which it retained sufficient size to be an impressive element in the composition. But in St. Sophia the structural importance of the column is small, and in contrast with the enormous dcme, 107ft. in diameter, it is a secondary factor, more decorative than otherwise.

The exterior of St. Sophia has little of architectural interest except its size. Here again is a marked change from the Roman point of view, which made the superficial appearance of a building the most important element in its composition. To impress the passing throng must have been as important to Roman builders as the ceremonies carried on within their buildings. At the advent of Christianity the congregation and the ceremonies within an enclosed space became the means of impressing people. Byzantine architecture, which gave such predominant importance to the interior, has had its influence on subsequent buildings up to the present day. Its best examples, however, have appeared in south-eastern Europe. In the course of time the exteriors of buildings were embellished also, the most notable example of such treatment being St. Mark, Venice. *(See* also BYZANTINE and ROMANESQUE ARCHITECTURE.)

VI. ROMANESQUE ARCHITECTURE

The evolution of western architecture from the end of the Roman empire in the West (A.D. 475) to the Renaissance is so intimately related to that of the Christian Church that discussion of it belongs more properly to a study of the progress of the Church than to its particular manifestations in special countries. The early Christians, a persecuted people worshipping in secret, left little architecture; but where they were able to gather a following large enough to erect churches we find a most interesting combination of great religious fervour and ignorance of the building art as it had been evolved by Greece and Rome.

Throughout the dark ages the problem of the Christian Church was to tell the story of religion to a people unable to read and unacquainted with architecture, painting or sculpture. The Church was the poor man's only recourse; the struggle for existence had again become harsh and man again, as in Egypt, placed his hopes of happiness in life after death; the symbolism of the Church, the enshrined saints and the carved reliefs, all brought his goal of future happiness nearer. Symbolism and conventionalization of ornament became evident in all manner of embellishments. Sculpture became a more coherent part of buildings than it had been in Rome where niches, pediments and pedestals were prepared to receive works of sculpture that might or might not be specially designed. Eventually spiritual conceptions were carried outside the Church and appeared as elements in more elaborzte exterior designs. As Christianity became more general churches became outstanding architectural monuments in each community.

The style of architecture known as Romanesque which developed during this early period in the countries of Western Europe that had belonged to Rome, varied somewhat with the localities in which it appeared, yet was always dominated by Roman ideas, parts of Roman buildings being frequently installed in the new structures. The masonry arch was the structural form most used but understanding knowledge of its structural possibilities was limited. Attempts at great spans were few, and the compositions were essentially low and heavy. Used as a pier to support arches the column was stocky, robust, not graceful. Italian Romanesque, being nearer to the source and containing more columns and other motives taken from Roman buildings, was more graceful in proportion but lacked individual character and distinction; it has, therefore, been less influential in present-day design than French and German.

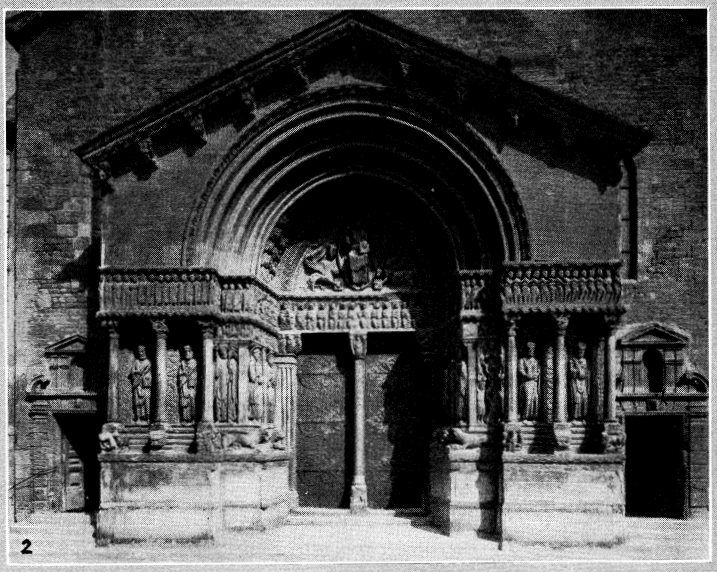
In plan, the addition of transepts and the prolongation of the sanctuary or chancel turned the Roman basilica, which was the model for early Christian churches, into a well defined cross. Walls were roughly built with external buttresses, massive and of great weight. Round arches supported on columns carried the wall of the clerestory in which small openings with semicircular arches occurred singly, in pairs or sometimes groups of three. One is impressed by the great amount of masonry used and the small proportion of the openings to the walled surface. Columns of stumpy proportion, with widespreading capitals in variations of the Corinthian or Ionic orders, gave to these structures a sense of stability and permanence to which time has proved they were entitled.

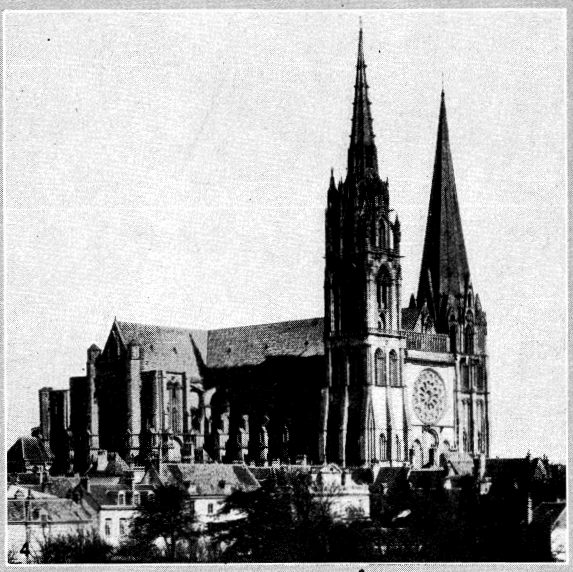
Among the best examples of the Romanesque style in architecture are: Pisa Cathedral; S. Zeno Maggiore, Verona; the Abbaye-aux-Dames, Caen; St. Trophime, Arles; Church of the Apostles, Cologne; Spires Cathedral; and Romsey Abbey, Hampshire. *(See* also BYZANTINE and ROMANESQUE ARCHITECTURE.)

VII. GOTHIC ARCHITECTURE

By the end of the 12th century the old Roman Empire had broken up into a number of distinct nations. The Church dominated each, however, for ecclesiastics possessed most of the knowledge and controlled much of the wealth of the period. Commerce had increased and the cities and towns rivalled each other in their architecture as they grew. About the year 1150 the architecture of western Europe changed rapidly toward a slenderer and more energetic type of building now called Gothic. For four centuries the art of building in this style, especially in France, was pursued with such zeal that incontestably superb churches exist within short distances of each other.

We continually refer to ecclesiastical architecture because it was absolutely dominant. The church in each community was the measure of its culture. For the people of the time the cathedrals

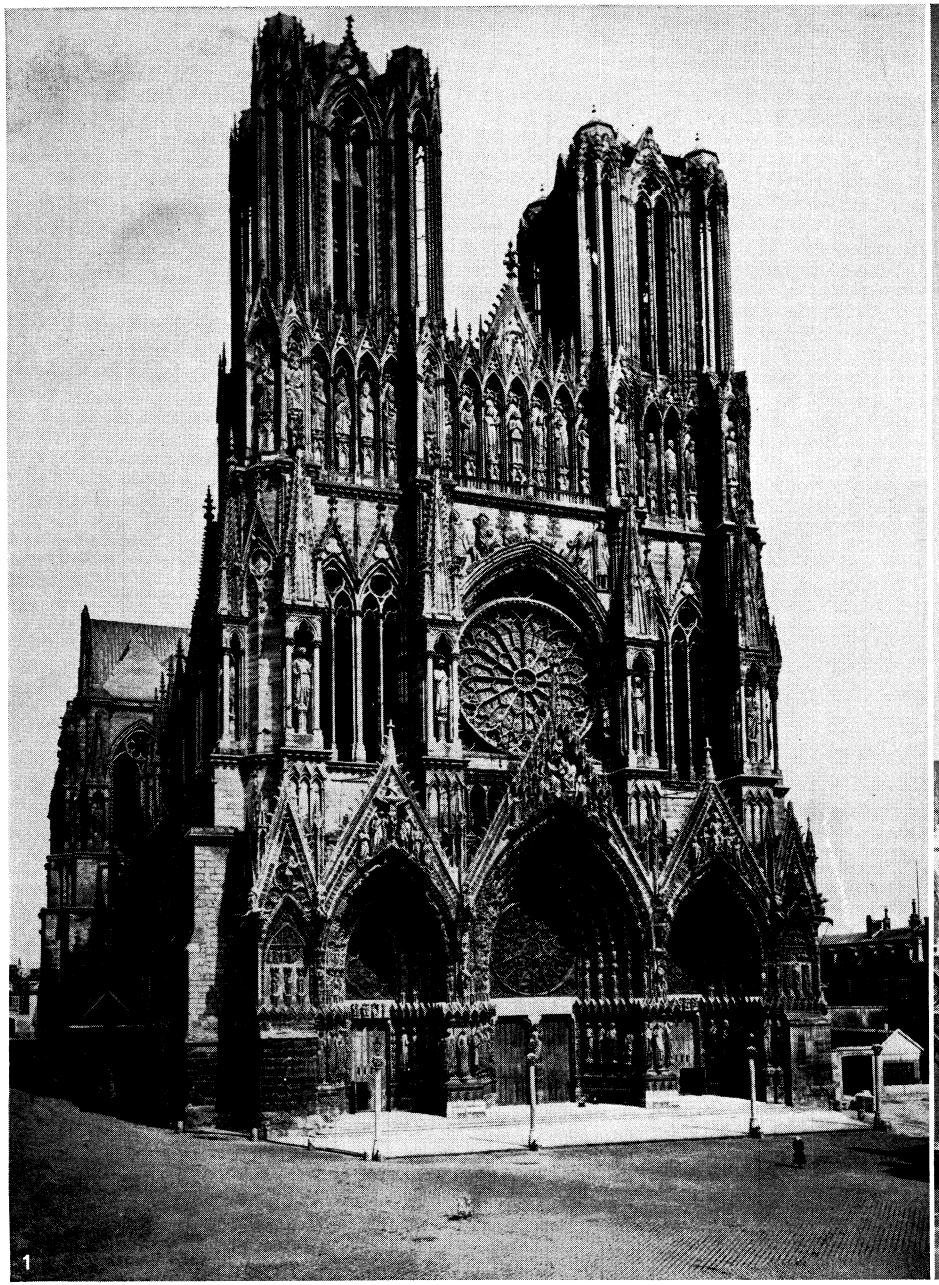




BY COURTESY OF (1) THE STAATLICHE BILDSTELLE, BERLIN, (2) BRAUN AND CIE.; PHOTOGRAPHS, (3, 4) EWING GALLOWAY, (5, 6) ALINARI

CHURCH ARCHITECTURE IN THE MIDDLE AGES IN CONSTANTINOPLE, FRANCE AND ITALY

1. Constantinople. Interior of St. Sophia, begun A.D. 532. Early Byzantine style
2. Arles, France. Porch of the church of St. Trophîme, 12th century. Provençal Romanesque
3. Venice. St. Mark's church. Italian Byzantine of the 11th century, with Venetian Gothic gables and pinnacles added later
4. Chartres cathedral, French Gothic. Second half of the 12th century; north tower early 16th century. The exterior buttressing to support interior vaulting is an essential feature of true Gothic construction
5. Siena cathedral. Italian Gothic, with purely decorative use of pointed detail having no structural function
6. Milan. Church of Sta Maria delle Grazie, early Italian Gothic, showing transition from the Romanesque



PHOTOGRAPHS, (1) EWING GALLOWAY, (2) BURTON HOLMES FROM EWING GALLOWAY

FRENCH AND ENGLISH GOTHIC ARCHITECTURE

1. Reims cathedral, as it was before World War I, showing a unity of composition in which lateral entrances flank the main entrance, above which the rose window lifts and unifies the whole

2. Westminster Abbey, with two towers balanced in mass, the entrance an inconspicuous part of the entire window, which rises to the full height of the nave

represented everything to which they might aspire. While the influence of Gothic verticality was felt, non-religious architecture remained essentially horizontal. To-day, in travelling through the mediaeval towns of Europe in which the modern spirit is not yet apparent, one finds the cathedral on the hilltop, rising above the little dwellings clustered at its foot and magnifying its importance, to be the only important piece of architecture.

The immense monastic activity of the time, and the need of accomplishing large results with limited means caused innovations in planning and structure contrary to Roman or even Romanesque methods. Through many experiments, the designers of the cathedrals learned that stone would carry much greater weight superimposed than had previously been imagined. The massive columns of the Romanesque evolved into tenuous and moulded Gothic piers. Every line was designed to carry the eye upward; the pointed arch, crowning the vault at the highest point of a transept, arrests the eye without, like the semicircular arch, swinging it back again. To add to this effect of lightness and delicacy, and to get the area of stone necessary to sustain the weight and take up the vault's outward thrust, the supporting piers were turned at right angles to the main axis of the nave, and great openings were left to be filled by stone tracery and leaded glass.

The pointed arch often referred to as the characteristic of the Gothic style is in fact only one feature; the most impressive characteristic is that of verticality and lightness. In the Roman work, and to a degree in the Romanesque, the points of change in the structural features—such as the archivolt, where an arch rested on a pier and the line changed from the straight to the curve; or the keystone of the arch, which locked it in position and made possible the removal of the temporary centring used during construction—were points of ornamentation and elaboration. This was not so in Gothic. The stones were merely a necessary factor. Regular courses, in the Roman many times rusticated so as'to accentuate the structural idea, were changed in the Gothic to irregular and random sizes as if to conceal their presence. To turn the eye from the horizontal to the vertical, ribs and mouldings were cut through. Overhanging cornices, which would have produced long horizontal lines, were largely eliminated. The great buttresses were converted into the lighter, well known flying buttresses; at its abutment each was strengthened by a vertical weight which, instead of being a massive block, was composed of a series of small stones piled in diminishing ratio one above the other and carved and embellished in the vertical spirit so as always to carry the eye upward to a point which seemed gradually to thin out to nothing. The horizontal bands used were interrupted by finials. Corbels were purposely so separated as to break any continued horizontality.

Complete in all parts, the Cathedral of Chartres is a splendid example of what this art was at its zenith. The plan has a nave with aisles, transepts with aisles on each side, a choir with two aisles all round it, and chapels beyond them. There are two immense steeples at the west end, two towers to each transept and two towers at the junction of the choir with its apse. The doorways are triple at the west end, whilst to each transept is a vast triple porch in front of the three doorways. The whole of these doorways are covered with sculpture, much of it refined, spirited and interesting to the highest degree. The interior even surpasses the exterior. The order of the columns and arches, and of all the details, is so noble and simple that no fault can be found. The whole is admirably executed; and, finally, every window is full of the richest glass coeval with the fabric.

The separation that exists to-day between architect, builder and labourer, with the architect as a professional man concerned with the preparation of drawings and specifications, the builder as an executive directing or assembling different sub-contractors in the execution of work, and each sub-contractor employing and directing men in his particular field, was not so marked in the days of the cathedral builders. All building was a more leisurely proceeding then; not that the workers had shorter hours, but time, the paramount factor in present-day life. was less important. It is very evident that the workers took pride and personal interest in their performance. They regarded it as ensuring their happiness in the next world. They recognized themselves as small but essential cogs in the wheel of progress. In studying the great cathedrals one realizes and feels the personal factor. Guilds of skilled craftsmen in stone, iron, bronze, gold, silver and glass developed, and their art was perpetuated through systems of apprenticeship. Each generation was guided by older and more experienced workers, gained knowledge from personal experience and evolved new methods after knowing and thoroughly understanding earlier ones. The cathedral builders were workmen who, feeling themselves to be part and parcel of the structure they were erecting, left evidence of their identities. To build in Gothic now with the full spirit of the original, requires either an exact copy of what has been done, in which case, of course, the copy is inevitably cold and uninspiring, or else re-creation of the guilds of workers actuated and guided by the same spiritual forces, and limited by the same physical and mechanical handicaps that existed when the cathedrals were built.

Exhaustive studies made by such men as Prof. W. H. Goodyear seem to prove that the cathedral builders employed studied refinements similar in principle to those practised by the Greeks. The lack of scientific instruments might easily have caused inaccuracies. But variations from rigid lines, right angles and repetitions in the inter-axe or spacing of the piers and other elements of the composition recur so frequently in the same manner as to indicate that they were designed. In the Christian church, which assembled people within its walls, the effect on the worshippers of subdued light, incense, candles and processionals became the starting point of religious influence. Anything that could impress a worshipper with fear of the cruel retribution in store for him if he failed to live according to the ethics of the Church, and with hope of reward for proper conduct, became potent in architectural design. Through their fear, religion held sway over a sensitive and superstitious people. Grotesque gargoyles and demons were carved in stone and, together with saints and angels depicted in glass, mosaics and paintings, created the special atmosphere desired. The dim interior of the old Romanesque churches was due to small and widely spaced openings. The grace and delicacy of Gothic cathedrals resulted in structures whose many and large openings would have flooded the interiors with light had stained glass not been used. But with great rose windows and pointed arch openings filled with deeply coloured glass on which the glory of the saints and the suffering of sinners was told and retold, a religious atmosphere was produced that inspires and uplifts even unbelievers in this materialistic age. (See also GOTHIC ARCHITECTURE.)

VIII. RENAISSANCE ARCHITECTURE

Greece sprang from the seeds of Egyptian and Western Asiatic cultures; Rome, in its turn, from the seed of Greece. The Renaissance (*q.v.*) that started in Italy during the 14th century was a new phenomenon only in that it affected all Western Europe and, later, even the American colonies. This modern Renaissance, which we purposely call modern because the present is part of its growth, was literally a rebirth of the arts, science, refinements of living, culture in general. Centuries of gradual change in the spiritual and material environments of man had nurtured the cultural seeds of the Roman empire. One, the Gothic, was carried so far afield and grew up in such alien soil that it flowered like a new species, distinctly separated from other architectural forms. Another for a time lay dormant in the south, particularly in Italy where something of the splendour and popular enlightenment of the ancient Roman civilization was perpetuated; it flowered in the Renaissance, carrying on the direct line of architectural development where it had broken off with the downfall of the Western empire.

The invention of printing (1453) made classical literature, from which the Renaissance drew its chief impulse, more generally known throughout Western Europe. By taking an important function from the painter, the sculptor and, indirectly, the architect, it revolutionized art. Henceforth, lessons that had been taught through the mediums of sculpture, painting, stained glass and fresco could be brought more immediately before mankind by the printed page. This change, however, was not sudden and those in

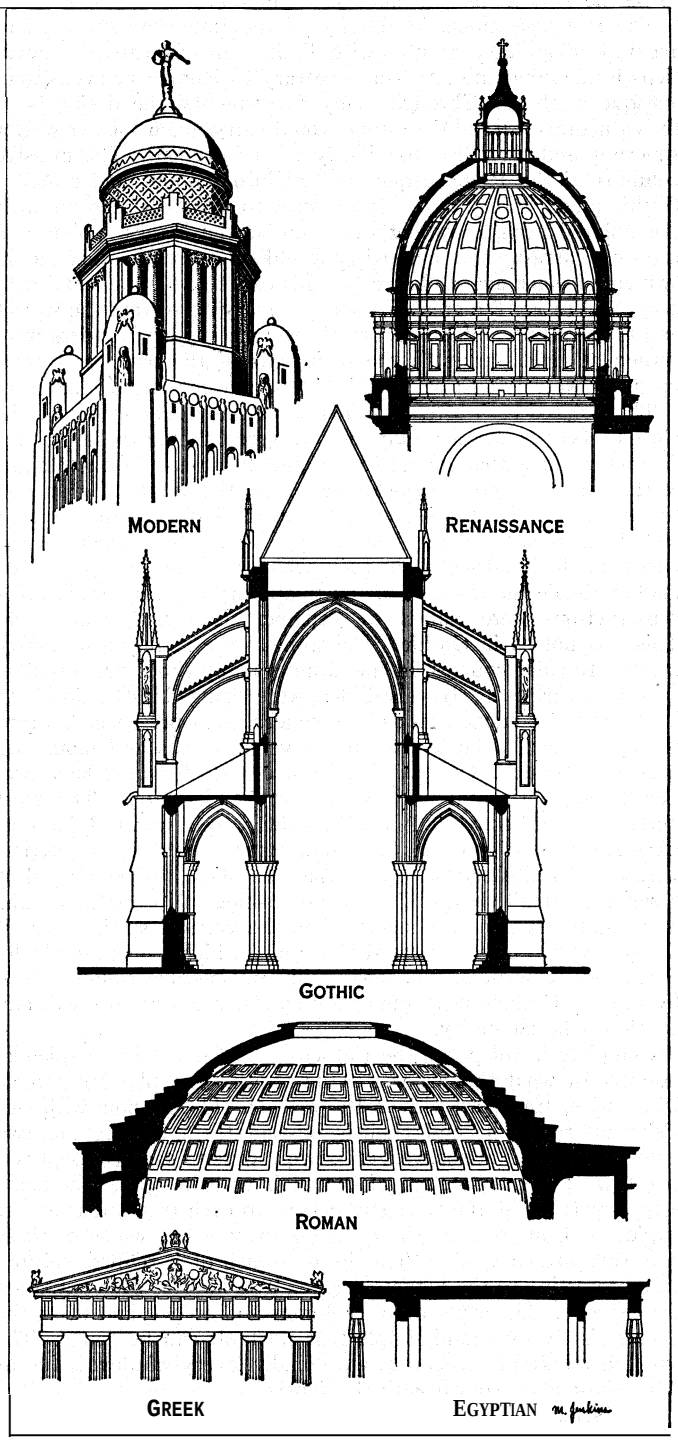
power continued to use buildings, monuments, etc., to demonstrate their importance. National governments became stabilized, material interests increased and wealth grew. Nobles, vying in material display even with the Church, became patrons of art. Scientists, philosophers, artists and scholars, whose individualities were again recognized, explored other than religious phases of life, diversifying thought. This was an age in which artist, craftsman and architect were one; artists were ready and able to accomplish whatever their patrons demanded. Michelangelo executed paintings in the Sistine chapel, sculpture in the Medici Mausoleum and the final architectural design for St. Peter's. Leonardo da Vinci, judging from his letter of self-recommendation, seems to have been prepared for any undertaking in art, science or war.

Throughout the first two centuries of the Renaissance, architecture and the other arts as part and parcel of it, developed with the Roman influence paramount. The manuscript of Vitruvius, a Roman architect, was discovered about 1452; it admirably describes the building materials employed in his day (c. 25 B.C.) and gives the correct proportions of the various orders (*q.v.*) together with a series of rules for their use. None of the original illustrations of this manuscript were preserved, and when parts of it were published by Italian architects, among whom Vignola and Palladio were the more important, woodcuts representing their interpretations of the lost illustrations were inserted. Thus textbooks of the orders were established. The Roman orders themselves became the architectural alphabet, and definite forms became the accepted fashion of the time.

The spirit of verticality so admirably developed by the Gothicists was abandoned. The column was used in free-standing colonnades, as engaged columns partly buried in walls and as pilasters to decorate wall surfaces and to frame openings. A comparatively new form appeared in the interior of basilica churches, where the clerestory wall was sometimes supported on columns and a semicircular arch substituted for a lintel. Many of the palazzi show a treatment distinctly characteristic of the period. Erected in the congested centres of cities, they were built on the street line with relatively few windows and a great expanse of simple wall heavily rusticated. The ground floor was particularly solid in appearance; its windows, small and high above the street level, were protected by metal grilles as if the designers had to provide for defence against mobs or rival families. The interior courtyard was treated lightly and delicately with two or more storeys in the form of an open arcade on which the grandiose rooms about the central patio opened. The wall was capped with an imposing cornice whose projection was proportionate to the height of the building. The palazzi were invariably built on a magnificent scale; the Palazzo Strozzi, Florence, for example, with only three apparent storeys, is 104ft. from street level to top of cornice.

In the later Renaissance the dignity of the simple interior wall was somewhat diminished by adding rows of paired pilasters, cornices and balustrades. Such decorative features occur in the Palazzo della Cancelleria, the Palazzo Pietro Massimi and the Palazzo Farnese, all in Rome. In these, the proportion of window openings to wall spaces was much greater than in the Florentine palazzi; pilasters were used as frames to windows and to give prominence to the central motif of the second storey. Most interesting combinations of ancient Roman motifs were developed; the villa of Pope Julius, Rome, has, on the garden side, a semicircular façade reminiscent of forms used in Roman baths.

While dominant in Italy, the Renaissance swept throughout western Europe, and the rise of independent nations gave the general movement distinctive trends. The conceptions of its early period, when artists' imaginations were inspired by an opportunity to create in an environment not yet conventionalized, were fresh, pure, naive. As more knowledge of ancient Roman architecture, with its mechanically repeated motifs and impressive scale, was acquired, the earlier charm of the Renaissance was supplanted by excessive standardization and a consequent loss of intimate interest. But artists, seeking new means of expressing their ideas, ever revolt at rules, and the Baroque style resulted from their struggle at this time to give imagination freer rein (*see* BAROQUE ARCHITECTURE). Flamboyant and grotesque forms which distorted classic motifs appeared in all countries. They produced little of lasting value because their inspiration was not due to a desire for structural improvement, but only for ornamentation and embellishment. Having broken his bonds, the artist found he had nowhere to go.



FROM THE POSTS AND LINTEL OF EGYPT AND GREECE TO THE MODERN ENCASEMENT OF THE STEEL FRAME. ROOFING HAS DEVELOPED WITH AN EVER INCREASING SPAN AND HEIGHT

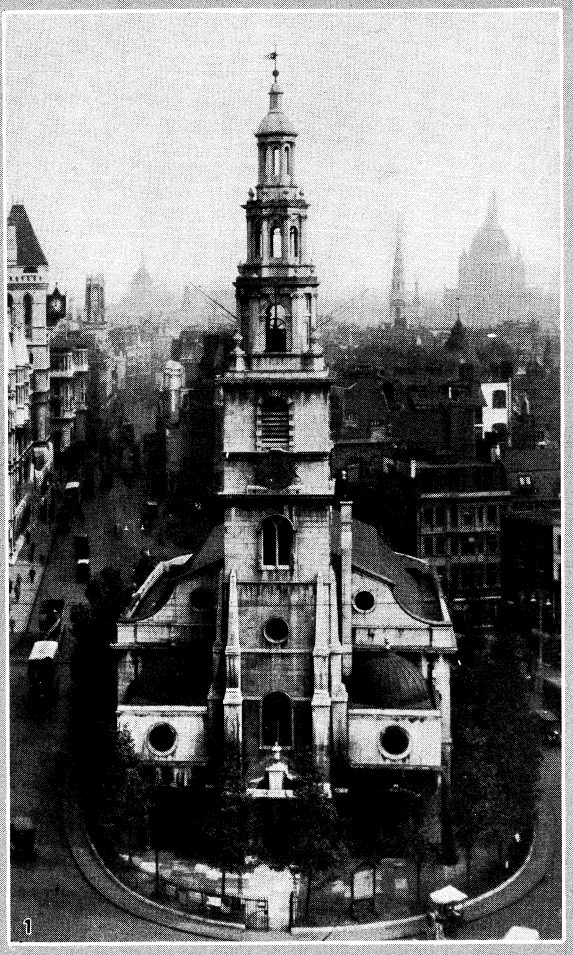
Fashion in architecture has generally been set by the country of greatest wealth and power, and during the 17th century forces were at work in England that were to take full form under the empire builders a hundred years later. English architecture showed the result of increasing prosperity, power and national consciousness. The Roman influence was as marked as it had been in Italy earlier, but it was somewhat differently ex-

PHOTOGRAPHS, (1) ALINARI, (2) ANDERSON, (3) W. F. MANSELL, (4, 5) F. FRITH AND COMPANY, (6) VALENTINE AND SONS

RENAISSANCE STYLE IN ITALY, FRANCE AND ENGLAND

1. Villa di Papa Giulio, Rome, designed by Giacomo Barozzo da Vignola in **1550.** A characteristic example of the Italian Renaissance palace, showing subtlety of proportion and a carefully adjusted relation between the mass of the façade and its decorative features. The contiast between the heavily rusticated entrance and the lighter loggia above is one often seen in this style
2. Farnese palace, Rome, built in **1534,** Antonio Sangallo the younger, architect. An example of the box-like type of building, showing a three-part horizontal composition, the three storeys being of nearly equal heioht. An effect of unitv is achieved by the repetition of motifs; the detail is finely conceived and carried out, but subordinated to the whole
3. Chlteau de Chambord, Touraine, built in **1526,** Pierre Nepveu, architect. An illustration of the French Renaissance chlteau style, characterised by the variety of its outlines and decorative motifs, in contrast with the more severe dignity of the Italian forms
4. Banqueting House, Whitehall, London, built **1619-21** by Inigo Jones, showing a strong Italian influence with two-part horizontal composition. The regularity of window arrangement and repetition of detail give an effect of uniformity, as in the Farnese palace
5. Hampton Court palace, Middlesex, combines Tudor and Renaissance architecture. The Tudor part was erected in **1515** for Cardinal Wolsey and the Renaissance part shown above was designed by Sir Christopher Wren and is a notable example of the combination of brick and stone frequently used in the English Renaissance,. The simplicity and regularity of the composition exhibit the Italian influence.
6. Blenheim palace, Oxfordshire, designed 1705 by Sir John Vanbrugh for the first Duke of Marlborough. A monumental example of the English Renaissance mansion. The plan shows perfect symmetry, with an imposing treatment of the entrance, in which the use of heavy two-storey columns unifies this feature and makes it an integral part of the whole design

ARCHITECTURE



PHOTOGRAPHS (1) EWING GALLOWAY, (2, 3) GIRAUDON

FURTHER EXAMPLES OF THE RENAISSANCE STYLE IN ENGLAND AND FRANCE

1. Church of St. Clement Danes, the Strand, London, Sir Christopher Wren, architect; built in 1684, the steeple finished in 1719. In the spires, a feature of many of Wren's churches, the pointed form, reminiscent of the Gothic, was successfully combined with classical features. The church was destroyed in a German air raid in World War II
2. Church of the **Val-de-Grâce,** Paris, built 1645–50, **François Mansart,** architect, showing Italian influence, with great freedom and variety in the use of classical forms. The dome is regarded by architects as notably successful, and the composition as a whole has been the source of many subsequent designs
3. The Louvre, Paris. The present building was begun in 1546, in the reign of Francis **I.,** from the plans of Pierre Lescot, under whom worked Jean **Goujon,** the greatest decorative sculptor of the French Renaissance. The building illustrates successive stages of development in the Renaissance style, and was not **completed** until about 1880. The colonnade shown here, built about 1665, is from the design of Claude Perrauit. The long, monotonous **façade** has been relieved by the use of the recessed wall at either side of the central motif. The flatness of the end pavilion walls has been similarly relieved by recessing the central windows

pressed. A more stabilized society caused the city palace to be a building not of defence but of impressive elegance, and the growth of an imperial yet representative government necessitated great buildings to house its agencies. The work of Sir Christopher Wren in the latter part of the century inspired succeeding generations of architects, even influencing styles in America. Wren, working in the Renaissance spirit, adapted Roman forms to churches, which in northern countries had always been Gothic; even the spire, an essentially Gothic element, was designed classically by Wren in a number of ecclesiastical structures which pierce the London skyline. In the 18th century government buildings, hospitals, palatial estates and university and college buildings gave evidence of the growing wealth and power of the State and the genius of English architects. (See also RENAISSANCE ARCHITECTURE.)

CONCLUSION

Architecture was at a low ebb throughout the 19th century (see MODERN ARCHITECTURE, 18TH AND 19TH CENTURIES), a period that to-day seems to have been compounded of pompous and complacent materialism, conventionality and self-sufficiency. While painters, writers and musicians were preoccupied with developing new forms of expression, architects, in both Europe and America, were chiefly concerned with adapting, and much too often awkwardly adapting, the old. In America, the 19th century gave birth to the steel skeleton, but of architecturally memorable design it was almost barren everywhere. Fresh conceptions in mass or line were unknown until its end.

Between great periods of art there is a time of darkness in which inventiveness lies stagnant. For architecture, the 19th century was such. The material world was literally in flux. Such abrupt changes in man's ways of life as then occurred in swift succession might stimulate the painter or the writer, but at first they were appalling to the architect, for while the former may follow the dictates of imaginative impulse, the latter is always strictly governed by the need for buildings and the kind of buildings needed. In the 19th century he was called upon to build on a larger scale, an ever-growing scale, for a larger and ever-increasing number of persons without any special taste or knowledge of what constitutes the beautiful. Dissolution of old conceptions and development of new were alike impossible. Inevitably the age became one of revivals.

A few men persisted, as they still do, in the classic tradition, writing and talking as well as building in their efforts to perpetuate it. But the exuberance, the fresh vitality of spirit, that in the early Renaissance had given new meaning to fundamentally old forms, was lacking in the 19th century. Consequently the works in classic style at this time were for the most part uninspired and uninspiring. The so-called Gothic and Romanesque revivals were no more productive.

Art remained alive, but only among small groups. Life was speeded up by mechanical inventions and the attention of those men who had been patrons of the arts was turned from the problem of making their environment more pleasing to keeping pace with its improvements. Those who continued to regard building as an art, over-emphasized, perhaps quite naturally, the beauty of past periods. The mind absorbed with Greek or Gothic forms was hardly capable of designing for the steel skeleton when it appeared after the three-quarter century mark had passed. Thus the 19th lost to the 20th century what might have been a claim to architectural distinction, had its designers solved creatively the new problems in proportions, masses and spaces to be enclosed. The artists were not alone to blame for their sterility; lack of demand inevitably decreased the production of artistic works. For this there were three reasons.

The human capacity to absorb the arts is limited. When one predominates the others are sacrificed. Throughout antiquity, the middle ages and the early Renaissance, the arts of design were of first importance. Thereafter, the spread of literature was enormous, and it turned men's minds to reading. The fine arts, including architecture, became secondary and have so remained.

Democracy proved successful, and rulers who were also patrons of the arts vanished with the vestiges of feudalism. Formerly, each ruler and powerful noble created, as a manifestation of his importance, a setting which was designed to surpass his rival's and to which artists, architects and craftsmen all contributed. Various styles of Renaissance architecture resulted from such efforts of strong personalities, of which Napoleon was the last, to record their existence. Beauty in all its forms was then evidence of superiority. When class barriers were broken down, however, wealth and power passed from an aristocracy, which had employed and inspired artists as a necessary adjunct of its position, to any individual, irrespective of training or background, who could grasp them. The man of wealth but no official title was perhaps no different in his desires for display, but he lacked cultural and material precedents, such as the buildings and their contents belonging to historic families. He was afraid to create an artistic setting of his own, to demand works of art designed especially for himself. Feeling safe in surrounding himself with things of proved value that his bank account could procure, he turned, moreover, to works of art that had already been created and the ownership of which signified wealth.

The tremendous Progress of science and invention during the 19th century is the third reason for the stagnation of the arts. Men's energies, thoughts and talents were absorbed by exploration of these fields which ignorance and dogmatism had kept sealed during the middle ages and the early Renaissance. The subsequent evolution of industrialism with its concomitant mass production and mass consumption helped to turn men's eyes from creation and enjoyment of the arts to the problem of how to achieve more concentration, more production and knowledge of natural forces.

At the beginning of this article it was pointed out that modern architecture is becoming more truly expressive of contemporary culture; changes in the three conditions cited above indicate that a new flowering of the Renaissance is not impossible. The motion picture increases interest in things visual, and the radio is replacing printed words as a means of setting forth ideas. The quantity of literature now produced is so enormous that men are beginning to lift their eyes from printed pages and look about with growing enthusiasm for beautiful ,surroundings and a slowly awakening critical sense. Democracy, having passed through its formative period, functions more or less mechanically, releasing men's energies from the struggle to maintain it. Science and invention still occupy men's imaginations, but they produce for all mankind the two things most essential to successful art: wealth and leisure. Possessed of these, both individual and group are becoming less uncertain as to how to express themselves artistically; they are turning from the purchase and display of antiques to settings and environments created by contemporary artists. This demand for beauty is growing on every side and, like the early Renaissance, it encourages fresh design.

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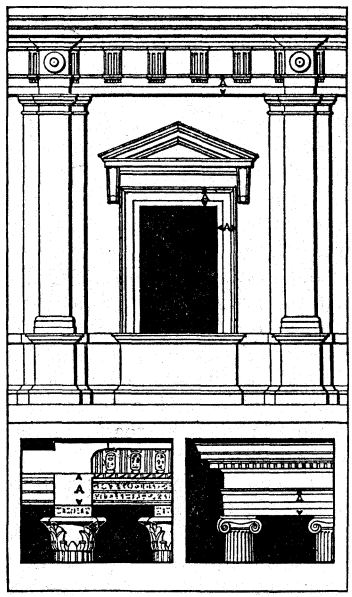
ARCHITRAVE, an architectural term for the chief beam which carries the superstructure and rests immediately on the columns In the classical entablature (*q.v.*) it is the lowest of the three divisions, the other two being the frieze and the cornice (see ORDER). The term is also applied to the moulded frame of any opening or panel.



"A" MARKS THE LOCATION OF VARIOUS ARCHITRAVES. UPPER FIGURE, ITALIAN RENAISSANCE; LOWER LEFT, EGYPTIAN. LOWER RIGHT. GREEK

ARCHIVE, a term (generally used in the plural) properly denoting the building in which are kept the records, charters, and other papers belonging to any state, community, or family (Lat. *archivum,* a transliteration of Gr. ἀρχεῖον, an official building), but now generally applied to the documents themselves (see RECORD).

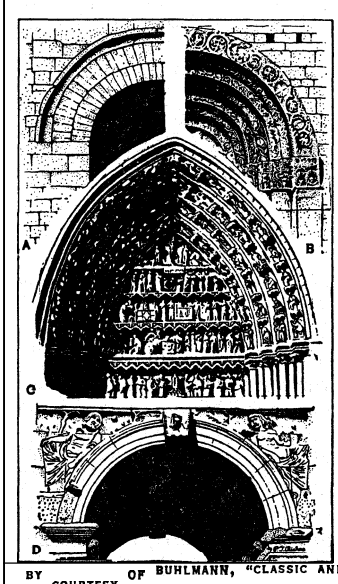
ARCHIVOLT, an architectural term applied to the mouldings of an architrave when carried round an arched opening. (See next column.)

ARCHON, the title of the highest magistrate in many ancient Greek states (ἄρχων, ruler). The archons represented the ancient kings, whose absolutism yielded in process of time to the power of the noble families, supported no doubt by the fighting force of the state. Aristotle's *Constitution* of *Athens* (*q.v.*) mentions five stages: (1) the institution of the polemarch, who took over the military duties of the king; (2) the institution of *the* archon to relieve the king of his civil duties; (3) the tenure of office was reduced to ten years; (4) the office was taken from the "royal" clan and thrown open to all Eupatridae; (5) the office was made annual, and to the existing three offices, military, civil and religious, were added the six *thesmothetai,* whose duty it was to record judicial decisions. The change was effected by the devolution of the military and civil powers of the king to the polemarch and the archon, while the archon basileus (or king-archon) retained control of state religion. The archon became the chief state official and gave his name to the year (hence *archōn epōnumos*). The early history of the *thesmothetai* is not clear, but there is no reason for supposing that in the early times they, with the three chief archons, constituted a collective magistracy. At the time of the Cylonian conspiracy responsibility attached to the archon Megacles, not to the whole body. According to Aristotle, collective responsibility began in Solon's time.

Evolution of the Office.—The history of the democratization of the archonship is beset with equal difficulty. In the early days, the importance of the office (confined as it was to the highest class) must have been immense; there was no audit, no written law, no executive council. The popular assembly was ill-organized and summoned by the archons themselves. The only control came from the Areopagus (*q.v.*), which would generally be favourably disposed from the fact that the military and civil powers were not vested in the same hands. The institution of popular courts by Solon had within it the germ of democratic supremacy, but the immediate result was small; thus, Damasias held the archonship for more than two years in defiance of the new constitution. Gradually the archonship lost its power in judicial matters, until it retained merely the right of holding the preliminary investigation and the formal direction of the popular courts. Its administrative powers, save those wielded by the polemarch (*see* next column and cf. STRATEGUS), dwindled away into matters of routine. After 487 B.C. the list of archons contains no name of importance. This is due to the growing importance of the Strategus and to the institution of sortition (see next column), which, whether as cause or effect, is by the 5th century indicative of diminished importance.

Sortition.—From the Constitution of Athens (22) we gather that from the fall of the Tyranny to 487 B.C. the archons were αἱρετοί, not κληρωτοί (*i.e.*, chosen by vote, not by lot), and that in 487, limited sortition was introduced whereby fifty candidates were elected by each tribe, and from these the archons and their "secretary" were chosen by lot. It is perfectly clear that the lot was not used between the Tyranny and 487 B.C. and that after 487 the lot was always used; in fact, at a date not known, the mixed system of Aristeides gave place to double sortition, in which the first nomination also was by lot. To enter here into the theory of the lot is impossible. It should, however, be observed that in the somewhat material atmosphere of constitutional Athens the religious significance of the lot had vanished; no important office in the 5th and 4th centuries was entrusted to its decision. The real effect of sortition was to equalize the chances of rich and poor without civil strife.

Qualifications and Functions.—It remains to give a brief analysis of the qualifications and functions of the archons after the year 487 B.C. After election a short time had to elapse before entering on office to allow of the dokintasia (examination of fitness). In this the whole life of the nominee was investigated, and each had to prove that he was physically without flaw. Failure to pass the scrutiny involved a certain loss of civic rights (*e.g.,* that of addressing the people). The successful candidate had to take an oath to the people (that he would not take bribes, etc.) and to go through certain preliminary rites. Any citizen could bring an impeachment (eisangelia) against the archons. Any delinquency involved a trial before the Heliaea. Finally, an examination took place at the end of the year of office, when each archon had to answer for his actions with person and possessions; till then he could not leave the country, be adopted into another family, dispose of his property, or receive any "crown of honour." The archons at the end of their year of office became members of the Areopagus, which was, therefore, a body composed of ex-archons of tried probity and wisdom. On entering upon office the archon (*archōn epōnumos*) made proclamation by his herald that he would not interfere with private property. His official residence was the Prytaneum (q *v.*) where he presided over all questions of family, *e.g.,* the protection of parents against children and vice versa, protection of widows, wardship of heiresses and orphans, divorce; in religious matters he superintended the Dionysia, the Thargelia, the processions in honour of Zeus the Saviour and Asclepios. The archon basileus superintended the holy places, the mysteries, the *Lampadephoria* (Torch race), etc., questions of national religion and certain cases of bloodguiltiness. His official residence was the Stoa Basileios, and his wife, as officially representing the wife of Dionysus, was called *basilinna* (queen). The polemarch, who was commander-in-chief down to about 487 B.C., became in the 5th century a sort of consul who watched over the rights of resident aliens (metoikoi) in their family and legal affairs. He offered sacrifices to Artemis Agrotera and Enyalios, superintended funeral games and arranged for the annual honours paid to the tyrannicides His official residence was the *Epilukeion*



BY COURTESY OF BUHLMANN, "CLASSIC AND RENAISSANCE ARCHITECTURE" (NEFF & HELBURN)
ARCHIVOLTS
A ETRUSCAN. B, ITALIAN LOMBARD ROMANESQUE. C, FRENCH GOTHIC; D ROMAN AND RENAISSANCE TYPE

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ARCHPRIEST, in the Christian Church, originally the priest who presided over the presbyters of a diocese and assisted the

bishop in matters of public worship. Where, as in Germany, the dioceses were of vast extent, these were divided into several archpresbyterates or rural deaneries, the office of archpriest ultimately becoming synonymous with that of rural dean. In Rome, the office of archpriest of St. Peter's developed into that of cardinal-vicar. The Roman Catholic clergy in England were under an "archpriest" from 1598 to 1623. In the Lutheran Church in Germany the title archpriest (*Erzpriester*) was in some cases long retained, his functions being much the same as those of the rural dean.

ARCHYTAS (c. 428–347 B.C.), of Tarentum, Greek philosopher and scientist of the Pythagorean school, famous as the intimate friend of Plato. He was seven times elected commander of the army. Under his leadership, Tarentum fought with unvarying success against the Messapii, Lucania and even Syracuse. According to a tradition suggested by Horace (*Odes,* i. 28), he was drowned on a voyage across the Adriatic, and he was buried, we are told, at Matinum in Apulia. He is described as the eighth leader of the Pythagorean school, and was a pupil of Philolaus. He was the first to draw up a methodical treatment of mechanics with the aid of geometry, and to distinguish harmonic from arithmetical and geometrical progressions. He evolved an ingenious solution of the duplication of the cube. The theory of proportion, and the study of acoustics and music were advanced by his investigations. He was said to be the inventor of a kind of flying-machine (see Aulus Gellius Noct. Att., x. 12, 9).

Fragments of his ethical and metaphysical writings are quoted by Stobaeus, Simplicius and others. Such of them as seem to be authentic are of small philosophical value, but Archytas must have been famous as a philosopher, as Aristotle wrote a special treatise (not extant) On the *Philosophy* of Archytas. Some positive idea of his speculations may be derived from two of his observations: the one in which he notices that the parts of animals and plants are in general rounded in form, and the other dealing with the sense of hearing, which, in virtue of its limited receptivity, he compares with vessels which when filled can hold no more.

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ARCIS-SUR-AUBE, a town of eastern France, in the department of Aube, about 20 mi. N. of Troyes. Pop. (1936), 2,455. The ancient settlement was destroyed by successive fires from 1719 to 1814; and the little town now has an 18th-century appearance. A 15th-century church, however (St. Etienne), with a good portal, survives. In front of it stands a statue of Danton, who was born there. There is some carrying trade with Paris on the Aube, which becomes navigable at this point.

A battle was fought there on March 20 and 21, 1814, between Napoleon and the Austro-Russian army under Schwarzenburg. (See NAPOLEONIC CAMPAIGNS.)

ARCO (Ital., bow), a word used in music when, after a *pizzicato* passage (*i.e.,* a passage played by plucking the strings with the fingers) the player of a bowed instrument, such as the violin, is required to resume playing col arco or "with the bow."

ARCOLE, a village of N. Italy, 16m. E.S.E. of Verona, on the Alpone stream near the confluence with the Adige below Verona. The village names the three days' battle of Arcole (Nov. 15, 16, 17, 1796), in which Napoleon defeated the Austrians commanded by Allvintzy. This battle, perhaps the most critical in Napoleon's early career, is dealt with under FRENCH REVOLUTIONARY WARS. Its close was signalized by the successful ruse of sending a few French trumpeters to sound the charge in the rear of the Austrian army. Pop. (town) 1,945 (commune) 4,480.

ARCOS DE LA FRONTERA, a town in Spain, province of Cádiz; on the right bank of the river Guadalete. Pop. (1930) 17,675. It occupies a ridge of sandstone, washed on three sides by the river, and commanding fine views of the lofty peak of San Cristóbal on the east and the fertile Guadalete valley celebrated in ancient Spanish ballads for its horses. From the highest point a Gothic church with a fine gateway and a modern tower overlooks the town. The fame of its ten bells dates from the wars between Spaniards and Muslims in which "Arcos of the Frontier" received its name. The town was captured in 1250 by Ferdinand III. of Castile and Leon.

ARCOT, the name of a city and two districts of British India in the presidency of Madras. Arcot city is the principal town in the district of North Arcot. Prominent in the history of the British conquest, it has now lost its manufactures and trade and preserves only a few mosques, tombs and ruined fortifications as traces of its former grandeur. It is a station on the line of railway from Madras to Beypur. The most famous episode in its history is the capture and defence of Arcot by Clive. In the middle of the 18th century, during the war between the rival claimants to the throne of the Carnatic, Mohammed Ali and Chanda Sahib, the English supported the claims of the former and the French those of the latter. In order to divert the attention of Chanda Sahib from the siege of Trichinopoly, Clive attacked Arcot—which was garrisoned by a force of 1,100—with a force of only 200 Europeans and 300 natives, and took the fortress without a struggle. Chanda Sahib was obliged to detach a large force of 10,000 men to recapture the city, and the pressure on the English garrison at Trichinopoly was removed. Arcot was afterwards captured by the French; but in 1760 was retaken after the battle of Wandiwash. It was also taken by Hyder Ali when he ravaged the Carnatic in 1780, and held by him for some time. The town of Arcot, together with the whole of the territory of the Carnatic, passed into the hands of the British in 1801. Pop. (1931), 14,232.

The district of North Arcot is bounded on the north by the district of Chittore; on the east by the district of Chingleput; on the south by the districts of South Arcot and Salem; and on the west by the Mysore territory. The area of North Arcot is 4,648 sq.m., and the population in 1931 was 2,266,989. The country is flat and uninteresting in the east and south, but the west, along the foot of the eastern Ghats, as well as all the country northwards from Trivellam to Tripali and the Karkambadi Pass, is mountainous. The western elevated platform is comparatively cool, being 2,000ft. above the level of the sea. The hills are principally granite and syenite, with little vegetation, but they abound in minerals, especially copper and iron ores. The narrow valleys between the hills are very fertile and well watered at all seasons. The principal river is the Palar, which rises in Mysore and flows through North Arcot from west to east, eventually falling into the sea at Sadras. Although a considerable stream in the rainy season, and often impassable, the bed is dry or nearly so during the rest of the year. The largest towns are Vellore (the district headquarters), Tirupati (a great religious centre), and Wallajapet.

The district of South Arcot is bounded on the north by the districts of North Arcot and Chingleput; on the east by the French territory of Pondicherry and the Bay of Bengal; on the south by the British districts of Tanjore and Trichinopoly; and on the west by the British district of Salem. It contains an area of 4,207 sq.m., and its population in 1931 was 2,454,507. The country is low and sandy near the sea, and for the most part level till near the western border, where ranges of hills form the boundary between this and the neighbouring district of Salem. These ranges are in some parts about 5,000ft. high, with solitary hills scattered about the district. The principal river is the Coleroon which forms the southern boundary of the district, separating it from Trichinopoly. This river flows strongly far most of the year, and two irrigating channels distribute its waters. Other rivers are the Vellar, Pennar and Gadalum. A considerable proportion of land is irrigated from the rivers and from tanks. Manufacture and export of native cloth have now been almost entirely superseded by the introduction of European piece goods. The chief seaport of South Xrcot is Cuddalore, close to the site of Ft. St. David. The principal crops in both districts are rice, niillet, other food grains and ground nuts.

ARCTIC REGIONS, the term applied to the regions round the North Pole, covering the area (both ocean and lands) where the characteristic polar conditions of climate, etc., obtain. The Arctic circle is drawn at 66° 30′ N., but this has no geographical value as a boundary. A more satisfactory delimitation is the area north of the limit of tree growth. This embraces in addition to Greenland, Spitsbergen and other polar islands, the northern parts of the mainlands of Siberia, Alaska and Canada, the coasts of Labrador, the north of Iceland and a strip of the Arctic coast of Europe but the last, on other grounds, should be excluded.

EXPLORATION OF ARCTIC REGIONS

Ancient Ideas.—The ancients had no actual knowledge of the polar regions. By astronomical speculations the Greeks had come to the conclusion that north of the Arctic Circle there must be midnight sun at midsummer and no sun at midwinter. The general view was that the polar regions, north and south, belonged to the uninhabitable frozen zones; while according to a less scientific notion there was a happy region north of the north wind (Boreas), where the sun was always shining and the Hyperboreans led a peaceful life.

Pytheas.—The first traveller of history who probably approached the Arctic Circle was the Greek Pytheas (*q.v.*), from Massalia (Marseilles), who about 325 B.C. made a voyage of discovery northwards along the west coast of Europe. He visited Great Britain, the Orkneys, and probably also northern Norway, which he called Thule.

Irish Discovery of Iceland.—The Irish monk Dicuil, writing about 82j, mentions the discovery by Irish monks of a group of small islands (the Faeroes), and a greater island (Iceland), which he calls Thule. The fact that Irish monks lived in Iceland before the Norsemen settled there in the 9th century is verified by the Icelandic sagas.

Ottar.—In his translation of Orosius, King Alfred inserts the story of the Arctic voyage, told him by the Norwegian Ottar (Alfred calls him Ohthere), who about 870 rounded the North Cape, sailed eastwards and discovered the White sea, where he reached the south coast of the Kola peninsula and the boundary of the land of the Biarmians (Beormas). After Ottar's time many voyages, mostly of hostile nature but also for trade purposes, were undertaken from Norway to the White sea.

Eric the Red.—After having settled in Iceland in the end of the 9th century, the Norsemen soon discovered Greenland and settled there. The first who is reported to have seen the coast of Greenland was Gunnbjorn Ulfsson, who on his way to Iceland was storm-driven westwards. He came to some islands, afterwards called Gunnbjornskier, and saw a coast, but, without exploring the new land, he had evidently continued his way till he reached Iceland. The real discoverer and explorer of Greenland was Eric the Red, who, with his father had settled in Iceland. As he and his men had there been declared outlaws for having killed several people they had to leave Iceland for three years, and he went westward to find the land which Gunnbjorn was reported to have seen. He explored the west coast of Greenland for three years, probably about 982–985. He then returned to Iceland, but founded the following year a colony in Greenland (*q.v.*). Many colonists followed, and two Norse settlements were formed, viz., the *Österbygd* (*i.e.,* eastern settlement) on the south-eastern part of the Greenland west coast, between Cape Farewell and about 61° N. lat., and the Vesterbygd (*i.e.,* western settlement) between 63° and 66° N. lat. The Norse settlers carried on their seal and whale-hunting still farther north along the west coast certainly as far as Upernivik and even visited the east coast.

It is reported by Adam of Bremen (about 1070) that the Norwegian king Harold Haardraade (in the 11th century) made an expedition into the Arctic sea (probably northwards) in order to examine how far it extended, but we know nothing more about this voyage.

The Icelandic annals report that a land called Svalbardi (cold side or coast) was discovered in 1194. The land was, according to the sagas, situated four days' sailing from north-eastern Iceland northwards in the Hafsbotn (*i.e.,* the northern termination of the sea, which was supposed to end as a bay). There can be little doubt that this land was Spitsbergen.

On his way to Greenland from Norway in the year 1000 Leif Ericsson found America, certainly Labrador, and perhaps Newfoundland and Nova Scotia. Vinland the Good of the sagas may have referred to Nova Scotia, or it may have been a myth. A few years later Karlsefne is said to have sailed from Greenland to make a settlement in the land discovered by Leif. He found Helluland and Markland before reaching Vinland. Hostilities with the inhabitants caused the settlers to return to Greenland in 1066. The story is probably legendary. W

The Icelandic annals state that in 1347 a small Greenland ship which had sailed to Markland was afterwards storm-driven to Iceland with 17 men. This is the last known voyage made by the Norsemen of Greenland which with certainty reached America.

The discoveries of the old Norsemen extended over the northern seas from Novaya Zemlya in the east to Labrador and Newfoundland in the west; they visited all Arctic lands in these regions, and explored the White sea, the Barents sea and the Greenland sea, Davis strait, and even some part of Baffin bay. They were the first navigators in history who willingly left the coasts and sailed across the open ocean, and they crossed the Atlantic between Norway and America, thereby being the real discoverers of this ocean, as well as the pioneers in oceanic navigation. It is hardly an accident that the undertakings of England towards the west started from Bristol, where many Norwegians had settled, and which from the beginning of the 15th century had much trade with Iceland.

Cabot.—John Cabot, sent out by the merchants of Bristol, rediscovered the American continent in 1497. He came to Cape Breton and Nova Scotia, possibly the land that Leif Ericsson had discovered 500 years before. Of John Cabot's expedition towards the west in 1498 nothing is known, not even whether he returned or not. There is no reliable evidence to prove that John Cabot or his son Sebastian ever discovered Labrador, as has been generally believed.

The Portuguese Gaspar Corte-Real probably rediscovered Greenland in 1500, and in 1501 Newfoundland.

Cabot's and Corte-Real's discoveries were followed by the development of the Newfoundland and Labrador fisheries, and a whole fleet of English, Portuguese, Basque and Breton fishermen were soon met with in these waters: and they probably went along the Labrador coast northward as far as Hudson Strait, without having left any report of their discoveries.

It is believed, on good grounds, that expeditions (combined English-Portuguese) were sent out to the newly discovered regions from Bristol in 1501 and 1502. It is unknown what their discoveries were, but they may possibly have sailed along the coast of Labrador.

It is possible that Sebastian Cabot made an Arctic expedition in 1508–09, in search of a short passage to China towards the north-west, and later, in 1521, King Henry VIII. made an attempt to persuade the merchants of London to support him in sending out an expedition, under Sebastian Cabot, to the north-western countries. It is uncertain whether it ever started, but it is certain that it achieved nothing of importance.

Early in the 16th century several expeditions, including that of J. Rut (1527), tried to find a way to China through the Arctic seas, but no discoveries of importance are known to have been made in the Arctic regions.

Willoughby and Chancellor.—There are rumours that the Portuguese, as early as 1484, had sent out an expedition towards Novaya Zemlya in search of a north-east passage to India. The Genovese Paolo Centurione proposed to King Henry VIII. of England, in 1525, to make an expedition in search of such a passage to India north of Russia, and there is evidence to show that there had been much talk about an undertaking of this kind in England during the following period, as it was hoped that a new market might be found for English merchandise, especially cloth. But it led to nothing until 15j3, when Sebastian Cabot was one of the chief promoters. Three ships and 112 men under Sir Hugh Willoughby sailed from Ratcliffe on May 10 (20), 1553.

Richard Chancellor commanded one of the ships, which was separated from the two others in a gale off northern Norway on Aug. 3 (13). Willoughby, after having sighted land in various places, probably Kolguev Island, where they landed, the coast near the Pechora river and Kanin Nos, came on Sept. 14 (24) to a good harbour on the northern coast of the Kola Peninsula. Willoughby resolved to winter there, but he and all his men perished. Chancellor rounded the North Cape, to which he or his sailing-master, Stephen Borough, gave this name. He reached Vardohus, and followed the route of the Norsemen to the White sea and reached the Bay of St. Nicholas, with a monastery of this name, near the mouth of the Dvina river, where Archangel was built later. Chancellor undertook a journey to Moscow, made arrangements for commercial intercourse with Russia, and returned next year with his ship, which was, however, plundered by the Flemings, but he reached London safely with a letter from the tsar. In spite of the disaster of Willoughby and his men this expedition became of fundamental importance for the development of English trade. Chancellor's success and his so-called discovery of the passage to the White sea, which was well known to the Norwegian traders, proved to people in England the practical utility of polar voyages. It led to a charter being granted to the Muscovy Company of Merchant Adventurers, and gave a fresh impulse to Arctic discovery. Chancellor undertook a new expedition to the White sea and Moscow in 1555; on his way home in the following year he was wrecked on the coast of Scotland and perished.

In 1556 Stephen Borough (Burrough), who had served with Chancellor, was sent out by the Muscovy company to try to reach the river Ob, of which rumours had been heard. Novaya Zemlya, Vaigach Island, and the Rara strait were discovered. In 1580 the company fitted out two vessels under Arthur Pet and Charles Jackman, with orders to sail eastwards north of Russia and Asia to the lands of the emperor of Cathay (China). They penetrated through the Kara strait into the Kara sea; but met with much ice and were compelled to return. Pet reached London on Dec. 26, Jackman wintered with his ship in Norway and sailed thence in Feb., but was never heard of again.

About 1574 the Portuguese probably made an attempt to find the north-west passage under Vasqueanes Corte-Real. They reached "a great entrance," which may have been Hudson strait, and they "passed above twentie leagues" into it, "without all impediment of ice," "but their victailes fayling them, . . . they returned backe agayne with ioy."

Frobisher. — The opening of a profitable trade with Russia, via the White sea, inspired new life in the undertakings of England on the sea, at the same time the power of the Hanseatic merchants, called the Easterlings, was much reduced. It was therefore only natural that the plan of seeking a north-west passage to China and India should again come to the front in England. Sir Martin Frobisher opened that long series of expeditions all of which during 300 years were sent from England in search of the north-west passage. After having attempted in vain for 15 years to find support for his enterprise, he at last obtained assistance from Ambrose Dudley, earl of Warwick, and through him the interest of Queen Elizabeth was also secured. The Muscovy Company was now obliged to give a licence for the voyage in 1574, and the necessary money was found by London merchants. Frobisher sailed, on June 7, 1576, from Deptford with two small vessels of 20 and 25 tons, called the "Gabriel" and "Michael," and a small pinnace of 10 tons. On July 8 they lost sight of the pinnace, which was seen no more. On July 11 they sighted a high, rugged land, but could not approach it for ice. This was the east coast of Greenland, but, misled by his charts, Frobisher assumed it to be the fictitious Frisland, which was the fabrication of a Venetian, Niccolo Zeno, who in 1558 published a spurious narrative and map (which he pretended to have found) as the work of an ancestor and his brother in the 14th century. The Zeno map was chiefiy fabricated on the basis of a map by the Swede Olaus Magnus of 1537 and the map by the Dane Claudius Clavus of the 15th century. It was accepted at the time as a work of high authority, and its fictitious names and islands continued to appear on subsequent maps for at least a century, and have puzzled both geographers at home and explorers in the field. These islands had also been introduced on the charts of Mercator of 1569 and of Ortelius of 1570, which were probably used by Frobisher. Evidently frightened by the sight of the great quantities of ice off the Greenland coast, one ship, the "Michael" left him secretly, "and retourned home wyth greate reporte that he was cast awaye." Frobisher continued his voyage towards the north-west in the "Gabriel" alone. On July 29 (Aug. 8) he sighted high land which he called Queen Elizabeth's Foreland. This was the southern part of Baffin Island (Resolution Island) in about 62° N. lat. He entered an inlet which he considered to be the strait of the north-west passage, and he gave it his own name (it is now Frobisher bay or Baffin island). The land was called "Meta Incognita." Frobisher was not well prepared for going much farther, and after his boat with five men had disappeared he returned home, where, unfortunately, some "gold-finders" in London took it into their heads that a piece of dark heavy stone brought back contained gold ore. This caused great excitement; it was now considered much more important to collect this precious ore than to find the north-west passage, and much larger expeditions were sent out in the two following years. As many as 15 vessels formed the third expedition of 1578, and it was the intention to form a colony with 100 men in the gold land, but this scheme was given up. Frobisher came into Hudson strait, which was at first thought to be Frobisher strait and therefore called Mistaken strait. There was an open sea towards the west, and Frobisher was certain that he could sail through to the "Mare del Sur" (Pacific Ocean) and "Kathaya," but his first goal was the "gold mines," and the vessels returned home with full loads of the ore. One of them, a buss (small ship) called the "Emmanuel," reported that on her voyage home she had first sighted Frisland on Sept. 8 (18), but four days later she had sighted another land in the Atlantic and sailed along it till the following day; they reckoned its southern end to be in about 57½° N. lat. This land soon found its place on maps and charts south-west of Iceland under the name of Buss island, and as it was never seen again it was after 1745 called "the sunken land of Buss." The explanation is that, misled by the maps, Frobisher assumed Greenland to be Frisland of the Zeno map and Baffin island was afterwards assumed to be the east coast of Greenland. When the buss on her way home sighted Greenland in about 62" N., she therefore thought it to be Frisland, but when four days later she again sighted land near Cape Farem-ell and her dead reckoning probably had carried her about two degrees too far south, she naturally considered this to be a new land, which puzzled geographers and navigators for centuries. Owing to a similar mistake, not by Frobisher, but by later cartographers and especially by Davis, it was afterwards assumed that Frobisher strait (and also Mistaken strait) was not in Baffin Island but on the east coast of Greenland, where they remained on the maps till the 18th century.

Davis. — John Davis, who made the next attempt to discover a north-west passage, was one of the most scientific seamen of that age. Sailing from Dartmouth on June 7 (17), 1585, with two ships, he sighted on July 20 (30) "the most deformed, rocky and mountainous land, that ever he sawe." He named it the Land of Desolation, although he understood that he had rediscovcrcd "the shore which in ancient time was called Greenland." It was its east coast. He visited the west coast, where Frobisher had also landed mistaking it for Frisland. Davis anchored in a place called Gilbert's sound in 64" 10′ (near the present Danish settlement of Godthaab) and had much intercourse with the Eskimo. He then, crossing the strait which bears his name, traced a portion of its western shore southwards from about 66° 40' N. lat. and came into Cumberland sound, which he thought to be the strait of the north-west passage, but returned home on account of contrary winds. In his second voyage (with four ships) Davis traced the western shore of Davis strait still farther southwards, and sailed along the coast of Labrador. In his third voyage (with three ships) in 1587 he advanced far up his own strait along the west coast of Greenland and reached a lofty granite island in 72° 41′ N. lat., which he named Hope Sanderson. He met with

ice in the sea west of this place, but reported that there was not "any yce towards the north, but a great sea, free, large, very salt and blew, and of an unsearcheable depth." By contrary winds, however, he was prevented from sailing in that direction. He sailed into Cumberland sound, but now found that there was no passage. He also passed on his way southwards the entrance to Frobisher strait, which he named Lumley inlet, and Hudson strait, without understanding the importance of the latter. The result of Davis's discoveries are shown on the Molyneux globe, which is now in the library of the Middle Temple; they are also shown on the "new map" in Hakluyt's *Principal* **Navigations** (1598–1600).

Dutch Exploration. — As early as 1565 Dutch merchants formed a settlement in Kola, and in 1578 two Dutch ships anchored in the mouth of the river Dvina, and a Dutch settlement was established where Archangel was built a few years later. The leading man in these undertakings was Olivier Brunel, who is thus the founder of the White sea trade of the Dutch; he was also their first Arctic navigator. He had travelled both overland and along the coast to Siberia and reached the river Ob; he had also visited Kostin Shar on Novaya Zemlya. He propounded plans for the discovery of the north-east passage to China, and probably started with one ship in 1582, on the first Arctic expedition which left the Netherlands. Little is known of its fate except that it ended unsuccessfully with the wreck of the ship in the shallow Pechora bay, possibly after a vain attempt to penetrate through the Yugor strait into the Kara sea.

The Dutch, however, had begun to see the importance of a northern route to China and India, especially as the routes through the southern seas were jealously guarded by the Spaniards and Portuguese, and after 1584 all trade with Portugal, where the Dutch got Indian goods, was forbidden. By Brunel's efforts their attention had been directed towards the north-east passage, but it was not until 1594 that a new expedition was sent out, one of the promoters being Peter Plancius, the learned cosmographer of Amsterdam. Four ships sailed from Huysdunen on June 5, 1594. Two of these ships were under the command of Willem Barents, who sighted Novaya Zemlya, north of Matochkin Shar, on July 4; and from that date until Aug. 1 (11), Barents discovered the whole western coast as far as the Great Ice cape, the latitude of which he, with his admirable accuracy, determined to be 77° N. Having reached the Orange islands, he decided to return. The two other ships under the command of Cornelis Nay had discovered the Yugor strait, through which they sailed into the Kara sea on Aug. 1 (11). They reached the west coast of Yamal; finding the sea open, they thought they had found a free passage to Japan and China, and returned home on Aug. 11 (21). A new expedition the following year, 1595, with seven ships under the command of Cornelis Nay and Willem Barents merely made several unsuccessful attempts to enter the Kara sea through the Yugor strait. The third expedition was more important. Two vessels sailed from Amsterdam on May 10 (20), 1596, under the command of Jacob van Heemskerk and Corneliszoon Rijp. Barents accompanied Heemskerk as pilot, and Gerrit de Veer, the historian of the voyage, was on board as mate. They sailed northwards, and on June 9 (19) discovered Bear island. Continuing on the same course they sighted a mountainous snow-covered land in about 80° N. lat., soon afterwards being stopped by pack ice. This important discovery mas named Spitsbergen, and was believed to be a part of Greenland. Arriving at Bear island again on July 1, Rijp parted company, while Heemskerk and Barents proceeded eastward, intending to pass round the northern end of Novaya Zemlya. On Aug. 26 (Sept. 5) they reached Ice Haven, after rounding the northern extremity of the land. Here they wintered in a house built out of driftwood and planks and in the spring made their way in boats to the Lapland coast; but Barents died during the voyage. This was the first time that an Arctic winter was successfully faced. The voyages of Barents stand in the first rank among the polar enterprises of the 16th century.

The English enterprises were continued by the Muscovy Company, and by associations of merchants of London; and even the East India Company sent an expedition under Capt. Waymouth in 1602 to seek for a passage by the opening seen by Davis, but it had no success.

Hudson. — The best servant of the Muscovy Company in the work of polar discovery was Henry Hudson. His first voyage was undertaken in 1607, when he discovered the most northern known point of the east coast of Greenland in 73° 30' N. (Hold with Hope), and examined the ice between Greenland and Spitsbergen, probably reaching Hakluyt's headland in 79° 50′ N. On his way home he discovered the island now called Jan Mayen, which he named "Hudson's Tutches." In his second expedition, during the season of 1608, Hudson examined the edge of the ice between Spitsbergen and Novaya Zemlya. In his third voyage he was employed by the Dutch East India Company; he again approached Novaya Zemlya, but was compelled to return westwards, and he explored the coasts of North America, discovering the Hudson river. In 1610 he entered Hudson strait, and discovered the great bay which bears and immortalizes his name. He was obliged to winter there, undergoing no small hardships. On his way home his crew mutinied and set him, his little son and some sick men, adrift in a boat, and the explorer perished in the seas he had opened up.

The voyages of Hudson led immediately to the Spitsbergen whale fishery. English and Dutch whalers in the 17th century added much to the knowledge of Spitsbergen. Poole, Fotherby, Marmaduke, Edge and Carolus were noteworthy.

Meanwhile, the merchant adventurers of London continued to push forward the western discovery. Sir Thomas Button, with the "Resolution" and "Discovery," in 1612 entered Hudson bay, crossed to its western shore, and wintered at the mouth of a river in 57°10′ N. which was named Nelson river after the master of the ship, who died there. Next year Button explored the shore of Southampton Island as far as 65" N. An expedition under Captain Gibbons despatched in 1614 to Hudson bay was a failure; but in 1615 Robert Bylot and William Baffin in the "Discovery" examined the coasts of Hudson strait and to the north of Hudson bay. In 1616 Bylot and Baffin again set out in the "Discovery." Sailing up Davis strait they passed that navigator's farthest point at Sanderson's Hope, and sailed round Baffin bay. Baffin named the most northern opening Smith sound, after the first governor of the East India Company, and the promoter of the voyage, Sir Thomas Smith. Lancaster sound and Jones sound were named after other promoters. The fame of Baffin mainly rests upon the discovery of a great channel extending north from Davis strait; but it was unjustly dimmed for many years, owing to the omission of Purchas to publish the navigator's tabulated journal and map in his great collection of voyages. It was 200 years before a new expedition sailed north through Baffin bay. In 1619 Denmark sent out an expedition, under the command of Jens Munk, in search of the north-west passage, with two ships and 64 men. They reached the west coast of Hudson bay, where they wintered near Churchill river, but all died with the exception of one man, a boy, and Munk himself, who managed to sail home in the smallest ship.

In 1631 two expeditions were despatched, one by the merchants of London, the other by those of Bristol. In the London ship "Charles" Luke Fox explored the western side of Hudson bay as far as the place called "Sir Thomas Roe's Welcome." In Aug. he encountered Capt. James and the Bristol ship "Maria" in the middle of Hudson bay, and went north until he reached "North-west Fox his farthest," in 66" 47' N. Capt. James had to winter off Charlton Island, in James bay, the southern extreme of Hudson bay, and did not return until October 1632.

Hudson's Bay Company. — The Hudson's Bay Company was incorporated in 1670, and Prince Rupert sent out Zachariah Gillan, who wintered at Rupert river. A voyage undertaken in 1719 by J. Knight, nearly 80 years old, who had been appointed governor of the factory at Nelson river, was unfortunate, as his two ships were lost and the crews perished. A naval expedition under Capt. C. Middleton in 1742 discovered Wager river and Repulse bay. In 1746 Capt. W. Moor explored the Wager inlet. Later in the century the Hudson's Bay Company's servants mnde some

important land journeys. From 1769 to 1772 Samuel Hearne descended the Coppermine river to the sea; and in 1789 Alexander Mackenzie of the North Western Company discovered the mouth of the Mackenzie river.

The countrymen of Barents vied with the countrymen of Hudson in the whaling which annually brought fleets of ships to the Spitsbergen seas during the 17th and 18th centuries. Capt. Vlamingh, in 1664, advanced as far round the northern end of Novaya Zemlya as the winter quarters of Barents. In 1671 Frederick Martens, a German surgeon, visited Spitsbergen, and wrote the best account of its physical features and natural history that existed previous to the time of Scoresby. In 1707 Capt. Cornelis Gilies saw land to the east of Spitsbergen in 80° N., which has since been known as Gilies Land. The Dutch geographical knowledge of Spitsbergen was embodied in the famous chart of Van Keulen (edited by Gilies and Rep), (*c.* 1710). The Dutch whale fishery continued to flourish until the French Revolution, and formed a splendid nursery for training the seamen of the Netherlands.

The most flourishing period of the British fishery in the Spitsbergen and Greenland seas was from 1752 to 1820. In order to encourage discovery £5,000 was offered in 1776 to the first ship that should sail beyond the 89th parallel (16 Geo. III. c. 6). Among the numerous daring and able whaling captains, William Scoresby takes the first rank, alike as a successful whaler and a scientific observer. His admirable *Account* of *the Arctic Regions* is still a standard work. In 1806 he succeeded in advancing his ship "Resolution" as far north as 81° 12′ 42". In 1822 he forced his way through the ice on the east coast of Greenland, and surveyed that coast from 75° down to 69° N.

The Russians, after the acquisition of Siberia, succeeded in gradually exploring the whole of the northern shores of that vast region. In 1648 a Cossack named Simon Dezhneff equipped a boat expedition in the river Kolima, passed through the strait since named after Bering, and reached the Gulf of Anadir. In 1738 a voyage was made by two Russian officers frorn Archangel to the mouths of the Ob and the Yenisei. In 1735 Lieut. T. Chelyuskin got as far as 77° 25′ N. near the cape which bears his name; and in 1743 he rounded that most northern point of Siberia in sledges, in 77° 43' N. Captain Vitus Bering, a Dane, was appointed by Peter the Great to command an expedition in 1725. Two vessels were built at Okhotsk, and in July 1728 Bering ascertained the existence of a strait between Asia and America. In 1740 Bering sailed from Okhotsk in the "St. Paul," with G. W. Steller on board as naturalist. Their object was to discover the American side of the strait, and they sighted the peak named by Bering Mt. St. Elias. The Aleutian islands were also explored, but the ship was wrecked on an island named after the ill-fated discoverer. Bering died there on Dec. 8, 1741.

Thirty years after the death of Bering a Russian merchant named Lyakhov discovered the New Siberian or Lyakhov islands. These islands were more fully explored by an officer named Hedenstrom in 1809, and seekers for fossil ivory annually resorted to them.

From 1773 onwards to the end of the 19th century the objects of polar exploration were mainly the acquisition of knowledge in various branches of science. It was on these grounds that Daines Barrington and the Royal Society induced the British Government to undertake Arctic exploration once more. The result was that two vessels, the "Racehorse" and "Carcass," were commissioned, under Capt. C. J. Phipps. The expedition sailed on June 2, 1773, and was stopped by the ice to the north of Hakluyt headland, the north-western point of Spitsbergen. Phipps reached the Seven Islands and discovered Walden island. His highest latitude was 80° 48' N. Five years afterwards James Cook received instructions to proceed northward from Kamchatka and search for a north-east or north-west passage from the Pacific to the Atlantic. His ships, the "Resolution" and "Discovery," arrived at the edge of the ice, after passing Bering strait, in 70° 41′ N. The farthest point seen on the American side was named Icy Cape, and on the Asiatic side Cape North.

The wars following the French Revolution put an end to voyages of discovery till, after the peace of 1815, north polar research found a powerful and indefatigable advocate in Sir John Barrow. Through his influence a measure for promoting polar discovery became law in 1818 (58 Geo. III. c. 20), by which a reward of £20,000 was offered for making the north-west passage, and of £5,000 for reaching 89° N., while the commissioners of longitude were empowered to award proportionate sums to those who might achieve certain portions of such discoveries. In 1817 Barrow obtained sanction for the despatch of two expeditions, one to attempt discoveries by way of Spitsbergen and the other by Baffin bay. The vessels for the Spitsbergen route, the "Dorothea" and "Trent," were commanded by Capt. D. Buchan and Lieut. J. Franklin, and sailed in April 1818. Driven into the pack, both vessels were severely nipped, and had to return to England. The other expedition, consisting of the "Isabella" and "Alexander," commanded by Capt. J. Ross and Lieut. E. Parry, followed in the wake of Baffin's voyage of 1616. The voyage vindicated Baffin's accuracy as a discoverer and showed the way to a lucrative fishery in the "North Water" of Baffin bay, which continued to be frequented by a fleet of whalers every year. Ross thought that the inlets reported by Baffin were merely bays, while the opinion of his second in command was that a wide opening to the westward existed through the Lancaster sound of Baffin.

Parry and Franklin. — Parry was selected to command a new expedition in the following year. His two vessels, the "Hecla" and "Griper," passed through Lancaster sound, the continuation of which was named Barrow strait, and advanced westward. He was stopped by the impenetrable polar pack and obliged to winter in a harbour on the south coast of Melville island. Parry's scientific results were valuable. The vessels returned in Oct. 1820; and a fresh expedition in the "Fury" and "Hecla," again under the command of Parry, sailed on May 8, 1821, and passed their first winter on the coast of Melville peninsula in 66° 11′ N. Still persevering, Parry passed his second winter among the Eskimo at fgloolik in 69" 20′ N., and discovered Fury and Hecla strait. The expedition returned in the autumn of 1823. Meantime Franklin had been employed in attempts to reach by land the northern shores of America, hitherto only touched at two points by Hearne and Mackenzie. Franklin went out in 1819, with Dr. John Richardson, George Back and Robert Hood. They landed at York factory, and proceeded to the Great Slave lake. The following summer they descended the Coppermine river, and traced the coast from its mouth 550m. eastward to Cape Turnagain in 109° 25' W.

It was thought desirable that an attempt should be made to connect the Cape Turnagain of Franklin with the discoveries made by Parry during his second voyage. In 1824 three combined attempts were organized. While Parry again entered by Lancaster sound and pushed down Prince Regent inlet, Capt. Beechey was to enter Bering strait, and Franklin was to make a second journey by land to the shores of Arctic America. Parry was unfortunate, but Beechey entered Bering strait in the "Blossom" in Aug. 1826, and extended knowledge as far as Point Barrow in 71° 23′ 30″ N. lat. Franklin, in 1825–26, descended the Mackenzie river to its mouth, and explored the coast for 374m. to the westward; while Dr. Richardson discovered the shore between the mouths of the Mackenzie and Coppermine, and sighted land to the northward, named by him Wollaston Land, the dividing channel being called Union and Dolphin strait. They returned in the autumn of 1826.

Work was also being done in the Spitsbergen and Barents seas. From 1821 to 1824 the Russian Capt. Liitke was surveying the west coast of Novaya Zemlya as far as Cape Nassau. In May 1823 the "Griper," under Capt. D. Clavering, conveyed Capt. E. Sabine north to make pendulum observations. Clavering pushed through the ice in 75° 30' N., and reached the east coast of Greenland, where observations were taken on Pendulum island. He charted the coast-line from 76° to 72° N.

In 1827 Parry attempted to reach the pole from the north coast of Spitsbergen by means of sledge-boats (see PARRY). The highest latitude reached was 82" 45′ N., and the attempt was persevered in until it was found that the ice as a whole was drifting

to the south more rapidly than it was possible to travel over it to the north.

In 1829 Capt. W. A. Graah of the Danish navy rounded Cape Farewell in boats. He advanced as far as 65° 16′ N. on the east coast, where he was stopped by ice. He wintered in 63° 22′ N., and returned to the west side of Greenland in 1830.

In the year 1829 Capt. J. Ross, with his nephew J. C. Ross, having been furnished with funds by Felix Booth, undertook an expedition in the "Victory." Ross proceeded down Prince Regent inlet to the Gulf of Boothia, and wintered on the eastern side of a land named by him Boothia Felix. J. C. Ross crossed the land and discovered the position of the north magnetic pole on the western side of it, on June 1, 1831. He also discovered a land to the westward which he named King William Land, and the northern shore of which he examined. The Rosses, unable to get their little vessel out of its winter quarters, passed three winters there, and then fell back on the stores at Fury Beach, where they passed their fourth winter, 1832–33. Eventually they were picked up by a whaler in Barrow strait, and brought home. Great anxiety was naturally felt at their prolonged absence, and in 1833 Sir George Back, with Dr. R. King, set out by land in search of the missing explorers. They left Fort Reliance on June 7, 1834, and descended the Backs (Great Fish) river for 530m. In 1836 Back was sent, at the suggestion of the Royal Geographical Society, to proceed to Repulse bay in the "Terror," and then to cross an assumed isthmus and examine the coastline thence to the mouth of the Backs river; but the ship was obliged to winter in the drifting pack, and was brought home in a sinking condition.

The tracing of the polar shores of America was completed by the Hudson's Bay Company's servants. In June 1837 Thomas Simpson and P. W. Dease left Chipewyan, reached the mouth of the Mackenzie, and connected that position with Point Barrow, which had been discovered by the "Blossom" in 1826. In 1839 Simpson passed Cape Turnagain of Franklin, tracing the coast eastward so as to connect with Back's work at the mouth of Backs river. He landed at Montreal island, and then advanced eastward as far as Castor and Pollux river. On his return he travelled along the south shore of the King William island. Little remained to do in order to complete the delineation of the northern shores of the American continent, and this task was entrusted to Dr. J. Rae, a Hudson's Bay factor, in 1846. He went in boats to Repulse bay, where he wintered in a stone hut nearly on the Arctic circle; and there he and his six Orkney men maintained themselves on the deer they shot. During the spring of 1847 Dr. Rae explored on foot the shores of a great gulf having 700m. of coast-line. He thus connected the work of Parry, at the mouth of Fury and Hecla strait, with the work of Ross on the coast of Boothia, proving that Boothia was part of the American continent.

While British explorers were thus working hard to solve some of the geographical problems relating to Arctic America, the Russians were similarly engaged in Siberia. In 1821 P. F. Anjou made a complete survey of the New Siberian islands, and came to the conclusion that it was not possible to advance far from them in a northerly direction, owing to the thinness of the ice and to open water existing within 20 or 30m. Baron Wrangel in 1820–23 explored the coast between Cape Shelagski and the Kolima, making attempts to extend his journeys to some distance from the land, but he was always stopped by thin ice. In 1843 A. T. Middendorf explored the region around Cape Chelyuskin. The whole Arctic shore of Siberia had now been explored and delineated, but no vessel had yet rounded the extreme northern point.

The Franklin Expedition. — The success of Sir J. Ross's Antarctic expedition and the completion of the northern coastline of America by the Hudson's Bay Company's servants gave rise in 1845 to a fresh attempt to make the passage from Lancaster sound to Bering strait. The story of the unhappy expedition of Sir John Franklin, in the "Erebus" and "Terror," is told under FRANKLIN; but some geographical details may be given here. On leaving the winter quarters at Beechey island in 1846 Franklin found a channel leading south, along the west of North Somerset discovered by Parry in 1819. If he could reach the channel along the Canadian coast, he knew that he would be able to make his way to Bering strait. This channel, now called Peel sound, pointed directly to the south. He sailed down it towards King William island, with land on both sides. But directly the southern point of Prince of Wales island was passed and no longer shielded the channel, the great ice stream from the west was encountered and found impassable. Progress might have been made by rounding the eastern side of King William island, but its insularity was then unknown.

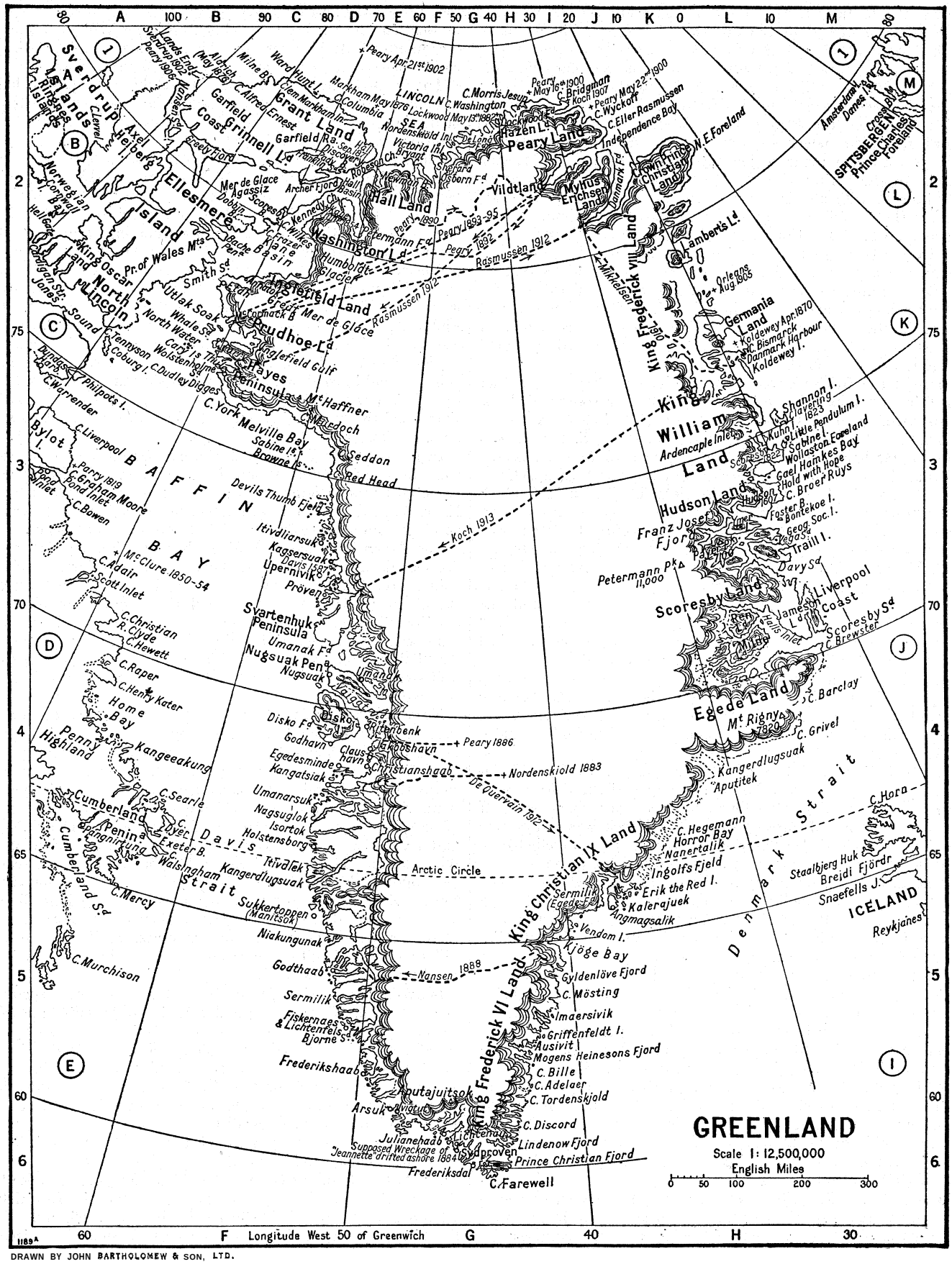
It was not until 1848 that anxiety began to be felt about the Franklin expedition. In the spring of that year Sir J. Ross was sent with the "Enterprise" and "Investigator," by way of Lancaster sound. He made a long sledge journey with Leopold M'Clintock along the northern and western coasts of the North Somerset, but found nothing.

On the return of the Ross expedition without any tidings, the country became thoroughly alarmed. An extensive plan of search was organized — the "Enterprise" and "Investigator" under Captains R. Collinson and R. M'Clure proceeding by Bering strait, while the "Assistance" and "Resolute," with two steam tenders, the "Pioneer" and "Intrepid," sailed on May 3, 1850, to renew the search by Barrow strait, under Capt. Horatio Austin. Two brigs, the "Lady Franklin" and "Sophia," under William Penny, an able whaling captain, were sent by the same route. He had with him Dr. A. Sutherland, a naturalist, who did much valuable scientific work. Austin and Penny entered Barrow Strait, and Franklin's winter quarters of 1845–46 were discovered at Beechey island; but there was no record of any kind indicating the direction taken by the ships. Austin's expedition wintered (1850–51) in the pack off Griffith island, and Penny found refuge in a harbour on the south coast of Cornwallis island. Penny undertook the search by Wellington channel. M'Clintock, who was with Austin, advanced to Melville island, marching over 770m. in 81 days; Captains E. Ommanney and S. Osborn pressed southward and discovered Prince of Wales island. W. H. Brown examined the western shore of Peel sound. The search was exhaustive; but, except the winter quarters at Beechey island, no record was discovered. Austin also examined the entrance of Jones sound on his way home, and returned to England in the autumn of 1851. This was a thoroughly well conducted expedition, especially as regards the sledge-travelling, which M'Clintock brought to great perfection.

In 1851 the "Prince Albert" schooner was sent out by Lady Franklin, under Capt. W. Kennedy, with Lieut. J. Bellot of the French navy as second. They wintered on the east coast of North Somerset, and in the spring of 1852 Bellot, in the course of a long sledging journey, discovered Bellot strait, thus proving that the Boothia coast facing the strait was the northern extremity of the continent of America.

The "Enterprise" and "Investigator" sailed from England in Jan. 1850, but accidentally parted company before they reached Bering strait. On May 6, 1851, the "Enterprise" passed the strait, and rounded Point Barrow on the 25th. Collinson then made his way up the narrow Prince of Wales strait, and reached Princess Royal islands, where M'Clure had been the previous year. Returning southwards, the "Enterprise" wintered in a sound in Prince Albert Land in 71° 35′ N. and 117° 35′ W. In the spring of 1852 sledge parties explored the strait and one reached Melville island. In Sept. 1852 the ship was free, and Collinson pressed eastward along the coast of Canada, reaching Cambridge bay (105° W.), where the second winter was passed. In the spring he examined the shores of Victoria Land as far as 70° 26′ N. and 100° 45′ W.; here he was within a few miles of Point Victory, where the fate of Franklin would have been ascertained. The "Enterprise" again put to sea on Aug. 5, 1853, and returned westward along the Canadian coast, until she was stopped by ice and obliged to pass a third winter at Camden bay, in 145° 29′ W. In 1854 Collinson brought the "Enterprise" back to England.

Meanwhile M'Clure, in the "Investigator," had passed the winter of 1850–51 at the Princess Royal islands, only 30m. from



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MAP OF GREENLAND SHOWING THE ROUTES OF THE CHIEF ARCTIC EXPLORERS

Barrow strait. In Oct. M'Clure ascended a hill whence he could see the frozen surface of Barrow strait, but it was impossible to reach it on account of heavy ice; so, as soon as he was free in 1851, M'Clure turned southwards, round the southern extreme of Banks island, and forced a passage to the northward. He at length reached a bay on the northern shore of Banks island, which he named the Bay of God's Mercy. Here the "Investigator" remained, never to move again. After the winter of 1851–52 M'Clure made a journey across the ice to Melville island. In the spring of 1853 M'Clure was preparing to abandon the ship with all hands, and attempt, like Franklin's crews, to reach the Canadian coast; but succour arrived in time.

The Hudson's Bay Company continued the search for Franklin. In 1848 Sir John Richardson and Dr. Rae examined the Canadian coast from the mouth of the Mackenzie to that of the Coppermine. In 1849 and 1850 Rae continued the search; and by a long sledge journey in the spring of 1851, and a boat voyage in the summer, he examined and mapped the shores of Wollaston and Victoria Lands, which were afterwards explored by Capt. Collinson in the "Enterprise."

In 1852 the British government resolved to despatch another expedition by Lancaster sound. Sir E. Belcher commanded the "Assistance," and S. Osborn the "Pioneer." Belcher went up Wellington Channel where he spent two winters. S. Osborn and Com. G. H. Richards made sledge journeys to Melville island, and thus discovered the northern side of the Parry group. Capt. H. Kellett received command of the "Resolute," with M'Clintock in the "Intrepid." George S. Nares, leader of the future expedition of 1874–75, was also on board the "Resolute." Kellett passed the winter of 1852–53 at Melville island. During the autumn G. F. Mecham discovered M'Clure's record, and the position of the "Investigator" was thus ascertained. Lieut. P. T. Pim made his way to this point early in the following spring, and the officers and crew of the "Investigator," led by M'Clure, arrived safely on board the "Resolute" on June 17, 1853. They reached England in the following year, having not only discovered but traversed a north-west passage, though not in the same ship and partly by travelling over ice. For this great feat M'Clure received the honour of knighthood, and a reward of £10.000 was voted to himself, the other officers, and the crew. Collinson also discovered another N.W. passage.

The travelling parties of Kellett's expedition, led by M'Clintock, Mecham and Vesey Hamilton, completed the discovery of the north and west of Melville island, and the whole outline of Prince Patrick island, farther west. M'Clintock was away from the ship with his sledge party for 105 days, and travelled over 1,328m. Mecham was away 94 days, and travelled over 1,163m. S. Osborn, in 1853, was away 97 days, and travelled over 935m. The "Resolute" was obliged to winter in the pack in 1853–54, and in the spring of 1854 Mecham made a remarkable journey of 1,336m. in 70 days in the hope of obtaining news of Capt. Collinson at the Princess Royal islands.

Fearing detention for a third winter, Belcher ordered all the ships to be abandoned in the ice, the officers and crews being taken home in vessels which had come out from England to communicate. They reached home in Oct. 1854.

The drift of the "Resolute" was a remarkable proof of the direction of the current out of Barrow strait. She was abandoned in 74° 41′ N. and 101° 11′ W. on May 14, 1854. On Sept. 10, 1855, an American whaler sighted the "Resolute" in 67" N. lat. about 20m. from Cape Mercy, in Davis strait. She had drifted nearly 1,000m., and having been brought into an American port, was purchased by the United States and presented to the British Government.

In 1854 Dr. J. Rae after a winter at Repulse bay succeeded in connecting the discoveries of Simpson with those of James Ross, and thus established the fact that King William Land was an island. Rae also brought home the first tidings and relics of Franklin's expedition gathered from the Eskimo, which decided the Admiralty to award him the £10,000 offered for definite news of Franklin's fate. Lady Franklin, however, sent out the "Fox" under the command of M'Clintock (see FRANKLIN). M'Clintock prosecuted an exhaustive search over part of the west coast of Boothia, the whole of the shores of King William island and the mouth of Backs river, and Allen Young completed the discovery of the southern side of Prince of Wales island.

The catastrophe of Sir John Franklin's expedition led to 7,000m. of coast-line being discovered, and to a vast extent of unknown country being explored, securing very considerable additions to geographical knowledge.

The American nation was first led to take an interest in polar research through sympathy for Franklin and his companions. Henry Grinnell of New York sent out in 1850 the "Advance" and "Rescue," to aid in the search. They reached Beechey island and assisted in the examination of Franklin's winter quarters, but returned without wintering. In 1853 Dr. E. K. Kane, who had been with the last expedition, undertook to lead an American expedition up Smith sound. The "Advance" was stopped by ice in 78° 45′ N. only 1 jm. from the entrance. Kane named his winter quarters Van Rensselaer harbour. A great glacier was discovered with a sea face 45m. long and named the Humboldt glacier. Morton crossed the foot of this glacier, and reached a point of land beyond named Cape Constitution. Scurvy attacked the whole party during the second winter. In May 1855 Kane abandoned the brig, and reached the Danish settlement of Upernivik on Aug. 5.

In July 1860 Dr. I. I. Hayes, who had served with Kane, sailed from Boston for Smith sound, in the schooner "United States." His object was to follow up the line of research opened by Dr. Kane. He wintered at Port Foulke, in 78° 17′ N., but achieved nothing of importance, and his narrative is not to be depended on.

The American, Charles Hall, in his first journey (1860–62), discovered remains of a stone house which Sir Martin Frobisher built on the Countess of Warwick island in 1578. In his second expedition (1864–69) Hall reached the line of the retreat of the Franklin survivors, at Todd's island and Peffer river, on the south coast of King William island. Finally, in 1871 he took the "Polaris" for 250m. up Smith sound through Kane basin to Robeson channel and wintered in Thank God harbour, 81° 38' N., and here Hall died.

Norwegian and Swedish Explorers. — The Spitsbergen seas were explored during last century by Norwegian fishermen as well as by Swedish and German expeditions and by British yachtsmen. In 1827 the Norwegian geologist M. Keilhau made an expedition to Bear island and Spitsbergen. In 1863 E. Carlsen circumnavigated the Spitsbergen group for the first time in the sloop "Jan Mayen." In 1864 S. Tobiesen sailed round North-East Land. In 1872 J. Altmann and Nils Johnsen visited Edge's Wiche's Land. In 1869 Carlsen crossed the Kara sea and reached the mouth of the Ob. In 1870 E. H. Johannesen circumnavigated Novaya Zemlya. In 1871 Carlsen succeeded in reaching the winter quarters of Barents in Ice Haven, Novaya Zemlya, the first visitor since 1597, an interval of 274 years. He found the house still standing and full of interesting relics, which are now in the naval museum at The Hague.

Between 1858 and 1872 the Swedes sent several expeditions to Spitsbergen. That of 1864 under A. E. Nordenskiold and N. C. Duner explored the north-east coasts of Spitsbergen. In 1872 an expedition, consisting of the "Polhem" and "Gladen," commanded by Nordenskiold and L. Palander, wintered in Mossel bay in the north of Spitsbergen. In the spring an important sledging journey of 60 days' duration was made over North-East Land. The expedition was in some distress as regards supplies, but in the summer of 1873 they were visited by Mr. Leigh Smith, in his yacht "Diana," and supplied with fresh provisions.

Dr. A. Petermann of Gotha urged his countrymen to take their share in the work of polar discovery, and at his own risk he fitted out the "Germania," which sailed in May 1868, under Capt. K. Koldewey who, failing to reach east Greenland, cruised on the east of Spitsbergen. In 1870 Baron von Heuglin with Count Zeil explored Stor Fjord. In 1868 a two years' expedition was organized under Koldewey, consisting of the "Germania" and the "Hansa" Julius Payer, the future explorer of Franz Josef Land, was on board the "Germania." The expedition sailed from

Bremen on June 15, 1869, for the east coast of Greenland. In latitude 70° 46' N. the "Hansa" was separated from her consort and crushed in the ice. The crew built a house of patent fuel on the floe. The current carried them to the south, and finally, on June 14, 1870, they arrived safely at the Moravian mission station of Friedriksthal, to the west of Cape Farewell. The "Germania" sailed up the east coast of Greenland as far as 75° 30' N., and wintered at the Pendulum Islands of Clavering in 74° 30' N. In March 1870 a party under Koldewey and Payer reached Cape Bismarck, the northern limit of their discoveries. A deep branching fjord, named Franz Josef fjord, was discovered in 73° 15′ N. The expedition returned to Bremen on Sept. 11,1870.

After examining the edge of the ice and possible routes to the north between Spitsbergen and Kovaya Zemlya in the "Isbjorn" in 1871, Payer and K. Weyprecht organized an Austro-Hungarian expedition in 1872. They hoped to make the north-east passage. The "Tegethoff" left Tromso on July 14, 1872. The vessel was closely beset near Cape Nassau, at the north of Novaya Zemlya, in the end of Aug., and drifted in the direction of the prevailing wind. At length, on Aug. 31, 1873, a mountainous country was sighted about 14m. to the north. In Oct. the vessel was within 3m. of an island lying off the main mass of land. Payer landed on it, and found the latitude to be 79° 54' N. It was named after Count Wilczek, one of the warmest friends of the expedition. Here the second winter was passed. In 1874 Payer made several long sledge journeys. The whole country was named Franz Josef Land. In May it became necessary to abandon the ship and retreat in boats; on Aug. 14 the explorers reached the edge of the pack in 77° 40' N., and launched the boats. Eventually they were picked up by a Russian schooner and arrived at Vardo on Sept. 3, 1874.

One of the most interesting problems connected with the physical geography of the polar regions is the actual condition of the elevated ice-covered interior of Greenland. In 1867 Mr. Edward Whymper and Dr. Robert Brown tried to penetrate the interior, but their progress was stopped, after going a short distance over the ice, by the breaking down of the dog-sledges. The expedition brought home geological and natural history collections of value. Dr. H. Rink, for many years royal inspector of South Greenland, also visited the inland ice. An important inland journey was undertaken by A. E. Nordenskiold in 1870, accompanied by S. Berggren. Nordenskiold chose for a starting-point the northern arm of Auleitsivikfjord, and advanced 35m. to a height of 2,200ft.

The enterprises of other countries rekindled the zeal of Great Britain for Arctic discovery; and in 1875 the British Government dispatched the "Alert" and "Discovery," under Capt. G. S. Nares. Coin. A. H. Markham, Lieut. Aldrich, and Capt. H. W. Feilden, R A., as naturalist, were also in the "Alert." The "Discovery" was commanded by Capt. H. F. Stephenson, with Lieut. L. 4. Beaumont as first lieutenant. The expedition entered Smith sound in the last days of July. Lady Franklin bay was reached in 81° 44' N., where the '(Discovery" was established in winter quarters. The "Alert" pressed onwards, and reached the edge of the heavy ice named by Nares the palaeocrystic sea, the ice-floes being from 80 to 100ft. in thickness. Leaving Robeson channel, the vessel made progress and passed the winter off the open coast and facing the great polar pack, in 82° 27′ N. Sledge parties started on April 3, 1876. Markham with Lieut. A. A. C. Parr advanced over the pack to 83° 20′ N., at the time a record northern latitude. Aldrich explored the coast-line to the westward for a distance of 220m. Beaumont made discoveries of great interest along the northern coast of Greenland. The parties were attacked by scurvy, which increased the difficulty and hardships of the work a hundredfold. The expedition returned to England in Oct. 1876. The "Alert" reached a higher latitude and wintered farther north than any ship had ever done before.

In the same year 1875 Sir A. Young in his steam yacht the "Pandora" entered Peel sound, reached a latitude of 72° 14′ N., and sighted Cape Bird But here he was obliged to retrace his track, returning to England. In 1876 Sir A. Young made another voyage in the "Pandora" to the entrance of Smith sound.

Koolemans Beynen, a young Dutch officer, who had shared Young's two polar voyages, on his return successfully endeavoured to interest his countrymen in polar discovery. It was wisely determined that the first expeditions of Holland should be summer reconnaissances on a small scale. The schooner "Willem Barents" was commanded by Lieut. A. de Bruyne, with Beynen as second, and sailed from Holland on May 6, 1878. Her instructions were to examine the ice in the Barents and Spitsbergen seas, take deep-sea soundings, and make natural history collections. She was also to erect memorials to early Dutch polar worthies at certain points. These instructions were ably carried out. Beynen died in the following year, but the work he initiated was carried on, the "Willem Barents" continuing to make annual polar cruises for many years.

In 1879 Sir Henry Gore-Booth and Captain A. H. Markham, in the "Isbjörn" sailed along the west coast of Novaya Zemlya to its most northern point, passed through the Matochkin Shar to the east coast, and examined the ice in the direction of Franz Josef Land as far as 78° 24′ N.

In 1880 Mr. B. Leigh Smith, who had previously made three voyages to Spitsbergen, reached Franz Josef Land in the steam yacht "Eira." The "Eira" sailed along the south side of Franz Josef Land to the westward and discovered 110m. of coast-line of a new island named Alexandra Land, until the coast trended north-west. In the following year Leigh Smith sailed again for Franz Josef Land and continued his work to the west. But in Aug. the ship was caught in the ice and sank. A hut was built on shore in which Leigh Smith and his crew passed the winter of 1881–82, their health being well maintained, thanks to the exertions of Dr. W. H. Neale. On June 21, 1882, they started in four boats to reach some vessels on the Novaya Zemlya coast. They were seen and welcomed by the "Willem Barents" on Aug. 2, and soon afterwards were taken on board the "Hope," a whaler which had come out to search for them under the command of Sir A. Young.

Nordenskiöld and the North-East Passage.—A. E. Nordenskiold in 1875 turned his attention to the possibility of navigating the seas along the northern coast of Siberia. Capt. Joseph Wiggins of Sunderland was a pioneer of this route and his voyages in 1874, 1875 and 1876 led the way for a trade between the ports of Europe and the mouth of the Yenisei river. In June 1875 Nordenskiöld sailed from Tromso in the "Proven," reached the Yenisei by way of the Kara sea, and discovered a harbour on the eastern side of its mouth, which was named Port Dickson, in honour of Baron Oscar Dickson of Gothenburg. Nordenskiold undertook a voyage in the following year in the "Ymer," which was equally successful and convinced him that the achievement of the north-east passage was feasible. The king of Sweden, Baron Oscar Dickson, and M. Sibiriakoff, a wealthy Siberian proprietor, supplied the funds, and the steamer "Vega" was purchased. Nordenskiold was leader of the expedition, Lieut. A. L. Palander was appointed commander of the ship, and there was an efficient staff of officers and naturalists, including Lieut. A. P. Hovgaard of the Danish and Lieut. G. Bove of the Italian navy. The "Lena" was to keep company with the "Vega" as far as the mouth of the Lena, and they sailed from Gothenburg on July 4, 1878. On Aug. 19 they reached the most northern point of Siberia, Cape Chelyuskin, in 77" 43' N. A week later the mouth of the river Lena was passed, and the "Vega" parted company with the "Lena," continuing her course eastward. Nordenskiold very nearly made the north-east passage in one season; but towards the end of Sept. the "Vega" was frozen in off the shore of a low plain in 67° 7′ N. and 173° 20' W. near the settlements of the Chukchees. On July 18, 1879, the "Vega" again proceeded on her voyage and passed Bering strait on the 20th. After a lapse of 326 years of intermittent effort, the north-east passage had at length been accomplished without the loss of a single life and without damage to the vessel. The "Vega" arrived at Yokohama on Sept. 2, 1879.

In 1879 an enterprise was undertaken in the United States, with the object of throwing further light on the fate of Franklin's expedition, by examining the west coast of King William

island in the summer, when the snow is off the ground. The party consisted of Lieut. F. Schwatka of the United States army and three others. Wintering near the entrance of Chesterfield Inlet in Hudson bay, they set out overland for the estuary of Backs river on April 1, 1879, and crossed over to King William island in June. They examined the western shore of the island as far as Cape Felix. The return journey was commenced in Nov. by ascending Backs river for some distance and then marching over the intervening region to Hudson bay. Some graves were found, as well as a medal belonging to Lieut. Irving of H.M.S. "Terror."

Mr. Gordon Bennett, the proprietor of the *New York Herald*, having resolved to despatch an expedition of discovery at his own expense by way of Bering strait, the "Pandora" was purchased from Sir A. Young and rechristened the "Jeannette." Lieut. de Long of the United States navy was appointed to command, and it was made a national undertaking by special act of Congress. The "Jeannette" sailed from San Francisco on July 8, 1879, and was last seen steaming towards Wrangel island on Sept. 3. The "Jeannette" was provisioned for three years, but as no tidings had been received of her by 1881, two steamers were sent up Bering strait in search. One of these, the "Rodgers," under Lieut. R. M. Berry, explored Wrangel island. No news was obtained of the "Jeannette," but soon afterwards melancholy tidings arrived from Siberia. After having been beset in heavy pack ice for 22 months, the "Jeannette" was crushed and sunk on June 13, 1881, in 77° 15′ N. lat., and 155° E. long. The officers and men dragged their boats over the ice to an island which was named Bennett Island, where they landed on July 29. They reached one of the New Siberian islands on Sept. 10, and on the 12th they set out for the mouth of the Lena. But in the same evening the three boats were separated in a gale of wind. A boat's crew with G. W. Melville, the engineer, reached the Lena delta and searching for the other parties found the ship's books on Nov. 14, and the dead bodies of De Long and two of his crew on March 23, 1882. Three survivors of De Long's party had succeeded in making their way to a Siberian village; but the third boat's crew was lost.

The Danes have been very active in prosecuting discoveries and scientific investigations in Greenland, since the journey of Nordenskiold in 1870. Lieut. J. A. D. Jensen made an attempt to penetrate the inland ice in 1878. In 1879 Captain L. A. Mourier, of the Danish "Ingolf," sighted the E. coast and was enabled to delineate it from 68° 10′ N. to 6j° 55′ N., this being the gap left between the discoveries of Scoresby in 1822 and those of Graah in 1829. Nansen sighted part of the same coast in 1882. Lieut. Hovgaard planned an expedition to ascertain if land existed to the north of Cape Chelyuskin. He fitted out "Dymphna" and sailed in July 1882, but was unfortunately beset and obliged to winter in the Kara sea. In 1883 A. E. Nordenskiold undertook another journey over the inland ice of Greenland. Starting from Auleitsivikfjord his party penetrated 84m. eastward, to an altitude of 5,000ft. The Laplanders who were of the party were sent farther on snow-shoes, travelling to a height of 6,600ft.

Danish expeditions under Lieut. G. Holm explored the east coast of Greenland from Cape Farewell northwards between 1883 and 1885, and at Angmagsalik they encountered a tribe of Eskimo who had never seen white men before. Lieuts. C. H. Ryder and T. V. Garde continued the exploration of East Greenland, and Ryder explored Scoresby fjord.

Circumpolar Stations.—On Sept. 18, 1875, C. Weyprecht, one of the discoverers of Franz Josef Land, urged the importance of establishing some several stations within or near the Arctic Circle, and also a ring of stations as near as possible to the Antarctic Circle, in order to record complete series of synchronous meteorological and magnetic observations. Weyprecht did not live to see his suggestions carried into execution, but they bore fruit in due time. The various nations of Europe were represented at an international polar conference held at Hamburg in 1879 under the presidency of Dr. Georg Neumayer, and at another at Berne in 1880; and it was decided that each nation should establish one or more stations where synchronous observations should be taken for a year from Aug. 1882. This fine project was successfully carried into execution. The stations arranged for in the North polar region were at the following localities:—

Norwegians: *Bossekop*, Alten fjord, Norway (M. Aksel S. Steen).
Swedes: *Ice fjord*, Spitsbergen (Professor N. Ekholm).
Dutch: *Port Dickson*, mouth of Yenisei, Siberia (Dr. M. Snellen).
Russians:
Sagastyr island, mouth of Lena, Siberia (Lieut. N. D. Jiirgens).
Novaya Zemlya, 72° 23′ N. (Lieut. C. Andreiev).
Finns: *Sodankyla*, Finland (Professor S. Lemström).
Americans:
Point Barrow, Alaska (Lieut. P. H. Ray, U.S.A.).
Lady Franklin Bay, 81° 44′ N. (Lieut. A. W. Greely, U.S.A.).
British: *Great Slave Lake*, Canada (Lieut. *H*. P. Dawson).
Germans: *Cumberland Bay*, Baffin island (Dr. W. Giese).
Danes: *Godthaab*, Greenland (Dr. A. Paulsen).
Austrians: *Jan Mayen* (Lieut. E. *V*. Wohlgemuth).

The whole scheme was successfully accomplished with the exception of the part assigned to the Dutch at Port Dickson. They started in the "Varna" but were beset in the Kara sea and obliged to winter there. The "Varna" was lost, and the crew took refuge on board Hovgaard's vessel, which was also forced to winter in the pack during 1882–83. The scientific observations were kept up on both vessels during the time they were drifting with the ice.

The American stations commenced work in 1882 and one of these furnished a rare example of heroic devotion to duty in face of difficulties due to the fault of those who should have brought relief at the appointed time. Lieut. A. W. Greely's party consisted of two other lieutenants, 20 sergeants and privates of the United States army, and Dr. O. Pavy. On Aug. 11, 1881, the "Proteus" conveyed Greely and his party to Lady Franklin bay during an exceptionally favourable season; a house was built at the "Discovery's" winter quarters, and they were left with two years' provisions. Two winters were passed without accident. Lieut. J. B. Lockwood with 12 men made a journey along the north coast of Greenland and reached Lockwood island in 83° 24′ N. and 40° 45′ W., the highest latitude reached up to that time. A promontory of Greenland seen to the north-east was named Cape Washington. The party returned to Fort Conger on June 10, 1882, after an absence of 59 days. Greely made two journeys westward into the interior of Grinnell Land following up the northern branch of Chandler fjord to Hazen lake. In the spring of 1883 Lockwood made still more extensive journeys, crossing Grinnell Land to Greely fjord. The central depression of Grinnell Land abounded in musk oxen and was free from ice, though the higher land to north and south lay under permanent ice-caps. Important as these geographical discoveries were, the main object of the expedition was the series of scientific observations at the headquarters, and these were carried out during the whole period with the most scrupulous exactness. As no relief ship came in 1882, nor in 1883, Greely started from Lady Franklin bay with his men in a steam launch and three boats on Aug. 9, expecting to find a vessel in Smith sound. The boats had to be abandoned, the party reaching the shore across the ice with great difficulty. On Oct. 21, 1883, they were obliged to winter at Cape Sabine. A few depots were found, which had been left by Sir George Nares and W. M. Beebe, but all supplies were exhausted before the spring. Then came a time of great misery and suffering; some of the party proved insubordinate and the sternest measures were required to maintain military discipline. When the sun returned in 1884 the men began to die of actual starvation; but it was not until June 22, 1884, that the relieving steamers "Thetis" and "Bear" reached Cape Sabine. Greely and six suffering companions were found just alive, but with all their scientific records, their instruments in order, and the great collections of specimens intact. The failure of the relief expeditions

to overcome difficulties which were child's play to what Greely and his companions had come through only enhances the courage and determination of the heroic survivors.

In July 1886 Lieut. Robert E. Peary, civil engineer, U.S. Navy, accompanied by the Dane Christian Maigaard, made a journey on the inland ice of Greenland eastward from Disco bay. They reached a height of 7,500 ft., 100m. from the coast, and then returned. Dr. Fridtjof Nansen with Otto Sverdrup and five other companions, after overcoming great difficulties in penetrating the ice-floes, succeeded in landing on the east coast of Greenland in Aug. 1888 in 64° 23' N. and reached a height of 8,920ft. on the inland ice, which was crossed on ski in about two weeks to the west coast. On Sept. 26 they reached the head of the Ameralik fjord in 64° 12' N., having traversed 260m. of glacier. An important principle acted on for the first time in Arctic travel on this journey was that of starting from the less accessible side and pushing straight through with no possibility of turning back, and thus with no necessity for forming a base or traversing the same route twice over.

Peary spent the winter of 1891–92 at Inglefield gulf on the north-west coast of Greenland, Mrs. Peary, Dr. F. A. Cook, Eivind Astrup and a coloured servant Matthew Henson being in his party, and a large number of the Etah Eskimo in the vicinity. In April 1892 he set out for a journey across the inland ice to the north-eastward in the hope of reaching the east coast and also the northern extremity of the land. The highest part of the inland ice was found to be about 5,700ft. Great hardships were experienced, but on July 4, having left the ice and reached bare land in 81° 37' N., where musk oxen and other game were found, Peary was rewarded by a glimpse of the sea to the north-eastward, and named it from the date Independence bay. He also traced a channel to the north beyond which lay a new land largely free from snow, no doubt the southern part of the land along the north of which Markham and Lockwood had travelled to their farthest north. Peary returned to northern Greenland in 1893; on the shore of Inglefield gulf he wintered with a party of 13, including Mrs. Peary, and there their daughter was born. A series of accidents prevented much exploration the first summer, but in spite of scanty stores, Peary with two of his party, H. J. Lee and M. Henson, remained at Inglefield gulf for another winter, and on April 1, 1895, set out for Independence bay. The journey there and back added little to knowledge, but the experience of ice-travel and of Eskimo nature gained in the four years' almost continuous residence in northern Greenland were, however, destined to bear rich fruit.

Crossing Greenland. — The ice-sheet has since been crossed on several occasions: by K. Rasmussen from Inglefield gulf to Denmark fjord and back in 1912; by A. de Quervain from Disco bay to Angmagsalik the same year; by J. P. Koch from Louise Land south-westward to near Proven in 1913; and by L. Koch along its northern edge in 1921 (see GREENLAND).

Nansen: Drift of the "Fram."—Dr. F. Nansen, after making an exhaustive study of the winds and currents of the Arctic sea, and influenced largely by the occurrence of driftwood on the shores past which the ice-laden waters flowed southward between Greenland and Spitsbergen, satisfied himself that there was a general drift across the polar basin and perhaps across the Pole. He planned an expedition to take advantage of this drift on the principle which guided his crossing of Greenland, that of entering at the least accessible point and not turning back, thus having no line of retreat and making a relief expedition impossible. He planned a ship, the "Fram," which was immensely strong, to resist crushing, and of such a section that if nipped in the ice the opposing ice-masses would pass under her and lift her on to the surface. The plan of the expedition was based on scientific reasoning, but the methods were totally at variance with those of previous explorers. Otto Sverdrup, who had been one of Nansen's party in crossing Greenland, was captain of the "Fram," and the party included 11 others. The "Fram" left Christiania in the summer of 1893 and made her way through the Kara sea and along the north coast of Asia, until on Sept. 20 she was run into the ice in 77° 30' N. off the New Siberian islands, and the great drift commenced. As anticipated, she rose to the pressure of the ice and was borne on an even keel high above the water for the whole duration of the drift. The movement of the ice was irregular, but on the whole north-westward, until Nov. 15, 1895, when the highest latitude of the ship was attained, 85° 55' N. in 66" 31' E.; then it was westward and finally southward until the ice was broken by blasting round the ship in June in 83° N. lat.; and after being afloat, though unable to make much progress until the middle of July, the "Fram" broke out of the ice off the north coast of Spitsbergen on Aug. 13, 1896. No ship before or since has reached so high a latitude. In all her drift the "Fram" came in sight of no new land, but the soundings made through the ice proved that the Arctic sea was of great depth, increasing towards the Pole, the greatest depth exceeding 2,000 fathoms. The ship's company all returned in perfect health. After the second winter on the "Fram" at a time when the northward movement of the drift seemed to be checked, Nansen, accompanied by Lieut. H. Johansen, left the ship in order to explore the regions towards the Pole by travelling on ski with dog sledges carrying kayaks. It was obviously hopeless to attempt to find the drifting ship on their return, and Nansen intended to make for Spitsbergen in the hope of meeting one of the tourist steamers there. A more daring plan was never formed, and it was justified by success. Leaving the ship on March 14, 1895, in 84" N. 102° E., they made a fairly rapid march northward, reaching a latitude of 86" 5′ N. on April 8, the nearest approach to the Pole so far achieved. Turning southwestwards they travelled with much difficulty, sometimes on the ice, sometimes in kayaks in the open lanes of water, incurring great danger from the attacks of bears and walrus, but at length reaching Franz Josef Land. They travelled westward through this archipelago until Aug. 28, when they built a small stone hut roofed with their light silk tent, in which they passed the winter on Jackson island. There they lived like Eskimo on bear and walrus meat cooked over a blubber lamp. The journey southward was resumed in the spring of 1896, and on June 15 they met Mr. F. G. Jackson, in whose relief ship, the "Windward," they returned to Norway. Nansen and Johansen reached Vardo on Aug. 13, 1896, full of anxiety for the fate of their old comrades, when by a coincidence unparalleled in the history of exploration, the "Fram" was on that very day breaking out of the ice off Spitshergen and the original party of 13 was reunited at Tromso the following week and returned together to Christiania. On this remarkable expedition no life was lost, and the ship came back undamaged under the skilled guidance of Sverdrup with a great harvest of scientific results.

Mr. F. G. Jackson planned an exploring expedition to attain a high latitude by the Franz Josef Land route and was supported financially by Mr. A. C. Harmsworth (Lord Northcliffe). He was accompanied by Lieut. Albert Armitage, as second in command, and six scientific men, including Dr. R. Koettlitz; Dr. W. S. Bruce and D. W. Wilton joined in the second year. The Jackson-Harmsworth expedition sailed in 1894, and was landed at Cape Flora, where log houses were built. In the spring of 1895 Jackson made a journey northward to 81° 19′ N. In this and other journeys by land and in boats, he surveyed a considerable portion of the group. The expedition returned in 1897.

Franz Josef Land was visited by the American explorer W. Wellman in 1898 and 1900, and his companion E. Baldwin in the former year made the discovery of several islands in the east of the archipelago. A wealthy American, W. Zeigler, also sent out expeditions to Franz Josef Land in 1901 and between 1903 and 1905, in the course of which A. Fiala reached the high latitude of 82° 4′ N. in the "America," but the ship was afterwards lost in Teplitz bay.

The Italian expedition under the command of H.R.H. Prince Luigi, duke of the Abruzzi, was the most successful of all those which have attempted to reach high latitudes by way of Franz Josef Land. Sailing in 1899 in the "Stella Polare" the expedition wintered in Teplitz bay in Rudolf island. In the spring of 1900 an effort was made to reach the North Pole by sledging over the sea-ice. The duke of the Abruzzi having been disabled by

frost-bite, the leadership of the northern party devolved upon Capt. Cagni, who started on March 10, 1900, with ten men and nearly 100 dogs. Before losing sight of Rudolf island three men forming the first supporting party started to return, but they never reached winter quarters and all must have perished. The second party returned safely from latitude 83° 10′ N. Cagni pushed on with three companions, and on April 25, 1900, succeeded in reaching 86° 34′ N. in 61° 20′ E. Diminishing food supplies made it necessary to turn at this point, and although he had reached it in 45 days it took Cagni 60 days to return. At the farthest north no land was visible.

Franz Josef Land was to be the base of a march to the Pole by the Russian, G. L. Sedoff, but on his death near Rudolf island in 1913 the journey was abandoned and the "Phoca" (later the "Suvorin") returned to Archangel. G. L. Brusilov sailed in 1912 in the "Santa Anna" to attempt the north-east passage. The ship was caught in the ice of the Kara sea and in a year and a half drifted to 83° N., long. 63° E., north of Franz Josef Land, where 11 men left the ship. Two of them were found by the "Phoca" at Cape Flora; the others perished on the way. Nothing is known of the fate of the ship and the remainder of the crew.

As early as 1895 a scheme for an exploring expedition in a balloon was put forward seriously, and in 1897 the Swedish aeronaut S. A. Andrée carried it out. He had brought a balloon to Danes island, Spitsbergen, the previous year, but the weather was unpropitious and the ascent had to be postponed. On July 11, 1897, he started in a new and larger balloon with about five tons of supplies and two companions. It was hoped that the balloon could be steered to some extent by the use of heavy guide ropes dragging over the ice, and Andrée had already made successful flights in this way. Rising at 2.30 P.M. the balloon was out of sight of Danes island in an hour. At 10 P.M. Andrée threw out a buoy containing a message which was recovered, and this stated that the balloon was in 82° N. 25° E., moving towards the north-east at an altitude of 800ft. above a rugged ice-field. This was the last news received, and in spite of many rumours, nothing further has ever been ascertained.

In 1897 and subsequent years Sir Martin Conway explored the interior of Spitsbergen. Dr. A. G. Nathorst explored the eastern coast and off-lying islands, including Gilies land. In 1899 Nathorst visited the north-east coast of Greenland, mapped Franz Josef fjord, and discovered the great King Oscar fjord.

In 1899 Admiral S. O. Makaroff of the Russian navy arranged for the trial trip of the great ice-breaker "Yermak," which he designed, to the sea-ice off Spitsbergen. Though no high latitude was attained on this occasion he formed the opinion that a vessel of sufficient size and power could force a passage even to the Pole. The Russian-Japanese War put an end to the polar projects of this gifted man of science.

In subsequent years valuable surveys and scientific observations were made by the Prince of Monaco in his yacht "Princesse Alice," by Dr. W. S. Bruce, notably on Prince Charles ioreland, and by others.

Spitsbergen Surveys — Much detailed work has been done in Spitsbergen in recent years by Norwegians, British and Swedes. Norwegian government surveys of the western part of the mainland have been completed by G. Isachsen, A. Staxrud, A. Hoel and the survey ship "Fram." The opening of coal mines has been responsible for other surveys. In 1912 a German exploring expedition under Lieut. Schroeder-Stranz came to grief and almost total loss on the north coast, but in the same area in 1924 an Oxford university expedition under G. Binney did useful work in North-East Land and adjacent coasts. An expedition under F. A. Worsley in the "Island" did some oceanographical work east of Spitsbergen in 1925.

Otto Sverdrup planned an Arctic voyage for the circumnavigation of Greenland in the "Fram." G. I. Isachsen was the surveyor. Starting in 1899, he was obliged to abandon the attempt to get northward through Smith sound, and making his way westward into Jones sound he spent three years in exploring islands to the north of the field of the Franklin search expeditions. Axel Heiberg and other islands between Ellesmere and Melville islands were discovered and mapped, and a great deal of valuable work was accomplished.

Stefansson and **Macmillan.**—The western part of the Canadian Arctic archipelago was extensively explored by V. Stefansson in several expeditions from 1906 to 1918. Stefansson always lived in Eskimo fashion, hunting as he went, and so could travel light and avoid the need of falling back on a base for supplies. He added much to the survey of the Parry Islands, islands to the west of Axel Heiberg islands, and Banks island. The southern branch of his expedition of 1914–18 under R. M. Anderson conducted researches in Victoria island and the mainland of Arctic Canada. The "Karluk," under R. A. Bartlett, was caught in the ice north of Alaska and drifted to destruction in 72° N., 173° 50′ W., but all except four men, including J. Murray, Forbes McKay and H. Beuchat were eventually saved by the exertions of Bartlett. Sledge journeys and soundings of this expedition, one of E. Mikkelsen in 1907 and of D. B. Macmillan in 1914 towards Peary's hypothetical Crocker Land practically proved the absence of any further land in the Beaufort sea. Further work in Ellesmere Land including a westward journey to 82° 30′ N., 108° 22′ 30″ W. in a vain search for Crocker Land was carried out by D. B. Macmillan, W. E. Ekblaw and others of an American expedition which had its base at Etah on Smith sound from 1913–17. The Royal Canadian Mounted Police, who maintain several ports in Baffin and Ellesmere islands and elsewhere in the Canadian Arctic, are annually surveying and exploring these islands.

Toll and **Vilkitski.**—Russian surveyors and explorers continued to map portions of the Siberian coast, and in 1886 Dr. A. Bunge and Baron E. von Toll visited the New Siberian islands. Baron Toll continued this work in 1893. He set out once more in 1901 in the "Zarya," hoping to reach Sannikov island, a land reported to the north of the New Siberian group. In Aug. 1902 he reached Bennett island with the astronomer Seeberg and two men, and remained there until Nov. Nothing more was heard of the expedition, and a relief expedition in 1904, under Lieuts. M. P. Brusneff and A. V. Kolchak, failed to find any trace of the explorers beyond a record left on Bennett island, which gave a summary of their movements up to the time of leaving the island.

Between 1912 and 1915 the Russian ice-breakers "Taimir" and "Vaigach," under the command of B. A. Vilkitski, were employed in surveys of the Arctic coast of Siberia. Besides much accurate charting of the coasts, and oceanographical work, they discovered in 1913 Nicholas Land (Northern Land) and two small islands north-west of Cape Chelyuskin and made partial surveys of them in 1914. The northern limits of Nicholas Land are unknown. Bennett island was also explored, Jokhov and Vilkitski islands discovered to the south-east of it and Sannikov land practically disproved.

Amundsen.—In 1901 Captain Roald Amundsen, a Norwegian, who had been mate on the "Belgica" in her Antarctic voyage, planned an expedition to the area of the north magnetic pole visited by Sir J. Ross in 1831, in order to re-locate it, and as a secondary object he had in view the accomplishment of the north-west passage by water for the first time. A small sealing sloop, the "Gjoa," was fitted with a petroleum motor and strengthened to withstand ice-pressure. She left Christiania on June 17, 1903, with a total company of six men, second in command being Lieut. G. Hansen of the Danish navy. She passed through Lancaster sound down the west side of Boothia Felix, and took up winter quarters in Gjoa harbour in Petetsen bay, King William island. Here the vessel remained for two years while observations were carried out, and sledging excursions were made to the magnetic pole and along the coasts of Victoria island, which was charted up to 72° N. In August 1905 the "Gjöa" proceeded westward along the Canadian coast, but was frozen in off King Point for a third winter. On July 11, 1906, she got free, reached Bering strait and entered the Pacific, the first ship to pass from ocean to ocean north of Patagonia.

Between 1918–21 Amundsen made the north-east passage in the "Maud," wintering three times on the Siberian coast on his

may to Alaska. The voyage was preliminary to a journey across the Arctic Ocean on the lines of Nansen's drift in the "Fram." Unfavourable ice-conditions delayed the successful start of the drift until 1922. Amundsen returned to Europe to prepare for his polar flight and O. Wisting commanded the "Maud." H. U. Sverdrup was the scientific leader. From Wrangel island the ship drifted for two years south of and parallel to the track of the "Jeannette" to the north of the New Siberian islands. Then after another winter at the Bear islands near the Kolima mouth the "Maud" returned to Nome.

Greenland.—Danish explorers have continued to concentrate their attention on Greenland. Lieut. G. D. Amdrup, in a series of expeditions between 1898 and 1900, charted the east coast as far north as 70° 1j' N. The duke of Orleans in the "Belgica," under the command of Captain Gerlache in 1905 cruised along the coast between 76° and 78" N., and fixed the general outline of the land. This expedition did a large amount of work in oceanography. L. Mylius-Erichsen sailed in the "Danmark" in June 1906 and found winter quarters in Danmarkhaven, 75° 43' N., where the ship remained for two years, while systematic observations were kept up at the base and the work of exploring to the northward was carried on by sledge. The coast was found to curve much farther to the north-eastward than had been anticipated. Having left the winter quarters on March 28, 1907, Mylius-Erichsen, with Capts. J. P. Koch, N. P. Hagen, an educated Eskimo, Bronlund and two others, reached north-east foreland, the eastern extremity of Greenland (81° 20′ N., 11° 15′ W.) charting the coast as they went. Here they divided; Koch with A. Berthelsen and the Eskimo Tobias went north-westward to explore the east coast of Peary Land, and succeeded in reaching Cape Bridgman in 83° 29' N., thus linking up with Peary's work in 1900. From this great journey he returned in safety to winter quarters. Meanwhile Mylius-Erichsen, with Hagen and Bronlund, followed the coast westward into what was believed to be the Independence bay seen from a distance by Peary; this turned out to be a deep inlet now named Danmark fjord. Keeping to the coast, they entered Independence bay and pushed on to Cape Glacier in 82° N. and 35° W. by June 14, 1907, within sight of Navy Cliff, which had been Peary's farthest coming from the west side. Here the softness of the snow kept them all summer. When they could travel, more than a fortnight was wasted adrift on a floe in the effort to cross Danmark fjord. Here the sun left them, while they were without food, almost worn out and more than 500m. from the ship. It was impossible to attempt the long journey round the coast, and the only chance of safety, and that a very slender one, was to make a way southward over the inland ice and so cut off the eastern horn of Greenland which the expedition had discovered. Under the most terrible difficulties they accomplished the feat of marching 160m. in 26 days, and reached the east coast again in 79" N. Hagen died on the way; Mylius-Erichsen himself struggled on until he nearly reached the provisions left on Lambert island on the northern journey; but he too perished, and only Bronlund reached the supplies. He was unable to proceed further, and after recording the journey in his diary, he died also alone in the Arctic night. His records were discovered in the following year by Koch, and Erichsen's in 1910 by E. Mikkelsen.

Using as a base the Eskimo trading station of Thule in North Star bay on Smith sound, K. Rasmussen, L. Koch and other Danes have carefully explored the north of Greenland, and in 1921–24 Rasmussen, P. Freuchen and K. Birket-Smith continued their researches in Eskimo culture by visiting, between them, all the tribes from Greenland to Alaska. They also surveyed parts of Baffin island (Cockburn Land). Eskimo stations on Scoresby sound, east Greenland, founded 1925–26, have been the base of other work by L. Koch. In 1926 a Cambridge expedition under J. M. Wordie did some survey on the east between 72° and 75° N.

Peary: Journey to the North Pole.—After the return of the Jackson-Harmsworth expedition, Lord Northcliffe presented the "Windward" to Peary, who resumed in 1898 his systematic explorations of the Smith Sound region in the hope of finding a way to the Pole. He made some long sledge journeys in the winter of 1898–99, having his feet badly frost-bitten and losing eight toes, and wintered amongst the Etah Eskimo in 1899–1900. Next spring he made a successful journey to the north of Greenland, and pushed north over the sea-ice for 20m. farther, reaching 83" 54' N. Peary wintered again at Fort Conger in 1900–1, and for the fourth year in succession he went through the Arctic winter, 1901–2, at Payer harbour. In the spring of 1902 he made a great journey to Cape Hecla in the north of Grant Land and thence northward over the frozen sea to 84° 17′ N. in 70° W. Frequent open leads of water and the moving of the ice-floes made further advance impossible, and after an unparalleled sojourn in the farthest north, Peary returned to the United States. The Peary Arctic Club of New York, formed to support this indomitable explorer, provided funds for a new expedition and a ship named the "Roosevelt." In her he proceeded in the summer of 1905 through Smith sound to Cape Sheridan on the north coast of Grant Land, Capt. R. A. Bartlett being in command of the ship. From this point he advanced by sledge to Cape Hecla, whence he made a most strenuous attempt to reach the North Pole. Organizing his large following of trained Eskimo, whose confidence in him had been won by many years of friendship, and his few white companions in separate parties, he set off at the end of February 1906. A very broad lead of open water was encountered in 84" 38' N., and as the party did not carry kayaks much time was lost in getting across. The floes had a marked eastward drift and it was difficult to make progress northward; however, Peary struggled on by forced marches to 87° 6' N., which he reached on April 21, 1906, the most northerly point so far attained. His return journey was the most dangerous in his experience; many leads had to be crossed, sometimes on ice so thin that it bent beneath the weight of the explorers, provisions were exhausted and the men were reduced to eating their dogs before they made land at Cape Neumayer in the north of Greenland.

Returning to America, Peary prepared for a last attempt. Leaving New York in July 1908 the "Roosevelt," again under the command of R. Bartlett, brought the party, with the Eskimo who were picked up on the way, to Cape Sheridan by Sept. 5. During the winter all supplies were transported to Cape Columbia, farther west on the coast of Grant Land. Here there were ready to start in the first light of the Arctic day seven explorers, 17 picked Eskimo and 133 of the best dogs in Greenland, with 19 sledges. As the outcome of all Peary's experience the expedition was arranged to consist of a lightly equipped advance party to select the route and make the trail by clearing a way through rough ice, and a main party composed of units of four men each with sledges containing all their requirements marching one day behind the pioneer party. From this unit parties were to return southward at intervals with the empty sledges, leaving the diminished main party to push on fully provisioned. The "big lead," said to mark the edge of the continental shelf in 84" N., was crossed after some delay and here the sun appeared for the first time on March 5, 1909. D. B. Macmillan with three Eskimo and three sledges returned along the outward trail after March 7 from 84" 29' N. A sounding at this point showed the depth of the sea to be 825 fathoms. After five more marches G. Borup turned back in 8j° 23' with three Eskimo and three sledges, the best Eskimo and dogs remaining with the main party. From this point the advance was regular; the pioneer party started from the snow-houses they had built and slept in when the main party arrived, and while the latter slept the pioneers marched, selected a camp, built new snow-houses, and slept till the main party came up. At 86° 38' N. R. G. Marvin turned back, as usual with the three worst Eskimo and the worst dogs. His party reached the ship, but he himself was drowned in recrossing the "big lead," the only casualty of the expedition. At 88" N. Bartlett turned back on April 1 in accordance with the system with two Eskimo, one sledge and 18 dogs. Up to this point Peary had saved himself as much as possible, leaving the path-finding and the observations to his very competent colleagues; but now he put forth all his strength for the arduous

140m. which separated him from the Pole. He was accompanied by Henson and four Eskimo. The ice improved as he went on, and it was possible to do 25m. in a daily march of 10 hours, and on one occasion 30m in 12 hours. On April 6 an observation gave 89" 57' N., and here a camp was made and observations taken throughout 24 hours to fix the position, as well as excursions a few miles farther on and a few miles to right and left so as to be sure of actually reaching the Pole. No land was to be seen, and a sounding through the ice gave a depth of 1,500 fathoms with no bottom. The American flag was hoisted; the goal of all the ages of exploration had been reached.

The return journey was quick and easy. The tracks kept open by the passage of the various return parties were distinct, the snow-houses stood ready, and a northerly gale kept the ice pressed well together and the leads closed. On April 23 Cape Columbia was reached and soon after the party was safe on board the "Roosevelt." Success was due to the accumulated experience of 23 years' constant Arctic work, and to the thorough acquaintance with the Eskimo and their dogs, which enabled the best work to be got out of them.

Dr. F. A. Cook spent two years in the Arctic regions, 1907–9, and claimed to have reached the Pole by sledging alone with two Eskimo a year before Peary. He submitted the evidence for this achievement to the university of Copenhagen, which failed to find it satisfactory, and Dr. Cook did not appear to challenge this decision.

Polar Flights. — Three flights were made to the North Pole in 1926–28. On May g, 1926, Commander R. E. Byrd of the U.S. navy, flew from Spitsbergen to the pole and back in 16 hours; two days later Roald Amundsen, who had failed with an aeroplane in 1925, started from the same base with L. Ellsworth and Umberto Nobile in the Italian built dirigible "Norge," crossed the pole and reached Teller, Alaska, a distance of 3,391m., in 71 hours. No land was seen on the way, but at times mist obscured the view. General Nobile, starting from the Spitsbergen base in May, 1928, in the dirigible "Italia," first made a survey eastward over Franz Josef Land, and then turned due north, reaching the pole on May 24. On his return, the "Italian" was wrecked on North East Land, east of Spitsbergen, but Nobile and most of his crew were saved after six weeks on the ice. Amundsen, who had joined in the search for Nobile's party in an aeroplane, was lost.

Leaving Point Barrow, Alaska, on April 15, 1928, Captain George H. Wilkins and Lieut. Eielson flew across the Arctic ocean, reaching Spitsbergen in 203 hours, and covering 2,200 miles. Wilkins was knighted on his return.

Future Exploration. — There is little likelihood of new land except a few islands in groups already known being discovered in the Arctic, but the successful exploration of the polar basin has yet to be undertaken. Detailed topographical and geological surveys are required in many Arctic lands. Geodetic measurements and gravity determinations with modern instruments of precision are much needed. Investigations of terrestrial magnetism are of great importance. The study of Arctic meteorology cannot fail to throw light on the atmospheric circulation in the northern hemisphere and on the origin and course of cyclones. Statistical data are fairly numerous, but there is urgent need of using modern methods of research on the spot. A study of ice formation and currents, apart from its own interest and its bearing on possible climatic changes will probably be found to have bearings on the weather of Europe. Lastly, there are numerous problems in biology and the conditions of life in polar regions, apart from mere collecting, that can only be studied on the spot. Exploration of the future requires not so much travelling expeditions as fixed stations operating for a year or more.

THE ARCTIC OCEAN

The broad outlines of the physical geography of Arctic regions are known, although much has to be done in filling in details. The landlocked Arctic sea or ocean, lying eccentric to the North Pole includes, with the Greenland and Norwegian seas, about 5,400,000sq.m. A feature of the Arctic sea is its wide continental shelf on which lie numerous groups of islands, Greenland, Spitsbergen, Franz Josef Land, Novaya Zemlya, the Canadian Arctic islands, etc. (*q.v.*). No islands are known in the deep polar basin and there is little likelihood of any existing. The tidal observations of the "Maud" discourage the probability of any extensive land in the Beaufort sea, which is the one large unexplored area in which land has been suggested.

Depths. — The wide continental shelf is marked by several depressions below 100 fathoms. Baffin bay falls to depths of over 1,000 fathoms; the Greenland sea, including its south-eastern part which is sometimes called the Norwegian sea, falls to 2,000 fathoms, and the Barents sea, which is really a gulf of the Greenland sea, reaches over 300 fathoms in the west. The Kara sea is a shallow sea scarcely over 100 fathoms in depth between Novaya Zemlya and the Yamal peninsula. The name Beaufort sea applies to that part of the ocean between Alaska and the Parry islands. The Bering sea lies between Bering strait and the Aleutian islands. The deep polar basin has not been accurately charted since its surface is generally ice-covered. The deepest soundings are 2,100 fathoms in 81" N., 130′ E.; 2,020 fathoms in 84° 30' N., 75° E.; 2,050 fathoms in 87° 43' N., 10° 20' W.; and 3,076 fathoms in 77° 45' N., 175° W. The last is an echo sounding. A sounding of 2,561 fathoms in 72" N. 147° W. suggests the need of confirmation; it was probably only about 1,383 fathoms. Peary found 1,500 fathoms within five miles of the Pole. The basin of the Greenland sea is cut off from the polar basin by a ridge at about 800 fathoms between Greenland and Spitsbergen. This ridge has not been accurately defined. The Faeroe-Icelandic and Wyville Thompson ridge at less than 300 fathoms separates the deep Greenland sea from the depths of the Atlantic basin. Other connections of the Arctic waters and the great ocean basins are by the many shallow channels among the Canadian Arctic islands and the narrow Bering strait which is only 30 fathoms deep.

The origin of the polar basin is not clear, but there is some evidence that it is a relatively recent feature of the earth's surface and did not exist in Palaeozoic times. The wide continental shelf is probably a plain of marine abrasion in which the disintegrating power of frost, an active agent of destruction in the Arctic, has helped the action of the waves. If this explanation is true there must have been a change in the relative level of land and sea; either a sinking of the land or a rising of the sea. The lowering of sea-level during the Pleistocene ice age owing to the abstraction of water from the oceans offers a partial explanation, but wave and frost action needed a larger period of time than the duration of the ice age. Since its formation began the shelf has been undergoing depression by the weight of land waste accumulating on its floor, and at the same time denudation, by decreasing the weight of the land, is causing the coastal region to rise. The strandflat, a rocky platform at 60 to 100ft. above sea-level, is another significant feature of many Arctic and sub-Arctic lands. Nansen sees in it another plain of marine abrasion formed when the ocean water stood higher owing to feeble glaciation.

Deposits. — Bottom deposits in high latitudes contain little organic matter and only 1 to 4% of $CaCO_3$. Between Spitsbergen and Greenland the amount of lime increases to over 20 or even 30% owing to foraminifera. Diatoms which are abundant in surface waters do not, among the rock waste, form a high enough proportion to justify the name of diatom-ooze for any Arctic deposit.

Circulation. — Arctic surface waters in spite of being cold are relatively light on account of their low salinity, due both to lack of evaporation and steady inflow of great volumes of fresh water from the Eurasian and American rivers. The tendency of the light surface layers is to spread outwards, a movement which is helped by the prevailing winds, and the overflow necessary from a constricted basin to which inflow of river water is considerable and where evaporation is slight. Within the polar basin the surface waters are sweeping across from Alaska and Siberia towards Spitsbergen and Greenland on the Asiatic side of the Arctic sea. Most of this water and the ice it carries finds its way southwards into the Barents and Greenland seas by the east Spitsbergen and east Greenland currents which flow southward along these coasts

and tend to block them with streams of pack-ice. Some of the polar water finds its way out through Smith sound and other channels west of Greenland and feeds the Labrador current along the west of Davis straits and the coast of Labrador. Lastly some of the water finds its way westward through the Beaufort sea and merges again in the great transpolar drift except a little which flows southward on the western side of Bering strait. The Labrador current is dissipated by the Gulf Stream on the Newfoundland banks. The east Greenland current splits, sending one branch eastward to the north of Iceland and the Faeroes, eventually to be lost in the north Atlantic drift, and another round Cape Farewell and northward into Davis strait. In opposition to these cold outflowing currents there are northward setting drifts due to prevalent winds. The most noteworthy is the north Atlantic drift. This washes the coasts of Britain and Norway and has four main branches: (1) the North Cape drift along the Murman coast into the Barents sea; (2) the Spitsbergen drift northward past Bear island and western Spitsbergen; (3) the Irminger current, northwestward along the south and west coasts of Iceland into Denmark strait; (4) another north-westerly stream into Davis strait, washing the coasts of south-west Greenland. A small current sets northward along the eastern side of Bering strait. All these currents vary in intensity from year to year. The ultimate causes of the variation between inflow and outflow are not clear.

Temperature and Salinity. — In the polar basin the vertical distribution of temperature and salinity vary little in all places examined. From the surface to 100 fathoms temperature is below the freezing point of fresh water with a minimum of 28·6° or 28·7° (−1·9°C. or −1·8°C.) at 30 fathoms. Salinity increases from 29 or 30 per mille at the surface to nearly 35 at 100 fathoms, and below that depth it seems to remain constant. Temperature rises at 160 or 200 fathoms to 32·5° (0·3°C.) or even 33·8° (1°C.) and then falls to a second minimum of 30·5° (−0·8°C.) at 1,400 to 1,600 fathoms, below which it rises a few tenths of a degree towards the bottom. There is little variation in these figures in summer and winter, except near the surface, where a relatively fresh layer of 5 to 6ft. may occur owing to melting snow on pack-ice. Near the Siberian coast there is in summer a layer of warm surface water from the Siberian rivers which helps to keep those coasts free from ice at that season. In the Greenland and Norwegian seas the water below about 400 fathoms has a uniform salinity of nearly 35 per mille and a temperature at that depth slightly below 32°, falling to 29.8' (−1·2°C.) at the bottom. This is the same water that fills the polar basin. The lower temperature at the bottom of the Greenland sea than in the polar basin confirms the existence of a submarine ridge between Greenland and Spitsbergen which cuts off the colder bottom water of the Greenland sea. In the Spitsbergen current from the south. maximum surface temperatures of 41° at 42.8" and a maximum salinity of 35 per mille occur west of Spitsbergen. It is this Atlantic water which forms the warmer layer already referred to.

In the Barents sea the Atlantic drift waters have a salinity of nearly 35 per mille and a temperature of 41° to 43° (5° to 6°C.). The bottom temperature in the west and south-west is above 32". In the eastern part salinity and temperature are lower and the bottom temperature falls below 30·2° (−1°C.).

The Kara sea, with much river water, has a low salinity of 29 to 34 per mille. Baffin bay like the polar basin has an intermediate warm layer between cold surface and bottom layers.

Pack-ice. — Two-thirds of the Arctic sea is covered by drifting pack-ice which is formed by the freezing of surface layers during autumn, winter and spring. A small part of the ice comes from glaciers. This berg ice is distinguished easily by size and structure from sea-ice. It comes principally from Greenland with some from Franz Josef Land, Spitsbergen, Novaya Zemlya and Ellesmere island, but large icebergs, except in west Greenland waters, are rare in the Arctic. Pack-ice seldom grows thicker than 6 to 7ft. in one year, but by yearly accretions it may attain 15ft. or more. Floes are generally covered with sufficient weight of snow to depress the actual surface of the ice to sea-level. Pressure due to currents and wind may cause piled or rafted hummocks 40 to soft. above sea-level. Nares' palaeocrystic ice was probably rafted ice mixed with floe'-bergs from glaciers but was not more than four or five years old. There is some surface melting by solar radiation in summer, but it is only by drifting into warmer waters that much ice is destroyed. Apart from actual melting under those conditions the floes become soft and friable and easily disintegrate under wave action. All polar ice is in motion even in mid-winter and lanes and pools frequently appear between the floes.

Marine Life. — Those parts of the ocean continually covered with ice have a poor development of surface plant life, due probably to a lack of light, and a consequent poor development of animal life. The deeper strata are also poor in individuals though fairly rich in species. Where the sea is more open plant life teems in the surface waters to such an extent that diatoms sometimes tinge the sea bright green. This abundant phytoplankton is due to a combination of conditions. Warmer deep layers of water in which nitrates and carbon dioxide set free by animal metabolism rise to the surface in polar seas and afford food for pelagic plants, while the low temperature of the waters retards the actions of denitrifying bacteria. Animal plankton is less abundant, but in all shallow seas there is an abundant bottom fauna. The occurrence and erosive action of ice impedes the growth of a littoral fauna and flora on many coasts. Fishes are numerous, including a species of sea char or salmon, cod and halibut. Seals are abundant, especially along the margins of the drifting packs. Whales have been much reduced in number by hunting, but still occur outside the pack. In the ice-covered seas mammalian life is scarce except for a few seals, an occasional narwhal and a few wandering polar bears, but the Arctic is not a lifeless desert.

ARCTIC LANDS

Geology. — The northern parts of Europe, Asia and America almost encircle the Arctic sea. Beyond these Arctic mainlands lie various islands and island groups on the continental shelf. All these are relics of more extensive land areas and most of them show geological continuity with the nearest continental land. Some of them, such as Nicholas Land and the De Long islands, have been inadequately explored from a geological standpoint. In ice-covered lands the geological structure can only be inferred from the marginal rocks, and in few Arctic lands does the snowfall allow geological exploration except for a few weeks in summer. While Archaean rocks predominate in the Canadian Arctic and Greenland, rocks of palaeozoic and later ages are found exclusively in the Eurasian Arctic islands. For details see GREENLAND, SPITSBERGEN, etc. Present volcanic activity is rare. Beerenberg in Jan Mayen is an active volcano. Warm springs occur in Wood bay, Spitsbergen. Past volcanic activity is notable in the Tertiary basalts of Greenland, Spitsbergen, Franz Josef Land and the New Siberian Islands. There is clear geological evidence of a warmer Arctic climate during tertiary times, but during the Pleistocene ice age climate was more severe than at present and probably most Arctic land, except the Canadian Arctic islands, was ice covered.

Most Arctic hills are edged by slopes or scree of coarse or fine debris from the weathering of the rocks above. This loose material freezes together in winter, and though loose on the surface in summer is not carried away by running water, except where deep gullies cut across it. These screes hide the solid rock and make geological work difficult. Raised beaches are of frequent occurrence and deltaic lands are forming in many fjords.

Native Population. — The original people of the north of Europe are the nomadic Lapps who live by fishing and reindeer breeding, and further east in Russia and western Siberia the Samoyedes who follow the same mode of life. They also have small settlements on Novaya Zemlya. In eastern Siberia the chief Arctic people are the Chukchee, reindeer herders, between the Kolima mouth and Bering strait, but other tribes touch or occasionally visit the northern coast. American Indians wander north of the Arctic Circle in Alaska and Canada. Eskimo (*q.v.*) extend from eastern Siberia and Alaska to Ungava, Labrador and Greenland. They appear to be dying out by contact with civilization in spite of the protective measures of the Canadian and Danish gov-

ernments. Practically all the Eskimo of west Greenland, except the Polar Eskimo or Arctic Highlanders north of Melville bay, have Danish blood in their veins. There has never been a native population in Spitsbergen, Franz Josef Land and the New Siberian Islands.

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CLIMATIC CONDITIONS

It is a commonplace of modern geography that there are two main kinds of climate, continental and insular, with the seacoasts of continents partaking somewhat of the insular qualities In continental climates there are greater extremes of heat and cold than on islands. It follows that the most intense cold in the Arctic is nowhere near either the mathematical centre, called the North Pole, or the sea-ice centre, called the Pole of Inaccessibility (84° N. lat., 160° W. long.). In Arctic Alaska, the coldest weather is, so far as we know, in the Yukon basin; in Canada it is in Yukon Territory; and in Siberia it is in the province of Yakutsk. All these places have been inhabited for a quarter of a century or more by Europeans who are not known to have been materially discouraged in their work by the mere disagreeableness of the climate, although they have been handicapped by the frozen ground and in other things that result directly from the cold.

The Coldest Region. — The coldest known region of the northern hemisphere is the province of Yakutsk, in the vicinity of the Arctic Circle, where temperatures colder than go" F below zero have been reliably recorded — and that on the edge of cereal farming, for the great Russian atlas issued just before the World War indicates that wheat, barley, oats and rye are cultivated, if not at the very cold pole of the Northern Hemisphere, at least within a camparatively short distance from it, where the temperature frequently drops lower than 80° below zero. This is colder than any known region in Arctic Alaska or Arctic Canada. We may conclude, then, that winter cold does not frighten away Europeans through its mere disagreeableness nor render it impossible for them to make a living.

No records apparently authentic of temperatures colder than 60" F below zero are available from any of the Arctic islands, and it is almost certain that they do not occur. The coldest spells that do occur come when the wind blows from the interiors of the islands. It seems unlikely, therefore, that the temperature ever drops as low as 55° below zero at the North Pole, the Pole of Inaccessibility, or, indeed, at any point on the Arctic sea.

Summer Temperatures. — There is probably no spot on a lowland in the continental Arctic, whether in Asia or America, that does not occasionally have a summer temperature warmer than 80° F in the shade. Or, if there is such a place, it must be on a peninsula, or on a narrow coastal strip between ice-covered mountains and the sea. Many places in the continental Arctic have occasional temperatures above 85" in the shade, and at least one Arctic weather bureau station, that of the U.S. Government at Ft. Yukon, Alaska, has a record of 100° in the shade. The slowness of the public to realize that there is such great summer heat in the Arctic is due partly to the prevalence of the ancient view that all the Arctic is always cold, and partly to the reports of travellers whose entire Arctic experience has been on the ocean or on a sea-coast.

The reason for the great mid-summer heat on Arctic lowlands is, of course, that the sun delivers an adequate number of heat units per day to account for it. The ordinarily accepted figures are 3 or 4% more at the North Pole than at the equator for the top of the atmosphere and 3 or 4% less for sea-level. This means that you would have "tropical" heat at any place in the Arctic where the sun's rays strike a dark surface and where there is no local reservoir of "cold" to neutralize it. The places, therefore, that do show a "tropical" heat are on lowlands that are sheltered from ocean breezes and from winds that come from ice-covered mountains. If the length of summer is measured by the season during which streams flow unfrozen and during which certain insects are alive and more or less active, the Arctic summer would range from a maximum of about five and a half months in such places as the north shore of Great Bear lake, to perhaps two months in places like Borden island.

But an important thing to remember is that there is a direct dependence of animals on plant life and that plants measure their summer not by the calendar but by the number of hours of sunlight. At Ft. Yukon, Alaska, for instance, on a day that varies from, let us say, 65" at the coldest to 95° at the warmest (in the shade), there would be approximately as much growing time as in two ordinary days in the humid tropics. This is why some plants grow so much more rapidly in certain parts of the Arctic than the same plants do in any part of the tropics or temperate zone. An interesting, and to most botanists an unexpected, corollary is that some plants also grow to far greater size in the Arctic than in the temperate zone or tropics, as cabbages, for instance. This may possibly be because they lose speed in the temperate zone where they have to stop and start again to conform with alternation of day and night, but can maintain a continuous and fairly uniform rate of growth in the Arctic where the daylight is continuous.

Arctic Weather. — Dr. Fridtjof Nansen announced as one of the outstanding conclusioris of his great scientific expedition of 1893–96, that the Arctic is, on the average, one of the least stormy large regions of the world. Stefansson's observations as a result

of 11 years spent north of the Arctic Circle and the studies of other observers have tended to confirm Nansen. In many parts violent gales are quite absent, or at least have not yet been observed by scientific men. Gales are common only where an open ocean is faced by high mountains or a plateau.

Snowfall. — It is difficult to measure Arctic snowfall because the snow is usually very dry and fluify and is driven about a great deal by even the lightest winds. There is no doubt that, however, on the average, Arctic precipitation is very light. It is estimated that, if the snow of winter be added to the rain of summer, the result would be about eight inches of water, certainly not more than ten, on most parts of the Arctic lowlands of Canada and Alaska. The Siberian lowlands may be even drier. We have, therefore, the apparent paradox that the average snowfall of the Arctic is much less than that of Scotland or of Illinois, for instance.

Glaciers. — It is now well established that there is no permanent snow or ice on any land in the Arctic unless it be mountainous. The required height of mountains varies roughly with the varying precipitation. The highest mountains of Melville island, for instance, are probably not more than 4,000 feet. This is not enough for the formation of any real glaciers. E. de K. Leffingwell, in his studies of Arctic Alaska, found that in the first coast range south of Flaxman island, the altitude of 6,000ft. was not enough for the formation of glaciers. But in the second range, a little farther south, which runs up towards 10,000ft., there were some glaciers. So far as we yet know, there is no evidence of ancient glaciation on the great low plains of Arctic Alaska. This must have been because they were then as now a region of very light snowfall.

Fogs. — Since fogs are caused by the meeting of air currents of differing humidity and temperature, it is obvious that the insular Arctic and the coast lands must be regions of frequent fogs. In summer, for instance, with a lowland steaming under a sun that creates an 80° temperature in the shade, and just in front of it an ocean the surface of which is around 30° F, any breeze blowing from the land would be suddenly cooled, producing a sea fog. Similarly, any breeze coming from the ocean would produce a fog over the superheated land. Such fogs would be thickest and most frequent where the sea and land meet. We gradually work out of the land fogs when we travel inland and out of the sea fogs when we steam away from land. From the flying point of view, it is important that these fogs have been found by experience to be very low on the average. They are often thick on the decks of whaling ships, but so thin at the masthead that the captains in the crow's-nests can see each other plainly while the men on the decks have no visual evidence that other ships are near.

Summing up, the Arctic winters are longer than those of most extremely cold places now inhabited by prosperous and contented Europeans, such as Dakota and Manitoba, for instance. They are also a little colder. But they are, on the other hand, less stormy and with a lighter snowfall. The summers, although shorter, are in some places almost or quite as hot. It would seem, then, that the same sort of people might be willing to live in the Arctic who are willing to live in Dakota and Manitoba. It will undoubtedly be difficult to get people to colonize the Arctic, but in the opinion of many this will not be any special Arctic problem but rather a general frontier one. For the tendency which brings American farmers to the cities, increasing the percentage of urban population, makes it as difficult to induce Londoners who are out of work to migrate to sub-tropical Australia as to sub-Arctic Canada. The weakening or dying out of the frontier spirit is one of the conspicuous social phenomena of our time.

NATURALRESOURCES

Since the climate, as such, will not prevent Arctic colonization, the ascertained resources may be enumerated.

Coal. — It is now known that coal is almost, if not quite, as likely to be found in the Arctic as in tropical or temperate lands It is not surprising, therefore, that seams of coal, of varying quality, of course, have been reported by most Arctic explorers. Stefansson, for instance, found coal in all but two of the islands north of western Canada. In these, Victoria island and Meighen island, further exploration may show coal. Coal of quality said to be equal to the best Welsh has been mined for several decades in Spitsbergen, some 500 or 600m. N. of the Arctic Circle, and these mines should eventually supply a great part of northern Scandinavia and of northern Russia. In Alaska, a coal mine at Cape Lisburne, well north of the Arctic Circle, was worked to supply the whaling fleet even before 188 j, and fell into disuse only with the abandonment of the whaling industry. The natives of the north coast of Alaska mine coal at Wainwright for their own use and to sell locally to missionaries, government schools, traders, etc. The members of Stefansson's expedition, living by hunting on Melville island, maintained two winter camps, one in Liddon gulf and the other on the north coast near Cape Grassy. They burned bituminous shale in the southern camp, but in the northern they burned lignite of good quality, some of it saturated with oil.

Oil. — Indications of oil have been found in many parts of the Arctic. The Imperial Oil Company of Canada, a branch of the Standard Oil Company of New Jersey, has wells on the Mackenzie river just south of the Arctic Circle, and the same oil-fields are known to extend beyond the circle. About 500m. N. from these wells and, therefore, about 500m. N. of the Arctic Circle, Stefansson found oil on northern Melville island. The U.S. navy has recently set aside a vast oil reserve in Arctic Alaska, and both private prospectors and representatives of large oil companies have staked claims east of the government reserve. These claims are near Cape Simpson which, but for Barrow, is the most northerly cape in Alaska.

Iron and Copper. — Hardly less fundamental than oil and coal are iron and copper. No large Arctic deposits of iron ore are known. There are iron "prospects," however, in many places. But the copper fields that lie between Bear lake and the centre of Victoria island in a district roughly 200m.sq., give great promise—if the world's need of copper increases, or if the spread of settlements to that country make mining more feasible. There are copper prospects in other parts of the Arctic, and gold, silver, platinum and tin have been found.

Vegetation. — A more fundamental resource than even the oil and coal is the vegetation of the Arctic that makes food-production possible. The coniferous forest extends beyond the Arctic Circle, in Canada in certain river valleys as much as 100m., and even farther in Siberia. Trees 100ft. high are found well north of the Arctic Circle. They rnake the Arctic more homelike to those who are used to forests, and they are doubtless valuable.. But many consider that the same land would be more immediately valuable if the trees were absent, for then it would be covered with grass, like most of the rest of the Arctic, whether continental or insular. It is one of the exploded beliefs that Arctic vegetation is mainly mosses and lichens. In 1909 Sir Cleinents Markham published the statement that the Arctic possesses 28 species of ferns, 250 lichens, 332 mosses and 762 flowering plants. Many species have been discovered since then, and many others will be discovered hereafter. There will probably be little disagreement with the estimate that we have in the Arctic at least ten times as many kinds of flowering plants as of non-flowering. There are a few small portions of the Arctic where cereals can be profitably cultivated, and still others where garden vegetables will be of some value. But, so far as can be seen at present, the chief thing to do with the Arctic soil is to permit that vegetation to continue growing which grows there already and to make an economic use of it by converting it into meat, hides and other animal products.

Reindeer. — There is one suitable animal, the reindeer, domestic in the Old World since prehistoric times. No one knows how many of these there may be in Arctic Siberia, where single owners often have from 5,000 to 10,000 head. But there are definite figures for the entire period of reindeer domestication in Alaska. The US. Government commenced by importing 16 head from Siberia in 1892. Up to 1902, when importation ceased because of an embargo imposed by the tsar's government, 1,280 animals

were brought from Siberia. These have never failed to double every three years since importation, so that by the spring of 1928 there were 800,000 head. The U.S. department of agriculture estimates that the grazing resources of Arctic and sub-Arctic Alaska will be adequate for 3,000,000 to 4,000,000. Since the climate and vegetation of Arctic Canada are, for reindeer purposes, the same as those of Arctic Alaska, with an area ten times greater, we can say, roughly, that Canada will support from 30,000,000 to 40,000,000 head. Undoubtedly the reindeer area in Asia and northern Europe is twice as large as the Alaskan and Canadian together, which would make total world figures between 100,000,000 and 125,000,000. This estimate is probably low. No animal now domestic can be profitable in the Arctic except the reindeer. Cattle, sheep, horses and goats can, of course, be raised in many parts, but under present costs and prices they would not pay. The reindeer pays handsomely because it needs no barn for shelter, no hay for feed, nor any protection from wind or weather.

Domestication of **Ovibos.**—There was a project under discussion in 1928 of domesticating the ovibos (musk ox) because it eats certain Arctic vegetation that reindeer do not eat and because the reindeer produces only meat and hides while the ovibos produces wool in addition. Ovibos beef is indistinguishable from ordinary domestic beef in colour, flavour, texture and odour. The wool, as determined by the textiles department of the University of Leeds (Prof. Aldred F. Barker), has good heat-retaining and wearing qualities, is easy to bleach and dye, is softer than cashmere, and will not shrink—in other words, is one of the finest of known wools. With the ovibos domesticated, the potentialities of the Arctic will be greater. But with only the reindeer, there is no doubt that the Arctic grasslands (which means all lands in the Arctic not so high and mountainous as to be snow-covered) will be colonized unless, indeed, the world movement of population from the country to the cities entirely stops further colonization. In most cases mining will develop after the ranchmen have occupied the grazing lands. But in some cases, notably with oil, the mining will precede colonization. That gold mining will precede colonization seems for the moment unlikely, although that is the one kind of mining that has hitherto taken people to the Arctic. But the rise in the cost of living is only another expression for a drop in the value of gold, so that the gold deposits, which paid fabulously in Alaska 20 years ago, are not so paying now even where production remains uniform.

Site-value.—Finally we must point out a resource of the Arctic that has nothing to do with climate, minerals or the like, but is due entirely to position. The history of civilization as we know it is essentially the history of the Northern Hemisphere. Generally speaking, civilization seems to have started in the sub-tropics—Yucatan for the New World; Egypt, Asia Minor, etc., for the Old World. As civilization has been spreading northward during historic time, it has really been spreading toward the centre of a circle. That centre is the Arctic.

It was an Elizabethan ideal to find a sea-way north from Europe to the Indies. No practical route was ever found, because of the floating ice in the Arctic sea. So, perforce, we have gone roundabout. But now ships of the air are opening up the roads of the air which lie straight in any desired direction. As the Elizabethans knew, China is north of Europe. But Peking is also north of New York, and the wheat-fields that are spreading over central Siberia are north of the growing wheat-fields of central Canada. The cities springing up in those wheat lands will be far from each other east and west, but not half so far north and south.

Air Routes.—The world is developing an increasing speed mania, both for messages and for passengers. The flying conditions of the Arctic are probably, on the average, as good as those of any other equally large area of the world. It follows, therefore, that the centre of the circle of civilization, which is the Arctic, will be the flying crossroads of the world. This will necessitate the establishment of way stations here and there. Of itself, that will to a small extent require colonization. It will have a vastly greater indirect effect by spreading accurate knowledge af the Arctic throughout the world. Thereupon will follow such colonization as the real climate and actual resources justify.

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ARCTICS, the term commonly applied to overshoes of rubber or rubberized fabric, worn over the ordinary shoes in stormy weather. They fasten up the leg with buttons, latches or by an interlocking mechanism known in the United States as the zipper. The original arctic was of black waterproofed material, fleece-lined and constructed for utility rather than for style. It became popular with young people, particularly college students, but since the great vogue among women for dainty shoes and light-coloured hosiery arctics have been generally adopted by them only for warmth and protection during winter weather. They have become an important factor in shoe manufacture and every effort is made to offer a dainty and stylish article to the fastidious patron. In large cities where heavy traffic keeps the streets in a muddy state over a long winter season the arctic has supplanted the old-fashioned "rubber" or low overshoe which is clumsy and offers no protection except to the sole and lower part of the shoe.

ARCTINUS, of Miletus, author, according to Proclus in the Chrestonzathy, of two poems of the epic cycle, the *Aithiopis,* which took up the narrative from the close of the Iliad, beginning with the famous deeds and death of the Amazon Penthesileia, and ending with the death and burial of Achilles and the dispute for his arms, and the Sack of Troy (*Iliou* Persis), which gave the story of the wooden horse and ended with the departure of the Greeks after the outrage of Cassandra. (Of this poem 12 lines are extant.) The Little Iliad of Lesches formed the transition between the two. The poems are attributed to other authors by the Tabula Iliaca, Athenaeus and Pausanias.

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ARCTURUS, one of the three brightest stars in the northern hemisphere, situated in the constellation Bootes (*q.v.*) in an almost direct line with the tail (ζ and η) of the constellation Ursa Major (great bear); hence its derivation from the Gr. ἄρκτος, "bear," οὖρος, "guard." In the Hebrew Bible, the Vulgate reads Arcturus for the stars mentioned in Job ix. 9, xxxviii. 32, and Amos v. 8. According to a Greek legend Arcas, son of Lycaon, king of Arcadia, was killed by his father and his flesh was served up in a banquet to Zeus, who was indignant at the crime and restored him to life. Subsequently Arcas, when hunting, chanced to pursue his mother Callisto, who had been transformed into a bear, as far as the temple of Lycaean Zeus; to prevent the crime of matricide, Zeus transported them both to the heavens (Ovid, Mefam., ii, 410), where Callisto became the constellation Ursa Major, and Arcas the star Arcturus (see LYCAON and CALLISTO).

ARCUEIL, a town in France, department of Seine, on the Bièvre, 2½ mi. N.E. of Sceaux. Pop. (1936) 16,590. The town takes its name from a Roman aqueduct, the *Arcus Iuliani* (Arculi), traces of which still remain. In 1613–24 a bridge-aqueduct over 1,300 ft. long was constructed to convey water from the ipring of Rungis, 4 mi. S. of Arcueil, across the Bièvre to the Luxembourg palace in Paris. In 1868–72 another aqueduct, still longer, was superimposed to help convey water from the river Vanne to Paris. In the 16th century it was the meeting place of

the poets of La Pléiade, headed by Ronsard. Bleaching, the manufacture of bottle capsules, patent leather and other articles are carried on at Arcueil and there are important stone quarries.

ARCULF, a Frankish bishop and pilgrim-traveller, who visited the Levant about 680, and was the earliest Christian traveller and observer of any importance in the Nearer East after the rise of Islam. On his return he was driven by contrary winds to Britain, and so came to Iona, where he related his experiences to his host, Adamnan Abbot of Iona, 679 to 704. The narrative of his journey, as written by Adamnan, was presented to Aldfrith the Wise, last of the great Northumbrian kings, at York about 701, and came to the knowledge of Bede, who inserted a brief summary of it in his *Ecclesiastical History of the English Nation,* and also drew up a separate and longer digest which obtained great popularity throughout the middle ages as a standard guide-book (the so-called *Libellus de locis sanctis*) to the holy places of Syria.

For bibliography *see* ADAMNAN.

ARDABIL, chief town of one of the administrative districts of the province of Azerbaijan, in north-western Persia, 48° 21′ E. and 38° 14′ N., 38m. from the Caspian sea and 25m. from the Araxes. The town stands on an almost circular plateau 4,940ft. above the sea-level surrounded on all sides by mountains, the most prominent peak being Savalan (15,792ft.) on the west. No trees or shrubs are visible for many miles round and the white chalk soil can be made fruitful only by artificial irrigation. The climate of the town, owing to its high situation, is inclement but is regarded as healthy. The vine, oranges and melons do not grow, but pears and apples are produced in abundance. Near the town are found warm mineral springs, on account of which, and the healthy air, Ardabil was formerly a favourite residence of the Persian court.

Ardabil is an important road centre: to Astara on the coast, to Tabriz, and to other places. Trade, unimportant compared with former times and mostly in the hands of Armenians, is mainly a transit trade between Russia and Persia through the Caspian port of Astara, where, in 1925–26, 10,000 tons of merchandise were landed and 5,700 tons shipped. The chief articles produced in the district for export are dried fruits, carpets and rugs.

The town, which is of great antiquity though it contains no ancient buildings of note, covers a large area surrounded by a ruinous mud wall flanked by towers, while 500 yards to the east is a mud fort constructed by Gardanne (a French general in Persian employ) ip the early years of the 19th century, now also in ruins. In the first half of the 8th century Ardabil was the residence of Shaikh Safi-ud-Din who died here: his shrine is an object of general veneration and is much visited by many Persians. The sanctuary also contains the tomb of the Shah Ismail (died 1524) founder of the Safavi dynasty. The building suffered considerably in the sack of the town by the Russians in 1827, and the famous library of Shaikh Safi, once the greatest in all Persia, was sent to St. Petersburg in 1827 and became part of the Imperial Library.

The European travellers Olearius (1637) and Chardin (1671) describe Ardabil as the most flourishing Persian town of the time, but Morier, in 1813, counted only 4,000 inhabitants. The town has now an estimated population of 16,000–20,000.

See F. Sarre, *Denkmäler Persischer Baukunst* (1901).

ARDAN, a small independent linguistic stock of South American Indians, so called from the Ardas, the most important of its tribes. The Ardan tribes lived west of Iquitos in north-eastern Peru, on the upper Mazan and Nanay rivers, tributaries of the lower Napo. They were of simple culture, and beyond the fact that their language (now extinct) seems to be quite unrelated to any other, little or nothing is known of them.

See A. F. Chamberlain, "Sur quelques familles linguistiques," etc. *(Journal Soc. Americanistes de Paris* [n.s.], vol. vii., pp. 179–202).

ARDASHIR, the modern form of the Persian royal name ARTAXERXES (*q.v.*), "he whose empire is excellent." After the three Achaemenian kings of this name, it occurs in Armenia, in the shortened form Artaxias (Armenian, *Artashes* or *Artaxes),* and among the dynasts of Persia who maintained their independence during the Parthian period *(see* PERSIS).

One of these, (1) Artaxerxes or ARDASHIR I. (in his Greek inscriptions he calls himself Artaxares, and the same form occurs in Agathias ii. 25, iv. 24), became the founder of the New-Persian or Sassanian empire. Of his reign we have only very scanty information, as the Greek and Roman authors mention only his victory over the Parthians and his wars with Rome. A trustworthy tradition about the origin of his power, from Persian sources, has been preserved by the Arabic historian Tabari (Th. Noldeke, *Geschichte der Perser und Araber zur Zeit der Sasaniden, aus der arabischen Chronik des Tabari,* 1879). He was the second son of Papak (Bābek), the offspring of Sassan (Sāsān), after whom the dynasty is named. Pāpak had made himself king of the district of Istakhr (in the neighbourhood of Persepolis, which had fallen to ruins). After the death of Pāpak and his oldest son Shapur (Shihpuhr, Sapores), Ardashir made himself king (probably A.D. 212), put his other brothers to death and began war against the neighbouring dynasts of Persis. When he had conquered a great part of Persis and Carmania, the Parthian king Artabanus IV. interfered. But he was defeated in three battles and at last killed (A.D. 226). Ardashir now considered himself sovereign of the whole empire of the Parthians and called himself "King of Kings of the Iranians." But his aspirations went farther. In Persis the traditions of the Achaemenian empire had always been alive, as the name of Ardashir himself shows, and with them, the national religion of Zoroaster. Ardashir, who was a zealous worshipper of Ahuramazda and in intimate connection with the magian priests, established the orthodox Zoroastrian creed as the official religion of his new kingdom, persecuted the infidels, and tried to restore the old Persian empire, which under the Achaemenids had extended over Asia from the Aegean Sea to the Indus. At the same time he put down the local dynasts and tried to create a strong concentrated power. His empire is thus quite different in character from the Parthian kingdom of the Arsacids, which had no national and religious basis but leant towards Hellenism, and whose organization had always been very loose. Ardashir extirpated the whole race of the Arsacids, with the exception of those princes who had found refuge in Armenia, and in many wars, in which, however, as the Persian tradition shows, he occasionally suffered heavy defeats, he succeeded in subjugating the greater part of Iran, Susiana and Babylonia. The Parthian capital Ctesiphon (*q.v.*) remained the principal residence of the Sassanian kingdom, by the side of the national metropolis Istakhr, which was too far out of the way to become the centre of administration. Opposite to Ctesiphon, on the right bank of the Tigris, Ardashir restored Seleucia under the name of Weh-Ardashir. The attempt to conquer Mesopotamia, Armenia and Cappadocia led to a war with Rome, in which he was repelled by Alexander Severus (A.D. 233). Before his death (A.D. 241) Ardashir associated with himself on the throne his son Shapur, who successfully continued his work.

Under the tombs of Darius I. at Persepolis, on the surface of the rock, Ardashir has sculptured his image and that of the god Ahuramazda (Ormuzd or Ormazd). Both are on horseback; the god is giving the diadem to the king. Under the horse of the king lies a defeated enemy, the Parthian king Artaban; under the horse of Ormuzd, the devil Ahriman, with two snakes rising from his head. In the bilingual inscription (Greek and Pehlevi), Ardashir I. calls himself "the Mazdayasnian (*i.e.* "worshipper of Ahuramazda") god Artaxares, king of the kings of the Arianes (Iranians), of godly origin, son of the god Pāpak the king" *(see* Sir R. Ker Porter, *Travels* (1821–22), i. 548 foll.; Flandin et Coste, *Voyage en Perse,* iv. 182; F. Stolze and J. C. Andreas, *Persepolis,* pl. 116; Marcel Dieulafoy, *L'Art antique de la Perse,* 1884–89, v. pl. 14). A similar inscription and sculpture is on a rock near Gur (Firuzabad) in Persia. On his coins he has the same titles (in Pehlevi). Like his father and his successors, he was worshipped as a god, probably as an incarnation of a secondary deity of the Persian creed.

Like the history of the founder of the Achaemenian empire, that of Ardashir has from the beginning been overgrown with legends; like Cyrus he is the son of a shepherd, his future greatness is predicted by dreams and visions, and by the calculations of astronomers he becomes a servcnt at the court of king Arta-

banus and then flies to Persia and begins the rebellion; he fights with the great dragon, the enemy of god, etc. A Pehlevi text, which contains this legend, has been translated by Noldeke (*Geschichte* des Artachshir *i Pāpakān,* 1879). On the same tradition the account of Firdusi in the Shahnameh is based; it occurs also, with some variations, in Agathias ii. 26 seq. Another work, which contained religious and moral admonitions which were put into the mouth of the king, has not come down to us. On the other hand the genealogy of Ardashir has of course been connected with the Achaemenids, on whose behalf he exacts vengeance from the Parthians, and with the legendary kings of old Iran.

(2) ARDASHIR II. (379–383). Under the reign of his brother Shapur II. he had been governor (king) of Adiabene, where he persecuted the Christians. After Shapur's death, he was raised to the throne by the magnates, although more than 70 years old. Having tried to make himself independent from the court, and having executed some of the grandees, he was deposed after a reign of four years.

(3) ARDASHIR III. (628–630), son of Kavadh II., was raised to the throne as a boy of seven years, but was killed two years afterwards by his general, Shahrbaraz. (ED. M.)

ARDEA, a town of the Rutuli, Latium, 3m. from the south-est coast, where its harbour (*Castrum Inui*) lay, at the mouth of the Fosso dell' Incastro, and 23m. S. of Rome by the Via Ardeatina. Its legendary founder was a son of Odysseus and Circe, or Danae, mother of Perseus. It was one of the oldest coast cities of Latium and the capital of Turnus, the opponent of Aeneas. In the treaty with Carthage 509 B.C. it was Roman but was later one of the 30 cities of the Latin league. It had the charge of the shrine of Venus in Lavinium. In imperial times the unhealthiness of the place led to its rapid decline. In the forests of the neighbourhood the imperial elephants were kept. A road, the Via Ardeatina, led to Xrdea direct from Rome.

The primitive site, later the citadel, holds the modern village; it is at the end of a long plateau between two valleys, and has perpendicular tufa cliffs some 60ft. high on all sides except the north-east, where it joins the plateau. Here it is defended by a fine wall of rectangular blocks of volcanic stone (tufa). The area of the place was apparently twice extended, a further portion of the narrow plateau, which now bears the name of Cittavecchia, being each time taken in and defended by mound and ditch; the nearer and better-preserved is about ½m. from the city and measures some 2,000ft. long, 133ft. wide and 66ft. high, the ditch being some 80ft. wide. The second, ½m. farther north-east, is smaller. "*Et* nunc *magnum manet* Ardea *nomen:* sed *fortuna fuit*"—"Ardea is still a mighty name: but its star has set"—as Virgil says.

w *See* O. Richter, in *Annali* dell' *Instituto* (1884), 90; J. H. Parker in Archaeologia, xlix. 169 (1885); A. Pasqui, in Notizie degli *scavi* (1900), 53.

ARDECHE, a department of France at the Cevenol edge of the *Plateau* Central bounded, east, by the river Rhône, south by Gard, south-west by Lozkre, north-west, by Haute Loire and Loire. Area 2,145 sq.mi. Pop. (1936) 272,698, marking a considerable decline during the 20th century. It was formed in 1790 from the Vivarais district of Languedoc. It is a hill country marked by valleys most of which run either north-west-south-east or south-west-north-east. The high volcanic mass of the Coirons stretches south-east-north-west to the eastern part of the larger volcanic area of Vélay, where Mt. Mézenc (5,755ft.), itself a volcanic mass, forms the culminating point of the department; thence the Mts. du Vivarais stretch north-eastward with the departmental boundary along their heights. The department stretches westward to the uppermost Loire and the Allier forms a good deal of its boundary over against Lozkre. The rivers are mostly torrential, with sudden floods and much of the scenery is wild.

In the south near the Rhône the climate is warm, but on the higher land winter is long and severe and even in summer sudden cold may occur. Grain (wheat and rye) and potatoes are cultivated, also the vine and olive near the Rhône in the south, the department's southern and more open lands marking the northern limit of cultivation of the olive in the Rhône valley. The vineyards of St. Péray near the Rhône in the northern part of the department are famous for white wines. Chestnut, walnut and mulberry, the last for silkworms, are widely grown. The rocky hills are useful for goats as well as for sheep and their skins promote a glove-making industry. There are also paper factories at Annonay. Hydraulic lime is produced from quarries at Le Teil and there are supplies of coal, iron, lead and zinc. Medicinal springs are numerous and some are hot; the chief are at Vals les Bains (cold), St. Laurent les Bains, Celles, Neyrac, etc.

Ardèche is served by the P.L.M. railway and has 43 miles of navigable river. The towns of Privas, Largentikre (capital of the department) and Tournon give their names to the three arrondissements; there are 31 cantons and 349 communes. The department forms the diocese of Viviers in the archbishopric of Avignon; it is in the region of the 15th Army Corps, in the *académie* (educational area) of Grenoble, and under the court of appeal at Nîmes.

Privas was destroyed in the 17th century religious quarrels, so it has little that is older, but there are many interesting Romanesque churches in the department (Bourg St. Andéol, Thines, Mélas, Cruas), while Mazan has a large church once part of a great abbey. Viviers cathedral is set on a rock above the town.

ARDEE, town, County Louth. Eire. on the river Dee, 48 mi. N.W. from Dublin, on a branch of the Great Northern railway. Pop. (1936) 2,383. The town is of high antiquity, and its name (Ather-dee) is taken to signify the ford of the Dee, a point of strategic importance. A large rath, or encampment, with remains of fortifications, stands to the south of the town. A castle of the lords of the manor was built early in the 14th century and remains, as does another adjacent fortified building of the same period. Roger de Peppart, lord of the manor early in the 13th century, founded the church (the present Protestant church) and a house of Crutched Friars. There was also a house of Carmelite Friars, but neither of these remains. Ardee received its first recorded charter in 1377. It was sacked by Edward Bruce (1315) and by O'Neill (1538); it was taken by the Irish and recaptured by the English in the wars of 1641, and was occupied later by the forces of James II. and of William III.

ARDEN, FOREST OF, a well marked physical area of north Warwickshire, England, the "woodland" as opposed to the "felden" or "fielden"; *i.e.,* open country, in the south, the river Avon separating the two. Originally part of a forest tract of far wider extent than that within the confines of the county, it is still, though lacking the true character of a forest, well-wooded. The undulating surface is from 250 to 500 ft. high. Wide lands in this district were held, in Edward the Confessor's day, by Alwin, whose son, Thurkill of Warwick, or "of Arden," founded the family of the Warwickshire Ardens who, in Queen Elizabeth's time, still held several of the manors. Shakespeare, whose mother, Mary Arden claimed to be of this family, knew the district well, and it probably inspired his pictures of forest life in As You Like It. The name is preserved in Henley-in-Arden and Hampton-in-Arden, etc.

ARDENNES, a district covering some portion of the ancient forest of Ardenne, and extending over the greater part of the Belgian province of Luxembourg, part of the grand duchy, and the French department of Ardennes. One derivation is from a word meaning "the forest," turned into Latin as Arduenna Silva, and derived from the Celtic word *ardu* (dark, obscure). Another derivation is from ar-Denn or ar-Tann, Breton for the, or among *the,* oaks, whence Ardenne would be forest of oaks. A. Carnoy, a modern worker, derives it from a Celtic form for high-land, *Ardu-enna* being from the Indo-European arduos = high. The Arduenna Silva was the most extensive forest of Gaul, and Caesar (Bello *Gallico,* lib.vi.cap.29) describes it as extending from the Rhine and the confines of the Treviri to the limits of the Nervii. At the division of the empire of Charlemagne between the three sons of Louis the Débonnaire, under the pact of Verdun in 843, the Ardenne forest had become the district *pagus Arduensis.* It was part of Lothair's share, and charters of 843 specify certain towns as in this pagus. In the 10th century the district had become a comitatus, subject to the powerful count of Verdun, who changed his style to that of count of Ardenne.

The geographical region of the Ardenne extends from France through Belgium to the Rhineland and the duchy of Luxembourg south and east of a line through Couvin, Rochefort, Marche, Durbry, Spa and Eupen, and its southern frontier is the Semois valley. Its geological boundary is that of the lower Devonian. It forms a broad low arch gently inclined north and south, the denuded base of a mountain chain once as high as the Alps, and then worn down to a peneplain. It consists of schists, sandstones and quartz-phyllites, with hardly any calcareous rock. The rivers in the uplifted peneplain cut gorges in the hard rocks, *e.g.*, Les fonds de Quarreux on the Amblkve, but have wider valleys where the rocks are softer. The picturesquely wooded ravines are less truly characteristic than the great flat tops, naked wastes in many cases, which account for most of the area. Decomposition of Cambrian schists has produced a waterproof clay soil in which sphagnum bogs grow, with their characteristic accumulation of basal peat. The Hautes Fagnes on the Baraque Michel plateau is the largest of these bogs. The peat was long used for fuel. On the more siliceous lands, farms have been established but woods cover large areas and are among the most beautiful in Europe. They include the woods of St. Hubert, the woods round La Roche, and those of the Amerois, Herbeumont and Chiny on the Semois. In the grand duchy the forest has almost entirely disappeared, but owing to the compulsory law of replanting in Belgium this fate does not seem likely to attend the Belgian Ardennes. There is still an immense quantity of wild game to be found in the Ardennes, including red and roe deer, wild boar, etc. Shooting is preserved either by the few great landed proprietors left in the country, or by the communes, who let the rights to individuals.

COURTESY OF THE BELGIAN NATIONAL RAILWAY

A PEASANT WOMAN OF ARDENNES ON THE WAY TO MARKET

ARDENNES, department, northern frontier, France, composed of the south-west side of the Ardennes towards the Paris basin, and of parts of the Meuse valley. Area 2,028sq.m.; pop. (1936) 253,632. After a long course nearly south to north between edges of secondary rocks, the Meuse turns west as it approaches the Ardennes. These are remnants of ancient mountains, planed down, and then slowly tilted up from the south-east, allowing the river time to cut its way down while the uplift went on. It thus happens that just below Mézières-Charleville the river enters a deep trench between moorland hills, and some of its entrenched meanders have given sites for isolated little towns like Revin. Mézières also is on the peninsula of a meander. Northwards towards Givet the country opens out again and that old fortress town is an outpost of France, which owns the Meuse trench but not the flanking highland, standing on limestone rock that gives the district a much drier character than has the Ardennes. The Meuse is small in volume for its length and has lost several tributaries, the now almost streamless valleys of which have been used for canals *e.g.*, that in this department between Meuse and Aisne.

In the south-west lowlands, with a fairly mild climate and often less than 800mm. of rain, general agriculture goes on, but among the higher lands (up to 1,640ft.) the winter is cold and the rainfall may exceed 1,000mm. Here there are riverside pastures, but the people depend partly on quarries of slates (Fumay) and building stone and also work in iron. There is also naturally a woollen industry centring at Sedan, and Mézières-Charleville is important as a railway junction. Mézières, Rethel and the tiny Vouziers give their names to arrondissements. The department is in Reims ecclesiastical province, Lille educational province (*académie*), Nancy appeal-court area and 2nd army corps province. The department was entirely occupied by the invaders 1914–18, but the defenders had just reached Sedan and Mézières at the end of the war. (For an account of the battles waged here in the World War see FRONTIER, BATTLES OF THE.)

ARDEN OF FEVERSHAM (FAVERSHAM), the title of an anonymous play, the first quarto of which was printed, in black letter, in 1592; there is a copy of this edition in the Bodleian Library, Oxford. The plot is founded on the story of Thomas Arden, mayor of Faversham (1548), who was murdered by his wife, her lover and accomplices in 1552. The style is dignified and restrained and it has been suggested that the play was, at any rate, revised by Shakespeare. There is, however, no internal evidence to support or refute this theory, and it is more probable that the author was Thomas Kyd (*q.v.*) or one of his school.

The play was acted in 1592, and not again until it was produced in London in 1897 and at Cambridge, England (by the Marlowe Dramatic Society) in 1921.

See Arden *of* Feversham, intro. by A. H. Bullen (1887); J. A. Symonds, Shakespeare's Predecessors (1900); *The Lamentable* and *True* Tragedy *of* M. Arden *of* Feversham, intro. by A. F. Hopkinson (1907).

ARDERNE, JOHN (c. 1306–*c.* 1390), English surgeon, practised first at Newark and then in London, and also in the army in France. He introduced certain new operations and was a bold and skilful surgeon and a good writer on his subject. See D'Arcy Power: Treatises of *Fistula* in Ano, etc. (1910); "The Lesser Writings of John Arderne," *XVIIth* Inter. Con. Med. *Sec.* XXIII. (1914).

ARDGLASS ("Green Height"), County Down, Ireland, 32m. S. by E. of Belfast on a branch of the Belfast and County Down railway. Pop. (1926) 634. Soon after the Norman invasion it became a busy port, a fact attested by the remains of no fewer than five castles in close proximity. There is an ancient church crowning the eastern hill and a curious fortified warehouse (called the New Works), dating probably from the 14th century, when a trading company was established here under a grant from Henry IV. Ardglass was a royal burgh and sent a representative to the Irish parliament. The chief industry is the herring fishery. Ardglass is a resort of visitors.

ARDITI, LUIGI (1822–1903), Italian musical composer and conductor, who, about the middle of the last century, was a prominent figure in London musical life, as conductor of the opera at Her Majesty's Theatre and in other capacities. He paid frequent visits also to America, conducting the opera in New York, where he produced his La *Spia* in 1856. His vocal waltz *Il* Bacio was sung by Patti and enjoyed much popularity.

ARDMORE, a city in the southern part of Oklahoma, U.S.A. 100 mi. S. by E. of Oklahoma City, 876 ft. above sea level; the county seat of Carter county. It is on federal highways 70 and 77, and is served by the Frisco and the Santa Fe railways. The area is 8 sq.mi.

The population of the city of Ardmore was 14.181 in 1920, of whom 2,008 were Negroes; 15,741 in 1930 and 16,886 in 1940 by federal census.

Ardmore is the wholesale and retail centre of southern Oklahoma serving a rich farming and grazing'region and numerous oil fields. The city has a daily newspaper and a radio station. An oil refinery, wholesale houses, cotton gins, cotton-seed oil mill, cotton compress, produce houses, flour mill and miscellaneous factories make up the industries. The Southern Oklahoma fair and exposition is held there. Among the educational institutions is Carter seminary, a school for Indian girls. Near Ardmore are the Lake Murray state park, comprising 20,000 ac., and the Arbuckle mountain regions. Ardmore was founded in 1887, incorporated in 1898. It adopted a commission-manager form of government in 1921.

ARDRES, ancient small town of northern France, in the department of Pas-de-Calais, 10m. south-south-east of Calais. Pop. (1936) 1,307. It was occupied by Francis I. at the time of his historic meeting with Henry VIII. in 1520, at the "Field of the Cloth of Gold" at Balinghem, 2½m. to the west. Ardres has a 14th century church and an important cattle market.

ARDROSSAN, seaport, municipal and police burgh, Ayrshire, Scotland, 29½m. S.W. from Glasgow by the L.M.S.R. Pop. (1938) 7,511. Hugh, 12th Earl of Eglinton, began the harbour and town in 1806, intending to connect it with Glasgow by canal; his successor completed the scheme on a reduced scale. The docks have since been extended. The exports are coal and

iron from collieries and iron-works in the neighbourhood; and the imports ores, timber, and general goods. Shipbuilding and fisheries are carried on. The town is under provost and council.

SALTCOATS (pop. 10,653), a mile to the south, is a police burgh and a popular seaside resort, with a brisk trade, due to its proximity to Ardrossan and Stevenston.

AREA, a Latin word, originally meaning a threshing-floor, namely a raised space in a field exposed on all sides to the wind; now applied in English (1) to a plot of ground on which a structure is to be erected, (2) to the court or sunk space in the front or rear of a building, (3) to the superficial space covered by a building, district, country, etc.

ARECIBO, an important town situated on the north coast of Puerto Rico. The population of the town itself was 12,863 in 1930 and 22,134 in 1940; and that of the municipal district in 1940 was 69,192. The port has not been improved, but a survey has been made and the development of the city as a port will follow. The district tributary to the city is rich in sugar-cane, coffee and fruits. Cotton and vegetables are also grown. The city is connected with the capital, San Juan, an important port and distributing station, by a railway which extends also west and south and almost around the island. First-class highways also extend east and west, while the interior is tapped by two main roads across the island.

Several industrial establishments are located in the town. The situation on a beautiful bay of the Atlantic is admirable, and the town has well paved streets, an independent water system, electric lights, telephone communication, hospitals, theatres and other public improvements. Arecibo has a superior school system, and religious, charitable and social institutions abound. There are many attractive residences and the stores and shops are modern and business conditions satisfactory. Arecibo is one of the oldest municipalities and towns of the island. The municipal corporation was authorized as early as 1537 by a royal decree of the Spanish Crown. The town itself was founded in 1616 by Felipe de Beaumont, who gave it the name of San Felipe de Arecibo.

(H. M. T.)

AREMBERG or **ARENBERG,** formerly a German duchy of the Holy Roman Empire in the circle of the Rhine Palatinate, between Jiilich and Cologne. The hamlet of Aremberg is at the foot of a basalt hill 2,067ft. high, on the summit of which are the ruins of the original castle of the family of Aremberg.

The lords of Aremberg first appear early in the 12th century, but had died out in the male line by 1279. From the marriage of the heiress Mathilda (1282–99) with Engelbert II., count of La Marck (d. 1328), sprang two sons. The second of these, Engelbert III. (d. 1387), inherited the lordship of Aremberg which remained in his family till 1547, when it passed, by his marriage with Margaret, sister of the childless Robert III., to John of Barbançon, of the great house of Ligne, who assumed the name and arms of Aremberg, and was created a count of the Empire by Charles V. He was governor of Friesland, and for a while commanded the Spanish and Catholic forces against the "beggars," falling at the battle of Heiligerlee in 1568. His son Charles (d. 1618) greatly increased the possessions of the house by his marriage with Ann of Croy, heiress of Croy and of Chimay-Aerschot, and in 1576 was made prince of the Empire by Maximilian II. His grandson, Philip Francis, was made duke in 1644 by the emperor Ferdinand III.

Duke Prosper Louis who had lost his possessions in 1810 by an act of Napoleon, regained them in 1815 at the Congress of Vienna, which, however, mediatized them.

ARENA, the central area of an amphitheatre on which the gladiatorial displays took place, its name being derived from the sand (Lat. *harena*) with which it was covered. The word is applied sometimes to any level open space on which spectacles take place.

ARENARIA or **SANDWORT,** a genus of plants of the pink family with small white flowers. They are annual or perennial, mostly weedy herbs and the majority inhabit sandy soil in temperate, arctic or alpine regions. There are about 100 species; some cultivated for ornament.

ARENDAL, a seaport of southern Norway, in Aust-Agder fylke (county), at the mouth of the river Nid, 46 mi. N.E. of Christiansand. Estimated pop. (1936) 10,400. It has a good harbour protected from the open waters of the Skagerrak by a series of islands, on some of which the town itself, founded in 1723, is built. At one time (1879) Arendal was second only to Oslo (then Christiania) as a ship-owning port, but it lagged behind when steamboats replaced sailing vessels. It is ordinarily a port of call for many steamship lines. The chief exports are timber, wood pulp, aluminum, ferroalloys, quartz and felspar. There are two smelting works in the neighbourhood (at Eydehavn) and quarries, sawmills, a wood-pulp factory and a shipbuilding yard. The vicinity is remarkable for its variety of minerals. A railway runs to Treitsund in Telemark. The town was occupied by German troops in April 1940.

ARENSKY, ANTON STEPHANOVICH (1861–1906), Russian musical composer, was born at Novgorod, July 31, 1861, and after studying with various teachers finally became a pupil of Rimsky-Korsakov at the conservatoire of St. Petersburg. In 1882 he became a professor at the Moscow conservatoire, and from 1894 to 1901 was director of music in the imperial chapel at St. Petersburg. He composed much chamber music, including the well-known trio and many songs, besides several operas, the chief of which are The Dream on the *Volga* (1890); Raphael (1894), and Nala and Damayanti (1899). He died at Terioki, Finland, Feb. 25, 1906.

AREOI (AREOITI), a secret society which originated in Tahiti and later extended its influence to other South Pacific islands. To its ranks both sexes were admitted. The society was primarily of a religious character. Members styled themselves descendants of Oro-Tetifa, the Polynesian god, and were divided into seven or more grades, each having its characteristic tattooing. Chiefs were at once qualified for the highest grade, but ordinary members attained promotion only through initiatory rites. The Areois enjoyed great privileges, and were considered as depositaries of knowiedge and as mediators between God and man. They were feared, too, as ministers of the taboo and were entitled to pronounce a kind of excommunication for offences against its rules. The chief purpose of the society was the worship of the generative powers of nature, and the ritual and ceremonies of initiation were grossly licentious. The women members were common property; the period of cohabitation was limited to three days, and the female Areois were bound by oath to strangle at birth any child born to them. If the infant was allowed to survive half an hour only, it was spared; but to have the right of keeping it the mother must find a male Areoi willing to adopt it. The Areois travelled about, devoting their whole time to feasting, dancing (the chief dance of the women being the grossly indecent Timorodee mentioned by Captain Cook), and debauchery, varied by elaborate realistic stage presentments of the lives and loves of gods and legendary heroes.

See R. W. Williamson, Social and Political Systems of Central Polynesia (1924).

AREOPAGUS, a bare, rocky hill, 370ft. high, north-west of the acropolis of Athens. The ancients interpreted the name as "Hill of Ares," but Ares was not worshipped on the Areopagus. Another explanation connects the name with arai, "Curses," known as Semnai, "awful goddesses," whose shrine was a cave at the foot of the hill, of which they were the guardian deities.

The council of the Areopagus (ἡ ἐν Ἀρείῳ Πάγῳ βουλή), is to be compared with the council of elders which we find among primitive peoples. Under the kings of Athens it must have resembled the council of elders described by Homer; it was the chief factor in the work of transforming the kingship into an aristocracy. Aristotle (Ath. Pol., viii. 2) attributes to it for the period of aristocracy the appointment to all offices, the chief work of administration, and the right to punish in cases, not only of violation of laws, but also of immorality. This evidence is corroborated by the remnants of political power left to it in later time, and by the designation *boulē,* which indicates that the body was once a State council. In addition to its political functions, the council from the time of Draco exercised jurisdiction in certain

cases of homicide. We may suppose that the name "Boulē of the Areopagus" developed from the simple term boulē, in order to distinguish it from the new Boulē (*q.v.*), or Council of Four Hundred. The reforms of Solon (594 B.C.) tended practically to limit the council of the Areopagus, though constitutionally it retained all its earlier powers augmented by the right to try persons accused of conspiracy against the state. It had power to inhibit in the Four Hundred or in the Ecclesia, (*q.v.*) any measure which it judged unconstitutional or prejudicial to the State, and in the levy of fines for violation of law or moral usage it remained irresponsible. The tyrants (*q.v.*) left to the council its cognizance of murder cases (560–510 B.C.), and the nominal enjoyment of its prerogatives. The council seems to have suffered no direct abridgment of power from the reforms of Cleisthenes (*q.v.*). In 487 B.C., however, the introduction of the lot in filling the archonship (see ARCHON) began to undermine its position through affecting the ability of its members. This deterioration was necessarily slow; in 480 B.C., on the eve of the battle of Salamis, the council of the Areopagus succeeded in manning the fleet, thereby regaining the confidence and respect of the people. The patriotic action of the council enabled it to recover considerable administrative control, which it exercised for the next 18 years, although its deterioration in ability, as well as the rapid rise of democratic ideas, prevented it from re-establishing its supremacy. Ephialtes (462 B.C.), Archestratus and Pericles (*q.v.*), carried measures for the transfer of most of its functions to the Boulē, the Ecclesia, and the popular courts of law. Among these functions were jurisdiction in cases of impiety, the supervision of magistrates and the censorship of the morals of citizens, and the inhibition of unconstitutional resolutions in the Boulē and the Ecclesia. It retained jurisdiction in cases of homicide and the care of sacred olive trees. From this time (462 B.C.) to the establishment of the "Thirty Tyrants" (404 B.C.), the Areopagitic council, degraded still further by the absolute use of the lot, was a political nullity. After the surrender of Athens and the appointment of the "Thirty," the appeal of the laws of Ephialtes and Archestratus prepared the way for the rehabilitation of the council as guardian of the constitution. The Areopagites could not hope to recover their full supremacy, but they did exercise considerable political influence, especially in crises. In the time of Demosthenes, accordingly, we find them annulling the election of individuals to offices for which they were unfit, exercising during a crisis a disciplinary power extending to life and death over all the Athenians "in conformity with ancestral law," procuring the banishment of one, the racking of another, and the infliction of capital punishment on several of the citizens. This authority seems to have been delegated to them by the Ecclesia. Lycurgus claims that by their action during the crisis after Chaeroneia (*q.v.*, see also PHILIP II.), they saved the State. Under Roman supremacy they had jurisdiction in cases of forgery and tampering with the standard measures; also the supervision of buildings, and the care of religion and of education. From the overthrow of the "Thirty" to the end of their history (C. A.D. 400), they held a reputation for ability and integrity.

The jurisdiction of the council in cases of homicide was as follows:—accusations were brought by relatives; on receiving the accusation the king-archon made three investigations of the case in the three successive months. After the examination he assigned the case to the proper court and presided over it during the trial which took place in the open air, that the judges and the accuser might not be polluted by being brought under the same room with the offender. The accuser and the accused, standing on two white stones termed "Relentlessness" (*Anaideia*) and "Outrage" (Hubris) respectively, bound themselves to the truth by solemn oaths. Each was allowed two speeches, and the trial lasted three days. After the first speech the accused, unless charged with parricide, was at liberty to withdraw into exile. If condemned, he lost his life, and his property was confiscated. A tie vote acquitted. (Aeschylus, Eumenides 735.) (See GREEK LAW.)

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AREQUIPA, a coast department of southern Peru, surrounded by the departments of Ica, Ayacucho, Apurimac, Cusco, Puno and Moquehua (area 21,952 sq.mi.; pop., 1940, 270,996). The department includes an arid coastal zone traversed by deeply entrenched rivers, and a barren, mountainous region including a series of great volcanoes with spurs projecting toward the coast, between which are numerous fertile valleys watered by mountain streams. Crops include cotton, rice, sugar-cane, wheat, alfalfa, maize, barley, potatoes; also fruits and wine. Live stock is raised in the upper valleys. The mountains are rich in minerals, largely unexploited, and valuable deposits of borax are located at Salinas about 50 mi. N. of the capital. The chief port is Mollendo, a partially-sheltered, artificial cove. In spite of primitive living conditions, there are (1940) 12,628 inhabitants, mostly employees of importing and exporting houses, commission merchants, shipping agents, etc. The Southern railway runs, via Arequipa, to Puno on Lake Titicaca, a distance of 325 mi., connecting there by steamer with a railway to La Paz, Bolivia. Mollendo is second only to Callao in imports, one-third of which go to Bolivia. The Pan American highway branches at Vitor, near Arequipa, one spur leading to Chile, the other to Bolivia.

AREQUIPA, the third city of Peru, capital of the department of the same name, is located at an altitude of 7,600 ft. about 100 mi. north of its seaport, Mollendo. It lies in a valley on both banks of the Rio Chili at the foot of the extinct volcano El Misti (19,200 ft.). Although it has been quiescent for two or three centuries, emitting only vapours from time to time, El Misti is regarded with veneration, connected as it is felt to be with periodic earthquakes, the last of which (1868) practically destroyed the city. Other great peaks, Chachani and Pichu-pichu fill one-third of the horizon. Arequipa is famed for its beauty, a white city of a Spanish colonial type, surrounded by orchards, fields, market-gardens and eucalyptus avenues in the midst of a lofty, barren plateau rising toward snow-capped peaks. The climate is dry, the air pure and invigorating. There is a summer rainfall of 5 to 6 in., and during that season the sky is overcast much of the time. The city has (1940) 79,185 inhabitants and is the centre of the intellectual, religious and commercial activities of southern Peru. The rectangular Plaza Mayor is surrounded by arcades. The houses are massively built to resist earthquakes, the material used (*sillar*) is a white porous volcanic stone which hardens with age. There is a cathedral, many beautiful churches, monasteries, hospitals, a chamber of commerce, city hall and other public buildings, such as the prefecture and III. Army Division headquarters. The city, the seat of a bishopric, is noted for its religious fervour as well as for its intellectual activity. The Universidad del Gran Padre Augustín was founded in 1821 (four faculties, Philosophy, History and Letters, Natural Science, Political Science and Jurisprudence). There are several colleges, a normal school for girls and elementary schools. Arequipa is a distributing centre for mountain products. Wool is washed and prepared for export, and there are several large wholesale import and export houses, foreign and Peruvian, woollen and cotton textile mills, chocolate and biscuit factories, flour mills, foundries and machine shops for the Southern railway, and other smaller industries, also branches of many of the larger banks of Lima. The Sociedad Eléctrica de Arequipa, Ltd., furnishes power from its plant 10 mi. from the city. The city is well situated with respect to transportation. The Pan American highway provides direct routes to Lima, Puno, Mollendo and Arica. The Southern railway of Peru runs from Mollendo to Cusco and Puno via Arequipa, and a steamer from Puno to Guaqui on Lake Titicaca links the Southern Ry. with the railroads of Bolivia, which have direct connections with Buenos Aires. Regular plane service is maintained by the Faucett Aviation Co., and Arequipa is a scheduled stop on the Panagra-Panair flight from Lima to Rio de Janeiro. Telephone and telegraph lines connect with cable at Mollendo. There are paved highways to nearby resorts, such as the poetic Vale of Tiabaya. The favourite promenade is along the shady left bank of the Rio Chili to the springs of Tingo. The district of Arequipa is famous for its hot and cold springs, especially those of Yura and Jesús, the waters of which are bottled and used

throughout the country. The Boyden station of the Harvard college observatory (U.S.A.) founded in 1891, was located in Arequipa until 1927, when it was transferred to South Africa. The site of Arequipa was discovered, so the legend goes, by the Inca Mayna Capac, who sent 3.000 families to settle there. Diego de Almagro visited it on his return from Chile in 1537, and the present city was founded by Pizarro in 1540. It has since been the scene of events of importance in the history of Peru (*q.v.*) and the birthplace of many famous men.

ARES, in ancient Greek mythology, the god of war, or rather of battle, son of Zeus and Hera. (For the Roman god, identified with Ares, see MARS.) As contrasted with Athena, who added to her other attributes that of being the goddess of skilfully conducted military operations, he personifies brute strength and the wild rage of conflict. His delight is in war and bloodshed; he loves fighting for fighting's sake, and takes the side of the one or the other combatant indifferently, regardless of the justice of the cause. Splendidly armed, he goes to battle, sometimes on foot, sometimes in the war chariot made ready by his sons Deimos and Phobos ("Panic" and "Fear"), his usual companions. In his train also are found Enyo, the goddess of war (cf. the Roman Bellona), who delights in bloodshed and the destruction of cities; his sister, Eris, goddess of fighting and strife, and the Kēres, goddesses of death, whose function it is especially to roam the battle-field, carrying off the dead to Hades.

The primitive character of Ares has been much discussed. He is a god of storms; a god of light or a solar god; a chthonian god, one of the deities of the subterranean world, who could bring prosperity as well as ruin upon men. In this last aspect he was one of the chief gods of the Thracians, amongst whom his home was placed even in the time of Homer. In Scythia an old iron sword served as the symbol of the god, to which yearly sacrifices of cattle and horses were made, and in earlier times (as apparently also at Sparta) human victims, selected from prisoners of war, were offered. Thus Ares developed into the god of war, in which character he made his way into Greece. The story of his imprisonment for 13 months (Iliad, v. 385) by the Aloïdae (*q.v.*) points to the conquest of this chthonian destroyer of the fields by the arts of peace, especially agriculture.

In the Odyssey (viii.) Ares is the lover of Aphrodite, the wife of Hephaestus, who catches them together in a net and holds them up to the ridicule of the gods. In what appears to be a very early development of her character, Aphrodite also was a war-goddess, known under the name of Areia; and in Thebes, the most important seat of the worship of Ares, she was his wife. His worship was not so widely spread over Greece as that of other gods, although he was honoured here and there with festivals and sacrifices. At Sparta young dogs were offered to him under the name of Thēreitas. At Athens he had a temple at the foot of the Areopagus, where he was tried and acquitted by the gods for the murder of Halirrhothius, who had violated his daughter.

The figure of Ares appears in various stories of ancient mythology. Thus he engages in combat with Heracles on two occasions to avenge the death of his son Cycnus; once Zeus separates the combatants by a flash of lightning, but in the second encounter Ares is severely wounded by his adversary, who has the active support of Athena; maddened by jealousy, he changes himself into the boar which slew Adonis, the favourite of Aphrodite; and stirs up the war between the Lapithae and Centaurs (*q.v.*). His attributes were the spear and the burning torch, symbolical of the devastation caused by war (in ancient times the hurling of a torch was the signal for the commencement of hostilities). The dog and the vulture were sacred to him.

The worship of Ares being less general throughout Greece than that of the gods of peace, the number of statues of him is small; those of Ares-Mars, among the Romans, are more frequent. Previous to the 5th century B.C., he was represented as full bearded, grim featured and in full armour. From that time, apparently under the influence of Athenian sculptors, he was conceived as the ideal of a youthful warrior. He then appears as a vigorous youth, beardless, with curly hair, broad head, and stalwart shoulders and wearing helmet and chlamys. In the Villa Ludovisi statue (after the style of Lysippus) he appears seated in an attitude of thought; his arms are laid aside, and Eros peeps out at his feet. In the Borghese Ares (also taken for Achilles) he is standing, his only armour being the helmet on his head. He also appears in many other groups, with Aphrodite, in marble and on engraved gems of Roman times. But before this grouping had recommended itself to the Romans, with their legend of Mars and Rhea Silvia, the Greek Ares had again become under Macedonian influence a bearded, armed, and powerful god.

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ARETAEUS, of Cappadocia, a Greek physician, who lived at Rome in the second half of the 2nd century A.D. We possess two treatises by him, each in four books, in the Ionic dialect: On the *Causes* and *Indications* of Acute and Chronic Diseases, and On their Treatment. His work was founded on that of Archigenes; like him, he belonged to the eclectic school, but did not ignore the theories of the "Pneumatics," who made the heart the seat of life and of the soul.

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ARETAS, the Greek form of a name borne by kings of the Nabataeans resident at Petra in Arabia (Arab, *Hāritha*). (1) A king in the time of Antiochus IV. Epiphanes (II. Macc. v. 8). (2) The father-in-law of Herod Antipas (Jos. Ant. xviii. 5. 1, 3). In II. Cor. xi. 32 he is described as ruler of Damascus (*q.v.*) at the time of Paul's conversion. Herod Antipas had married a daughter of Aretas, but afterwards discarded her in favour of Herodias. This led to a war with Aretas in which Antipas was defeated.

An Aretas is mentioned in I. Macc. xv. 22, but the true reading is probably Ariarathes (king of Cappadocia). (See NABATAEANS.)

ARETE, a ridge or sharp edge (O.Fr. areste, Lat. arista, ear of corn, fish bone or spine), a French term used in Switzerland to denote any sharp bayonet-like ridge of precipitous rock; *e.g.,* the Weisshorn is formed of three great sharp ridges which meet in a pyramidal point. Arête now denotes any sharp mountain edge denuded by frost action above the snowline, where the consequent angular ridges give "house-roof" form.

ARETHAS (c. 860–940), Byzantine theological writer and scholar, archbishop of Caesarea in Cappadocia, was born at Patrae. He was a pupil of Photius, and was the author of a Greek commentary on the Apocalypse avowedly based upon that of Andrew, the previous archbishop. He annotated the margins of his classical texts with numerous scholia (many of which are preserved), and had several mss. copied at his own expense, amongst them the Codex Clarkianus of Plato (brought to England from the monastery of St. John in Patmos), and the Dorvillian ms. of Euclid (now at Oxford).

Most divergent opinions have been held as to the time in which Arethas lived; the reasons for the dates given above will be found succinctly stated in the article "Aretas," by A. Jiilicher in Pauly-Wissowa's Realencyklopadie der *klassischen Altertumswissenschaft* (1896). The text of the commentary is given in Migne, *Patrologia* Graeca, cvi.

ARETHUSA (*Arethusa bulbosa*), a common North American plant of the orchis family, found in bogs and swampy regions during May and June from Newfoundland south to North Carolina and west to Indiana and Minnesota. The flowers are magenta-crimson, having a crest formed of three hairy ridges, white or

yellow in colour, and with a lower lip spotted with magenta. They grow on single stalks 5in. to 10in. in height. The leaves appear after the flowers open and are long, narrow and single. The root is bulbous. A common name for arethusa is Indian pink.

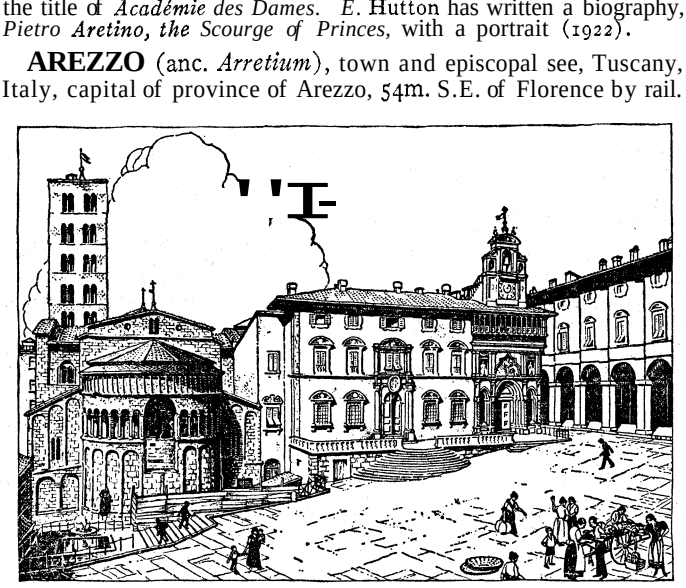
ARETHUSA, in Greek mythology, a nymph who gave her name to a spring in Elis and to another in the island of Ortygia near Syracuse. The river-god Alpheus fell in love with Arethusa, one of the retinue of Artemis; Arethusa fled to Ortygia, where she was changed into a spring; Alpheus made his way beneath the sea, and united his waters with those of the spring. In Ovid (*Metam.* v. 572 et seq.), Arethusa, while bathing in the Alpheus, was seen and pursued by the river-god in human form; Artemis changed her into a spring, which, flowing underground, emerged at Ortygia. In an earlier form of the legend, it is Artemis, not Arethusa, who is the object of the god's affections, and who escapes by smearing her face with mire, so that he fails to recognize her. The story probably originated from the fact that Artemis *Alpheiaia* was worshipped in both Elis and Ortygia, and also that the Alpheus in its upper part runs underground, as is confirmed by modern explorers. In Virgil (*Ecl.,* x.1) Arethusa is addressed as a divinity of poetical inspiration, like one of the Muses, who were themselves originally nymphs of springs.

For Arethusa on Syracusan coins, *see* B. V. Head, *Historia Numorum* (1911).

ARETINO, PIETRO (1492–1556), Italian author, born April 20 1492. Banished from Arezzo, his birthplace, for writing a satirical sonnet against indulgences, he made his way to Rome, where he found favour with Pope Leo X., until the composition, in 1523, of his obscene "Sonnetti Lussuriosi." He then left Rome, and was attached to the court of Giovanni de' Medici. At the death of Giovanni de' Medici he withdrew to Venice, where, living on the gifts of nobles and princes who feared his satire, he spent his time in writing licentious sonnets, dialogues, and comedies.

The dialogues and sonnets have been translated into French, under the title of *Académie des Dames.* *E.* Hutton has written a biography, *Pietro Aretino, the Scourge of Princes,* with a portrait (1922).

AREZZO (anc. *Arretium*), town and episcopal see, Tuscany, Italy, capital of province of Arezzo, 54m. S.E. of Florence by rail.



THE PIAZZA GRANDE. AREZZO. SHOWING THE PALAZZO DELLA FRATERNITA AND THE 11TH CENTURY APSE OF THE CHURCH OF S. MARIA DELLA PIEVE

Pop. (1936) 24,411 (town), 60,284 (commune). It is attractively situated on a hiil 840 to 970ft. above sea-level, in a fertile district. Its walls were erected in 1320 by Guido Tarlati di Pietramala, its warlike bishop, and reconstructed by Cosimo I. de' Medici between 1541 and 1568, on which occasion the bronze statues of Pallas and the Chimaera, now at Florence, were discovered. The streets radiate fanwise from the citadel (1502). The cathedral, close by, is good Italian Gothic (1277–1511) and contains some finely executed 14th-century sculptures. S. Maria della Pieve has campanile and façade of 1216. In the cloisters of S. Bernardo, on the site of the ancient amphitheatre, is a remarkable view of mediaeval Rome. S Francesco contains famous frescoes by Piero de' Franceschi, representing scenes from the legend of the Holy Cross. The Renaissance churches of S. Maria delle Grazie and the Santissima Annunziata may be noted. The most famous natives are the poet Petrarch, Pietro Aretino, the satirist (1492–1556), and Vasari, famous for his lives of Italian painters. Guido of Arezzo (d. c. 1050), inventor of the modern system of musical notation, was a resident of the city. Arezzo was the seat of a school of civil law and is important as the outlet for the wool of the Casentino. (See ARNO.)

See C. Signorini, *Arezzo, Citta e Provincia, Guida illustrata* (Arezzo, 1904); G. Franciosi, Arezzo (Arti Grafiche, Bergamo, 1909).

ARGALI (*ahr'gă-lĭ*), the Tartar name of the great wild sheep, *Ovis ammon,* of the Altai and other parts of Siberia. Standing as high as a large donkey, the argali is the finest of all the wild sheep. There are several related central Asian species, such as *O.* sairensis and O. littledalei. See SHEEP.

ARGAND BURNER, the first scientifically constructed oil-burner, was invented by A. Argand of Geneva in 1784. It consisted of a cylindrical wick confined between two concentric tubes; this device gave a circular flame with a current of air brought to play upon its inner surface. A glass chimney increased the draught and improved the illumination. Nearly a century later, Murdock, the pioneer of gas-lighting, adapted the Argand idea of two concentric circular pipes in the designing of gas-burners (see LIGHTING AND ARTIFICIAL ILLUMINATION).

ARGAO, a municipality on Bohol strait, 36 mi. S.S.W. of Cebu City, capital of the province of Cebu, Philippine Islands. Population (1939), 37,331, of whom 17,576 were males; there were no whites. Legazpi, first governor of the Philippines, assigned the municipality in *encomienda* in 1571, and the Augustinians and later the Jesuits established missions there at an early period. Much excellent cacao is produced in the vicinity, and rice and corn are other important products. A small amount of cotton is raised and woven, and some sinamay is exported. Literacy (ages of 10 years and upward) was 38.2% in 1939, and the school population in that year numbered 12,537, of whom 26.5% attended school. The number of parcels of land declared for taxation in 1938 was 19,291, and the number of owners was 12,408. (C. S. L.)

ARGAUM, a village of British India in the Akola district of the Central Provinces, 32m. north of Akola. The village is memorable for an action which took place on Nov. 28, 1803, between the British army, commanded by Maj.-Gen. Wellesley (afterwards duke of Wellington), and the Mahrattas under Sindhia and the raja of Berar, in which the latter were defeated with great loss. A medal struck in England in 1851 commemorates the victory.

ARGEI (*ahr-gā'-ē*), the name given by the ancient Romans to a number of rush puppets (24 or 27), resembling men tied hand and foot, which were taken down to the ancient bridge over the Tiber (pons sublicius) on May 14 by the *pontifices* and magistrates, with the wife of the Flamen Dialis in mourning guise, and there thrown into the Tiber by the Vestal virgins. There were also in various parts of the four Servian regions of the city a number of *sacella Argeorum* (chapels), round which a procession seems to have taken place on March 17, and where the puppets were probably kept until the second procession. The Romans had no historical explanation of these curious rites, and the theory of the common people that the puppets were substitutes for old men who used at one time to be sacrificed to the river, is not generally accepted.

W. Mannhardt, comparing numerous examples of similar customs among other European peoples, concluded that the rite was of extreme antiquity, of dramatic rather than sacrificial character, and that its object was possibly to procure rain; while Wissowa, who refuses to date it farther back than the latter half of the 3rd century B.C., sees in it the yearly representation of an original sacrifice of 27 captive Greeks (taking Argei as a Latin form of Gr. Argeioi) by drowning in the Tiber.

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ARGELANDER, FRIEDRICH WILHELM AUGUST (1799–1875), German astronomer, was born at Memel on March

22, 1799, and studied at Konigsberg. His treatise on the path of the great comet of 1811 appeared in 1822; he was, in 1823, made director of the observatory at Åbo; and he exchanged it for a similar charge at Helsingfors in 1832. His investigation of the sun's motion in space was published in 1837; and in the same year he was appointed professor of astronomy in the university of Bonn, where he died Feb. 17, 1875. He also published *Observatioaes Astronomicae Aboae Pactae* (1830–32); *DLX Stellarum Fixarum Positiones Mediae* (183 j); and the first seven volumes of *Astronomische Beobachtungen auf der Sternwarte zu Bonn* (1846–69), containing his observations of northern and southern star-zones, and his great *Durchmusterung* (vols. iii.-v., 1859–62) of 324,198 stars, from the north pole to −2° Dec. The corresponding atlas was issued in 1863. His observations (begun in 1838) and discussions of variable stars were embodied in vol. vii. of the same series.

See E. Schönfeld in *Vierteljahrsschrift der Astronomischen Gesellschaft,* x. pp. 150–178.

ARGENS, JEAN BAPTISTE DE BOYER, MARQUIS D' (1704–1771), was born at Aix in Provence on June 24, 1704 and died at Toulon on Jan. 11, 1771. After a dissipated and adventurous youth, he settled for a time at Amsterdam, where he began his *Lettres juives* (The Hague, 1738–42), *Lettres chinoises* (The Hague, 1739–42), and *Lettres cabalistiques,* 2nd. ed. (1769); also the *Mémoires secrets de la république des lettres* (1743–48), afterwards revised and augmented as *Histoire de l'esprit humain* (1765–68). He was invited by Prince Frederick (afterwards Frederick the Great) to Potsdam, and received high honours at court; but Frederick was bitterly offended by his marrying a Berlin actress, Mlle. Cochois.

ARGENSOLA, LUPERCIO LEONARD0 DE (1559–1613), Spanish dramatist and poet, was baptized at Barbastro on Dec. 14, 1559. He was appointed historiographer of Aragon in 1599, and in 1610 accompanied the count de Lemos to Naples, where he died in March, 1613. His tragedies — Filis, *Isabela,* and *Alejandra* — *are* said by Cervantes to have "filled all who heard them with admiration, delight, and interest"; *Filis* is lost and *Isabela* and *Alejandra,* which were not printed till 1772, are ponderous imitations of Seneca. Argensola's poems were published with those of his brother in 1634; they consist of excellent translations from the Latin poets, and of original satires.

His brother, BARTOLOMÉ LEONARDO DE ARGENSOLA (1562–1631), Spanish poet and historian, was baptized at Barbastro on Aug. 26, 1562. He was attached to the suite of the count de Lemos, viceroy of Naples in 1610, and succeeded his brother as historiographer of Aragon in 1613. He died at Saragossa on Feb. 4, 1631. His principal prose works are the *Conquista de las Islas Molucas* (1609), and a supplement to Zurita's *Anales de Aragdn,* which was published in 1630.

ARGENSON, the name of a French family, derived from an old hamlet in what is now the department of Indre-et-Loire. MARC RENE DE VOYER, marquis de Paulmy and marquis d'Argenson (1652–1721) held various legal offices at the French court, and in 1697 was appointed lieutenant-general of police. He held this post for 21 years, during which he was a party to every state secret, and a familiar friend of Louis XIV.; in 1709 he directed the destruction of the Jansenist monastery of Port Royal. In 1718 he became keeper of the seals and president of the council of finance; he was appointed by the regent to suppress the resistance of the parlements and to reorganize the finances, and was blamed for the failure of the schemes of John Law. He resigned in 1720 and died on May 8, 1721. *See* the contemporary memoirs, especially those of Saint-Simon (de Boislisle's ed.), Dangeau and Math. Marais; Barbier's *Journal;* "Correspondance administrative sous Louis XIV." in *Coll. des* doc. *inéd. sur l'histoire de France,* ed. G. B. Depping (1850–55); *Correspondance des contrôleurs-Généraux des finances,* pub. by de Boislisle (1873–1900); *Correspondance de M. de Marville avec M. de Maurepas* (1896–97); *Rapports de police de René d'Argenson,* pub. by P. Cottin (undated); P. Clément, *La police sous Louis XIV.* (1873).

RENÉ LOUIS DE VOYER DE PAULMY, marquis d'Argenson (1694–1757), eldest son of the preceding, was also a lawyer. As intendant of justice, police and finance in Hainaut he was employed in provisioning the troops, who were suffering from the economic confusion resulting from Law's system. He returned to the court in 1724 to exercise his functions as councillor of state. He was the friend of Voltaire, and frequented the Club de l'Entresol, the history of which he wrote in his memoirs. In May 1744 he was appointed member of the council of finance, and in November secretary of state for foreign affairs, his brother, the comte d'Argenson being at the same time secretary of state for war. France was then engaged in the War of the Austrian Succession, and the government was virtually in the hands of the two brothers. The marquis d'Argenson dreamed of a "European Republic," and wished to establish arbitration between nations. But the generals negotiated in opposition to his instructions; his colleagues laid the blame on him; the intrigues of the courtiers passed unnoticed by him; and the secret diplomacy of the king neutralized his initiative. He concluded the marriage of the dauphin to the daughter of Augustus III., king of Poland, but was unable to prevent the election of the grand duke of Tuscany as emperor in 1745. In 1747 he retired and spent the rest of his life in working at the Académie des Inscriptions, of which he was appointed president by the king in 1747, and in revising his *Mémoires.* Voltaire declared him to be "the best citizen that had ever tasted the ministry."

BIBLIOGRAPHY.—His son, Antoine René, published his *Considtrations sur le gouvernement de France* (Amsterdam, 1764), and *Essais dans le goût de ceux de Montaigne (ib.* 1785), republished as *Loisirs d'un ministre d'état* (1787). There are two important editions of the Mtmoires, the first with some letters not elsewhere published, by the marquis d'Argenson, his great-grand-nephew (1857, *et seq.);* the second, more correct, but less complete, published by J. B. Rathery, for the Société de l'Histoire de France 1859, *et seq.).* *See* Sainte-Beuve, *Causeries du lundi* (vols. xii. and xiv.); Levasseur, "Le Marquis d'Argenson" in the *Mémoires de l'Académie des Sciences Morales et Politiques* (vol. lxxxvii. 1868); and, especially, E. Zevort, *Le Marquis d'Argenson et le ministère des affaires étrangères* (1880). *See* also G. de R. de Flassan, *Histoire de la diplomatie française* (2nd ed., 1811); E. Boutaric, *Correspondance secrlte inédite de Louis XV.* (1866); E. Champion, "Le Marquis d'Argenson," in the *Révolution française* (vol. xxxvi., 1899); Arthur Ogle, *The Marquis d'Argenson* (1893); A. Alem, *D'Argenson tconomiste* (1899).

Other noted members of the family were: MARC PIERRE DE VOYER DE PAULMY, Comte d'Argenson (1696–1764), younger brother of the preceding, who, as secretary of state for war, began the reform of the new armies constituted after the War of the Austrian Succession; his nephew MARC ANTOINE RENÉ DE VOYER (1722–87) who after being employed as ambassador to Poland (1762–64) and at Venice (1766–70) devoted his time to history, and published *Mélanges tire's d'une grande bibliothèque,* 65 vols. (1779–88); MARC RENÉ, marquis de Voyer (1721–82), who fought in the War of the Austrian Succession and in the Seven Years War; and his son MARC RENÉ, marquis d'Argenson (1771–1842), who embraced the revolutionary cause, and later, as an adherent of Napoleon, helped to repel the English invasion of South Beveland and Walcheren (1809).

ARGENTA, province of Ferrara, Emilia, Italy, 25m. S. of Ravenna by rail, 13 ft. above sea-level. Pop. (1936) town, 3,684; commune, 28,032. It has some interesting mediaeval and Renaissance buildings and churches, and a good picture gallery.

See A. Beltramelli, *Da Comacchio ad Argenta* (Bergamo, Arti Grafiche, 1905).

ARGENTAN, capital of an arrondissement in the department of Orne, N.W. France, 27 mi. N.N.W. of Alençon by rail. Pop. (1936) 6,291. It is situated on the slope of a hill on the right bank of the Orne at its confluence with the Ure. Argentan was a viscounty from the 11th century onwards; it was often taken and pillaged. During the Religious Wars it remained attached to the Catholic Party. The château, now used as a law court, dates from the 15th century. The church of St. Martin (15th century) has good stained glass; that of St. Germain has a 15th-century sculptured porch. Argentan is the seat of a sub-prefect, has a tribunal of first instance and of commerce, and a communal college. Leather-working and the manufacture of stained-glass are leading industries. There are quarries of limestone in the vicinity.

ARGENTEUIL, a town of northern France, in the department of Seine-et-Oise, on the Seine, 3 mi. northwest of the fortifications of Paris. Pop, (1936) 59,314. Argenteuil grew up round a monastery (A.D. 656), which Charlemagne changed into a nunnery; it was afterwards famous for its connection with Héloïse (see ABÉLARD), and on her expulsion in 1129 was again turned into a monastery. It is a residential area related to Paris, having market gardens and vineyards. The *Fête* des *Vendanges* held in autumn is well known. Machine and chemical industries are carried on.

ARGENTINA, or the Argentine Republic (officially República Argentina), is second in area and population of the countries of South America. It has the shape of a wedge with the point towards the south and occupies the greater part of the southern extremity of the continent. The length of Argentine territory from north to south is approximately 2,070mi. and its greatest width about 860 miles. The area is 1,079,965 sq mi., not including the Falkland islands (*q.v.*), to which Argentina lays claim. On the north and north-east the country abuts on Bolivia, Paraguay, Brazil and Uruguay, with the Pilcomayo, Paraguay, Paraná and Uruguay rivers constituting the greater part of the boundary itself. Argentina is bounded on the west throughout its entire length by Chile; on the east and south-east by the Atlantic ocean; on the south by the converging lines of Chile and the Atlantic.

Physical Geography. — The Andean mountain chain which extends the entire length of South America forms a natural division between Argentina and Chile, as the boundary line is marked in large part by the highest peaks of the Andes which form the watershed for streams flowing in the general directions of the Atlantic and of the Pacific. In the north the Andean ranges extend east through approximately one-third of Argentine territory but farther south the width of the mountainous border diminishes sharply. All of the Argentine territory to the east of the Andes, comprising by far the greater part of the country, has the character of a plain rising from sea-level at the Atlantic coast to the Andean foothills.

The northern part of the Argentine plain is known as the Gran Chaco and is in part wooded and swampy. The treeless, grassy pampa, the fertile agricultural and grazing territory which has made the wealth of Argentina, occupies the central portion. From the Rio Kegro south the country is known as Patagonia and is composed principally of cold, arid steppes.

From the Bolivian border south to the Rio Negro (approximately one-half the length of the country) the Andean mountain zone extends east through one-third to one-fourth of the territory and comprises the elevated cordilleras and their plateaus, with flanking ranges and spurs towards the east. In the north the elevated plateaus and the valleys are semi-arid and are covered with extensive saline deposits. Along the Chilean border lies an extensive region of elevated desert land and mountain, without drainage, known as the Puna de Atacama. In the province of Córdoba are three short parallel ranges belonging to another and older formation than the Andes. North of the Córdoba Sierras lies a great saline depression known as "salinas grandes," 643ft. above sea-level, while to the north-east is another extensive saline basin enclosing the "Mar Chiquita" (Small Sea) and the morasses into which the waters of the Rio Saladillo disappear. The highest elevations in the Argentine Andes occur north of the Rio Negro, along the Chilean border. Of these the most important are: Aconcagua, the highest mountain in the Americas (23,080ft.); Mercedario (22,31jft.); and Tupungato (21,550ft.).

The Patagonian Andes, extending from the latitude of the Rio Negro to the southern extremity of the continent, differ in character from the northern Andes. They are much lower and diminish in height towards the south, the greatest elevation in Rio Negro being 11,155ft. and in Chubut and Santa Cruz, 6,988 and 7,090ft. respectively.

The region known as the Gran Chaco comprises that part of the Argentine plain extending from the Rio Pilcomayo on the northern border south to the Rio Salado del Norte. Its northern extremity lies within the torrid zone and is made up of tropical forest alternating with plain. The general elevation of the Gran Chaco varies from 600ft. to 800ft. above sea-level. As the slope to the east is very slight the rivers are commonly obstructed by sand bars, floating trees and vegetarion, and large areas are regularly flooded during the rainy season. A large part of the Gran Chaco region is wooded; in the south and south-west there are large grassy plains and large areas covered with salt pans. The Argentine "Mesopotamia," the area lying between the Paraná and Uruguay rivers, belongs naturally to the Gran Chaco region. It is wooded, flat and swampy in the north, but higher and undulating in the south.

The central, or pampa, region of Argentina is the most productive and has within its area or on its margin the bulk of the population and all the large cities of the country. It comprises the area from the Gran Chaco south to the Rio Negro, stretching through about 10 degrees of latitude It is a treeless, grassy plain, apparently lying on a dead level but in reality rising gradually from the Atlantic westward at an average rate of about 3ft. to the mile. This uniform level is broken along its southern margin, in the south of the province of Buenos Aires, by the small Tandil and Ventana Sierras and by ranges of hills and low mountains in the southern and eastern part of the territory of La Pampa. Extensive depressions are found, some of them subject to inundations, as along the lower Rio Salado in Buenos Aires. In a straight line west the elevation of the pampa varies from 65ft. at Buenos Aires to 1,250ft. at a point 400 mi. west.

Contrasting with the fertile pampa the southern region known as Patagonia is made up principally of arid steppes. Patagonia includes the area from the Rio Negro to the southern extremity of the continent. Except for a narrow coastal plain of varying width the surface of Patagonia is formed by a series of high plateaus at elevations varying from 300 to 1,600ft., with the general aspect of a great plain sloping from the west to the east. The surface of the plateaus is very uneven, with outcroppings of stone, and is crossed from east to west by deep, broad valleys between high cliffs. In the west the plateau area is separated from the Cordillera by a longitudinal depression or belt, within which conditions of climate and soil are more favourable than in any other part of Patagonia. This longitudinal belt is not continuous, but is broken into sections, one of which, in the south, is 200mi. long. Fertile and wooded, it offers most inducements to colonists.

The island of Tierra del Fuego adjoins the continent at the south. Its eastern section belongs to Argentina and the west to Chile. In character it is similar to Patagonia. In the north the surface is undulating prairie and in the south wooded hills with glaciers and numerous rivers and lakes.

Rivers and Lakes. — The three great rivers that form the Plata system — the Paraguay, the Paraná and the Uruguay — with their tributaries, drain the northern part of Argentina. The rivers of this mighty system have a total length of 2,330mi. and are navigable throughout 1,997 miles. The Paraguay, Paraná and Uruguay have their source in the highlands of Brazil and flow south. Each forms a part of the boundaries of Argentina with the countries to the north. The largest tributaries of the Plata system are the Pilcomayo, which rises in Bolivia and forms the north-eastern boundary of Argentina for about 400mi. and joins the Paraguay; the Bermejo, which rises on the northern frontier and flows south-east into the Paraguay; and the Salado del Norte (called the Rio del Juramento in its upper course), which rises on the slopes of the Andes in the province of Salta and flows south-east into the Paraná. The area known as the Mesopotamia, included between the Paraná and the Uruguay, is watered by a number of small streams which flow into those rivers.

The Rio de la Plata is in reality an enormous estuary and forms an ample gulf. It is about 100mi. long and 23mi. wide at the confluence of the Paraná and the Uruguay. Measured at its widest point, which is slightly west of Montevideo in Uruguay, the Plata is about 56mi. wide. The port of Buenos Aires has been constructed on the banks of the Plata.

The central part of the pampa region, including a considerable part of the province of Buenos Aires and La Pampa territory, is almost entirely without running streams, though it is not in any sense arid. On the eastern and southern pampa there are a num-

ber of small streams flowing into the Plata estuary and the Atlantic. Of these the only important one is the Salado del Sur, 360 mi. long. Many of the rivers of Argentina are brackish or saline in character, as implied by their names (Salado and Saladillo).

On the southern margin of the pampa flow the Colorado and Negro rivers, crossing the entire republic from the Andes to the Atlantic. Both are navigable. The Rio Negro is nearly 400mi. long and after the large tributaries of the Plata is the largest river in Argentina. Its waters are used for irrigating a large area.

The Patagonian region has a number of rivers which rise in the foothills of the Andes and flow in an easterly direction to the Atlantic. Of these the largest is the Rio Chubut, which has an important tributary, the Rio Chico. There are many large snow-fed lakes in Patagonia set in the Andean foothills, of which the largest are Lago Viedma, Lago Buenos Aires, Lago Argentina and Lago Nahuel Huapi. The scenery in the lake region of Patagonia, with its rugged snow mountains, forests and glaciers, is magnificent.

The lakes of Argentina are exceptionally numerous, though, except in Patagonia, few of them are large enough to be shown on an ordinary map. Buenos Aires province has more than 600 lakes, mostly small and some brackish. La Pampa territory, too, is dotted with small lakes. The large saline Mar Chiquita in Córdoba is fed from the Córdoba Sierra, and, like many lakes of the region, has no outlet.

Ocean and River **Ports.**—Argentina has a coast on the Atlantic 1,656mi. long, including the estuary of the Plata, but there are few natural harbours. The two ports most frequented by ocean-going vessels are those of Buenos Aires and Ensenada (La Plata), both in the Plata estuary, and both constructed by the National Government at great expense. The best natural harbour of the republic is probably that of Bahia Blanca on the Atlantic coast in the southern part of Buenos Aires province, 534mi. by sea from Buenos Aires. Here there is a large bay of good depth, sheltered by islands. The port is known as Puerto Belgrano, or Puerto Militar, as there is a naval base there. It is under the jurisdiction of the National Government. With a little dredging the harbour is kept accessible to the largest ocean-going vessels. There are ample port works and equipment. Within a few miles of Bahia Blanca are two other small ports known as Ingeniero White and Puerto Galván.

There are several small ports on the coast of Patagonia, visited only by coast-line steamers. These include San Antonio in Rio Negro; Comodoro Rivadavia (the centre of the Argentine petroleum industry) and Puerto Madryn in Chubut; Santa Cruz, San Julián and Puerto Deseado in Santa Cruz. Ushuaia on the Beagle channel is the port of Tierra del Fuego.

The port of Buenos Aires is situated on the Plata river at a point where it is approximately 24mi. wide. After New York it has a larger movement of traffic than any other American port. The harbour is made up of four sections known respectively as Riachuelo Port, Port Madero, New Port and South Dock. There is an aggregate of 6mi. of quay served by hydraulic and electric cranes. The Government warehouses in the port area have floor space of more than 90,000sq.ft., and over 7jmi. of railway lines. Five grain elevators have a capacity of 167,000 tons. Between 14,000 and 16,000 ships, averaging 13,000,000 to 14,000,000 tons, call annually. Some 5,000 of these, aggregating 8,000,000 to 9,000,000 tons, are foreign.

Argentina has within and adjacent to its territories several navigable rivers. This fact has been of importance in the development of the country as ocean-going steamers can penetrate to centres of production. The port of Rosario on the Paraná river, 260mi. inland from Buenos Aires, is the second port of the republic in commercial importance. It receives nearly the whole of the shipping traffic of the higher Paraná and Paraguay rivers and can be reached by overseas steamers drawing up to 21ft. of water. The port of Santa FC on the Rio Paraná, 360mi. from Buenos Aires, is also accessible to overseas steamers. There are many other river ports with a traffic of relative importance scattered along the banks of the Paraná, the Paraguay and the Uruguay. (X.)

Geology.—The older sedimentary rocks in Argentina are exposed in the Cordillera of the Andes, which borders the country on the west and constitutes the "backbone" of South America. The Andes are of geologically recent origin, having been uplifted in Tertiary time. The uplift was accompanied or followed by vulcanism, which produced extensive areas of rugged volcanic rock, mainly andesite, trachyte and basalt. Plastic igneous material intruded into the older rocks formed on cooling bodies of granite, syenite and diorite, and uplifted, folded and faulted the sedimentary Palaeozoic beds that lay along or near the axis of the range. The Cordillera is paralleled on the east and in places joined by the Sierras, lower ranges in which also intrusive rocks, Palaeozoic sedimentary beds and volcanic rocks are exposed. In areas somewhat farther east the older Palaeozoic rocks are overlain by beds of sandstone containing thin seams of coal and the remains of plants. Among the latter are some that belong to the Glossopteris or *Gangamopteris* flora, which thrived in India, Australia and South Africa in Permian time, when glaciers appear to have existed in South America. The occurrence of these fossil plants in Argentina favours the view, held by some, that a great land area, which has been called Gondwanaland, once extended from India to South America. The fossil plants of the Glossopteris flora were found at Bajo de Velis, in the province of San Luis. Fossil plants found elsewhere in Argentina belong to a higher geologic horizon—the upper Triassic, equivalent to the Rhanetic of Europe. Jurassic beds are seen in the Cordillera. Some Cretaceous freshwater beds are found in the western part of the country. The early Tertiary deposits consist largely of beds of reddish sandstone, which are exposed in the Cordillera and the Sierras, where they reach, at some places, a height of 100,000ft., and where they were folded by the Andean uplift. The marine deposits of late Tertiary time are confined to the neighbourhood of the coast and were probably laid down after the Andes had been uplifted, but freshwater deposits of about the same age are found in inland areas, especially in Patagonia.

The fauna of middle Tertiary and Quaternary time includes the remains of a gigantic ningless bird (*Phororhacus*), a huge armadillo-like animal (Glyptodon), giant ground sloths (*Megatherium* and Mylodon), a horse (*Hippidion*), and a bear-like animal (Arctotherium). Some of these have been found in the Pleistocene beds of the pampas, which consist mainly of rather loose deposits of very fine sand and clay. Large areas of glacial deposits show that masses of ice covered the Andean slopes in glacial time.

Ores of gold, silver, lead and copper are found in the neighbourhood of the eruptive rocks in the hilly regions near the Andes. (G. McL. Wo.)

Climate and Rainfall.—With the exception of the small area which lies north of the Tropic of Capricorn in the Torrid Zone, Argentina lies in the South Temperate Zone. The central or pampa district including the most populous provinces has a temperate, healthful climate, enjoying a large amount of sunshine and, as a whole, adequate rainfall. All over the republic January is the warmest month and the coolest season June and July.

There is little variation of climate over the pampa region considering its great extent, nearly ten degrees of latitude. It includes the provinces of Buenos Aires, southern Santa FC, the eastern part of Córdoba and La Pampa territory. In the capital of Córdoba, on the northern margin of the pampa, the annual average temperature is 62·4° F. The average temperature for January is 77" and 49·6° for June. In the city of Buenos Aires the average annual temperature is 61·1° F.; for January 73·7° and for July 49·2° F. There is thus little difference in temperature between Buenos Aires and Córdoba but there is a marked difference in rainfall. In Buenos Aires the rainfall reaches 37·9in., well distributed throughout the year, while Córdoba has 28 inches. Light frosts are sometimes experienced in Buenos Aires during the cold months but the vegetation is never frozen. The city of Bahia Blanca in the southern part of Buenos Aires province is on the southern margin of the pampa. It has an average annual temperature of 60° F., 70·4° F. for the month of January and 46·7° for the coldest month, July, with an average annual rainfall of 21·j inches.

Due to the length of Argentine territory, which extends through 33 degrees of latitude, and the great variations in altitude in its range from the Atlantic coast level to the peaks of the Andes, there is necessarily great variation of climate. The climate is further modified by prevailing winds and mountain barriers. Southern Patagonia and Tierra del Fuego, although they correspond in latitude to Labrador, are made habitable and an excellent sheep-raising country by the southern equatorial current along the continental coast.

The Torrid Zone area in the extreme north extends through about 1½ degrees and is about 30,720 sq.mi. in area. The eastern part of this area is the low, wooded plain of the Gran Chaco where the mean annual temperature is 73° F. and the annual rainfall 63 inches. The western extremity is the arid plateau of the Puna where the annual average temperature falls below 57° and the rainfall to 2 inches.

The region comprising the provinces of San Luis, Catamarca, La Rioja, San Juan, Mendoza, western Córdoba and south-viestern Santiago del Estero has a scant rainfall and irrigation is necessary for agriculture. The climate is hotter than on the pampa. In Santiago del Estero the temperature sometimes reaches 118° F. The climate in the Mesopotamian district does not present great variation of temperature. The Gran Chaco region has the heaviest rainfall of any part of the republic. Tucumán has ample rainfall with a hot summer in the lower sections. Salta and Jujuy are arid in part but have moisture in the lower valleys. The winter months (May to August) are the dryest in all parts of the republic north of the Rio Negro. In the northern Andean region there is a well marked dry and rainy season.

In general in Patagonia the temperature falls progressing southward, though Santa Cruz is colder than Tierra del Fuego. The climate is everywhere healthy. The coldest part of the republic in winter is a point in the western part of Santa Cruz where the mean temperature is 32°.

Flora. — Each of the different climatic zones of Argentina has its own characteristic flora—the tropical and subtropical regions of the north. the arid plateaus of the west and north-west, the pampa and the desert steppes of Patagonia. The territory within and bordering on the Torrid Zone has a vegetation of tropical luxuriance. In the forests the palm predominates in the extreme north, intermingled south of the Rio Bermejo with heavy growths of native hardwoods distinguished by the evenness and clearness of their grain and colour. In the elevated, dry and saline regions of the north-west and west where the rainfall is slight, the vegetation is sparse and of the desert type. There are large thickets of thorny bushes with scant foliage; cacti, some of great size, are characteristic of this region.

The pampa, covering so large a part of the republic, has no native trees whatever. The only trees on the pampa have been planted by men, often about their habitations. The pampa, except where the land is under crops, is covered with grasses edible for cattle, divided into two main classes: pasto duro (hard grass) and pasto blando (soft grass). The pasto duro is the native grass which is coarse and of strong growth This has been replaced in a steadily growing area by pasto blando or cultivated pastures, grown from imported seed. This substitution is an important gain from the economic point of view. The natural fertility of the pampa and the amount of rainfall over most of its area make it readily adaptable to every kind of cultivation suitable to this climate.

The greater part of Patagonia is barren and there is no arboreal growth except in the well watered valleys of the Andean foothills. Here there are regions of good, cultivable land, pasture land and timber. The water courses and depressions of the steppes afford pasturage sufficient for sheep. In places the steppes have a thorny shrub growth.

In Tierra del Fuego there is much moisture and an Antarctic vegetation is found. There are rich pastures and the forest growth is vigorous. The forests of Tierra del Fuego and of the Andean foothill region of Patagonia include pine, cypress, cedar, fir and Antarctic beech.

The total forest region of Argentina is 346,260.9 square miles. The provinces having the largest forest area are Salta, Santiago del Estero, Santa Fé and La Rioja and El Chaco territory. The native varieties include choice hardwoods suitable for cabinet making and a very important collection of woods for tanning, dyeing, textile and medicinal purposes. Many of the trees are indigenous and are identified only by their Indian names. The better known varieties found in the forests of northern Argentina include the algarrobo, the jacaranda, the laurel, the white and red quebracho, the lignum vitae, rosewood, walnut and orangewood.

The most valuable single item produced by the forests of Argentina is the quebracho, used in tanning. The red quebracho is also a particularly valuable hardwood for railway sleepers (ties), bridge piles, fence posts, paving blocks and the like. The variety of plants suitable for tanning and dyes is particularly large, with 23 species of dye plants in the Mesopotamian region alone, but, except for quebracho, this source of wealth is as yet little exploited. Yerba mate (Paraguay tea), a shrub native to the forests along the Upper Paraná, is now being extensively cultivated in Formosa and Misiones territories.

The advent of European civilization in Argentina created an extraordinary change in the Argentine flora, as it now includes useful trees and plants from every part of the world, including the cereals, alfalfa and new grasses for the plains and all varieties of fruits. The Australian eucalyptus has been planted in many places and thrives on the pampa. Other varieties which have been planted extensively in the pampa region include the acacia, the sycamore, the paraiso and a variety of evergreens.

Fauna. — Comparatively few species of animals exist on the steppes of Patagonia. In the northern provinces of Jujuy and Salta the wildcat and chinchilla are found. The guanaco, a wild species similar to the llama, the alpaca, vicuña and the vizcacha, a native variety of rodent, inhabit the cordillera. In the tropical region of the north and on its borders are found several species of monkey, the puma, the jaguar, ferret, racoon, vizcacha, anteater and rabbit as well as other species usual to the South American jungle. On the pampa are found the fox, skunk, martin, deer and armadillo The hare is found everywhere and the Patagonian hare on the pampa and in Patagonia. The carpincho, a wild pig, and the nutria are found in many provinces. Among the fauna of Patagonia are the fox, martin, guanaco, puma, deer. rabbit and armadillo. The vizcacha is found in Rio Negro territory. In the lagoons of the Mesopotamia are two species of cayman, popularly known as yacuarés. Frogs and toads are found on the pampa.

Argentina has a great variety of bird life. The condor inhabits the Andes and the Córdoba Sierras. Among those that inhabit the pampa are hawks, falcons, owls, herons, storks, swans, partridge, plovers, ducks, chajas and many others known by native names. Parrots and similar tropical birds are found in the extreme north. There is a variety of rhea in Patagonia and on the pampa. Penguins are found in Tierra del Fuego.

The coast waters and the Plata and interior rivers have an abundance of fish. The common varieties of shell fish are represented. Among fresh water fish are trout, salmon, eels and the pejerrey, considered a great delicacy.

GOVERNMENT AND ADMINISTRATION

Population. — Since independence three censuses of the entire country have been taken, with results as follows: 1869—1,830,214; 1895—3,954,911; 1914—7,885,237. Official estimates as of 1941 gave a total of 13,318,320. A census of the Federal District (co-terminous with the city of Buenos Aires) in 1936 gave 2,415,142, but official estimates were 2,290,778. The entire metropolitan area was estimated at 3,666,585. The other principal cities were officially estimated as follows (Dec. 31, 1940): Rosario, 512,872; Avellaneda (a suburb of Buenos Aires), 386.372; Córdcba, 310,070; La Plata, 247,515; Tucumán, 157,480; Santa Fé, 147,583; Bahia Blanca, 115,148; Mendoza, 86,500; Paraná, 74,856.

The same (1940) estimates gave the population of the Federal District and the provinces as follows: Federal District, 2,386,103; Buenos Aires, 3,525,068; Córdoba, 1,291,188; Santa Fé, 1,559,542; Entre Rios, 752,247; Tucumin, 550,279; Corrientes,

526,318; Mendoza, 523,141; Santiago del Estero, 496,530; San Juan, 221,452; Salta, 217,565; San Luis, 200,135; Catamarca, 152,519; Jujuy, 115,789; La Rioja, 111,899. The national territories as a whole were officially estimated as 688,545. Normally reliable, unofficial (1940) estimates. however, placed the figure 50% higher, as follows: El Chaco, 329,400; La Pampa, 148,700; Misiones, 186,200; Río Negro, 135,200; Formosa, 56,900; Chubut, 86,100; Neuquén, 75,200; Santa Cruz, 18,700; Los Andes, 7,100; Tierra del Fuego, 2,300.

During the first half of the 19th century civil wars and despotic government seriously restricted the growth of the population but since the consolidation of the republic in 1860, it has increased rapidly. Attracted by the good climate and opportunities, European immigrants arrived in ever increasing numbers. It will be noted that the population approximately doubled in the period of 26 years intervening between the first census and the second and again in the period of 19 years intervening between the second census and the third. During the years of World War I the number of those who left the country exceeded the number who entered by 214,959 and during this period growth was only from the natural increase. From 1914 to the end of 1938 the total increase of population was 4,736,964 of which 3,801,005 resulted from the surplus of births over deaths and 935,959 was the surplus of immigration over emigration.

Vital Statistics. — For the five years 1934 to 1938 inclusive, births averaged 25 per 1,000 for the republic and deaths 12.2 per 1,000. Both declined steadily during the 1930's (1910–14 average: 38.87 births, 17.08 deaths per 1,000). The natural increase was 12.5 per 1,000 (20.79 in 1910–14). The birth and death rates were highest in Jujuy (44.9 births, 31.1 deaths per 1,000) and lowest in the Federal District (18.0 and 11.9) and the province of Buenos Aires (20.34 and 10.26).

The Race. — As in the United States, a new type has developed in Argentina as the result of a mixture of European races. There is less admixture of non-white blood than in any other American nation, with the possible exceptions of Canada and Uruguay. The native Indians have almost died out, the 1914 census showing 53,000, or less than .68%. Subsequent immigration has further reduced the proportion. Nearly all the Indians live in the national territories of the north, Los Andes, Formosa, Chaco and Misiones. The southern territories include a few hundreds each. In the thinly populated northern provinces, a fair portion of the population has some Indian blood, but the more populous provinces have practically no admixture. The number of Negroes in the country is negligible.

During the period of Spanish domination the great bulk of immigration was Spanish, so that the stock on which the republic was built was principally Spanish creole. Since 1857, approximately 43.5% of the net immigration has been Italian, and 27% Spanish. Although the Italian portion has materially declined since 1914, the Italian strain in the Argentine population is estimated at 30% and higher. The 1936 census of the Federal District disclosed that 36.06% of the inhabitants of Buenos Aires were foreign-born, 33.3% being still unnaturalized. Around 35% of the foreign-born were natives of Spain, 30% of Italy.

Migration. — Argentina has used every means to attract immigration. The Immigration Law passed in 1876 includes provisions that immigrants shall be lodged and boarded for a limited time, and transported to their destination within the country at the expense of the Government; shall be assisted in finding work and allowed to import their goods duty free. During the Alvear administration a group of the principal private railroad companies organized to co-operate with the Government in colonizing along their respective lines. They will sell small land holdings to settlers on long term payments, without profit on the sale of land, and in other ways assist settlers. A Jewish colonization enterprise owns large holdings of land in the pampa provinces. For many years there has been a great movement of immigration, partially balanced by a counter-movement of emigration, largely composed of "swallows," that is, of persons who came for a season to work in the harvesting. In the World War decade of 1911–20, 935,825 immigrants arrived, but due to heavy emigration the net gain was only 269,094. In the next decade, however, a net of 970,435 remained, out of 1,397,415 immigrants entering the country.

In 1860 there were 5,656 immigrants and the number increased each year to 39,967 in 1870. Thereafter years that established new records of entries were: 1873—76,332; 1885—108,722; 1889—260,000; 1906—302,000; 1908—303,000. From 1910 to 1914 the migratory movement was very heavy. In 1910 345,275 entered and 136,405 left, with a net gain to the country of 208,870; in 1913 364.878 entered and 219,519 left, net gain 145,359. The war prevented workers from leaving Europe in the same numbers as previously and the number who returned to their countries was greater than those incoming, resulting in a net loss of 153,930 in the years 1914 to 1918 inclusive. In 1919 the movement was about balanced and by 1923 it was restored to its pre-war proportions. In that year, a net of 160,799 entered the country, and the annual net averaged 97,000 through the entire decade. During the depression years 1930–33 inclusive, the average annual gain from immigration was but 7,500, but by 1938, the annual net had reached 40,000.

During the years 1857 to 1937 inclusive, the total number of immigrants was 6,544,874, and of emigrants 3,109,397, leaving a net gain to the country of 3,435,477. After deducting emigrants, the immigration in that period comprised national groups as follows: Italians, 1,485,537; Spanish, 930,478; French, 132,439; Germans, 87.233; Russians, 73,024; Turks, Syrians, etc., 64,375; British, 58,404; Austro-Hungarians, 43,682; Portuguese, 29,762; Poles, 20,387; Swiss, 18.488; Yugoslavs, 13,431; North Americans, 8,898; Belgians, 8,017; Danes, 7,157; Netherlanders, 5,517; Swedes, 1,896; other nations, 120,543. In 1938 and 1939 the net immigration was 25.849 and 4,671, with Italian, German, Spanish and Polish nationals leading.

Government. — The Argentine Republic consists of 14 provinces, 10 territories (called *gobernaciones*) and a federal district. The national constitution is dated May 25, 1853, with modifications in 1860, 1866 and 1898. It is modeled closely on the constitution of the United States. The form of government is similar to that of the United States, the principal difference being that in Argentina power is somewhat more centralized in the National Government, which, under certain conditions, can intervene in the administration of the provinces. The legislative power is vested in a congress of two chambers, the senate composed of 30 members, and the chamber of deputies, composed of 158 members. There are two senators from each province and two from the federal district. The constitution provides that there shall be one deputy for every 33,000 inhabitants. Senators must have been citizens of the country for six years and deputies for four years. Senators are elected by the legislatures of the provinces and in the federal district by a special body of electors, for a term of nine years, and deputies are elected by direct popular vote. The two chambers meet annually from May 1 to September 30 in Buenos Aires, the national capital.

The president of the republic is elected by electors voted for by the people. His term is six years and he cannot succeed himself. The president must be native born and of the Roman Catholic faith. He is commander-in-chief of the army and navy and appoints all civil, military, naval and judicial officers. The vice-president is elected in the same way as the president and is the presiding officer of the senate. The president in his executive capacity is assisted by a cabinet of eight ministers, appointed by him, who are ministers of the interior, foreign affairs and worship, treasury, justice and public instruction, war, navy, agriculture and public works. There is universal male suffrage. In 1912 the electoral laws were modified and the secret ballot system substituted for open voting. The benefits resulting from this reform have been very important.

Local Governments. — Each province has its own constitution and elects its governor, legislators and provincial functionaries. Each has its own judicial system and enacts laws relating to the administration of justice, the distribution and imposition of taxes and all other local affairs. All the public acts and judicial decisions of one province have full legal effect and authority in all the others. Under certain conditions the National Government has the

right to intervene in the administration of any province by the appointment of an interventor who becomes the executive head of the province and fills the other provincial offices with his own appointees. This right of intervention has been invoked from time to time. Under Provisional President Uriburu (1930–32) there were interventions in 12 of the 14 provinces.

The territories are under the direct control of the National Government. The city of Buenos Aires is a federal district and is not a part of the province of Buenos Aires. It has a municipal council of 22 members elected by the taxpayers. The executive head is the *Intendente Municipal*, or mayor, who is appointed by the president of the republic.

Justice. — The judicial system is made up of federal courts and provincial courts. The supreme court of the nation in Buenos Aires has five members. There are five federal courts of appeal, each composed of five members, located in the federal district and at La Plata. Córdoba, Paraná and Rosario. There are also federal district judges. one at least in each province. The provinces each have their own judicial organization headed by a supreme court, with minor courts. There is also a system of local courts in the city of Buenos Aires. The federal courts deal with cases of national character, or in which different provinces or inhabitants of different provinces are parties. The judges of the federal supreme court and courts of appeal and the district judges are appointed by the president of the nation for life, with the approval of the senate.

Educational System. — Argentina has very complete and advanced legislation governing education. The constitution provides for free and compulsory primary education and the laws apply this to children from 6 to 14. The present school lam dates from 1884. Public instruction includes no religious instruction. Elementary education is under the control of the provincial Governments in the provinces. In the federal district and the national territories it is under the direction of the National Council of Education appointed by the president. The nation subsidizes primary education in the provinces. Furthermore, to combat illiteracy, a law was passed in 1905 providing for the establishment of nationally supported elementary schools in certain provinces. These, known as Lainez schools, are for the most part in isolated rural districts. In 1926 there were 3,004 of them; by 1932 the number had increased to 5,029, with an enrolment of 702,609. Within the next five years 50 more were established, and enrolment rose to 831,994. The budget for 1938 allotted 48,966,618 pesos to their support. Except for the Lainez schools, elementary education is supported by the provinces. In 1936, there were, all told, 12.286 public elementary schools, with 1,733,133 pupils. The 1938 national budget allotted 131,901,526 pesos to primary education Expenditures for 1939 were estimated in excess of 136,000,000 pesos.

Secondary or preparatory instruction is given in 258 public secondary schools, whose enrolment in 1936 was 105,350. There are likewise numerous private schools, many of them foreign-controlled and designed for foreigners and first-generation natives. During 1938, as a result of an investigation of charges of indoctrination of alien ideas in such schools in La Pampa territory, foreign schools were placed under more stringent regulation than formerly.

There are, principally in Buenos Aires, facilities for professional education too numerous to describe. These include commercial, professional and technical education, and instruction in the arts and crafts, languages, accounting, mining, agriculture, arts, music, dramatic art, dressmaking, etc.

The three census takings since the establishment of the republic have shown the following proportion of illiterates:

	Census, 1869	Census, 1895	Census, 1914
Men, per thousand	748	508	349
Women, per thousand	817	585	419

These figures show the progress accomplished by the educational system in the reduction of illiteracy. The great numbers of illiterate adults who have constantly arrived from abroad over a long period should be taken into consideration in connection with the figures of illiteracy, also the fact that the development of Argentina on anything like its present basis is comparatively recent. In 1913 illiteracy was lowest in the province of Buenos Aires, where it was 308 per thousand, and highest in the provinces of Jujuy and Los Andes, which had 674 and 667 per thousand. respectively.

Universities. — Argentina has six national universities, the national universities of Córdoba, founded in the 17th century; Buenos Aires, founded in 1821; La Plata, founded in 1906; the Littoral (divided between Rosario, Santa FC, Paraná and Corrientes) and Tucumán, both founded in 1918; and Cuyo, founded in 1939. The private Catholic university is at Buenos Aires.

The University of Buenos Aires is the most important and attracts students from other South American countries. It comprises six faculties, law and social sciences, medical sciences, philosophy and letters, economic sciences, agronomy and veterinary science. In 1926 there were 20,746 students enrolled in all the universities with 1,893 teachers. The cost of university instruction is approximately 20,000,000 pesos annually. The total annual expenditures of the nation and provinces on education are 236,000,000 pesos, or about one-fifth of the aggregate revenues of the nation, provinces and municipalities.

The Press. — Argentina is the most important Spanish-speaking country in the Western Hemisphere in publishing and printing. Books published at Buenos Aires circulate throughout the Spanish-speaking world. The industrial census of 1935 showed 2,187 establishments engaged in printing and allied enterprise, employing 26,795 persons, with an annual production aggregating 140,191,446 pesos. Of these, 1,302, with 19,436 employees, were located in the federal capital. Out of 844 dailies, periodicals and reviews being published, with 10,119 persons employed, 238, with 7,808 employees, were in Buenos Aires. The great daily *La Prensa* of Buenos Aires is ranked as one of the world's four best newspapers, and many regard its rival *La Nación* as its equal. Two important English-language dailies and several German and Italian newspapers are published.

Museums. — The most important museum is at La Plata, capital of Buenos Aires province. It has a large collection of specimens of the plant, animal and insect life of Argentina and South America and departments of geology, anthropology and mineralogy. The National Art Gallery (Museo de Bellas Artes) at Buenos Aires is small and has the nucleus of a collection of works of European painters, modern and old, as well as a number of works by contemporary Argentines and some interesting specimens of American Colonial art. The National History Museum, the Mitre Museum and Library, the Fernández Blanco Museum and the Municipal Museum, all in Buenos Aires, are small collections of objects connected with Argentine history. The Natural History Museum and the National Library are also in Buenos Aires.

Religion. — The constitution provides that the State shall support the Roman Catholic Church, but that there shall be liberty for all cults. The president of the republic must be a Roman Catholic. The great majority of the population profess this religion and there is no other religious movement that includes any important proportion of the population. The bulk of the immigration has been Catholic. There are several small churches of Protestant denominations in Buenos Aires, attended mostly by foreigners.

While the Argentines as a race are strongly Roman Catholic, the church confines itself to its function of spiritual guidance, especially in the more populous districts, and religious considerations enter very little into political issues. Instruction in the national and provincial schools is without religious bias. The president of the republic has the right of presentation to bishoprics and approves the bulls of the pope in accord with the supreme court. They require a law when they contain general and permanent provisions.

FINANCE

While the national expenditures have increased rapidly to keep pace with the needs of a growing country the opinion of com-

petent authorities is that they have not been excessive in view of the national resources. The financial situation of the Argentine Government is generally regarded as strong

Revenues. — For many years Government accounts have regularly shown an annual deficit. The excess of expenditures over revenues was due to various causes, but primarily to the unwillingness of congress to provide sufficient additional revenues to meet steadily increasing public expenditures. Much of the deficit, however, actually represented public works expenditures which, while properly capital items, were not segregated, so that no definite statement of their amount can be made. The 1935 budget was balanced, officially, and showed an actual surplus of 25,000,000 pesos. A nominal surplus was shown in 1936. In 1937, while expenditures ran ahead of estimates, cash revenues were very considerably greater than had been expected, and a 10.000.000 peso surplus existed. Disastrous crop failures in 1938, however, brought about a serious economic decline, and rigorous retrenchment A revised budget for the year called for total ordinary expenditures of 995,684.539 pesos and estimated revenues at 918,567,000 pesos, a deficit of 77,200,000 pesos. Estimates for 1939 presumed a further deficit of 134,465,546 pesos even after making a blanket allowance of 60,000,000 pesos in further economies. Actual revenues for the year, however, cut the anticipated deficit to 60,500,000 pesos.

Main Classifications of Revenue and Expenditure, 1939 Budget Estimates
(in thousands of paper pesos)

Government revenues and expenditures have mounted greatly since the World War of 1914–18. In 1919 they were, respectively, 401,000,000 and 427,900,000 pesos. In recent years at least, the increase can be ascribed in part to the falling value of the peso in terms of dollars and pounds sterling, as the greater part of the national debt is payable in those currencies. In addition the important Law for the Unification of Taxes, enacted in Dec. 1934, had considerable effect. Under this law the provincial Governments gave up their right to levy taxes on commodities already taxed by the Federal Government, in return for block grants. The arrangement is to have a duration of 20 years, with the possibility of extension for a further 10 years. Besides the effect of enlarging the national budget and of facilitating greater freedom of trade within the republic, the law, through other provisions, imposed a degree of control on the borrowings of the provincial Governments.

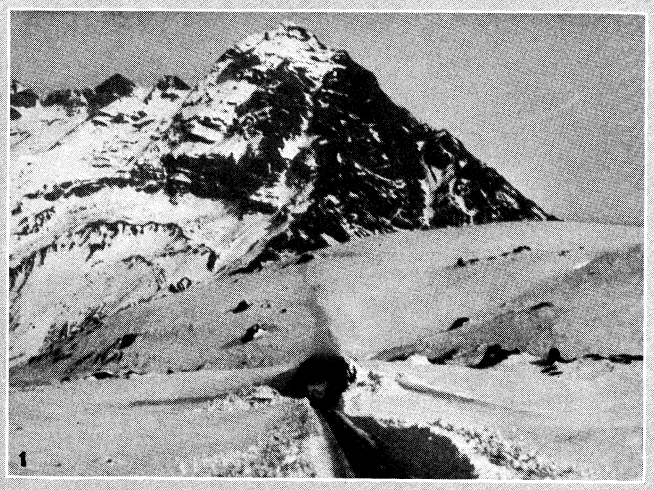
Foreign Investment. — Like the United States in an earlier period, the economic development of Argentina has been financed principally by foreign capital, either in the form of loans to the Governments used for public works, or foreign capital invested in railroads, public utilities and to some extent industries. The need for foreign capital still exists and will exist for many years to come. The chief source of capital has been Great Britain. During the World War the European money markets were closed to Argentina and the necessary accommodation was secured in the United States. Since 1918 the United States has continued to be the principal source of new capital, especially in loans. In 193j it was estimated that 45% of the investment in industry was foreign capital, British and North American direct investment in nianufacturing and utilities representing a third of the whole. British interests control most of the railways of the country and have an important stake in the United States-dominated meat-packing industry. Considerable additional British capital is in agriculture and livestock. French, German, Netherlands, Belgian, Italian, Norwegian and Swedish investment are also important.

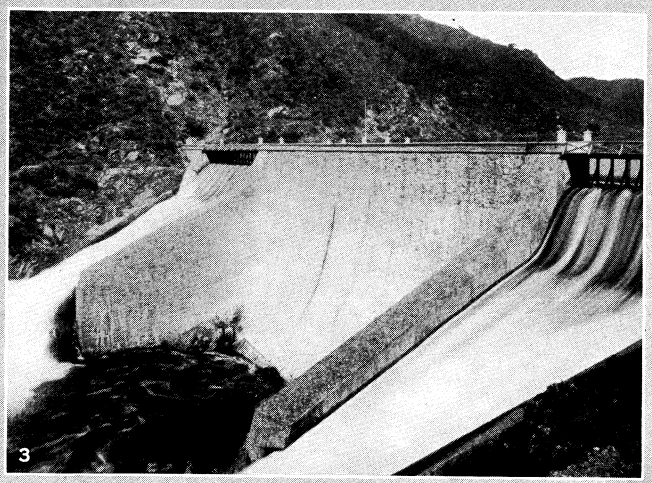
As with the United States, the economic situation of Argentina was greatly consolidated during the World War, which created an unlimited demand for all Argentine products at prices without precedent. The large trade balances in favour of the country during the years of the war and those immediately following increased the national wealth and the gold stock.

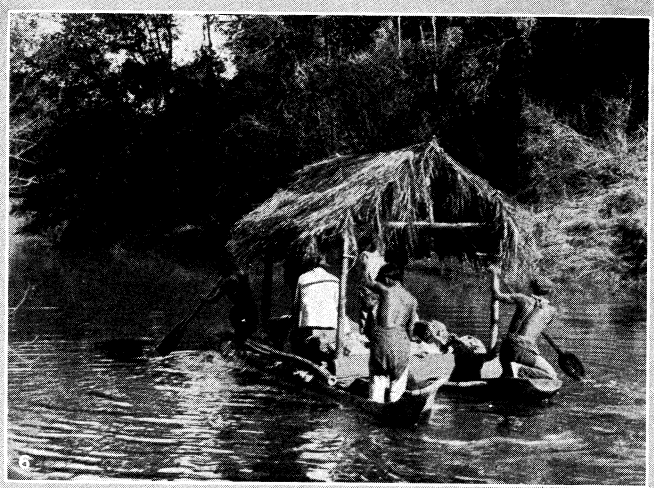
Public Debt. — Due to economic progress and to the excellent record of promptness in meeting obligations, the securities of the Argentine Government itself command a higher price in world markets than do those of any other South American Government. During the 1920's, at a time when bond issues of other Governments were made at 7% and 8%, Argentine loans were floated at 6%. More recently many of those issues have been called and new issues made at a lower interest rate. Thus, in Oct. 1938, a $25,000,000 bond issue bearing 4½% interest was floated in New York at 9jf. No Argentine Government bonds have been in default either as to principal or interest, although some of the provinces and other subdivisions have felt compelled to default and to make readjustment. The dollar debt of Argentina (Jan. 1, 1939) was made up of four national issues totalling $151,603,000, 14 provincial issues totalling $75,175,290 and three municipal issues totalling $7,020,000, a grand total of $233,798,290. Two municipal issues were the only ones in complete default. In addition to the dollar indebtedness Argentina had external obligations as follows: £55,953,338; 129,932,450 Swiss francs; 90,785,000 Spanish pesetas; 40,085,500 French francs; 11,667,900 Italian lire; and further external indebtedness convertible into internal obligations of 3,527,100 gold pesos. On June 30, 1939, the internal indebtedness was 5,289,075,000 pesos, of which 3,574,021,000 pesos was national debt. In March 1939 two internal loans, of 100,000,000 pesos at 4½% and 50,000,000 pesos at 4% respectively, were issued.

Monetary System. — The Argentine monetary system is among the most stable in South America. Despite the uncertainties attendant upon the finances of a country whose prosperity depends preponderantly upon export of commodities whose value fluctuates widely in world markets, Argentina has maintained a relatively stable currency throughout the 20th century. In 1899. after a long period of unsatisfactory national finance, there was created, under the so-called Conversion Act, what was in effect an internal currency, *moneda nacional* (national money), represented by the paper peso. This was redeemable in gold pesos of 1 6129 grams of a standard of 9/10 fine gold at a fixed value of 44 cents gold for one paper peso. The gold peso, therefore, was $0.9648, par value, the paper peso $0.4245 in the U.S. dollar then current. The Caja de Conversión (Conversion Office) was given control of gold-buying and selling in order to maintain this ratio

At the outbreak of the World War in 1914, gold payments were suspended and not resumed until 1927. Meanwhile, the paper peso sank as low as 31½ cents U.S. in value in 1921, but gradually regained its legal level. Again, on Dec. 16, 1929, at the outset of the world-wide depression, gold payment was suspended, In the years immediately following, the Conversion system proved too inflexible, and the paper peso fell in international exchange. In 1931, therefore, a new system was inaugurated. In brief, it sought to stabilize peso quotations (initially in terms of dollars, after 1933 in relation to sterling) by restrictions on the buying and selling of foreign exchange. Under this plan exchange derived from exports was required to be sold to the exchange control commission of the Banco de la Nación (and after 1935 to the newly created Banco Central) with the dual purpose of eliminating short time fluctuations and of maintaining a fixed value in gold. The exchange control commission then disposed of this exchange in a rather well defined order of preference, with debt service coming first, then imports in order of their necessity. Should exchange be scarce the prospective importer might be denied it and be obliged to use what has come to be called in foreign exchange transactions the "unofficial peso," whose value has fluctuated considerably, but is always more costly to the importer than the "official peso." A part of the exchange policy has likewise been to give preference to exchange desired to cover imports from countries with which Argentina has a favourable trade balance. When the United States abandoned gold in 1933, the official rate was







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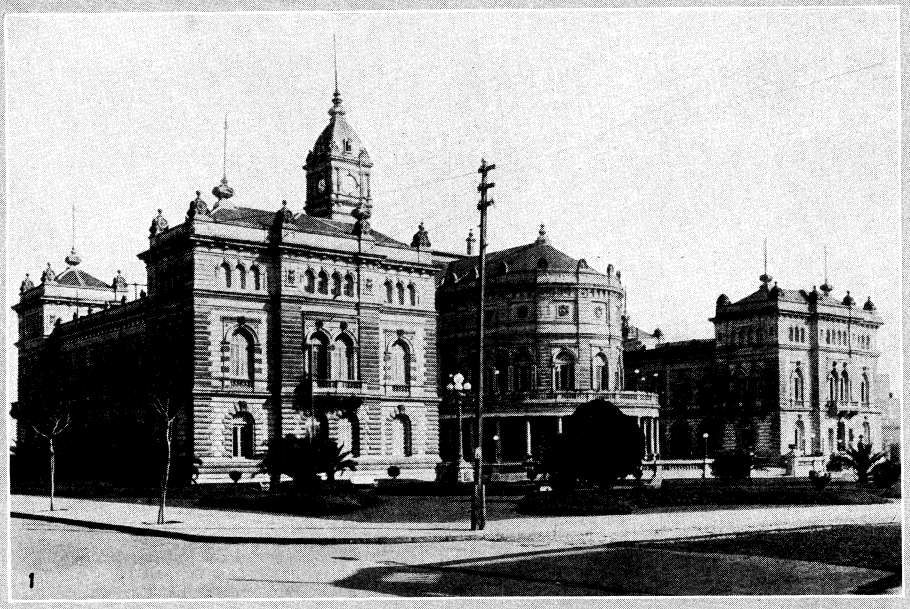
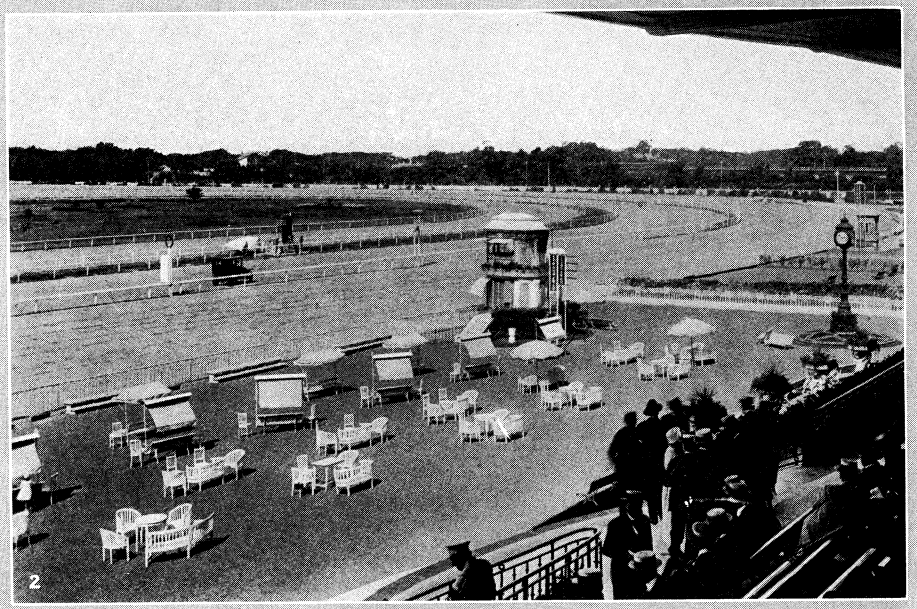
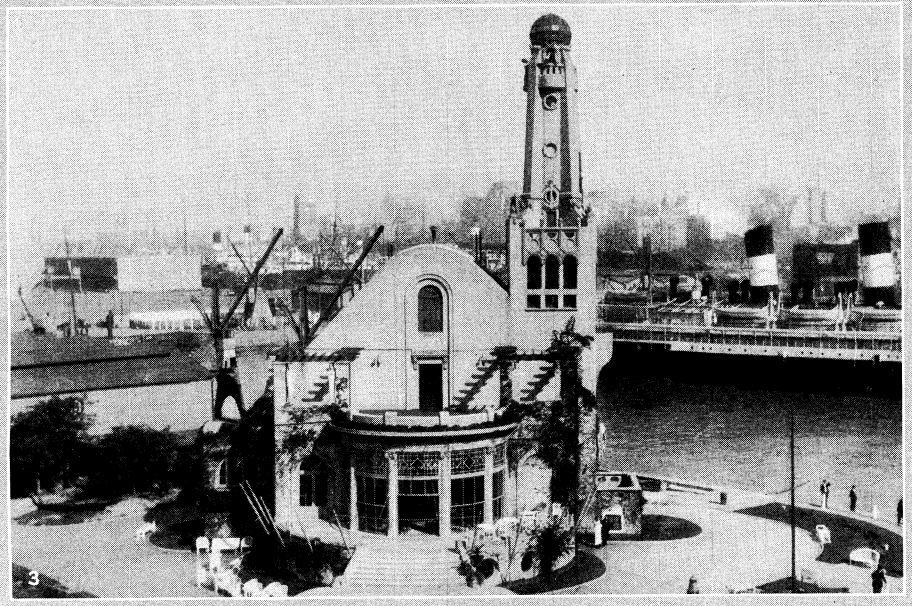
RIVER AND MOUNTAIN SCENERY IN ARGENTINA

1. Snow shed of the Transandine railway at Portillo, in the Andes, completed in 1909 and closed in 1934 because of landslides
2. View of the Lujan or Mendoza river, which supplies the water used for the irrigating system of the plains near the foot of the Sierra de los Paramillos
3. The San Roaue dam at Cordoba, one of several built for irrigation purposes in Argentina
4. The cataracts of Iguazu Fails, South America's greatest natural wonder, on the borderland between Argentina and Brazil
5. Cattle grazing on the Argentine pampas
6. A small raft navigating the Iguazu river on a trip to Iguazu Falls. The raft is roofed with evergreen brush to protect the white travellers from the sun







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PUBLIC BUILDINGS AND AMUSEMENT CENTRES IN ARGENTINE CAPITALS

1. The municipal building in La Plata, capital of the province of Buenos Aires
2. Race track of the Argentine Jockey club as seen from a grand-stand
3. Buenos Aires Yacht club, showing the harbour in the background
4. Statues in front of the Government palace at La Plata

tied to the pound sterling at the rate of 15 pesos to the pound, with some changes later. On Nov. 8, 1938, the rate was fixed at 17 pesos to the pound. In Nov. 1939, however, the official rate was fixed to the dollar at 26.81 cents per peso. The uncontrolled peso, however, averaged 23.1 cents U.S. in value in 1939 and closely approximated that figure in 1940.

Banking. — Argentine banking was thoroughly localized and unsettled until the formation in 1891 of the Banco de la Nación Argentina, which thereafter filled a position of great importance, acting as the Government's financial agent, while at the same time it established a wide network of branches throughout the country for the conduct of commercial banking business. The autonomous Caja de Conversión (Office of Conversion), was founded shortly afterward, with its main purpose the maintenance of the legal ratio between theoretical "money of account" and actually circulating currency. The need for a greater elasticity of currency, however, and for reform in general brought about an investigation of the system by British banking experts in 1933. Upon the basis of the reforms recommended, a group of financial reconstruction measures, with the Central Bank Bill as a nucleus, was adopted by the Government early in 1935, and the Banco Central de Argentina (Central Bank of Argentina) was established on May 31 of that year. The new institution took over the functions of the now abolished Caja de Conversión, together with those of sundry other autonomous bodies, as the Rediscount Committee and the Redemption Board. It also became Government depository, and was given general supervision over the banks of the country.

The same legislation of 1935 modified the existing regulations for the Banco de la Nación and the Banco Hipotecario, both Government institutions, and created several other financial organizations, notably a committee of experts representing various economic activities in an advisory capacity to the Government in financial and monetary reconstruction. In their essence the five different lams enacted created a unified system with the Banco Central to give unity to previously scattered functions, as the care of the circulating medium, rediscount operations and the regulation of the foreign exchange value of the national currency. The Banco Central is capitalized at 30,000,000 pesos, nith Government participation to the extent of 10,000,000, an equal sum being divided among the existing banks (including foreign banks) capitalized at 1,000,000 pesos or more. The balance was held for future allotment among banks attaining the minimum capitalization.

The Banco Central had (March 31, 1940) assets and liabilities of 2,567,502,860.12 pesos. Forty-one commercial banks, which together handle approximately 97% of the nation's banking business, had assets and liabilities of 5,493,316,300 pesos.

DEFENCE

Army. — Military service is obligatory for all citizens 20 years of age and lasts one year. After that the conscripts pass to the reserves. From 21 to 29 years of age they belong to the standing army, between 30 and 39 to the national guard and between 40 and 45 to the territorial guard. It is estimated that there are approximately 600.000 ex-conscripts in the three reserves. Students who can comply with certain conditions serve only three months. The permanent army numbers about 47,240 combatants, enlisted men and officers. The military college at San Martin near the national capital prepares all future officers. In 1937 it had 910 cadets. The Superior War-Training school provides training for officers. In 1936 there were 106 army aircraft in service.

Navy.—The Argentine navy had its origin in the Wars of Independence, in the second decade of the 19th century. Although its record in that, as well as later wars, was a commendable one, it was not until the closing years of the 19th century that boundary disputes and threat of war with Chile induced the Government to develop an appreciable navy. Throughout the 20th century a keen naval rivalry with Chile and, especially, with Brazil has been maintained.

In 1939 the Argentine navy consisted of a sea squadron of 2 battleships, the "Moreno" and the "Rivadavia," completed in 1914 and 1915, 3 cruisers, including "La Argentina," completed in 1938, 16 destroyers, 3 submarines, 6 mine-sweepers and 3 auxiliary ships and a river squadron of 4 gunboats and 8 mine-sweepers. Thirty planes are attached to the sea squadron, 20 planes to the river squadron.

There are two principal naval bases, Puerto Belgrano and Rio Santiago, with aerial forces of 70 and 35 planes respectively. These have dry docks and facilities for repair and construction of ships and arms. In addition there is a navy yard at Buenos Aires and an artillery arsenal at Zárate.

Under the navy come the following institutions: a war college for commanders, a naval and aviation school (with 470 midshipmen). a training-ship for midshipmen, three mine-sweepers for midshipmen training, a school for enlisted men and petty officers and two training-ships (one cruiser and one frigate) for sailors.

Naval personnel (1939) included: 1,065 officers, 1,200 petty officers, 3,500 corporals, 6,500 enlisted men, 5,000 conscripts (serving two years) and 3,000 enlisted men (maritime prefecture police).

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PRODUCTION AND TRADE

Argentina is a producer of agricultural and pastoral products on a vast scale for export, purchasing the bulk of requirements of manufactured goods abroad. During the first quarter of the 20th century the republic progressed from a comparatively obscure position to one of considerable importance among the nations of the world, and to a place in the first rank of food-producing countries This rapid progress is the result of the great colonization movement which transformed the pampa. It can be said that the entire country lives from the pampa as the industries of the outlying districts have been developed primarily to supply the pampa, notably, the sugar industry of Tucumán and the wine industry of Mendoza. The pampa in turn lives on export. Its development has been made possible by the growth in population and the industrialization of the European countries, especially England. Depending so largely on export trade Argentine prosperity reacts quickly to changes in the economic situation of the European countries, which are its principal customers, and suffers during times of depression in those countries.

Agriculture. — Argentina is essentially an agricultural country, there being no other industries comparable in any way with crop farming and cattle raising, which, with their allied industries such as the elaboration of meat, sugar and wine, maintain the bulk of the population. Practically all items of production are articles of prime necessity which the world will need in increasing amounts. Although agriculture has had such a great development the full possibilities of the country have by no means been realized. The total land area is estimated at 279,271,300 hectares (689,409,000 ac.), distributed as follows:

Land According to Actual Development

Type	Acres	Per cent of total
Under cultivation	74,130,000	10.8
Pasture	306,404,000	44.4
Unproductive land, mountains; lakes and rivers	185,325,000	26.9
Forested regions	123,550,000	17.9
	689,409,000	100.00

Land According to Potential Development

Especially adaptable for cereal crops	197,680,000	28.7
Adaptable for other agriculture and for pastoral purposes	269,339,000	39.1
Forested regions	123,550,000	17.9
Unproductive areas	98,840,000	14.3
	689,409,000	100.00

The area under cultivation has increased by almost 25% since 1920, but it still represents only a small part of the cultivable portion. Even in Buenos Aires, the most highly developed province, there is still much room for growth. This should come with the extension of irrigation and transportation and the growth of the population. On the pampa the rainfall is generally sufficient,

but in the provinces of the west and north-west, nearly all farming is done by irrigation.

The principal agricultural problem confronting Argentina is that of the tenant farmer. A major part of the cultivable land is held by large landowners, many of whom live in Buenos Aires, or are absent from their farms a great part of the year. The crops are produced by tenants, many of whom wander the country in search of work, and who, by reason of high land values, only occasionally succeed in acquiring holdings for themselves. The need for settling stable groups of small farmers on lands of their own has long been recognized, but progress in that direction has been small. Private attempts at correction have usually failed because of the rapid increase in land values. Legislation to bring the assistance of the Federal Government to capable farmers who wish to acquire their own land has been drafted, however, and there is confidence that the program will bring satisfactory results.

Wheat. — Wheat is the leading crop, constituting in some years about $\frac{1}{5}$ the total value of exports. Argentina is one of the three leading wheat exporters of the world. The development of wheat production on a large scale has been comparatively recent, as in 1890 Argentina had only about 1% of the total world production. Over 95% (98% in 1938) of the wheat crop is produced in the provinces of Buenos Aires, Santa FC, Córdoba and Entre Rios.

The extension of the present wheat belt is limited because of the fact that the area to the south and west of it has an average rainfall less than 19in., insufficient for wheat, but the introduction of dry farming and irrigation will eventually permit extension. Weather conditions at times diminish the crop, principally droughts, late frosts and hail. In less degree rust and grasshoppers are a menace. The average yield per acre in Argentina is not high, 12 bushels against 17 for Canada and 30 for England. The yield per acre has already been increased and will be further increased with the development of more intensive methods. The total area sown to wheat increased from 3,379,000 hectares in 1900 to 7,216,798 hectares in 1939–40. Exports were 1,940,356 metric tons in 1938 and 4,745,944 in 1939, compared with 6,613,342 in 1929, the highest on record. Annual production averages somewhat over 6,000,000 metric tons (5,029,000 in 1937–38; 9,150,000 in 1938–39, second highest on record; estimates for 1939–40 were 3,212,000). From 30% to 40% of the production is milled within the country.

Other Crops. — In point of exports maize is the second crop in value. Argentina has second place as a maize-growing country after the United States and is the first exporter of maize. The best corn belt lies in the north-east section of Buenos Aires province where 50% of the entire crop is produced.

In 1939 production of maize was 4,864,000 metric tons, a slight increase over that of the drought year 1938 (4,424,000 in 1938, 9,134,730 in 1937 and 10,051,206 in 1936). Exports were 2,642,150 metric tons in 1939 (2,641,527 in 1938 and 9,087,363 in 1937).

Linseed ranks after wheat and maize in importance as an export commodity. Little progress has been made locally in exploiting the textile fibre of this plant, and it is cultivated for its seed. Argentina is the world's leading producer, with over half the world exportation. Linseed is produced mainly in Buenos Aires, Entre Rios and Santa Fé provinces. In 1939–40, 3,075,496 hectares were in linseed. Production was estimated at 1,127,000 metric tons (1,410,000 tons in 1938–39). Exportation for 1939 was 1,183,203 metric tons (1938: 1,265,150), against a record high of 2,027,609 metric tons in 1932. Two other cereal crops, oats and barley, constitute export items of importance. The area sown with oats in 1939–40 was 1,394,639 hectares. Production in 1939 was estimated at 924,000 metric tons (738,000 in 1938). Exportation was 359,791 metric tons (1938: 381,795 tons; 1937: 403,397). In 1939 there were 858,555 hectares sown with barley. Production was 400,000 metric tons against 480,000 in 1938 and 513,500 in 1937. Exportation was 259,513 in 1939 (211,360 in 1938 and 254,496 in 1937). Rye and birdseed also are raised extensively for export.

Cotton raising has undergone great development since 1930. From 1,738 hectares under cultivation in 1909–10, the area in cotton increased to 195,000 in 1933–34 and averaged 380,780 hectares and 59,700 tons production of cotton fibre a year for the five-year period 1934/35–1938/39. In 1938–39, 406,700 hectares were sown, producing 70,900 metric tons. Exports in 1938 were 22,361, practically all to Germany, but declined to 19,400 tons in the bumper year 1939. Alfalfa, sugar, yerba mate and grapes are important for domestic consumption. Acreage in alfalfa (5,560,000 hectares in 1937–38) is second only to wheat. Sugar cane production (180,000 hectares in 1938) totalled 521,000 metric tons in 1939, against normal consumption of 425,000 tons Sugar cane is produced principally in Tucumán, Jujuy and Chaco. The southern territory of Rio Negro produced 391 tons of beet sugar in 1938. Yerba mate (Paraguay tea), the national beverage, was formerly imported from Paraguay and Brazil in large quantities, but Argentina has now become the world's greatest producer. From 73 hectares in 1909–10 and 45,503 in 1934–35, the area devoted to yerba mate cultivation increased to 63,000 in 1937–38, although a third the domestic consumption is still imported, most of it from Brazil. In 1938, domestic production was 106.330 metric tons.

The grape and wine industry centres in Mendoza and, with fruit culture, makes the prosperity of that province. It is also carried on considerably in San Juan. (See under Grape and Wine Industry.)

Fruit Culture. — The longitudinal extension of Argentina is so great that it has the climate necessary to produce any variety of fruit. Mendoza is the leading fruit producer. For many years fruit has been exported to Uruguay and Brazil and since 1920 to North America and Europe. Pears, apples, grapes, plums, pomegranates and various melons, particularly the honey-dew, are the principal fresh fruits exported. In 1939, 52,700 tons (net weight) of fruits were exported, an all time high. Of the fruits exported, 53·2% were pears, 22·5% were apples and 17·6% were grapes.

Pastoral. — Cattle raising is the oldest and most characteristic of the Argentine industries. From the beginning the economic structure of the country has been built up around it. Crop farming, which requires a higher degree of economic development, early in this century became more important in value of output but that did not hinder the continued development of the cattle industry. The gaucho, or Argentine cowboy, is still regarded as the typical son of the pampa although his setting has changed in modern times. The large cattle breeders formed the first aristocracy and many of them are still of high economic and social position. Hides and tallow were the first trade articles. Live cattle have always been exported to the neighbouring countries and in the latter part of the 19th century England began to import cattle from Argentina. To cater to the British trade it was necessary to improve the native or "criollo" race. The more progressive breeders began to import pedigreed stock, bulls, cattle, sheep and swine, from abroad, mostly from England. English breeders also went into the business in Argentina. Since that time every effort has been made to improve the Argentine race. The best breeding animals have been bought abroad and the highest prices paid. There are rural associations devoted to this end and the numerous cattle shows attract great interest.

Meat Packing. — Frozen meat was first exported from Argentina in 1877. Previously meat was exported, dried, principally to Brazil and Cuba. An English concern in Argentina built the first freezing plant in 1883. Two other large meat preparing plants were established soon after. The number has increased steadily until the industry now represents a vast investment and fills a very important place in the economic life of the country. The industrial census of 1935 showed that there were 21 freezing plants, employing 26.210 persons, with an annual payroll of 44,006,160 pesos. Other meat-packing activity was carried on by 227 establishments, employing 1,783 persons. In 1938, 7,069,397 cattle, 7,838,557 sheep and 1,244,737 swine were slaughtered. The exports of the meat industry comprise approximately a third of the total exports (37% in 1938), the proportion varying from year to year. Its products include chilled and frozen meat, salted and canned meat, meat extract, hides and a large number of by-products, as bones (for fertilizer), tallow and margarine, The

packing companies are, with one important exception, controlled by foreign, principally British and North American, interests. The cattle industry has had its periods of prosperity, but the rampant economic nationalism of the world in the decade preceding the outbreak of the European war in 1939 so restricted the export trade that the industry's normal state was one of depression. Over half the total livestock products, and between 80 and 90% of the chilled and frozen meat was taken by Great Britain, largely because of the tremendous British exportation to Argentina. The market of the United States is practically closed to Argentine meat except in canned form, by tariff restrictions and the subterfuge of sanitary regulation.

The bulk of the meat is shipped chilled or frozen. Chilled meat must be consumed within 40 days after slaughtering. England takes principally chilled meat and the Continent frozen meat, for which the lower grades of cattle are used. European war demands more than doubled the export volume of frozen beef. Meat exports in recent years have been as follows (in tons):

	1935	1936	1937	1938	1939
Frozenmutton	49,881	50,035	51,660	47,623	54,772
Frozen beef	20,352	38,738	81,655	96,486	109,059
Chilled beef	353,817	363,890	353,103	347,964	350,055
Preservedbeef	56,178	59,145	62,925	60,474	80,744

Cattle raising is carried on principally in the provinces of Buenos Aires, Corrientes, Santa FC, Córdoba and Entre Rios. These same provinces and Santiago del Estero, along with the territories of Chubut, Santa Cruz, Rio Negro and La Pampa are sheep-raising centres. Buenos Aires province has approximately a third of the cattle, sheep and swine of the country. The livestock census of 1937 showed 33,100,512 cattle; 43,790,166 sheep; 3,975,716 swine; 8,527,181 horses; 4,875,990 goats; 905,041 mules and asses; and 43,285,311 poultry. The oniy outstanding changes from the previous census (1930) were in a slight decline of roughly 10% each in horses, goats and mules, and a 20% increase in poultry. Since 1922 the number of swine has almost tripled.

The number of sheep has fallen off since 1907, when the herds numbered 67,000,000, but after a progressive decrease to 36,000,000 in 1922, it rose to nearly 44,000,000, according to the livestock census of 1937. The greatest increase in recent years has been in Patagonia. Exports of wool in 1938 were 151,877 metric tons (116,101 in 1937).

Hides, which were one of the first trade articles of the country, still form an export item of value. Exports of dry and salted ox hides, horse hides and sheep and goat skins in 1937 aggregated 165,656 metric tons, and in 1938, 157,681.

Mining Industry. — Apart from building materials the only mineral production of importance in value is petroleum. Gold, silver, lead, zinc, copper, wolfram, tin, vanadium, asphalt, sulphur, asbestos, mica and talc are mined in a small way in different parts of the republic, mostly in very old workings, but the aggregate value of the output is not great. Salt is worked in various deposits for domestic consumption. Deposits of low grade coal and lignite have been located in various parts of the republic, the best quality being found in the province of Mendoza. Practically all the coal consumed however is imported, mostly from England. Coal imports in 1937 were 3,074,835 tons. Marble and onyx are quarried in different regions and there are deposits of semi-precious stones. It is claimed that iron and manganese have been found in large quantities in the provinces of Córdoba, Santiago del Estero and Tucumán. There is no mineral export of any importance and practically all the metals consumed in the country are imported.

Petroleum Production. — Petroleum was discovered in 1907 in the vicinity of Comodoro Rivadavia in Chubut (Patagonia). This oil region, which extends into the northern part of Santa Cruz, is still the principal producing field of Argentina, although fields in Salta and in Neuquén territory are important. The combined output is not highly significant when compared with the value of other Argentine products. The Government has taken the lead in petroleum development and nearly half the national production is from State-owned wells. Recent Government policy has been to restrict further expansion of private enterprise, although domestic production is sufficient to take care of only a little more than half of the country's needs. Production started in 1907 and increased slowly to a total for the country in 1915 of 81,580 cubic metres. In 1916 private companies began operations. Since then it has increased steadily, reaching 2,958,996 cubic metres in 1939, of which 1,625,204 was from State-owned wells. Of this, around 80% was from the Comodoro Rivadavia field. Production in 1939 increased 9% over that of 1938 (1938: 2,714,823 cubic metres). In 1939 Argentina ranked 11th in world production.

Petroleum Production in *Argentina* (1917-39)
(figures in cubic metres)

	Fiscal (State) production	Private production	Total
1917	181,704	10,667	192,371
1918	197,596	17,281	214,877
1919	188,112	23,188	211,300
1920	227,156	35,339	262,495
1921	278,725	48,180	326,905
1922	348,888	106,610	455,498
1923	407,186	123,023	530,209
1924	553,921	186,776	740,697
1925	624,170	328,029	952,199
1926	743,825	504,293	1,248,118
1927	822,931	549,089	1,372,020
1928	863,604	581,468	1,442,072
1929	872,171	620,896	1,493,067
1930	828,013	603,094	1,431,107
1931	873,592	987,821	1,861,413
1932	902,255	1,186,576	2,088,831
1933	921,788	1,254,771	2,176,559
1934	835,565	1,394,056	2,229,621
1935	943,830	1,328,775	2,272,605
1936	1,141,078	1,316,999	2,458,077
1937	1,237,313	1,438,420	2,675,733
1938	1,430,599	1,284,224	2,714,823
1939	1,625,204	1,333,792	2,958,996

Forests. — The forest area and timber resources are given under Flora. Forest products comprise one of the three main classifications of Argentine exports but this is made up entirely of quebracho extract and logs, with a negligible item of firewood. No other forest products enter the export trade and apart from quehracho the lumber industry supplies only home consumption. It is carried on principally in north Santa FC, Santiago del Estero, Salta and Jujuy provinces and the national territories of Formosa, El Chaco and Misiones. Pine and spruce timber are imported in large quantities, also hardwoods from North America.

Fisheries. — Argentina has abundant resources of fish in the Uruguay, Paraná, Plata and other rivers and along the Atlantic coast but this source of wealth has been neglected as the fishing industry is little organized. Not only is a limited amount of fish taken from the fresh and salt waters hut fish in considerable quantity is imported fresh or frozen from Montevideo and in less quantity from Brazil and Chile, also the United States, England and Spain. In 1935, there were 164 boats with a total tonnage of 18,011 engaged in maritime fishing. The value of all fish and game products exported in 1938 was 6,813,571 pesos.

Manufactures. — Argentina, in common with other more advanced Hispanic American countries, has experienced a marked industrial expansion since 1914. This has been motivated by a desire to free the country from the instability of world markets, inasmuch as nationalistic sentiments in her best customer countries have occasioned many attempts to restrict imports from Argentina, placing the markets for consumption of her most important exports on an unstable basis when viewed over a period of years. By encouraging industrialization and placing less emphasis on exports Argentina is proportionately less dependent upon widely fluctuating prices of raw commodities, and the ensuing strong repercussions which such changes effect in her entire economic and financial structure.

In 1935 an exhaustive industrial census was taken, the first since the national census of 1914. Total figures of the two censuses were as follows:

	Number of establishments	Personnel employed	Motive power (horsepower)	Raw material used (in 000's of paper pesos)	Value of goods manufactured (000's of paper pesos)
1914	48,779	410,201	678,757	1,086,779,606	1,861,789,710
1935	43,767	534,736	2,557,376	1,960,445,754	3,442,408,296
Per cent of increase or decrease, 1935 census as compared to that of 1914					
	−17	+34	+277	+80	+85

Estimates of capital invested and the value of production of several important consumption goods industries for the years 1931–32 and 1934 compare as follows (in paper pesos, 000's omitted):

	1931–32		1934	
	Capital	Value of product	Capital	Value of product
Cement	20,200	17,450	60,800	29,000
Shoes	23,200	43,500	46,000	80,725
Chemicals	22,695	24,785	60,000	85,000
Glass	18,796	11,043	18,000	20,000
Rubber goods, including tires and casings	21,779	15,293	48,778	26,752

Many new industries have been established in recent years, including factories for the production of silk goods, automotive products, electric and radio parts, toilet preparations and agricultural machinery. Foreign and domestic capital has been invested heavily in new plants. One of the largest of these is the pooling of interests of the Du Pont Company and Imperial Chemicals to form a company manufacturing a line ranging from heavy commercial and industrial chemicals to paints, dyes and mosquito killers.

In 1936 consumption of goods reached 4,817,000,000 pesos, of which 3,700,000,000 represented domestic production and 1,117,000,000 pesos (23·2%) imports, compared with the period 1910–13, when the imports accounted for 40% of consumption.

Of the country's 40,367 industrial establishments in 1935, 13,373 with 235,203 employees were located in the Federal District. 10,345 with 127,481 employees in Buenos Aires province. The Federal District and Buenos Aires province together produced over 70% of the goods manufactured. Santa FC and Tucumbn provinces were next in importance.

Textile Industry.— The industrial census of 1935 showed 4,727 establishments manufacturing textiles, employing 88,834 workers and using 360,979,064 pesos value of raw materials, with an annual production of 536,486,953 pesos value in finished materials. The most important subdivision was the weaving of woollen, cotton and other goods in 148 mills employing 25,055 persons, with a consumption of 24,372,412 pesos value of raw materials and 109,594,824 of finished product. The number of looms was 8,803; of spindles, 380,768. The vast majority of textile mills are in the Federal District, with almost all the remainder in Buenos Aires province.

Food Products: Sugar Industry.— The principal agricultural food products elaborated are sugar, wine, dairy products and flour. Of these the most important is the sugar cane industry, which centres in the northern provinces of Tucumbn, Salta and Jujuy. Of the total national production of 4,870,423 metric tons in 1937, 70·4% was produced in Tucumbn, 18·9% in Jujuy and 8·3% in Salta, the balance in Santa FC, Corrientes and Chaco territory. The industry began in Tucumbn in the middle of the 19th century. Tucumbn, which is the most densely populated of the Argentine provinces, has developed entirely around this industry. However, as Tucumbn is sub-tropical, sugar production there is very expensive as compared with tropical countries like Cuba and Java There are also other parts of Argentina better suited to sugar production. The sugar industry has always been protected, there being an import tariff on foreign sugars of about 7 cents gold per kilo. The industry formerly was on a more or less precarious basis because the native cane stock was degenerated and was sensitive to frosts and pests. In the years 1916–17 and 1917–18 the plantations were re-established almost entirely with new stock, known as the Java cane, which has given much better results. Since then the area planted to sugar has steadily increased, as well as the investment in mills. In 1935, out of 39 sugar mills in the country, 27 were located in Tucumán. In that year the value of the processed sugar totalled 98,739,795 pesos. National production is more or less balanced by consumption, although some sugar is imported, and a regular but small export trade to Bolivia exists.

The Tucumbn Experiment Station, founded in 1909 by the provincial Government, has done very important work in testing new varieties of cane and demonstrating the value of the Java stock now in general use. It fulfils various functions of supervision in connection with the sugar industry.

Grape and Wine Industry.— This industry is located in the provinces of Mendoza and San Juan. Mendoza, lying east of the Cordillera of the Andes, is flat and arid in the eastern part and elevated in the west. Irrigation has made it one of the most prosperous regions of Argentina. The grapes produced are of remarkable size and flavour. Out of the national total of 129,812 hectares planted in vineyards (1937–38) 83.750 hectares were in Mendoza, 26.861 in San Juan, 7,785 in Rio Negro. Low prices and decline in general quality of wine grapes in recent years have been met by Government regulation. Between 1934 and 1938 an average of 25% of the possible wine production was eliminated either by extirpation of vines or by purchase of grapes which afterwards were left to rot ungathered. In 1937 alone 15,875 hectares of vineyards, more than 10% of the entire wine grape area, were withdrawn from cultivation to eradicate diseased and low-producing vines. Over 14,000 hectares of this were in Mendoza. Exactly half of the 1,692 wineries of the country, producing annually 18,516,343 pesos value of wines (1935) out of the national production of 29,868,070 pesos value, are in Mendoza. In San Juan, 249 wineries produced 7,050,104 pesos value. In 1938–39 Argentine wine production totalled 925,460 kilolitres, 577,207 in 1936–37 and 790,742 in 1937–38.

Dairy Industry.— A subsidiary of the cattle industry is the dairy industry. Export of dairy products has, however, declined materially since 1930. Domestic consumption of butter accounts for approximately 22,000 tons annually, representing a lower per capita consumption than in most comparable countries. Exports in 1937 totalled 8,780 metric tons and 7,336 in 1938, compared with 25,363 tons in 1932 and an average of over 24,000 metric tons annually from 1919 to 1932. Over half of the butter exports normally go to Great Britain. Casein export in 1939 was 16.702 metric tons (15,474 in 1937; 19,933 in 1936). Cheese export, once an item of consequence (10,100 metric tons in 1920), averages between 1,000 and 1,500 tons annually.

Flour Milling.— Flour milling is carried on in nearly all the provinces, but principally in the Federal District, Santa FC, Córdoba and Buenos Aires provinces. Milling of wheat provided employment for 5,402 persons in 233 establishments in 1935. In 1938, 84.037 metric tons of wheat flour were exported (95,196 in 1937; 79,783 in 1936). Brazil normally takes about one-third, Great Britain, Paraguay and Bolivia take most of the remainder.

Quebracho Extraction Industry.— The most valuable single product of the Argentine forests is quebracho extract for tanning leather. The logging is carried on in the national territories of Formosa and Chaco. Formerly the trunks of the quebracho tree were exported but since 1911 exports in this form have steadily diminished while exports of extract have increased. Three and one-half tons of logs are required to produce one ton of extract so that shipping in the latter form produces a great saving in transportation. This industry is also carried on in Paraguay. The investment in Argentina alone is estimated at £10,000,000. The largest single enterprise in the industry is a British company. The process consists of chipping the quebracho logs to sawdust, which is treated with steam and water under pressure. Quebracho forms the largest single item of export after cereals and meat. In 1937 198,480 metric tons of quebracho extract mere exported, in 1938 167,940 metric tons and in 1939 195,863 metric tons. Exports of quebracho logs were 87,972 metric tons in 1937, 87,212 in 1938 and 87,241 in 1939.

Foreign Trade.— Under the Spanish regime trade mas a monopoly and free trading with foreign countries prohibited. There was therefore little incentive to increase production. The first trade articles were wool, tallow, fat and hides which as late as 1875 still constituted nearly the entire exportation. During the last part of the 19th century exports of these articles averaged about 60,000,000 gold pesos annually; from 1900 to 1920 about 80,000,000 gold pesos and in 1925 168,298,578 gold pesos. In 1875 exportation of cereals amounted to only 100,000 gold pesos, in 1885 to 11,000,000 gold pesos and in 189; io 40.000,000 gold pesos. In 1926 the value of cereal exports had reached the

vast total of 376,000,000 gold pesos. Meat contributed 7,000,000 gold pesos in 1888; in 1898 11,000,000 gold pesos; in 1905, 33,000,000 gold pesos; in 1912, 56,000,000 gold pesos; in 1926. 139,000,000 gold pesos. (The par value of the gold peso is $0.9648 U. S. currency.) By law of 1899 the paper peso was stabilized at 44 cents gold, and official statistics on exports and imports have been expressed in paper pesos, or *moneda nacional* (national money), since 1910. The foregoing figures have been rendered in gold for purposes of comparison.

For a long period previous to 1914 Argentina had a favourable merchandise trade balance (surplus in the value of exports over imports). In 1913 the total value of exports was 1,179,900,025 paper pesos and the value of imports 1,127,788,850 paper pesos. After 1914 prices obtained for Argentine commodities increased and the value of total exports increased each year until 1920 when the total was 2,372,921,295 paper pesos, the highest value for Argentine exports to that time. In 1913 the volume of exports was 11,800,000 metric tons. Volume fell off greatly in the years following, the increased values of exports over 1913 being due to higher prices, but 1920 mas a record year in volume as well as value, the volume in that year reaching 12,900,000 metric tons. The year 1921 was one of world-wide depression in nearly all commodities and in Argentina the tide turned. The volume of exports in 1921 fell to 8,000,000 metric tons and the value to 1,525,294,136 paper pesos. In 1922 the volume increased to 10,-100,000 metric tons, but the value was only 1,536,382,475 paper pesos (little more than in 1921) due to lower prices. By 1928 exports had reached a record high, with a total of 2,396,608,299 paper pesos. A mild decline in 1929 was followed by a sharp drop during the depression years after 1929. Since 1930, only in the phenomenally prosperous year 1937, when exports totalled 2,310,997,802 pesos. have they been as high as the lowest year of the 1923–29 period. Exports in 1933 (1,120,841,522 pesos) were the lowest since 1914.

The figures of foreign trade (in 000's of paper pesos) for the four years ending Dec. 31, 1939, are as follows:

The main classifications of imports in 1939 and their values were as follows: alimentary products, 85,452,000 pesos; tobacco, 14,076,000 pesos; wine, alcohol and intoxicants, 4,304,000 pesos; textiles and their products (silk, wool, cotton, linen. etc.), 219,-902,000 pesos; chemicals, drugs and related products, 97,622,000 pesos; paper and paper products, books, newsprint, etc., 65,351,-000 pesos; lumber and allied products, 57,411,000 pesos; machinery, motors, agricultural machinery, tractors, automobiles, etc., 131,714,000 pesos; non-ferrous metals and their products, 64,354,000 pesos; construction materials, 38,170,000 pesos; coal, petroleum and allied products, 231,299,000 pesos; rubber and rubber products (tires, tubes, shoes, cloth, etc.), 43,208,000 pesos; miscellaneous (live animals, hides, skins, musical instruments, electrical goods, radios, etc), 73,666,000 pesos. These figures are as reported by the customs offices and are based on values for tariff purposes.

The value of the four principal classifications of exports in 1939 was: livestock products, 686,029,000 pesos; agricultural products, 766,696,000 pesos; forest products, 47.959,000 pesos; miscellaneous (food, wine, alcohol, tobacco, textiles and sundry industrial products), 69,542,000 pesos.

Products of the pastoral industry comprised 43.7% of the totall exportation in 1939. The principal items and their value were: animals on the hoof, 14,849,000 pesos; meat, 330,332,000 pesos: hides, 113,930,000 pesos; wool, 162,740,000 pesos; dairy produce, 19,775,000 pesos; by-products, 44,403,000 pesos.

Agricultural products constituted 48.8% of the total exportation. The principal items, with their values, were: cereals and linseed, 691,295,000 pesos; wheat flour and by-products, 25,718,-000 pesos; vegetable oil products, 9,024,000 pesos; fresh fruit and vegetables, 12,301,000 pesos; other agricultural products, 28,358,000 pesos.

Forest products, constituting 3.06% of the total, were as follows: quebracho extract, 41,877,000 pesos; quebracho logs, 3,822,-000 pesos; other forest products, 2,260,000 pesos.

COMMUNICATIONS AND TRANSPORT

Railroads. — The first railroad in Argentina, 6mi. long, was opened to traffic in 1857. This was the nucleus of the line now known as the Western. In 1854 a concession was obtained by William Wheelwright, an American, for a railway from Rosario to Córdoba, which he finally constructed with the aid of British capital. The first section was opened in 1864 and now forms part of the Central Argentine system. The first railroads in Argentina were constructed under interest guarantees or cash subsidies from the Government. The interest guarantees were later discontinued, the Government granting rescission bonds in settlement. Railroad construction progressed rapidly and the mileage increased steadily up to 1914.

Argentine sources in 1937 estimated the total capital investment in railways in Argentina at 4,584,684,000 paper pesos, a majority of which was British owned. The State-owned railways represent an investment of over 850,000,000 paper pesos.

Argentina has approximately 41% of South American railway mileage and ranks seventh in the world. The total railway mileage in 1939 was 42,020km. (26,111mi.) of which 29,397km. were privately owned, and 12,623km. State owned, including the 179km. Argentine Transandine railway, on which service has been interrupted since the landslides of 1934. This railroad was purchased by the Government in 1939 in accordance with its policy of eventual national onnership of all railways. Under this policy the British-owned Central Córdoba railway, 1,960km. in length, was leased in 1937 and subsequently purchased

The railroads nearly all radiate outward from the port of Buenos Aires and the province of Buenos Aires is covered by a network so close that no point within the province is over 25 miles distant from a railroad. The provinces of Santa FC and Córdoba come after Buenos Aires in length of railroad mileage. With the exception of Mendoza and Tucumán there is little railroad development within any of the other provinces but practically all the provinces and national territories north of Chubut have railroad connection with Buenos Aires. There are three different widths of gauge in the Argentine railroads, wide, standard and metre, but no great inconvenience results because of well organized grouping of the different gauges.

The principal railway systems are the State-owned Argentine North Central, 9,927km.; Buenos Aires Great Southern (British), 8,179km.; Central Argentine (British), 5,954km.; Buenos Aires and Pacific (British), 4,508km.; Buenos Aires Western (British). 3,106km.; and the Province of Santa FC (French), 2,137 kilometres.

The administration of the State-owned railroads is organized as a body separate from the national railroad administration. While the foreign owned railroads centre in Buenos Aires and the other principal ports, the State has constructed its railroads in the extreme south and the extreme north with the object of opening up new territory. The two international railroads of Argentina are State owned. These are the Argentine Transandine railway through Mendoza which connects with the Chile Transandine railway on the Chilean frontier, and the North Central Argentine railway which connects with a Bolivian railroad near La Quiaca on the frontier of Bolivia. The Government also owns a railroad in each of the territories of Patagonia running inland from the port of Comodoro Rivadavia in Rio Negro (124 mi.); from Puerto Madryn in Chubut (78mi.); from Puerto Deseado in Santa Cruz (178mi.). The State-owned Argentine North Eastern railway has connection by ferry with the Central Paraguay railway at Posadas, and there is connection by ferry with the railroads of Uruguay.

Foreign Steamship Lines. — The Argentine ports have regular steamship service to the principal ports of Europe, North America

and Brazil, South Africa, Japan, etc., and are visited regularly by French, British, Italian, Dutch, Spanish, German, Swedish, Danish, Austrian, Brazilian, Greek, Japanese and North American steamers. The European passenger service includes some of the largest transatlantic steamers. In 1938 service to and from the United States mas improved by the addition of speedy de luxe ships operated by the United States Maritime Commission. Over 50 foreign lines maintain regular service to Argentine ports. In addition to the service on the interior waterways there are four domestic companies in coast service between Argentine ports including those of Pataqonia and one of these companies serves the port of Rio Grande in Brazil. The Argentine merchant marine itself stands at about 345.000 tons.

Highway System.—For many years concentration on railway building was such that but little thought was given to highway development, and as late as 1925 official figures gave the total highway mileage as 15,525mi., only two-thirds of the railway mileage. With the continued development of the automobile, however, there was created in 1932 the *Dirección Nacional* de *Vialidad*, or National Highway Board, charged with the duty of setting up a network of highways to serve the entire country. The plan adopted by the board included construction of two kinds. Building of "feeder" lines with funds collected from a tax on railroad income, already in force, was continued. These roads are primarily to facilitate traffic to and from the railways. In addition an independent system of highways was established. financed by taxes on the sale of gasoline. This system, when completed, will consist of two types of highway, 30,000mi. of arterial national highway exclusively under direction of the board, and 600,000mi. of provincial roads, jointly financed and supervised by the board and the individual provinces. It was originally designed by the board and the individual provinces. It was originally designed to take fifteen years, but it is estimated that it should be substantially completed in a much shorter time. From 1933 to the end of 1937 the National Highway Board spent approximately 135,000,000 pesos on construction of the national system, contributed 45,500,000 pesos for provincial highways and paid out 9,500,000 pesos for construction of "feeder" highways. In addition 16,000,000 pesos was spent on maintenance of already existing roads. A total of 214,628mi. of highways, mostly dirt, but some of them gravelled or hard-surfaced, were in use in 1937.

International highways are under construction and partially opened, from Buenos Aires to Chile, across the Andes; and by way of Rosario and Córdoba to Bolivia. One of these two roads will be the route of the projected Pan American highway. Other roads are being constructed to the Brazilian, Paraguayan and Uruguayan frontiers, all of which will utilize ferry service to cross the boundary rivers.

The number of automobiles in Argentina in 1939 was 405,743 (435,822 in 1930), slightly above one and a half to each mile of completed highway.

Aviation.— Since 1927, when a French company, Air France, inaugurated regular service between Natal, Brazil and Buenos Aires, there has been a phenomenal development in air transport facilities in Argentina. There are five principal lines operating in the country, extending as far south as Tierra del Fuego. Direct international connections exist with neighbouring countries, and through them with all parts of America. Until the outbreak of war in 1939 regular connections with Germany by way of Brazil and the transatlantic service of the German Condor Syndicate were maintained.

Posts, Telegraphs **and** Telephones.— The postal service is well organized and reliable. From July 1, 1927, the Argentine Government put into force the provisions of the Pan-American Postal Convention signed in Mexico under which internal postal rates are extended to correspondence, printed matter, commercial papers and samples exchanged between the subscribing countries.

In 1937 the number of telephones was estimated at 348,000, two and a half times the number in 1922. Telephone service is privately owned. The telegraph lines, 140,000mi. in length, are Government owned, and are operated in connection with the postal system.

Argentina is estimated to have over 1,000,000 radio sets. Over 40 stations, including one short wave station, are in operation.

(L. W. BE.)

HISTORY

The first European to reach what is today Argentina was probably Juan Diaz de Solís, who discovered the Rio de la Plata in Feb. 1516, and claimed it for Spain. He named it the *Mar Dulce*, or Freshwater sea, but his immediate contemporaries called it the river of Solís. Solís himself was killed by Indians on the Uruguayan shore, but the remnant of his expedition carried word of the discovery home to Spain, and soon others followed in Solís' wake.

The present name of Silver river came later when Sebastian Cabot sent home to Spain a quantity of rude silver ornaments obtained from the Indians (1526). This was seven years before Pizarro's dazzling conquest of Peru, at a time when persistent rumours filled all Spain of a land with vast treasures of gold and silver somewhere in the interior of the continent. Cabot's silver seemed to locate this Eldorado.

Cabot, like Solís, had been chosen for his skill in navigation to carry exploration into the Pacific. He had no errand in the Paraná but was attracted up the river by the greater abundance of food there, his supplies having run out. He built a fort which he called *Sancti Spiritú* above the present city of Rosario. It was the first settlement in what is now Argentine territory. From there Cabot went up the Paraná into what is now Paraguay, but he met opposition; he had no resources nor authorization to explore and settle here, so after nearly four years he went back to Spain discouraged.

Within four years after Cabot's return Pizarro had conquered Peru and its gold and silver began to flow towards Spain. Immediately the kingdom was deluged with offers from individuals eager to fit out expeditions at their own expense to conquer new principalities for themselves and for Spain in the New World. Among them was Pedro de Mendoza, who came out with a force of 1,200 men and 100 horses. In Feb. 1536, he founded the first Buenos Aires. Cortés in Mexico and Pizarro in Peru had found Indians living in settled communities, with considerable agricultural knowledge and able to furnish supplies of food in quantity. Mendoza expected to sustain his men similarly, but on the River Plata estuary conditions were different. The Indians lived in scattered bands, uncivilized nomads picking up a precarious living by hunting small birds and animals. They had small knowledge of agriculture and scant stores of food beyond dried fish and fish meal. Capture of one small band of savages merely increased the hostility of the rest. The Spaniards' food supplies gave out, and famine was followed by sickness. After a futile search for supplies up the Paraná, Mendoza became discouraged. Already seriously ill, he himself sailed for Spain (late April 1537) to seek reinforcements, but died at sea. His lieutenant, Juan de Ayolas, was left officially in charge.

At the time of Mendoza's departure, Ayolas was up the Paraná, in the vicinity of Paraguay. Leaving a force behind him under Domingo Martinez de Irala, he explored far inland, but while returning, he and his own force were killed by Indians. Irala, meanwhile, founded Asunción, first permanent city in the Plata basin (1537). The country here was better and the Indians had gone further in agriculture than any Indians farther south and it proved possible here to establish *encomiendas* of enslaved Indians to win the products of the soil for Spanish masters, much as in Mexico and Peru, except that there were no mines of gold or silver. Irala encouraged marriage with the native women, for the Spaniards had brought few women with them and the Guarani women are attractive. Thus began the first Spanish colony of the La Plata basin, and thus was founded the race of modern Paraguay.

By 1541 Buenos Aires had become untenable because of the hostility of the Indians of the vicinity and mas abandoned. The following year Irala was officially superseded by Cabeza de Vaca, who had acquired fame for his explorations in North America, but the colonists expelled the new governor and reinstated Irala. By 1573 the colony controlled the territory between the Paraguay

and Paraná rivers and had completely broken the resistance of the Indians to Spanish seizure of their lands. The country abounded in grasses and had only the mildest of minters The few horses, cattle, sheep and goats which the Spaniards brought with them needed no care to make them multiply until their numbers were beyond computation. In a few years they had spread across the Paraná into the pampa, completely transforming the economic possibilities of the country and laying the founddtions of the present wealth of the Argentine people. It was a band of these creoles of Paraguay that in 1573 drove out the Indians — on horseback like themselves — and founded the city of Santa FC, under the leadership of a Basque veteran of the conquest of Peru, Juan de Garay. Already a current of colonization from Peru had flowed into the north-west region and in 1 j51 had founded Santiago del Estero, first permanent settlement in what is now Argentina. Spreading south and east this movement was responsible for the founding of Tucumán in 1564 and Córdoba in 1573, the same year that Santa FC was founded. The two currents now met, and within a few years the trail to Charcas (Bolivia) and Peru was established by may of Córdoba and Tucumán Both the interior and the littoral regions became important as sources of supply for the miners of Peru, whose horses, mules, grains, cattle and even textiles came from Tucumán, as the whole interior region was known, or from the banks of the Paraná and the Plata.

But the peak of Argentine interest in Paraguay came in 1580 when Garay succeeded in planting the first lasting colony at Buenos Aires. With flocks, herds and crude instruments of husbandry they had migrated like the patriarchs of old from the Paraguayan settlements of Asunción. There was no thought of conquest now, nor of Indians to be enslaved that their masters might enjoy the results. Garay came prepared to divide the land and till the soil. The new colony was to live by its own labour.

Spain regarded her colonies as the personal territory of the sovereign, to be exploited solely for his benefit. All South America was under the viceroy of Peru. Under him were captains general. Governing councils called *audiencias* exercised judicial and administrative control under the captains general, or in cases like Bolivia (Upper Peru), where there was no captain general, constituted the complete government. The Argentine was under the Audiencia of Charcas in Bolivia. Each city had a cabildo of not more than 12 men appointed for life who exercised local judicial and administrative functions. On these cabildos occasionally creoles could serve; this was their only participation in the government. The settlements at Córdoba, Tucumán and Salta on the side of Bolivia were at watercourses in dry country, where cattle, mules and fodder could be raised for the mining lands of Peru. They were expected to supply themselves with European wares from Peru which in turn was to get them from the ships that came from Spain to Porto Bello on the Atlantic side of the Isthmus of Panama. Spanish interest in the new world was in the precious metals The Treasury's fifth was not safe unless the entire output could be made to flow through one channel. Exportation of precious metals through Buenos Aires was stringently forbidden; for that matter even tallow and hides and hair might not be sold there to English and Dutch ships. Everything the Buenos Aires creole had to sell must go overland to Panama. Everything he needed from Europe must be bought at Panama Even Spanish ships were almost completely barred from the Rio de la Plata.

The creoles of America could not fail to see that Spain conceded them no rights and made it her policy to hinder their increase of wealth and comfort in every way. Such a system could have but one result. Illicit trade grew apace in spite of the severity of penalties. The Dutch and English could furnish goods with profit at a sixth the price of those coming via Panama, and were glad to take in return hides and hair and such silver as had been smuggled down from Bolivia. The royal governors themselves connived at the trade. The people broke the laws at every chance. Still prices were exorbitant and life primitive. In 1618 permission was given to load two small ships at Cádiz with goods for Buenos Aires and attempts were made to keep these goods from getting into the interior and keep gold and silver from coming out in return, but all the interest of the people of the country was in evading the law.

For a long period a Portuguese settlement, Colonia, just across the river from Buenos Aires, afforded much opportunity for smuggling. The boundary between Portuguese and Spanish settlements was long indefinite. With its story is involved the terminating of the encomiendas in Paraguay in 1610, putting the Indians in the care of the Jesuits, the Jesuit missions, their invasion by the Paulistas from Brazil in 1632, the expulsion of the Jesuits in 1767 and the bargains between Spain and Portugal for territory. When the viceroyalty of the Rio de la Plata was formed in 1776, the Portuguese were at last driven out of Colonia, the south-west boundary of what is now Brazil was fixed about as now, and the Indians from the Jesuit missions took refuge in Spanish territory in Entre Rios or Uruguay. The new viceroyalty included the present republics of Uruguay, Paraguay and Bolivia as well as the Argentine. At this period the great bulk of the population was still in the northern provinces while Buenos Aires was a town of 20,000 people, the resort of smuggling merchants. With the creation of the viceroyalty it was given the privilege of free commerce with Spain At once the fact that the city was the only practicable outlet for the products of a large region began to bear fruit. The city grew rapidly in wealth and population. At the end of the century it had 40,000 white people

On the pampa between there had grown up among the teeming cattle and horses a new race, the *gauchos*. Spanish mainly of race, horsemen and cattle hunters by occupation, loyal followers of any man who was bolder and a better horseman than his fellows, almost exclusively meat-eaters, contemptuous of city people and city ways of life, recognizing no boundaries on unfenced pampa, no right but force, they were the natural material of revolutions. Edible grass in every month of the year and horses more numerous than people gave these gauchos extraordinary mobility. Cattle more numerous than the horses gave them self-transporting food. The introduction of Spanish cattle and horses into a prairie land which had been of no value at all nhen the Spaniards came was the most important outcome of the conquest of Peru. Indians of the pampa had soon learned to avail themselves of the herds and flocks and had been transformed from wretched savages into well fed formidable raiders.

The Buenos Aires people were prosperous and had increasing contacts with European culture. Young men of promise went to Europe for education or training in government and war. The writings of Rousseau, Voltaire and Montesquieu were familiar in the city. The revolt of the English Colonies in North America and events of the French Revolution mere followed with sympathy and interest. A traditional resistance to Spanish misrule was giving place to a recognition that Spain had no right to oppress them. This began to find articulate expression. Then the British came. In 1806 a fleet of British ships appe red off Buenos Aires with a landing force of 1,600 men under Sir Home Popham. When the viceroy Sobremonte received news of the fleet's appearance, he took refuge first in the citadel, then next day gathered what money he could from the Treasury, and fled inland to Córdoba. No defence was offered, and the British marched in.

Sullenly resentful of their viceroy's incompetence and cowardice the people of Buenos Aires at once began to organize for resistance. They had the help of Liniers, a capable French soldier long in the Spanish service, and the wealthy Spanish merchant Martin Alzaga, who provided funds for equipment, as well as the bodily assistance of many Spanish-born citizens. On August 12 they drove the invaders out of the city. A larger British force that came the nest year was also defeated and compelled to retire. The citizens distinguished themselves in this fighting to which the houses and streets of the city were well suited, and the creoles especially were elated. They felt it was their exploit, but though the Spanish governing body faiied them, Spanish-born citizens co-operated in every way and Liniers was no creole. When the poor viceroy came creeping down from Córdoba, just after they had won back the city from the British, they insisted on his instant removal from office. After a further display of ineptitude before Montevideo he departed for Europe.

In Europe Spain fared perhaps worse, for Napoleon had seized

Spain for his brother Joseph. A corner of Spain was free from enemy soldiers and a junta at Seville claimed to rule the kingdom in the name of the captive monarchs. Further it assumed authority over the colonies abroad. The main feeling in the New World was an outburst of patriotic fervour. Funds were raised to assist the home people against the invader. It will be understood that the creoles were often lukewarm in this. No one talked of independence from Spain, but the feeling was growing that the creole must have a more adequate part in ruling themselves. On May 20, 1810, a great assembly of people in arms in the public square of Buenos Aires demanded and obtained the resignation of the viceroy, and the convocation of a *cabildo abierto,* or open town meeting. Five days later, on May 25, the day celebrated ever since as Argentina's independence day, the *cabildo abierto* set up a governing junta of nine creoles. Though it professed to govern in the name of the captive Spanish king, this junta actually ruled independently. Formal independence of Spain was not declared until July 9, 1816, when deputies from all parts of the old viceroyalty met in assembly at Tucumán. But since the meeting of May 1810 no representative of Spain has ever governed in Buenos Aires.

Up in the silver country of Bolivia the Spaniards were strong and there fierce conflicts broke out between creoles and Spaniards. War was waged with the utmost savagery, each side shooting its prisoners. Among those thus summarily executed by the creoles were Liniers, hero of the reconquest, and Martin Alzaga, the wealthy Spaniard who supplied the defenders of Buenos Aires with funds. At last under the leadership of Belgrano the patriot armies won. But the greatest difficulty the creoles had to overcome was their incessant and violent quarrels with each other. In the decade following 1810 these disputes among the creoles would have enabled Spain to re-establish herself but for the singular steadfastness of the creole general, San Martin. Resigning a colonelcy in the Spanish armies, he returned to Buenos Aires in 1812. Convinced that no colony could be free until the Spanish were driven out of Bolivia and Peru, he set himself to drilling an army in Mendoza with which to invade Chile. Stubbornly refusing every summons from his friends to take part in civil wars, no matter hour desperate their need, he persisted in his preparations, training and equipping his 4,000 "horse grenadiers" till in 1817 he was able to take them, artillery and all, over the high passes of the Andes, above 12,000ft., and put an end to Spanish power in Chile by the battles of Chacabuco and Maipú. When the Spanish fleet on the Pacific had been dispersed by the daredevil seaman Lord Thomas Cochrane (later earl of Dundonald, *q.v.*) and others, San Martin was able to transport his army to Peru and, with Bolivar, put an end to Spanish rule on the South American continent.

But the dissensions among the creoles went on. Buenos Aires had by this time become preponderant in numbers as well as in wealth and culture and expected to rule the upland provinces in place of Spain, but this was by no means acceptable to the interior provinces. Agriculture and industry in the country were at so low an ebb that taxation mas almost impossible. The only considerable source of income was the custom-house. But the custom-house was at Buenos Aires and the province of Buenos Aires possessed it and used the revenue. It took many decades to force it to give up this income to the nation. Presently it appeared that there were two main parties in national affairs, Unitarists and Federalists. The Unitarists were strongest at Buenos Aires among people of wealth and culture, the Federalists were characteristic rather of the provinces, the gaucho party under local *caudillos* or chiefs. The year 1826 saw a constituent assembly in Unitarist control which elected Rivadavia president and put out a Unitarist constitution really giving Buenos Aires control over all the interior provinces. Rivadavia began many important works like schools, immigration, banking and correction of faults in government and the administration of justice, which seemed theoretical and impractical to many people, and the Government was rejected by the interior provinces, civil war breaking out more violently than ever. In Rivadavia's time, Uruguay, which had been overrun and conquered by the Portuguese from Brazil several years before *(see* URUGUAY), revolted against the now independent Brazil (1825), and Argentina soon entered the conflict, hoping that Uruguay might be brought into the Argentine Republic. Instead, however, largely through British mediation, Uruguay was erected into an independent republic (1828), despite Argentine victories over Brazil. Meanwhile, Rivadavia had fallen, and Federalists came into power under Manuel Dorrego. Returning troops from the campaigns against Brazil, however, soon overturned Dorrego's Government and executed him forthwith. The reaction against this violent act brought the Federalists back into power at Buenos Aires under a kinsman of Dorrego, Juan Manuel de Rosas.

Unification of the country was the great achievement of Rosas, who dominated the Argentine Confederation from 1829 to 1852. At the outset he was little more than senior partner in a quasi-alliance with regional leaders in the provinces, as Estanislao López of Santa FC, Bustos and Quiroga. With their aid long campaigns were waged against the Unitarists, who were suppressed for the time. In 1833 Rosas retired temporarily from formal office-holding, but retained control of the army and of the public eye by leading a successful campaign against the Indians of southern Buenos Aires province. During the late 1830's he made war on the dictator Santa Cruz of Bolivia, suppressed a Unitarist rising which was aided by the French, successfully resisted a French blockade and involved himself in partisan struggles in Uruguay, mhich he attempted to dominate.

Like most dictators Rosas ruled by force and, if force was insufficient, by terrorism. The so-called *Mazorca* (Ear of Corn) secret society, his chief weapon of fear, was like the Ogpu and Gestapo of the 20th century, spying for the dictator and inflicting direful punishment upon any disloyalty. Anti-Rosas writers have claimed that as many as 15,000 persons were put to death by Rosas and his lieutenants. To such action the Unitarists replied in kind when they could. Rosas has been called "the Creole Louis XI" for his elimination of opposition. One by one, by fair means and foul, potential rivals among his allies in the interior were done away with and power concentrated in Buenos Aires. A strongly nationalistic policy was followed mhich brought him, in 1845, into conflict with France and Great Britain, whose fleets blockaded Buenos Aires and regions under Rosas' rule for over two years. This broke his power, for it seriously injured the commerce of Buenos Aires from which he derived the revenues of his Government, and in 1851, his former lieutenant, Justo José de Urquiza, governor of Entre Rios, broke with him, and, allying himself with Brazil, the Unitarists and the anti-Rosas elements of Uruguay, and with British and French blessing, defeated Rosas at the battle of Caseros (Feb. 3, 1852) and forced him to flee the country on a British ship.

Urquiza called together a convention in Santa FC which in 1853 adopted a constitution much like that of the United States. What turned out important for political considerations was that the republic was to have the custom-house revenues, which Buenos Aires was now collecting, and that internal customs were abolished, which destroyed the main revenue of the interior provinces. For further discomfiture of the Buenos Aires people that city was to be made federal and separated from its province. As Buenos Aires declined to come into the confederation on those terms the national capital was temporarily loaned the city of Paraná, capital of the province of Entre Rios, for headquarters. Urquiza had been elected president by the convention, which was fortunate, for the nation had no money as yet and no military force and Urquiza had both, as landowner and caudillo of Entre Rios. Presently Buenos Aires was in rebellion and Urquiza had to go down and defeat General Bartolomé Mitre's army in the battle of Cepeda. Then he marched into Buenos Aires, which agreed to come into the confederation and give up part of the customs duties for the next five years. Urquiza's six years ended in 1860 and Derqui became president after him, the constitution forbidding the president to succeed himself. Urquiza was now merely general of the national army, which did not exist. Derqui had no province, no resources. Urquiza seemed lukewarm in his support and wanted Paraná for his own provincial capital. Disorders broke out in the impoverished interior provinces; Derqui intervened and restored order, in some cases by summary executions.

The president's obvious weakness encouraged Buenos Aires under Mitre to further resistance culminating in the battle of Pavón, Sept. 17, 1861, in which Mitre's troops decisively defeated the national forces. The main fighting for the federals was done by an army Derqui had raised in Córdoba. Urquiza was present at the battle with 4,000 men from Entre Rios, but hardly took part and as soon as things went against Derqui, withdrew his troops to Entre Rios. On November 5 Derqui resigned from the presidency and went to Montevideo. In May 1862 a new convention met and Mitre was elected president of the republic, arranging that Buenos Aires should remain the capital of the province but should entertain the Federal Government and give up the revenues from the custom house. In 1864 President Mitre helped foment trouble in Uruguay by supporting his old companion in arms, Venancio Flores, in a revolution there. Similar Brazilian aid, and active military intervention on Flores' behalf brought, first, protests from Paraguay, where Francisco Solano López was dictator at the time, and ultimately the Paraguayan War (see PARAGUAY), in which Argentina participated actively from 1865 to 1870.

Mitre took office Oct. 12, 1862, as president of the republic. In a way he was the last of the caudillos, but a very different type of man from most of them. His varied accomplishments would have won him recognition in any land. His histories of Belgrano and San Martin are classic works that have gone to many editions, and after completing his active military and political career he founded the newspaper La *Nación* in Buenos Aires which won him honour wherever it was known. He was governor of Buenos Aires when Mendoza was destroyed by an earthquake in March 1861 and won gratitude by the promptness of his province's generosity. As president he made treaties, opened the Paraná to navigation and encouraged immigration that had hitherto been impossible, prevented at first by Spanish prohibition and later by universal civil war. In Urquiza's day immigrants from Switzerland, Germany and Italy began to come into the almost worthless lands of Santa FC and to transform them almost as magically as Spanish horses and cattle had done three centuries before. In Rosas' day hides, hair, wool and tallow were almost the only resources of the land. Except in Buenos Aires no one ate bread and the bread for Buenos Aires was made in part from imported wheat. The country did not raise enough for its own needs.

Sarmiento was elected to succeed Mitre in 1868 without disorder. He called himself the schoolmaster president and was an enthusiastic believer in the need of popular education to maintain real prosperity in the country. He had studied schools in New England, and he founded teacher-training schools in the republic with teachers brought from the United States. He founded too the astronomical observatory at Córdoba. The country was prosperous. Sarmiento's measures could not hope to be generally popular, however. All knew that the cost was high. His nomination of Avcllaneda to succeed him as president caused some rioting, put down by young Col. Julio A. Roca of Salta.

Avellaneda was inaugurated in 1874. He made Roca his minister of war. Then came Roca's final reduction of the Indians on the pampa. They had come back on the fall of Rosas but now they were destroyed or captured and placed in servile capacities in the cities of the land. Buenos Aires felt a grievance when the new lands were divided among several provinces instead of coming intact to her. The city put up a candidate for president but Avellaneda controlled the election and Roca was easily elected in 1880, the sixth of the constitutional presidents. He was the first president to dispose of a really effective army of federal troops. He made the city of Buenos Aires a federal district, founding the new city of La Plata as provincial capital, thus solving the most difficult problem of the republic. His administration was a period of great material expansion. Immigration attained 40,000 a year and was increasing rapidly at the conclusion of his term. Production increased, railway mileage was doubled and in 1884 the country was for many months on a gold basis, a thing almost unheard of in South America. Roca's brother-in-law, Juárez Celmán, took over the succession in 1886 but proved unequal to the task. In 1890, after a period of disastrous extravagance and dishonesty, he was obliged to resign and the vice-president, Carlos Pellegrini, became president. In 1892 Luis Sáenz Peña became president, followed in 1898 by Roca on a second term. (M. JE.; C. PR.; X.)

The Twentieth Century. — With the turn of the century there was a recurrence of border quarrels with Chile, in two region — the Puna de Atacama in the north and Patagonia in the south. The former was settled in **1899** by arbitration of the American minister in Buenos Aires, but without appeasing popular agitation in either country. Three years later, the king of England, who had been asked to arbitrate the dispute in Patagonia, announced his award, which was a virtual division of the contested area. Thus was ended a controversy that had lasted more than a half century (1847–1902). In commemoration of this settlement the two nations later joined in erecting on their common boundary above the tunnel of the Transandine railway the famous statue known as the "Christ of the Andes." In 1904, Roca was succeeded in office by Manuel Quintana who served only two years of his six-year term before dying in office. The presidency then passed to José Figueroa Alcorta, who, in Oct. 1910, was followed by the regularly elected president, Dr. Roque Sáenz Peña. In 1910 the republic celebrated the centenary of her first bid for independence, commemorating with a successful international exhibition the events of May 25, 1810, when the residents of Buenos Aires ejected from office the Spanish-controlled municipal council and deposed the viceroy Cisneros.

After 100 years of recurrent political disturbances, a new era for Argentina had opened. The newly installed president gave the closest attention to reforms designed to foster and strengthen public respect for and confidence in the institutions of the country. The first step in this direction was the reformed electoral law which instituted the secret ballot. This was the outstanding and most valuable of his official actions, and incidentally it is worth noting that the first effect of the reform, at the next presidential election in **1916,** was the defeat of the Conservative party to which the author of the new law belonged, and which had enjoyed political control of the country for over a quarter of a century. Late in 1913 President Saenz Peiia was too ill to fulfil his duties, and the presidential mandate was assumed by the vice-president, Dr. Victorino de la Plaza.

President SBenz Peiia died in 1914, leaving to his successor, Dr. de la Plaza, the difficult task of directing the affairs of the nation through the early years of the World War. In a country with such a cosmopolitan population the sudden disruption of international relations necessarily had an immediate repercussion. All important contracts involving shipping, the exportation of grain and meat and the importation of manufactures, were cancelled and something like a business panic was imminent. It was averted only by the declaration of a moratorium. The strict neutrality of Argentina was proclaimed. It was soon recognized that the republic would play an important part in the provisioning of Europe, and out of a moment of threatened panic, the country emerged in a spirit of confidence that at least it could not be adversely affected by the war. So far as the shortage of manufactured goods was concerned Argentina found a substantial source of supply in the United States. The national wealth increased substantially during the war, the high prices obtained for foodstuffs more than compensating for any loss the country suffered by the adverse effect of the war in retarding the normal development program. The production of most cereals was enormously increased and the pastoral industry became more prosperous than it had ever been before.

Radical Administration. — The presidential election in **1916** withdrew all attention from the war to domestic politics. For the first time the elections were to be "free" under the secret voting system introduced by President Sáenz Peiia. The Radicals, in opposition for 30 years, nominated Dr. Hipdlito Irigoyen against the candidate whom the Conservatives confidently put forward. The result was a sensational victory for the Radicals. Dr. Irigoyen was comparatively unknown to the new generation, but 25 years earlier he had been one of the most vigorous "caudillos," or political "bosses" in the country, and had suffered exile for his association with Leandro N. Alem in the revolution of **1893.** When in the early part of 1917 the United States entered the war and President Wilson appealed to the Latin American countries to follow her lead, strong influences were brought to bear to change the official attitude of Argentina, but President Irigoyen permitted no departure from the country's proclaimed neutrality. The conclusion of the war was as entirely unexpected in Argentina as its outbreak. The country was enjoying great prosperity, suffering only to a limited extent from shortages of coal and certain manufactures. Immediately the armistice was signed there was confusion, especially as regards the condition of the primary industries engaged in supplying war contracts. Economic readjustments set in accompanied by frequent labour disturbances. Industrial troubles endured until after the end of Irigoyen's term of office. The president, however, was sympathetic toward the "proletariat," and much of the energies of his cabinet had been devoted to legislation designed to ameliorate the conditions of the labouring masses. The principal acts passed related to employers' liability; compensation for injured workers and those incapacitated by disease contracted at their work; the early closing of shops and business establishments; restriction of Sunday labour; official control of

sweated industries; and the provision of cheap homes ior workers.

Argentina joined the League of Nations in 1919 but withdrew the following year in protest against the repressive policy of the Allies toward Germany and did not resume membership until 1927.

In Oct. 1922 Dr. Irigoyen was succeeded as president by another Radical, Dr. Marcelo T. de Alvear. Under this administration, after a brief period of depression, the country entered upon four years of unprecedented prosperity. The gold standard was re-established in 1927 and by 1928 the republic was one of the largest gold holding countries in the world. In April 1928 Dr. Irigoyen was again chosen president, seemingly with sufficient strength to proceed with his party's program of social reform and industrial expansion. But his career was sharply terminated in 1930 by a conservative revolution, which ousted him from office and set up a provisional government under Gen. José Francisco Uriburu.

Several disturbances in the provinces occurred during 1931. President Uriburu followed a rigorous policy of repression and intervened in 12 of the 14 provinces. The Radical Party was declared ineligible to participate in the presidential elections. On Nov. 8, 1931, General Agustin Justo was elected president. In general his presidential acts were definitely more moderate than those of his predecessor, although political feeling continued to run high. His administration was featured by development of public works and by the prominent role played by his foreign minister, Carlos Saavedra Lamas, in developing cordial relations with neighbouring countries. In Nov. 1937, Roberto M. Ortiz, a former Radical who had served in the Justo cabinet, was elected president over former President Alvear in an election tainted by charges of many electoral irregularities. He took office Feb. 20, 1938.

Internally, the most important development under President Ortiz was his vigorous advocacy of honest elections and enforcement of the Sáenz Peña Law of 1912. In Jan. 1940 a serious political crisis broke when, defying the Conservative elements which had elected him, he exercised his constitutional prerogative and intervened in Catamarca province, where serious election frauds had occurred. Three Conservative members of his cabinet resigned in protest. When, a few weeks later, he intervened in Buenos Aires province, where corrupt political practices had been notorious for a decade, an open break with the Conservatives resulted. As a result of his vigorous stand, the Radical Party rallied its forces and in the congressional elections which followed obtained a majority in the lower house for the first time since 1930. The new political alignment was seriously threatened, however, in June, when illness forced Pres. Ortiz temporarily to relinquish his office to his Conservative vice-president, Ramón Castillo Two months later, when a scandal affecting members of the cabinet brobe, Pres. Ortiz resigned, but the resignation was rejected by the Congress.

At the outbreak of the European war, in 1939, Argentina proclaimed her neutrality and took a leading part in the Inter-American congress at Panama. Subsequently she led in forcing the expulsion of Russia from the League of Nations. Arrival of the crew of the scuttled German battleship "Admiral Graf Spce" at Buenos Aires (Dec. 1939) put a strain on Argentine maintenance of neutrality. Argentina in general co-operated closely with the United States on Western Hemisphere defence problems, although giving only qualified support at the Havana conference (July 1940).

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ARGENTITE, a mineral consisting of silver sulphide (Ag_2S). It is occasionally found as uneven cubes and octahedra, but more often as dendritic or earthy masses, with a blackish lead-grey colour and metallic lustre. The mineral is perfectly sectile and has a shining streak; hardness 2.5, specific gravity 7·3. It occurs in mineral veins, and when found in large masses, as in Mexico and in the Comstock lode in Nevada, it is an important ore of silver. Silver sulphide is, however, cubic in crystallization only at temperatures above 91° C.; the cubic crystals found in nature sre really paramorphs, consisting of an intricate lamellar aggregate of orthorhombic crystals. The orthorhombic modification of silver sulphide stable below 91° C. is the mineral acanthite.

ARGENTON, a town on the north-western flank of the Plateau Central of France, on the Creuse, in the department of Indre. Pop. (1936) 5,240. Picturesque old houses line the river. Linen goods are made and there are numerous tanneries.

ARGETOIANU, CONSTANTIN (1871–), Rumanian statesman, was born at Craiova. He studied law and medicine in Paris and was in the diplomatic service from 1907 to 1913. In 1914 he was elected a Senator and became Minister of Justice in Gen. Averescu's Cabinet in 1918. Together with Averescu snd Cantacuzene he formed the People's League, which became the People's party in 1920. Later on, owing to dissensions, he left the party with a number of followers and joined the Nationalist-Democratic party under the presidency of Prof. Jorga. Later he was prominent in the National Rumanian party, and then leader of the Agrarian Union party. After the assassination of M. Calinescu in Sept. 1939, M. Argetoianu became premier.

ARGHANDAB, an Afghan river rising in the Hazara country north-west of Ghazni and flowing south-westward into the Helmand, 20 mi. below Girishk. Its upper course is said to be shallow and almost dry in summer, but it is very rapid and difficult to ford st other times. Irrigation results in a good population on its lower course, but here the water is said to be slightly brackish. It is 250 mi. long, and its chief confluent, the Tarnak, zoo mi. long, disputes with it the right to the ancient name Arachotus. The ruins at Ulân Robât, the supposed city of Arachosia, are in the Tarnak basin to the east of which lies Lake Ab-Istadah, the supposed Lake Arachotus. The Tarnak valley is used by the high road from Kabul to Kandahar, another reason for thinking it the Arachotus.

ARGHOUL, ARGHOOL or **ARGHUL** (in the Egyptian hieroglyphs, As or AS-IT). an ancient Egyptian and Arab woodwind instrument, still in use. It consists of two reed pipes of unequal lengths bound together so that the two mouthpieces lie side by side, and can be taken by the performer into his mouth at the same time. The mouthpiece consists of a reed having a small tongue detached by means of a longitudinal slit which forms the beating reed, as in the clarinet mouthpiece. An Egyptian

arghoul, presented by the Khedive to the Victoria and Albert Museum, measures 4ft. 8½ inches.

ARGILETUM, a district in ancient Rome, south of the Quirinal hill, occupied chiefly by mechanics and booksellers. Through it ran the street Subura.

ARGINUSAE, the name of certain islands off the coast of Asia Minor, opposite the southern end of Lesbos, and the scene of the last Athenian victory in the Peloponnesian War (Aug. 406 B.C.). The Athenian admiral Conon, having been pinned by superior Spartan forces in Mitylene, the Athenians by ruthless conscription of their last resources of men and wealth, raised a fresh fleet which engaged the Spartans and defeated them after 69 vessels had been sunk. A storm rose immediately and the eight generals in charge of the Athenian fleet retired to shelter without attempting to rescue the Athenian sailors on the 12 triremes that were sinking. For this, those of them who returned to Athens were executed, sharing with Houchard the distinction of being the only generals executed for incompetence after a victory.

ARGO, the large Ptolemaic constellation (*q.v.*) of the southern hemisphere (argo, a ship), which was subdivided by Sir John Herschel (*q.v.*) into Vela (sails), Puppis (poop), and Carina (keel) (*qq.v.*). Some writers however still refer to it as one complete constellation, *e.g.*, the variable star η Carinae is also called η Argus.

ARGOL, the commercial name of crude tartar (*q.v.*). It is a semi-crystalline deposit which forms on wine vats, and is generally grey or red in colour.

ARGON, a gaseous constituent of atmospheric air. For more than 100 years before 1894 it had been supposed that the composition of the atmosphere was thoroughly known. Beyond variable quantities of moisture and traces of carbonic acid, hydrogen, ammonia, etc., the only constituents recognized were nitrogen and oxygen. The analysis of air was conducted by determining the amount of oxygen present and assuming the remainder to be nitrogen. Since the time of Henry Cavendish no one seemed even to have asked the question whether the residue was, in truth, all capable of conversion into nitric acid.

Discovery of Inert Gas in Air.—The manner in which this condition of complacent ignorance came to be disturbed is instructive. Observations undertaken mainly in the interest of Prout's law, and extending over many years, had been conducted to determine afresh the densities of the principal gases—hydrogen, oxygen and nitrogen. In the latter case, the first preparations were according to the convenient method devised by Vernon Harcourt, in which air charged with ammonia is passed over red-hot copper. Under the influence of the heat the atmospheric oxygen unites with the hydrogen of the ammonia, and when the excess of the latter is removed with sulphuric acid, the gas properly desiccated should be pure nitrogen, derived in part from the ammonia, but principally from the air. A few concordant determinations of density having been effected, the question was at first regarded as disposed of, until the thought occurred that it might be desirable to try also the more usual method of preparation in which the oxygen is removed by actual oxidation of copper without the aid of ammonia. Determinations made thus were equally concordant among themselves, but the resulting density was about $\frac{1}{1000}$ part greater than that found by Harcourt's method (Rayleigh, 1892). Subsequently when *oxygen* was substituted for air in the first method, so that all (instead of about 3 part) of the nitrogen was derived from ammonia, the difference rose to ½%. Further experiment only brought out more clearly the diversity of the gases hitherto assumed to be identical. Whatever were the means employed to rid air of accompanying oxygen, a uniform value of the density was arrived at, and this value was ½% greater than that appertaining to nitrogen extracted from compounds such as nitrous oxide, ammonia and ammonium nitrate. No impurity consisting of any known substance could be discovered capable of explaining an excessive weight in the one case or a deficiency in the other. Storage for eight months did not disturb the density of the chemically extracted gas, nor had the silent electric discharge any influence upon either quality. ("On an Anomaly encountered in determining the Density of Nitrogen Gas," *Proc. Roy. Soc.*, 1894.)

At this stage it became clear that the complication depended upon some hitherto unknown body, and probability inclined to the existence of a gas in the atmosphere heavier than nitrogen, and remaining unacted upon during the removal of the oxygen—a conclusion afterwards fully established by Lord Rayleigh and Sir William Ramsay. The question which now pressed was as to the character of the evidence for the universally accepted view that the so-called nitrogen of the atmosphere was all of one kind, that the nitrogen of the air was the same as the nitrogen of nitre. Reference to Cavendish showed that he had already raised this question in the most distinct manner, and indeed, to a certain extent, resolved it. In his memoir of 1785 he writes:—

"As far as the experiments hitherto published extend, we scarcely know more of the phlogisticated part of our atmosphere than that it is not diminished by lime-water, caustic alkalies or nitrous air; that it is unfit to support fire or maintain life in animals; and that its specific gravity is not much less than that of common air; so that, though the nitrous acid, by being united to phlogiston, is converted into air possessed of these properties, and consequently, though it was reasonable to suppose, that part at least of the phlogisticated air of the atmosphere consists of this acid united to phlogiston, yet it may fairly be doubted whether the whole is of this kind, or whether there are not in reality many different substances confounded together by us under the name of phlogisticated air. I therefore made an experiment to determine whether the whole of a given portion of the phlogisticated air of the atmosphere could be reduced to nitrous acid, or whether there was not a part of a different nature to the rest which would refuse to undergo that change. The foregoing experiments indeed, in some measure, decided this point, as much the greatest part of air let up into the tube lost its elasticity; yet, as some remained unabsorbed, it did not appear for certain whether that was of the same nature as the rest or not. For this purpose I diminished a similar mixture of dephlogisticated [oxygen] and common air, in the same manner as before [by sparks over alkali], till it was reduced to a small part of its original bulk. I then, in order to decompound as much as I could of the phlogisticated air [nitrogen] which remained in the tube, added some dephlogisticated air to it and continued the spark until no further diminution took place. Having by these means condensed as much as I could of the phlogisticated air, I let up some solution of liver of sulphur to absorb the dephlogisticated air; after which only a small bubble of air remained unabsorbed, which certainly was not more than $\frac{1}{120}$ of the bulk of the dephlogisticated air let up into the tube; so that, if there be any part of the dephlogisticated air of our atmosphere which differs from the rest, and cannot be reduced to nitrous acid, we may safely conclude that it is not more than $\frac{1}{120}$ part of the whole."

Although, as was natural, Cavendish was satisfied with his result, and does not decide whether the small residue was genuine, it is probable that his residue was really of a different kind from the main bulk of the "phlogisticated air," and contained the gas afterwards named argon. The announcement to the British Association in 1894 by Rayleigh and Ramsay of a new gas in the atmosphere was received with a good deal of scepticism. Some doubted the discovery of a new gas altogether, while others denied that it was present in the atmosphere. Yet there was nothing inconsistent with any previously ascertained fact in the asserted presence of 1% of a non-oxidizable gas about half as heavy again as nitrogen. The nearest approach to a difficulty lay in the behaviour of liquid air, from which it was supposed, as the event proved erroneously, that such a constituent would separate itself in the solid form. The evidence of the existence of a new gas (named Argon on account of its chemical inertness, Gr. ἀ- privative and ἔργον, work), and a statement of many of its properties, were communicated to the Royal Society by the discoverers in January 1895.

Isolation of Argon.—The isolation of the new substance by removal of nitrogen from air was effectedby two distinct methods. Of these the first is merely a development of that of Cavendish. The gases were contained in a test-tube (fig. 1) standing over

a large quantity of weak alkali, and the current was conveyed in wires insulated by U-shaped glass tubes passing through the liquid and round the mouth of the test-tube. The inner platinum ends of the wire may be sealed into the glass insulating tubes, but reliance should not be placed upon these sealings. In order to secure tightness in spite of cracks, mercury was placed in the bends. With a battery of five Grove cells and a Ruhmkorff coil of medium size, a somewhat short spark, or arc, of about 5mm. was found to be more favourable than a longer one. When the mixed gases were in the right proportion, the rate of absorption was about 30c.c. per hour, about 30 times as fast as Cavendish could work with the electrical machine of his day. A convenient adjunct to this apparatus is a small voltameter, with the aid of which oxygen or hydrogen can be introduced at pleasure. The gradual elimination of the nitrogen is tested at a moment's notice with a miniature spectroscope. For this purpose a small Leyden jar is connected as usual to the secondary terminals, and if necessary the force of the discharge is moderated by the insertion of resistance in the primary circuit. When with a fairly wide slit the yellow line is no longer visible, the residual nitrogen may be considered to have fallen below 2 or 3%. During this stage the oxygen should be in considerable excess. When the yellow line of nitrogen has disappeared, and no further contraction seems to be in progress, the oxygen may be removed by cautious introduction of hydrogen.

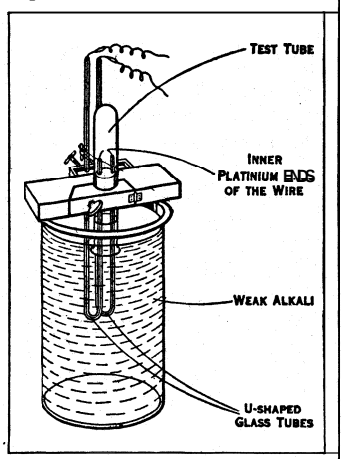


FIG. 1.—FIRST METHOD OF ISOLATING ARGON FROM AIR
Into a mixture of air and oxygen standing in a test tube over a weak caustic soda solution, wires, insulated by U-shaped glass tubes, are passed. The nitrogen is oxidised and absorbed. After removing the excess of oxygen, argon remains as a residue

The development of Cavendish's method upon a large scale involves arrangements different from what would at first be expected. The transformer working from a public supply should give about 6,000 volts on open circuit, although when the electric flame is established the voltage on the platinums is only from 1,600 to 2,000. No sufficient advantage is attained by raising the pressure of the gases above atmosphere, but a capacious vessel is necessary. This may consist of a glass sphere of 50 litres' capacity, into the neck of which, presented downwards, the necessary tubes are fitted. The whole of the interior surface is washed with a fountain of alkali, kept in circulation by means of a small centrifugal pump. In this apparatus, and with about one horse-power utilized at the transformer, the absorption of gas is 21 litres per hour. ("The Oxidation of Nitrogen Gas," Trans. *Chem. Soc.*, 1897.) In one egperiment, specially undertaken for the sake of measurement, the total air employed was 9,250c.c., and the oxygen consumed, manipulated with the aid of partially deaerated water, amounted to 10,820c.c. The oxygen contained in the air would be 1,942c.c.; so that the quantities of atmospheric nitrogen and of total oxygen which enter into combination would be 7,308c.c. and 12,762c.c. respectively. This corresponds to N+1·75O, the oxygen being decidedly in excess of the proportion required to form nitrous acid. The argon ultimately found was 75·0c.c., or a little more than 1% of the atmospheric nitrogen used.

The other method by which nitrogen may be absorbed on a considerable scale is by the aid of magnesium. The metal in the form of thin turnings is charged into hard glass or iron tubes heated to a full red in a combustion furnace. Into this air, previously deprived of oxygen by red-hot copper and thoroughly dried, is led in a continuous stream. At this temperature the nitrogen combines with the magnesium, and thus the argon is concentrated.

Preparation, Modern Methods.—In some respects the method of one of the discoverers of argon for preparing the gas may be regarded as obsolete. Argon is now produced on a commercial scale by processes depending *on* the liquefaction of air. The separation of argon is a more difficult problem than that of oxygen or nitrogen, as the boiling point is intermediate between those of the main constituents of air. Effective methods have been developed by Linde, Claude and others. In Claude's method, a jet of the mixture is partially liquefied by passing through a cooled vertical tube. The most volatile constituent, nitrogen, is got rid of and blows off above, while the liquid falls back and is treated in a rectifying column for the separation of oxygen and argon. Any residual oxygen may be burnt out with hydrogen.

It is not, in general, practicable to get rid of the last traces of nitrogen by these methods. For some purposes, however, *e.g.*, the use in incandescent lamps, this is not necessary, and a few units % of nitrogen may, without serious detriment, be allowed to remain. On the other hand, for experiments on the physical properties of argon, and on its behaviour under the electric discharge, high purity is necessary. On a small scale this is conveniently attained by purification with heated turnings of metallic calcium, which absorb nitrogen far more readily than the magnesium originally used, and have the advantage of absorbing a moderate quantity of other likely impurities as well. For larger-scale purification, heated calcium carbide may be used as an absorbent of the residual nitrogen, but, though cheaper, it is not so convenient in use as calcium.

A demonstration experiment may here be described by which the presence of argon in atmospheric air can be shown very quickly and simply. A vacuum discharge tube (fig. 2) is used consisting of two elongated electrode bulbs united by a capillary tube of, say, 1·5mm. internal diameter. The bulbs each contain a pool of the liquid alloy of sodium and potassium, introduced with a pipette before the glass work is sealed together. This tube is excited by an induction coil, the current being passed during continued exhaustion by a high-vacuum pump until the alloy ceases to give off hydrogen. A small dose of air, say 0·1c.c., is then introduced by means of the small space included between the stop-cocks. The alloy is, of course, avid of oxygen, but it also rapidly removes atmospheric nitrogen under the influence of the discharge, and the well-known band spectrum of the latter disappears, giving place to a line spectrum characteristic of argon. A further dose of air is then introduced, and similarly treated. If the tube is initially in the proper condition, enough argon to show the spectrum strongly can be separated in this way in a minute or two.

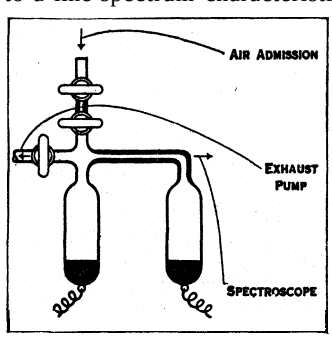


FIG. 2.—APPARATUS FOR RAPID OF THE PRESENCE OF ARGON IN AIR
The electric discharge is passed several times through successive doses of rarefied air, between two pools of sodium-potassium alloy. The oxygen and nitrogen are rapidly absorbed and the lines of the argon spectrum come out strongly

Spectrum.—As a rule, the spectrum of argon does not intrude itself upon the spectroscopist. The reason for this is now seen to lie in the high excitation potential of the usual argon lines,- which exceeds by several volts that of the red nitrogen bands. The result is that unless the argon atoms are present in high relative concentration, they have little chance of being excited, for the available energy of an impinging electron is almost certain to be taken up in exciting a nitrogen molecule before it has reached the value necessary for excitation of the visible argon lines. The case contrasts with that of the yellow sodium lines, which have a much lower excitation potential than, *e.g.*, the gases in a flame, and are therefore excited to the exclusion of the latter.

The spectrum of argon, when isolated, is somewhat complicated, and consists of numerous lines extending over the whole visual spectrum. None of these is of outstanding intensity, and the integrated effect in a vacuum discharge is of a rather pale red colour, easily distinguished by an accustomed eye from the red of nitrogen, hydrogen or neon. For recognizing the presence of argon the

group of green lines: 5,650·7, 5,607·8, 5,572·6, 5,158·7, 5.495.9, is conveniently made use of. Argon shows very conspicuously the abrupt change from an *arc* spectrum to a *spark* spectrum, the light changing from a red to a steely-blue colour when a condensed discharge is used. The blue spectrum is now known to be due to the ionized atom.

Properties. — Argon is soluble in water at 12° C. to about 4·0%, that is, it is about $2\frac{1}{2}$ times more soluble than nitrogen. The density of argon, prepared and purified by magnesium, was found by Sir William Ramsay to be 19·941 on the O = 16 scale. The volume actually weiqhed was 163c.c. Subsequently large-scale operations with the same apparatus as had been used for the principal gases gave an almost identical result (19·940) for argon prepared with oxygen. We should thus expect to find it in increased proportion in the dissolved gases of rain-water. Experiment has confirmed this anticipation. The weight of a mixture of argon and nitrogen prepared from the dissolved gases showed an excess of 24mg. over the weight of true nitrogen, the corresponding excess for the atmospheric mixture being only 11mg. Argon is contained in the gases liberated by many thermal springs, but not in special quantity. The gas collected from the King's Spring at Bath gave only $\frac{1}{2}$%, *i.e.,* half the atmospheric proportion. The refractivity of argon is 0·961 times that of air. The viscosity is 1·21 referred to air, somewhat higher than that of oxygen, which stands at the head of the list for the principal gases. The behaviour of argon at low temperatures was investigated by K. S. Olszewski. The following results are extracted from the table given by him: —

Name	Critical temp.	Critical press.	Boiling point	Freezing point
Nitrogen . .	—146·0° C	35.9 atmos.	—194° C	—214° C
Argon . .	—121·0	50·6	—187	—189·6°
Oxygen . .	—118·0	50·8	—182.7	?

The smallness of the interval between the boiling points and freezing points is noteworthy.

From the manner of preparation, it was clear from the first that argon would not combine with magnesium or calcium at a red heat, nor with oxygen, hydrogen or nitrogen under the influence of the electric discharge. Numerous other attempts to induce combination also failed; nor have observations on positive rays given evidence of even temporary association of argon atoms with one another, or with atoms of another element.

The positive-ray investigations of F. W. Aston indicate that argon consists in the main of one isotope, A^{40}, of exact atomic weight 39·971. A small quantity of A^{36}, amounting perhaps to 1% of the whole, is present in addition.

The most remarkable physical property of argon relates to the constant known as the ratio of specific heats. When a gas is warmed one degree, the heat which must be supplied depends upon whether the operation is conducted at a constant volume or at a constant pressure, being greater in the latter case. The ratio of specific heats of the principal gases is 1·4, which, according to the kinetic theory, is an indication that an important fraction of the energy absorbed is devoted to rotation or vibration. If the whole energy is translatory, the ratio of specific heats must be 1·67. This is precisely the number found from the velocity of sound in argon as determined by Kundt's method, and it leaves no room for any sensible energy of rotatory or vibrational motion. The same value had previously been found for mercury vapour by Kundt and Warburg, and had been regarded as confirmatory of the monatomic character attributed on chemical grounds to the mercury molecule. In the case of argon we have no chemical evidence to go upon to determine the atomicity, but the discoverers regarded it as monatomic on the grounds above stated.

Atomicity of Argon. — It was difficult to give any reason on the classical theory of atom mechanics why a single atom should be devoid of rotational energy, so at that time the evidence for the monatomicity of argon did not rest on a very secure foundation. The view now taken is as follows:—A very small moment of inertia results from the estimated minute dimensions of the atomic nucleus, in which the atomic mass is chiefly concentrated. If the energy of rotation is to be made large enough to be sensible in comparison with the known energy of translation at, *e.g.,* the ordinary temperature, a very rapid rotation of so small a fly-wheel will be needed. But Bohr's frequency condition, which has a weight of varied evidence behind it, only allows a certain limited series of rotational energies at a given frequency; and, with the rapid rotation indicated, even the lowest of the admissible energies is considerably too large to meet the requirements; so that the alternative of no rotational energy remains. This "explanation" is, of course, incomplete in the same measure as all explanations in terms of the quantum theory.

The conclusion then holds that argon is monatomic. This can be confirmed from other lines of evidence. Thus, the wave-length of the K-absorption edge in the X-ray spectrum of argon fixes the atomic number as 18, since it falls between chlorine (17) and potassium (19). The atomic weight must, therefore, be about double 18, and this leaves us no doubt that 40 must be taken, which is equal to the molecular weight, rather than 20, which would be half the molecular weight. Thus the atom and the molecule are identical. If we consider the periodic law (*q.v.*), and take the known X-ray spectra of the allied gases krypton and xenon into account, no room for doubt remains, and it is not necessary to enter on yet further evidence which might be cited.

Importance of Argon. — The discovery of argon was the starting point of many of the recent developments of physics. It led directly to the discovery of the other inert gases, helium (*q.v.*), neon, krypton and xenon (see ATMOSPHERE), and thus filled up a large *lacuna* in our systematic knowledge of the fundamental forms of matter. Through the discovery of helium, it led to further far-reaching discoveries. Argon has commercial importance as constituting the atmosphere in "gas filled" incandescent lamps. Its chemical inertness makes it much preferable to nitrogen for this purpose.

BIBLIOGRAPHY.—The fullest account of the discovery of argon will be found in the *Life of Lord Rayleigh,* by his son, the present Lord Rayleigh (1924). For a full account of the present state of the subject and a complete bibliography, *see* Gmelin's *Handbuch der Anorganischen Chemie* (1926). *(R.;* RA.)

ARGONAUTA, the paper nautilus, common in the Mediterranean. The female secretes a white beautifully fluted shell from two of her arms and carries her eggs therein. (See CEPHALOPODA. NAUTILUS.)

ARGONAUTS, in Greek legend, a band of heroes who went with Jason (q.v.) to fetch the golden fleece in the ship "Argo" (Gr. *Ἀργοναῦται,* sailors of the "Argo"). This task had been imposed on Jason by his uncle Pelias (q.v.), who had usurped the throne of Iolcus in Thessaly, which rightfully belonged to Jason's father Aeson. The story of the fleece follows: Jason's uncle Athamas had two children, Phrixus and Helle, by his wife Nephele, the cloud goddess. But after a time he became enamoured of Ino, the daughter of Cadmus, and neglected Nephele, who disappeared in anger. Ino, who hated the children of Nephele, persuaded Athamas, by means of a false oracle, to offer Phrixus as a sacrifice, as the only means of alleviating a famine which she herself had caused by ordering the grain to be secretly roasted before it was sown. But before the sacrifice, the shade of Nephele appeared to Phrixus, bringing a ram with a golden fleece on which he and his sister Helle endeavoured to escape over the sea. Helle fell off and was drowned in the strait, which after her was called the Hellespont. Phrixus, however, reached the other side in safety, and proceeding by land to Aea in Colchis on the farther shore of the Euxine Sea, sacrificed the ram, and hung up its fleece in the grove of Ares, where it was guarded by a sleepless dragon.

Jason, having undertaken the quest of the fleece, called upon the noblest heroes of Greece to take part in the expedition. According to the original story, the crew consisted of the chief members of Jason's own race, the Minyae. But when the legend became common property, other and better-known heroes were added to their number. The crew was supposed to consist of 50, agreeing in number with the 50 oars of the "Argo," so called from its builder Argos, or from Gr. *ἀργός* (swift). It was the first ship, or the first war-galley, ever built. Athena herself superintended its construction, and inserted in the prow a piece of oak from Dodona, which was endowed with the power of speaking

and delivering oracles. The Argonauts arrived at Lemnos, which was occupied only by women, who had put to death their fathers, husbands and brothers. Here they remained some months. It is known from Herodotus (iv. 145) that the Minyae had formed settlements at Lemnos at a very early date. Proceeding up the Hellespont, they sailed to the country of the Doliones, by whose king, Cyzicus, they were hospitably received. After their departure, being driven back to the same place by storm, they were attacked by the Doliones, who did not recognize them, and in a battle which took place Cyzicus was killed by Jason. After Cyzicus had been duly mourned and buried, the Argonauts proceeded along the coast of Mysia, where occurred the incident of Hercules and Hylas (q.v.). On reaching the country of the Bebryces, they again landed to get water, and were challenged by the king, Amycus, to match him with a boxer. Polydeuces accepted the challenge, and beat him. At the entrance to the Euxine, at Salmydessus, on the coast of Thrace, they met Phineus, the blind and aged king whose food was being constantly polluted by the Harpies. He knew the course to Colchis, and offered to tell it, if the Argonauts would free him from the Harpies. He was freed by the winged sons of Boreas, and Phineus now told them their course, and how to pass through the Symplegades or Cyanean rocks—two cliffs which moved on their bases and crushed whatever sought to pass. His advice was successfully followed, and the "Argo" made the passage unscathed, except for trifling damage to the stern. From that time the rocks became fixed and never closed again. After sundry minor adventures, they reached Colchis; but the king, Aeetes, would not give up the fleece until Jason should yoke his bulls, given him by Hephaestus, and which snorted fire and had hoofs of brpnze, to a plough, and with them plough the field of Ares. That done, the field was to be sown with the dragon's teeth, from which armed men were to spring. Helped by Aeetes's daughter, the sorceress Medea, who had fallen in love with him, Jason accomplished these tasks and carried off the fleece. He then fled with Medea, Aeetes meanwhile pursuing them. To delay him and thus obtain escape, Medea dismembered her young brother Absyrtus, whom she had taken with her, and cast his limbs about in the sea for his father to pick up.

In another account Absyrtus had grown to manhood then, and met his death in an encounter with Jason, in pursuit of whom he had been sent. Of the homeward course various accounts are given. In the oldest (Pindar), the "Argo" sailed along the river Phasis into the eastern Oceanus, round Asia to the south coast of Libya, thence to the mythical lake Tritonis, after being carried 12 days overland through Libya and thence again to Iolcus. Hecataeus of Miletus (Schol. Appollon. Rhod. iv. 259) suggested that from the Oceanus it may have sailed into the Nile, and so to the Mediterranean. Others, like Sophocles, described the return voyage as differing from the outward course only in taking the northern instead of the southern shore of the Euxine. Some (pseudo-Orpheus) supposed that the Argonauts had sailed up the river Tanaïs, passed into another river, and by it reached the North Sea, returning to the Mediterranean by the Pillars of Hercules. Again, others (Appollonius Rhodius) laid down the course as up the Danube (Ister), from it into the Adriatic by a supposed mouth of that river, and on to Corcyra. Then follow wanderings, partly based on those of Odysseus (q.v.), partly on the older Argonautic routes. Finally, they reached Iolcus, and the "Argo" was placed in a grove sacred to Poseidon on the isthmus of Corinth.

The story of the expedition of the Argonauts is very old. Homer was acquainted with it and speaks of the "Argo" as well known to all men; the wanderings of Odysseus may have been partly founded on its voyage. Pindar, in the fourth Pythian ode, gives the oldest detailed account of it. In ancient times, the expedition was regarded as a historical fact, an incident in the opening up of the Euxine to Greek commerce and colonization, and so it probably is, but with a great accretion of fabulous details of many kinds.

See Miss J. R. Bacon, *The Voyage of the* ***Argonauts*** (London, 1925), for further discussion and bibliography.

ARGONNE, a wooded plateau of north-east Prance, forming a natural barrier between Lorraine and Champagne, and including portions of the departments of Ardennes, Meuse, and Marne. The Argonne, S.S.E. to N.N.W., is 44m. long with an average breadth of 10m. and an average height of 1,150ft. It connects the plateaus of the Haute Marne and the Ardennes. The valleys of the Aire and other rivers traverse it longitudinally, a fact to which its importance as a bulwark of north-east France is largely due. On the east the plateau forms a line of rocky bluffs overlooking the plain of the Barre and the Aire gorge, but westwards it slopes gently towards the Aisne. The chief forest, the "Argonne," extends for 25m. See MEUSE-ARGONNE OPERATIONS.

ARGOS, the name of several ancient Greek cities or districts. Most important was the chief town in eastern Peloponnese, whence the peninsula of Argolis derives its name. The Argeia, or Argos proper, is a shelving plain at the head of the Argive gulf, well watered and fertile, with easy communications towards the Corinthian isthmus, and passes westward into Arcadia. Greek legends indicate its high antiquity and its early intercourse with Egypt, Lycia and other countries. Though eclipsed in the Homeric age, when it was the realm of Diomedes, by the later foundation of Mycenae, it regained its predominance after the invasion of the Dorians (*q.v.*), and was probably for some centuries the leading power in Peloponnesus. Under Pheidon Argos ruled all eastern Peloponnesus (8th or 7th century B.C.).

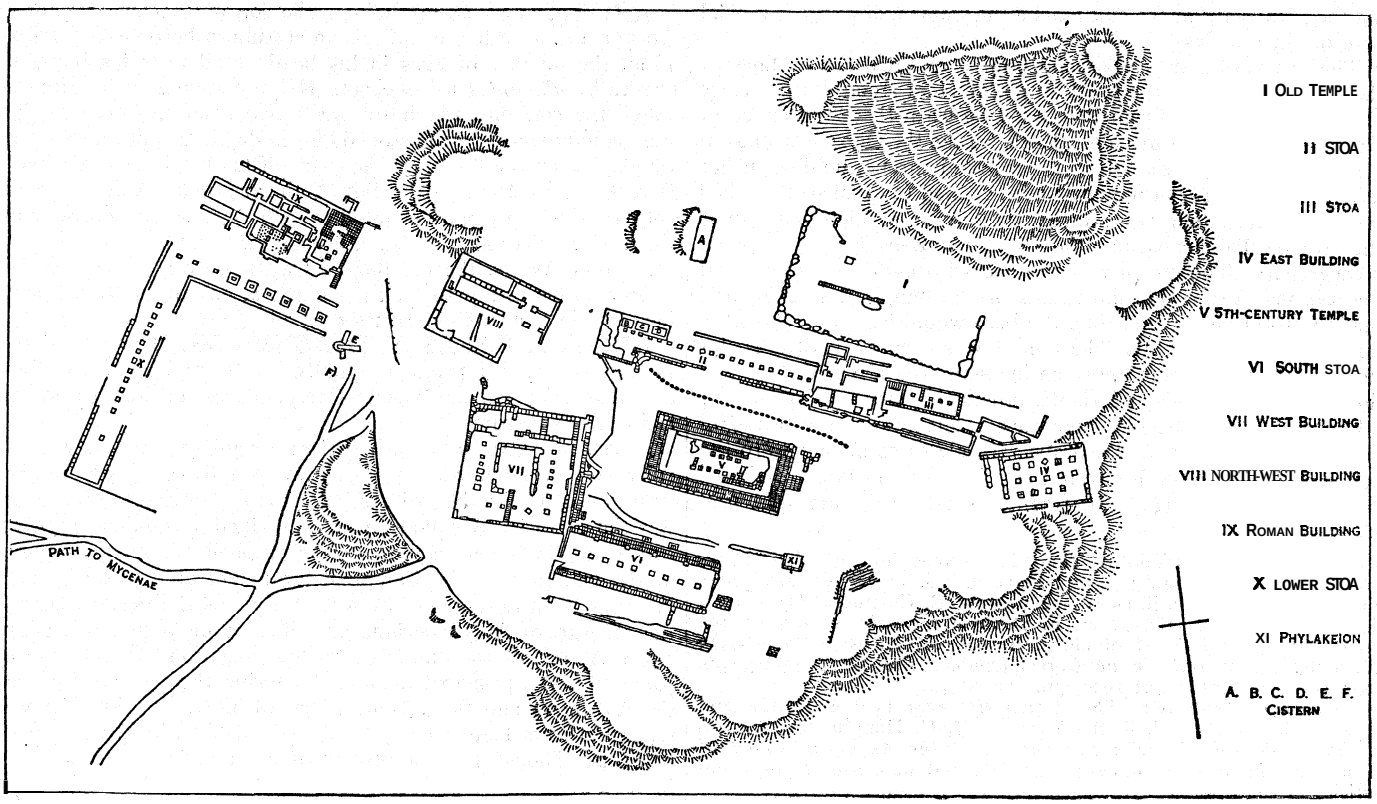
Argos was organized, like Sparta, in three Dorian tribes, with a class of Perioeci (neighbouring dependents), and one of serfs, nevertheless the two cities were enemies from the 8th century. In spite of a victory at Hysiae (apparently in 669 B.C.) the Argives were forced back. By 550 B C. they had lost the whole coast strip of Cynuria and were so weakened in about 495, through defeat by Cleomenes I., that they had to open the franchise to their Perioeci.

Argos (*c.* 470 B.C.) with the Arcadians fought Sparta again, but only destroyed their revolted dependencies of Mycenae and Tiryns in 468 or 464; they became allies of Athens in 461, renewing a link made by Peisistratus, but they had to make a truce with Sparta in 451.

During the early years of the Peloponnesian War Argos remained neutral; after the peace of Nicias (421) the alliance of this State, with its unimpaired resources and flourishing commerce, was courted on all sides. By throwing in her lot with the Peloponnesian democracies and Athens, Argos seriously endangered Sparta's supremacy, but the defeat of Mantineia (418) and a successful rising of the Argive oligarchs spoilt this chance. Though speedily restored the democracy gave Athens no further help except occasional mercenaries (see PELOPONNESIAN WAR).

In the early 4th century, Argos, in population and resources equalling Athens, was prominent in the Corinthian League against Sparta. Argives helped to garrison Corinth (394), and seem to have annexed it for a while. But the peace of Antalcidas (q v.) barred Argive pretensions to control all Argolis. After the battle of Leuctra the oligarchs attempted a revolution but were put down vindictively (370). The democracy consistently supported the victorious Thebans against Sparta, and sent a large contingent to the decisive field of Mantineia (362). When pressed in turn by their old foes, the Argives were among the first to call in Philip of Macedon, who reinstated them in Cynuria after becoming master of Greece. In the Lamian War Argos sided with the patriots against Macedonia; after its capture by Cassander from Polysperchon (317) it fell in 303 into the hands of Demetrius Poliorcetes. In 272 the Argives joined Sparta in resisting Pyrrhus of Epirus, who was killed in an unsuccessful night attack upon the city. They passed instead into the power of Antigonus Gonatas of Macedonia. Aratus (*q.v.*) contrived to win Argos for the Achaean League (229), in which it remained save during a brief occupation by the Spartans Cleomenes III. (*q.v.*) and Nabis (224 and 196).

The Roman conquest helped Argos by removing the trade competition of Corinth. Under the Empire, Argos was the headquarters of the Achaean synod and a resort of merchants. Though plundered by the Goths in AD. 267 and 395 it retained some of its commerce and culture in Byzantine days. The town was cap-



FROM THE "ARGIVE HERAEUM"

PLAN OF THE HERAEUM AT ARGOS. THE SANCTUARY OF THE GODDESS HERA, AND ONE OF THE OLDEST SACRED SITES IN GREEK LANDS

Below the floor level of the older temple (1) deposits of early figurines, vases, bronzes, engraved stones, etc., point to organized worship on this site many generations before Mycenae was built. The later temple (V) illustrates Grecian architecture of the 5th century B.C., and contained some of the works of the sculptor Polycleitus

tured by the Franks in 1210; after 1246 it was held in fief by the rulers of Athens. In 1397 and 1500 the Turks massacred the population at Argos in conflicts with the Venetians. Repeopled with Albanians, Argos was chosen as seat of the Greek national assembly in the wars of independence, was courageously defended by the patriots (1822), and was burnt to the ground by Ibrahim Pasha (1825) The present town of 10,000 inhabitants is purely agricultural. The Argive plain, though not yet sufficiently reclaimed, yields good crops of corn, rice and tobacco. The early Argives were known for their musical talent. Their school of bronze sculpture, whose first famous exponent was Ageladas (Hagelaidas), the reputed master of Pheidias, reached its climax towards the end of the 5th century in Polycleitus (*q.v.*) and his pupils. To this period also belongs the new Heraeum (see below), one of the most splendid temples of Greece.

The Argive **Heraeum.**—This temple was the most important centre of Hera worship in the ancient world; it always remained the chief sanctuary of the Argive district, and was one of the earliest sites in the country. It lies on the foothills east of the Argive plain, about 5m. from Argos, 3m. from Mycenae and Miden, and 6m. from Tiryns, and was maintained jointly by Argos and Mycenae till the destruction of the latter in 468. According to tradition the Heraeum was founded by Phoroneus at least thirteen generations before Agamemnon, *i.e.*, about 1750 B.C. This is in general agreement with the archaeological evidence for the earliest Minoan exploitation of the district. That the site was occupied at least as early as this is shown by rude walls and pottery of successive styles, beneath the later sanctuary; and close at hand there is a fine "bee-hive" tomb like those of Mycenae (*q.v.*). In the period of invaders in the 11th century, in spite of the new culture which was introduced by the Dorians the Heraeum maintained its importance; it was here that the succession of priestesses served as a chronological standard for the Argive people, and even far beyond their borders; and it was here that Pheidon deposited the discarded ingot-currency. ὀβελίσκοι, when he introduced coinage into Greece. When the old temple was burnt down in the year 423 B.C., through the negligence of the priestess Chryseis, the Argives erected a splendid new temple, built by Eupolemos, in which was placed the great gold and ivory statue of Hera, by the sculptor Polycleitus, contemporary and rival of Pheidias, which was one of the most perfect works of sculpture in antiquity. Pausanias describes the temple and its contents (ii. 17), and also saw the ruins of the older burnt temple.

In 1854 A. R. Rhangabé made tentative excavations on this site, and it was completely explored by the American Archaeological Institute and School of Athens in 1892–95, showing that the sanctuary, instead of consisting of but one temple with the ruins of the older one above it, contained at least 11 separate buildings, occupying an area of about 975 by 325 feet.

In the centre of the second terrace stands the substructure of the great second temple together with so much of the architectural members that it has been possible to design a complete restoration. On the north side of this terrace, between the second temple and the Cyclopean supporting wall, a long colonnade running from east to west ends in a well-house and waterworks. At the east end chambers were erected against the hill, in front of which were placed statues and inscriptions, and a large hall containing three rows of columns, with a porch and entrance facing the temple. Below the second terrace a large complicated building, earlier than the second temple, may have served as gymnasium or sanatorium. A ruder building north of this is probably much earlier. At the foot of the elevation on which this temple stands, and thus facing the city of Argos, a splendid stoa or colonnade, to which large flights of steps lead, was erected about the time of the building of the second temple, to give worthy access from the city of Argos. At the west extremity of the whole site lies a huge stoa running round two sides of a square and an extensive house of Roman times. The masses of votive offerings and other small objects illustrate a continuous succession of styles from the Middle Minoan to Roman; and are of exceptional interest for the period of transition from Minoan to Hellenic. Commonest dedications were small clay figures of the goddess, and bronze dress-pins prov-

ing the popularity of the cult among the women, always the special care of this goddess.

The excavations in the second temple revealed the outlines of the base upon which the great statue of Hera stood, but no trace of the statue itself. From Pausanias we learn that "the image of Hera is seated and is of colossal size." Like the Olympian Zeus of Pheidias, Hera was seated on a decorated throne, holding in her left hand a sceptre, surmounted by a cuckoo (as that of Zeus had an eagle), and in her right, instead of a figure of Victory (such as the Athena Parthenos and the Olympian Zeus held), simply a pomegranate. The crown was adorned with figures of graces and the seasons. From the dimensions of the temple it is computed that the total height including the base would be about 26ft., the seated figure about 18ft. The temple was decorated with "sculptures over the columns, representing some the birth of Zeus and the battle of the gods and giants, others the Trojan War and the taking of Ilium." Besides numerous fragments a very beautiful head, probably Hera, and a draped female torso belonging to the pediments, have been discovered. Of the metopes two are almost complete, and among many fragments ten heads are well preserved.

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See also C. Waldstein, *The Argive Heraeum* (vol. i. Boston and New York, 1902); vol. ii. the Vases by J. C. Hoppin, the Bronzes by H. F. de Cosa, 1905); *Excavations of the American School of Athens at the Heraion of Argos* (1892), and numerous reports and articles in the *American Archaeological Journal* since 1892.

(M.C.; C. WA.; J. L. MY.)

ARGOSTOLI, the capital of Cephalonia, Greece, one of the Ionian islands, and seat of a bishop of the Greek Church. Pop. 9,030. It possesses a good harbour, a quay a mile in length, and a fine bridge. Shipbuilding and silk-spinning are carried on. West of the harbour there is a curious stream, flowing *from* the sea, and employed to drive mills before losing itself in caverns inland. The fine ancient fortifications of Cranii are nearby.

See C. Fellows, *Journal* of *an Excursion in Asia Minor* in 1838, and Wiebel *Die Insel Kephalonia und die Meermühlen von Argostoli* (Hamburg, 1873); *see* also IONIAN ISLANDS.

ARGOSY, the term originally for a carrack or merchant ship from Ragusa and other Adriatic ports, now used poetically of any vessel carrying rich merchandise. In English writings of the 16th century the seaport named is variously spelt Ragusa, Aragouse or Aragosa, and ships coming thence were named Ragusyes, Arguzes and Argosies; the last form surviving and passing into literature. The incorrect derivation from Jason's ship, the "Argo," is of modern origin.

ARGUIN, an island (identified by some writers with Hanno's Cerne), off the west coast of Africa, immediately south-east of Cape Blanco, in 20° 25' N., 16° 37' W. It is some 4m. long by 2½ broad, produces gum-arabic, and is the seat of a lucrative turtle-fishery. Off the island, which was discovered by the Portuguese in the 15th century, are extensive and dangerous reefs. Arguin was occupied in turn by Portuguese, Dutch, English and finally French. Aridity and bad anchorage prevent permanent settlement; the fishing is mostly done from the Canary Isles.

ARGUMENT, a word meaning "proof," "evidence." (Lat. *arguere*, to make clear, from a root meaning bright, appearing in Greek ἀργής, white). From its primary sense are derived such applications of the word as a chain of reasoning, a fact or reason given to support a proposition, a discussion of the evidence or reasons for or against some theory. "Argument" means a synopsis of the contents of a book, the outline of a novel, play, etc. In logic it is used for the middle term in a syllogism, and for many species of fallacies (see FALLACY). In mathematics (*q.v.*) the term has received special meanings; in mathematical tables the "argument" is the quantity upon which the other quantities in the table are made to depend. The term is also used in astronomy (*q.v.*).

ARGUS, in Greek mythology, the son of Inachus, Agenor or Arestor, or, according to others, an earthborn hero (*autochthōn*). From the number of eyes in his head or all over his body, he was called Panoptes (all-seeing). He was appointed by Hera to watch the cow into which Io (*q.v.*) had been transformed, but was slain by Hermes, who stoned him to death, or put him to sleep by playing on the flute and then cut off his head. His eyes were transferred by Hera to the tail of the peacock. Argus with his countless eyes originally denoted the starry heavens. (Aeschylus, Prometheus *Vinctus* 569, Ovid, *Metam.* i. 264.)

Another ARGUS, the old dog of Odysseus, who recognized his master on his return to Ithaca, figures in one of the best-known incidents in Homer's Odyssey (xvii. 291–326).

ARGYLL, EARLS AND DUKES OF. The rise of this family of Scottish peers, originally the Campbells of Lochow and first ennobled as Barons Campbell, is referred to in the article ARGYLLSHIRE.

ARCHIBALD CAMPBELL, 5th earl of Argyll (1530–73), was the elder son of Archibald, 4th earl of Argyll (d. 1558), and a grandson of Colin, the 3rd earl (d. 1530). His great-grandfather was the 2nd earl, Archibald, who was killed at Flodden in 1513, and whose father was Colin, Lord Campbell (d. 1493), founder of the greatness of the Campbell family, created earl of Argyll in 1457. With Lord James Stuart, afterwards the regent Murray, the 5th earl of Argyll became an adherent of John Knox about 1jj6. As one of the "lords of the congregation" he was one of James Stuart's principal lieutenants during the warfare between the reformers and the regent, Mary of Lorraine; later he was separated from Knox's party by his friendship with Mary, Queen of Scots. Though he disapproved of her marriage with Darnley he took her part after Elizabeth's refusal to help Murray in 1565. Argyll was probably an accomplice in the murder of Rizzio; he was certainly a consenting party to that of Darnley; then separating from Murray he commanded Mary's soldiers after her escape from Lochleven. Soon afterwards he made his peace with Murray, but it is possible that he was accessory to the regent's murder in 1570. In 1572 Argyll became lord high chancellor of Scotland, and he died Sept. 12 1573. His first wife was an illegitimate daughter of James V., and he was thus half-brother-in-law to Mary and to Murray.

ARCHIBALD CAMPBELL, 1st marquis and 8th earl of Argyll (1607–61), eldest son of Archibald, 7th earl, by his first wife, Lady Anne Douglas, daughter of William, 1st earl of Morton, was born in 1607 (the date of 1598, previously accepted, is shown by Willcock to be incorrect), and educated at St. Andrews University. When his father renounced Protestantism in 1619 he took over the management of the estates. According to Baillie, "by far the most powerful subject in the kingdom," he had been made a privy councillor in 1628, and in 1638 Charles I. summoned him to London; but he refused to be won over and openly warned Charles against his despotic ecclesiastical policy. In consequence a secret commission was given to the earl of Antrim to invade Argyllshire and stir up the Macdonalds against the Campbells, a wild and foolish project which completely miscarried. Argyll, who inherited the title by the death of his father in 1638, now definitely took the side of the Covenanters in defence of the national religion and liberties. In 1639, in a statement to Laud, he defended the abolition of episcopacy by the Assembly, which continued to sit after its dissolution by Hamilton. After the pacification of Berwick he carried a motion, in opposition to Montrose, by which the estates secured to themselves the election of the lords of the articles, who had formerly been nominated by the king, and on the prorogation of the Parliament by Charles, in May 1640, Argyll moved that it should continue its sittings and that the Government and safety of the Kingdom should be secured by a committee of the estates. In June he carried out a commission against the royalists in Atholl and Angus with some cruelty. It was on this occasion that took place the burning of "the bonnie house of Airlie."

By this time the personal rivalry and difference in opinion between Montrose and Argyll had led to an open breach. The former arranged that on the occasion of Charles's approaching

visit to Scotland, Argyll should be accused of high treason in the Parliament. The plot, however, was disclosed, and Montrose with others was imprisoned. When the king arrived he was forced to make a series of concessions. He transferred the control over judicial and political appointments to the Parliament, created Argyll a marquis (1641) with a pension of £1,000 a year. Argyll was mainly instrumental at this crisis in keeping the national party faithful to what was to him evidently the common cause, and in accomplishing the alliance with the Long Parliament in 1643. In Jan. 1644 he accompanied the Scottish army into England as a member of the committee of both kingdoms and in command of a troop of horse, but was compelled to return in March to suppress royalist movements in the north and to defend his own territories. He compelled Huntly to retreat in April, and in July advanced to meet the Irish troops now landed in Argyllshire and acting in conjunction with Montrose, who was at the head of the royalist forces in Scotland. An indecisive campaign followed in the north. Argyll then threw up his commission, and retired to Inveraray Castle. Thither Montrose unexpectedly followed him in December, compelled him to flee to Roseneath and devastated his territories. On Feb. 2 1645, when following Montrose northwards, Argyll was surprised and defeated by him at Inverlochy, and was present at Montrose's further great victory on Aug. 15 at Kilsyth. He was at last delivered from his formidable antagonist by Montrose's final defeat at Philiphaugh on Sept. 13. In 1646 he was sent to negotiate with the king at Newcastle after his surrender to the Scottish army, when he endeavoured to moderate the demands of the Parliament. On July 7 1646, he was appointed a member of the Assembly of Divines.

Up to this point the statesmanship of Argyll had been highly successful. The national liberties and religion of Scotland had been defended and still further secured by the alliance with the English opposition, and by the triumph of the Parliament and Presbyterianism in England. Charles himself was a prisoner. But Argyll's influence could not survive the rupture of the alliance between the two nations on which his whole policy was constructed. He opposed in vain the secret treaty now concluded between the King and the Scots against the Parliament, and while Hamilton was defeated by Cromwell at Preston, Argyll joined the Whiggamores, a body of Covenanters at Edinburgh; and established a new Government, which welcomed Cromwell on Oct. 4. This alliance, however, was at once destroyed by the execution of Charles I., which excited universal horror in Scotland. In the series of tangled incidents which followed, Argyll lost control of the national policy. He supported the invitation from the Covenanters to Prince Charles to land in Scotland. When Charles came to Scotland, having signed the Covenant and repudiated Montrose, Argyll remained at the head of the administration.

After the defeat of Dunbar, Charles retained his support by the promise of a dukedom and the Garter, and Argyll attempted to marry the King to his daughter. On Jan. 1 1651, he placed the crown on Charles's head at Scone. But his power had now passed to the Hamilton party. He strongly opposed, but was unable to prevent, the expedition into England, and in the subsequent reduction of Scotland, after having held out in Inveraray Castle for nearly a year, was at last surprised in Aug. 1652, and submitted to the Commonwealth. His ruin was then complete. His policy had failed, his power had vanished, and he was hopelessly in debt. In Richard Cromwell's Parliament of 1659 Argyll sat as member for Aberdeenshire. At the Restoration he presented himself at Whitehall, but was at once arrested by order of Charles and placed in the Tower (1660), being sent to Edinburgh to stand his trial for high treason. He was acquitted of complicity in the death of Charles I., and his escape from the whole charge seemed imminent, but the arrival of a packet of letters written by Argyll to Monk showed conclusively his collaboration with Cromwell's government, particularly in the suppression of Glencairn's royalist rising in 1652. He was immediately sentenced to death and was beheaded May 27 1661.

While imprisoned in the Tower he wrote *Instructions* to a *Son* (1661; reprinted in 1689 and 1743). Some of his speeches, including the one delivered on the scaffold, were published and are printed in the *Harleian Miscellany*. He married Lady Margaret Douglas, daughter of William, 2nd earl of Morton, and had two sons and four daughters.

See also the *Life and Times of Archibald, Marquis of Argyll* (1903), by John Willcock, who prints for the first time the six incriminating letters to Monk; *Eng. Hist. Review*, xviii. 369 and 624; *Scottish History Society*, vol. xvii. (1894); *Charles II. and Scotland in 1650*, ed. by S. R. Gardiner, and vol. xviii. (1895); *History of Scotland*, by A. Lang, vol. iii. (1904).

ARCHIBALD CAMPBELL, 9th earl of Argyll (1629–85), eldest son of the 8th earl, studied abroad, and returned to Scotland with Prince Charles in 1650. The marquis of Lorne (by which title he was known until his accession to the earldom) fought at Dunbar (Sept. 3 1650), and after the battle of Worcester joined Glencairn in the Highlands. Lorne fell under the displeasure of both parties. He was imprisoned in 1657 for refusing to renounce allegiance to the Stuarts, and he was imprisoned (1663) after the Restoration for incautious attacks on the Government of Charles II. His staunch Protestantism, his opposition to the repressive measures against the Covenanters and his great territorial influence made him obnoxious to James, duke of York, when he came to Scotland as high commissioner. He was accused of treason, without any real evidence, in 1681, and sentenced to death. He escaped to Holland where he joined the conspiracy to set the duke of Monmouth on the throne. He then led an unsuccessful invasion of Scotland (1685), was taken prisoner at Inchinnan (June 18) and beheaded (June 29) by order of James II. on the old charge of 1681. His head was exposed on the west side of the Tolbooth, where his father's and Montrose's had also been exhibited.

See *Argyll Papers* (1834); *Letters from Archibald, 9th Earl of Argyle, to the Duke of Lauderdale* (1829); *Hist. MSS. Comm.*, vi. Rep. 606; *Life of Mr. Donald Cargile*, by P. Walker, pp. 45 et seq.; *The 3rd Part of the Protestant Plot . . . and a Brief Account of the Case of the Earl of Argyle* (1682); Sir George Mackenzie's *Hist. of Scotland*, p. 70; and J. Willcock, *A Scots Earl in Covenanting Times* (1907).

ARCHIBALD CAMPBELL, 1st duke of Argyll (?1651–1703), was the eldest son of the 9th earl. He tried to obtain the reversal of his father's attainder by seeking the king's favour, but being unsuccessful he went over to The Hague and joined William of Orange. In spite of the attainder, he was admitted in 1689 to the convention of the Scottish estates, and in 1690 an act was passed restoring his title and estates. The refusal of the Macdonalds of Glencoe to join in the submission to him led him to organize the terrible massacre which has made his name notorious. His political services were rewarded in 1701 by his being created duke of Argyll.

JOHN CAMPBELL, and duke of Argyll and duke of Greenwich (1678–1743), son of the preceding, was born Oct. 10 1678. In return for his services in promoting the Union, he was created (1705) a peer of England, with the titles of baron of Chatham and earl of Greenwich. He served at the battle of Oudenarde (1708) and at the sieges of Lille, Ghent, Bruges and Tournay, doing remarkable service at the battle of Malplaquet in 1709. He was very popular with the troops, and his rivalry with Marlborough on this account may have been the cause of their later enmity. In 1711 he was sent to take command in Spain; but being seized with a violent fever at Barcelona, and disappointed of supplies from home, he returned to England. In the House of Lords he censured the measures of the ministry with such freedom that all his places were disposed of to other noblemen; but at the accession of George I. he recovered his influence. In the rebellion of 1715 he was appointed commander-in-chief of the forces in north Britain, and effected the total extinction of the rebellion in Scotland without much bloodshed. He arrived in London early in March 1716, and at first stood high in the favour of the King, but in a few months was stripped of his offices. He supported the bill for the impeachment of Bishop Atterbury, and opposed the bill for punishing the city of Edinburgh for the Porteous riot. In the beginning of the year 1719 he was again admitted into favour, created Duke of Greenwich;

he held various offices in succession, and in 1735 was made a field marshal. He continued in the administration till after the accession of George II., when, in April 1740, a violent speech against the government led again to his dismissal from office. Restored on a change of the ministry, but disapproving the measures of the new administration, he shortly resigned all his posts, and spent the rest of his life in retirement. He died Oct. 4 1743. A monument by Roubillac was erected to his memory in Westminster Abbey.

ARCHIBALD CAMPBELL, 3rd duke of Argyll (1682–1761), brother of the preceding, was born in June 1682. He served for a short time under the Duke of Marlborough. In 1705 he was appointed treasurer of Scotland, and in the following year was one of the commissioners for treating of the Union. Having been raised to the peerage of Scotland as earl of Islay, he was chosen one of the 16 peers for Scotland in the first Parliament of Great Britain. In 1711 he was called to the privy council, and commanded the Royal Army at the battle of Sheriffmuir in 1715. He was appointed keeper of the privy seal in 1721, and was afterwards entrusted with the management of Scottish affairs to an extent which caused him to be called "king of Scotland." In 1733 he was made keeper of the great seal. Argyll was prominently connected (with Duncan Forbes of Culloden) with the movement for consolidating Scottish loyalty by the formation of locally recruited Highland regiments. He collected one of the most valuable private libraries in Great Britain. He died suddenly April 1 j 1761, without legitimate issue.

The succession now passed to the descendants of the younger son of the 9th earl, the Campbells of Mamore; the 4th duke died in 1770, and was succeeded by his son JOHN, the 5th duke (1723–1806). He fought at Dettingen and Culloden. In the House of Commons he represented Glasgow from 1744 to 1761, and Dover, till 1766, when he was created an English peer as Baron Sundridge, the title by which till 1892 the dukes of Argyll sat in the House of Lords. In 1759 he had married the widowed duchess of Hamilton (the beautiful Elizabeth Gunning), by whom he had two sons and two daughters. The eldest of his sons, George (d. 1841), became 6th duke, and on his death was succeeded as 7th duke by his brother John (1777–1847), who from 1799–1822 sat in Parliament as member for Argyllshire. He was thrice married, and by his second wife, Joan Glassell (d. 1828), had two sons, the elder of whom (b. 1821) died in 1837, and two daughters, the second of whom died in infancy.

GEORGE JOHN DOUGLAS CAMPBELL, 8th duke (1823–1900), the second son of the 7th duke, was born April 30 1823, and succeeded his father in April 1847. He had already written some pamphlets against the disruption of the Church of Scotland, and he rapidly became prominent on the Liberal side in Parliamentary politics. He was an eloquent speaker in the House of Lords, and sat as lord privy seal (1852) and postmaster-general (1855) in the cabinets of Lord Aberdeen and Lord Palmerston. In Mr. Gladstone's cabinet of 1868 he was secretary of state for India. His refusal, against the advice of the Indian Government, to promise the Amir of Afghanistan support against Russian aggression, threw the Xmir into the arms of Russia and was followed by the second Afghan War. In 1871 his son, the marquis of Lorne, married Princess Louise, the 4th daughter of Queen Victoria. His inability to assent to the Irish land legislation of 1881 led him to resign the office of lord privy seal which he held under Gladstone's administration of 1880. Detached from party politics the duke wrote many letters to *The Times* on questions which included the rights of landowners; but he opposed the Home Rule Bill with equal vigour. In spite of this political disagreement his personal relations with Gladstone, based on common intellectual interests, remained unchanged. His chief preoccupation was the reconciliation of the dogma of Christianity with the progress of scientific discovery. His books—he published *The Reign of Law* (1866), *Primeval Man* (1869), *The Unity of Nature* (1884), *The Unseen Foundations of Society* (1893), and other essays—found a wide public, and had a considerable influence on Victorian thought. He also wrote on the Eastern question, with especial reference to India, the history and antiquities of Iona, patronage in the Church of Scotland, and many other subjects. The duke (to whose Scottish title was added a dukedom of the United Kingdom in 1892) died April 24 1900. He was thrice married: first (1844) to a daughter of the 2nd duke of Sutherland (d. 1878); secondly (1881) to a daughter of Bishop Claughton of St. Albans (d. 1894); and thirdly (1895) to Ina Erskine M'Neill.

He was succeeded as 9th duke by his eldest son JOHN DOUGLAS SUTHERLAND CAMPBELL (1845–1914), whose marriage in 1871 to H.R.H. Princess Louise, daughter of Queen Victoria, gave him a special prominence in English public life. As marquis of Lorne he was governor-general of Canada from 1878 to 1883; Member of Parliament for South Manchester, in the Unionist interest, 1895 to 1900; and he also became known as a writer both in prose and verse. In 1907 he published his reminiscences, *Pages from tlze Past.* He died May 2 1914.

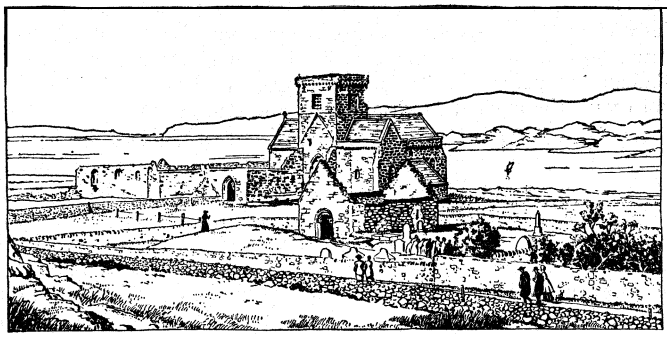
See the *Autobiography and Memoirs* of the 8th duke, edited by his widow (1906), which is full of interesting historical and personal detail.

ARGYLL ROOMS, famous London entertainment resort in the earlier part of the nineteenth century and one of the headquarters of the best public music in London for many years. They were situated near Oxford Circus in Argyll street (whence the name), on a site now occupied by 246 Regent street. Here the Philharmonic Society gave their first concerts, in the course of which Spohr, Moscheles, Liszt and Mendelssohn among others all made their first appearance in England. The premises were destroyed by fire in 1830 and though afterwards rebuilt never recovered their popularity.

ARGYLLSHIRE, a county on the west coast of Scotland, the second largest in the country, embracing a large tract on the mainland and a number of the Inner Hebrides including Coll, Tiree, Mull, Iona, Colonsay, Jura, Islay, Gigha, etc. The mainland portion is bounded on the north by Inverness-shire; on the east by Perth and Dumbarton, Loch Long and the Firth of Clyde; on the south by the North Channel (Irish sea); and on the west by the Atlantic. Area 1,990,472 acres (land) and 35,311 acres (water), total 3,165 square miles. It is for the most part mountainous and deeply indented by sea-lochs and fringed with islands; it has torrential rivers and many inland lochs and much of the finest scenery of western Scotland. In the north a peninsular portion of the mainland is defined by lochs Sheil, Eil and Linnhe. This portion is divided by Loch Sunart between the districts of Ardnamurchan and Morven, with Ardgour to the north-east, and is separated by the Sound of Mull from the island of Mull, in which Ben More reaches a height of 3,185 feet. The mainland rocks belong principally to the metamorphic series of the Scottish Highlands; late and sedimentary rocks, such as contain exposures of Jurassic age, cover only small areas, but among intrusive rocks there should be noticed the Tertiary gabbro which appears in Ardnamurchan Point (the western-most extension of the mainland of Scotland), and in islands farther north beyond the county boundary. Mull consists mainly of interbedded basalts, and the outlying islands, Coll and Tiree, of older gneissic rocks characteristic of the Hebrides. Many small islands lie west of Mull; among them Iona and Staffa (*qq.v.*) of historic and scenic fame. Loch Linnhe gives access far into the land, and to Glen More, the Great Glen, which strikes across the Highlands to Moray Firth on the east coast. The mainland part of Argyllshire east of Loch Linnhe may be demarcated into districts by the greater valleys radiating west, south-west and south from the western Grampians, and separated by ranges and groups of mountains. The valleys in this part of Argyllshire contain Loch Leven (an arm of Loch Linnhe), Loch Etive, Loch Fyne and Loch Long, sea-lochs, and Loch Awe (the largest inland loch in the county). Loch Etive connects with Loch Linnhe through a narrow channel at Connel Ferry, near which the Falls of Connel, more properly rapids, are carried by the rush of the ebbing tide over a rocky bar. Ossian called them the Falls of Lora.

Some district-names in this part of the county are well known in history and literature. Appin borders Loch Linnhe in the north; Benderloch lies between Loch Creran and Loch Etive. Lorne,

southward from Loch Etive, gives the title of marquess to the Campbells. Argyll, the district from which the shire takes name, is between lochs Awe and Fyne; it contains Inveraray castle and gives the titles of earl and duke to the Campbells. Cowall is between Loch Fyne and the Firth of Forth; Knapdale between Loch Fyne and the Sound of Jura. Southward from the last district extends the peninsula of Kintyre, almost isolated by West Loch Tarbert, and at its southern point, the Mull of Kintyre, reaching



THE CHURCH AT IONA, ARGYLLSHIRE, A REMINDER OF THE TIME WHEN THIS ISLAND WAS THE CENTRE OF CELTIC CHRISTIANITY. MANY MONASTIC RUINS ARE STILL EXTANT AND THE CHURCHYARD ON THE RIGHT HAS BEEN CALLED "THE BURIAL-PLACE OF KINGS"

within 13m. of the Irish coast, across the North Channel. The county includes the islands of Jura, Islay, Colonsay and others, westward of Knapdale and Kintyre.

The mountains of the mainland culminate in Ben Cruachan (3,689ft.), close above Loch Etive, where the upper part of that inlet penetrates deeply into an extensive mass of intrusive granite. Some of the very fine glens are famous in history, *e.g.* Glen Croe, Glen Etive, Glendaruel, Glen Lochy ("the wearisome glen" —some 10m. of bare hills and boulders—between Tyndrum and Dalmally), Glen Strae, Hell's Glen (off Loch Goil) and Glencoe, the scene of the massacre in 1692. The two principal rivers are the Orchy and the Awe. The Orchy flows from Loch Tulla through Glen Orchy, and falls into the north-eastern end of Loch Awe; and the Awe drains the loch at its north-west.

The metamorphic rocks already mentioned are associated with bands of epidiorite which have shared in the folding (north-east and south-west) and metamorphism of the region. Lower Old Red Sandstone, chiefly lavas and tuffs, rests unconformably upon the metamorphic series over a wide area in Lorne, in the high mountains on both sides of Glencoe, and elsewhere. Similarly the upper Old Red Sandstone forms isolated patches resting unconformably on all older rocks, on the west coast of Kintyre, etc. But the metamorphic series predominates generally in the county and nearly all its subdivisions (see SCOTLAND, Geology) are represented. A striking geological feature of the county is the number of dolerite and basalt dykes trending in a north-west direction and referred to the Tertiary period. Another group of dolerite dykes running east and west near Dunoon and elsewhere are cut by the former and are probably older.

History.—The early history of Argyll (Airer *gaidheal*) is obscure. At the close of the 5th century Fergus, son of Erc, a descendant of Conor II., *airdrigh* or high king of Ireland, came over with a band of Irish Scots and established himself in Argyll and Kintyre. Nothing more is known till, in the days of Conall I., the descendant of Fergus in the fourth generation, St. Columba appears. Conall died in 574, and Columba was mainly instrumental in establishing his first cousin, Aidan, founder of the Dalriad kingdom and ancestor of the royal house of Scotland, in power. In the 8th century the islands of Scotland and Man fell to the Norsemen who also fought and at times ruled on the mainland of Argyll until, in the 12th century, Somerled (or Somhairlie), a descendant of Colla-Uais, airdrigh of Ireland (327–331), established his authority as thane of Argyll and in Kintyre and the Western Islands. Somerled died in 1164 and his descendants maintained some measure of rule in Argyll and the islands, between the conflicting claims of the kings of Scotland, Norway and Man, until the end of the 15th century.

In 1222 Argyll was reduced by Alexander II., the Scottish king, to a sheriffdom, and was henceforth regarded as an integral part of Scotland. The Campbells of Loch Awe, a branch of the clan McArthur, now began to come to the fore, though the MacDougals owned most of the mainland. The house of Somerled were now feudatories of the king of Norway for the isles and of the king of Scotland for Argyll and they often kept a masterly neutrality. During the expedition of Alexander II. to the Western Isles in 1249, Ewan (Eoghan), lord of Argyll, refused to fight against the Norwegians; in 1263 the same Ewan refused to join Haakon of Norway in attacking Alexander III. Forty years later the clansmen of Argyll, mainly MacDougals, were warring on the side of Edward of England against Robert Bruce, by whom they were defeated on Loch Awe in 1309. The clansmen of the house of Somerled in the isles, on the other hand, the MacDonalds, remained loyal to Scotland in spite of the persuasions of John of Argyll, appointed admiral of Edward II.'s western fleet; and, under their chief Angus Og, they contributed much to the victory of Bannockburn. The alliance of John, earl of Ross and lord of the Isles, with Edward IV. of England in 1461 led to the breaking of the power of the house of Somerled, and in 1478 John was forced to resign Ross to the crown and, two years later, his lordships of Knapdale and Kintyre as well. In Argyll itself Colin, grandson of Sir Duncan Campbell of Lochow, first Lord Campbell, had married Isabel Stewart, eldest of the three co-heiresses of John, third lord of Lorne. He bought the greater part of the lands of the other sisters and got the lordship of Lorne from Walter their uncle, the heir in tail male, in exchange for lands in Perthshire. In 1457 he was created, by James II., earl of Argyll. He died on May 10, 1493. From him dates the greatness of the house of the earls and dukes of Argyll (*q.v.*), whose history belongs to that of Scotland. The house of Somerled survives in two main branches—that of Macdonald of the Isles, Alexander Macdonald (d. 1795) having been raised to the peerage in 1776, and that of the Macdonnells, earls of Antrim in Ireland. The principal clans in Argyll, besides those already mentioned, were the Macleans, the Stewarts of Appin, the Macquarries and the Macdonalds of Glencoe, and the Nacfarlanes of Glencoe. The Campbells are still very numerous in the county.

Argyllshire men have made few contributions to English literature. For long the natives spoke Gaelic only and their bards sang in Gaelic (see CELTIC LITERATURE, Scottish). Near Inistrynich on the north-east shore of Loch Awe stands the cairn in honour of Duncan Ban McIntyre (1724–1812), the most popular of modern Gaelic bards. But the beauty of the country has made it a favourite setting for the themes of many poets and story-tellers, from Ossian and Sir Walter Scott to Robert Louis Stevenson.

The antiquities comprise monoliths, circles of standing stones, crannogs and cairns. In almost all the burying-grounds—as at Campbeltown, Keil, Soroby, Kilchousland, Kilmun—there are examples of sculptured crosses and slabs. Besides the famous ecclesiastical remains at Iona (*q.v.*), there are ruins of a Cistercian priory in Oronsay, and of an abbey founded in the 12th century by Somerled, thane of Argyll, at Saddell. Among castles may be mentioned Dunstaffnage, Ardtornish, Skipness, Kilchurn (beloved of painters), Ardchonnel, Dunolly, Stalker, Dunderaw and Carrick.

Population and Government.—Owing to emigration, chiefly to Canada, the population declined, almost without a break, from 1831, when it was 100,973, to 70,902 in 1911. In 1921 it was 76,862, perhaps because taken in the tourist season. In 1931 it was 63,014. In that year the number of Gaelic-speaking persons was 20,913 (a decrease of nearly 4.000 since 1921), of whom 335 spoke Gaelic only. The chief towns are Campbeltown, Dunoon, Oban, with Ardrishaig, Ballachulish, Lochgilphead and Tarbert as smaller centres. It is in such places as these, and especially in those developed as holiday resorts and residential outposts from Glasgow, that the recent increase of population is found. The county returns a member to parliament. Argyllshire is a sheriffdom, and there are resident sheriffs-substitute at Campbeltown, Fort William and Oban; courts are held also at Dunoon and Bowmore in Islay. Both Presbyterian bodies are strongly represented;

there are Roman Catholic and Anglican Episcopal bishops of Argyll and the Isles, and there is a Roman Catholic pro-cathedral at Oban.

Agriculture.—Argyllshire was formerly partly covered with natural forests, and oak, ash, pine and birch are still visible in the mosses; but, owing to the clearance for sheep, and to past neglect of planting, the country is lacking in wood, except near Inveraray and a few other places. Nearly three-quarters of the county consists of mountain and moor, but many districts afford fine pasturage for sheep; and some of the valleys such as Glendaruel are fertile. The chief crops are oats and hay and there is a little barley. The crofting system exists, but is by no means universal: it is predominant in Tiree and the western district of the mainland, but elsewhere farms of moderate size are the rule. The cattle, though small, are good and are marketed in large numbers in the south. Dairy farming is carried on to some extent, especially in Kintyre, where there is a large proportion of arable land. In the higher tracts sheep have taken the place of cattle. The black-faced sheep is the species most generally reared by farmers in this county.

Industries.—Whisky is manufactured at Campbeltown, in Islay and at Oban. Gunpowder is made at Kames (Kyles of Bute) and Melfort. Coarse woollens are made for home use; but fishing is the most important industry and Loch Fyne is famous for its herrings, while fishing is carried on at one or other of the ports all the year round.

Communications.—Owing to paucity of industries and to the greatly indented coast-line (no place more than 12m. from the sea) the railway mileage in the country is very small. The Tyndrum to Oban section of the L.M.S. railway company's system is within the county limits; a small portion of the L.N.E. company's line to Mallaig skirts the extreme west of the shire, and the L.M.S. line from Oban to Ballachulish serves the north coast of the mainland. A cantilever bridge crosses the Falls of Lora with a span of 500ft., at a height of 125ft. above the waterway. The chief means of communication is by steamers, between Glasgow and various parts of the coast. The Crinan Canal (*q.v.*) (1793–1801) gives a short circuit for Kintyre. Before the railways the shire contained many famous coaching routes, now used by motor traffic, and in some directions in process of extension. In few other areas is the position of the main roads so closely controlled by physical conditions as it is in Argyllshire. Here they follow the lochs and the coast but an important one goes through the highlands from the head of Glen Falloch in Perthshire past the heads of Glen Lochy and Glen Orchy, along the west of Rannoch Moor past the top of Glen Etive to Glencoe, through which it descends to Loch Leven.

ARGYRASPIDES, "silver shields" a corps of Macedonian shield-bearers (hypaspists) which, after the death of Alexander, and still more after the death of Antipater (319) played an important part, under their general Antigenes, in the division of the empire. They consisted of 3,000 veterans. They were the sole body of Macedonian troops which had kept together as a unit, and they were in charge of the huge royal treasure at Cyinda. Popular opinion regarded them as invincible; their adhesion to Eumenes for two years was the basis of his power. In 317, in his war with Antigonus, they were for long his chief support, but after a defeat at Gabiene, they mutinied and handed Eumenes over to Antigonus, who executed him and burnt Antigenes alive. Antigonus then broke up the corps and distributed it among the forces of various frontier satraps.

ARGYRODITE, a mineral which is of interest as being that in which the element germanium was discovered. It is a silver sulpho-germanate, Ag_8GeS_6, and crystallizes in the cubic system. The botryoidal crusts of small indistinct crystals first found in a silver mine at Freiberg in Saxony were originally thought to be monoclinic, but were afterwards proved to be identical with the more distinctly developed crystals found in Bolivia. The colour is iron-black with a purplish tinge, and the lustre metallic. Hardness 2½, specific gravity 6·2. Isomorphous with argyrodite is the corresponding tin compound Ag_8SnS_6, also found in Bolivia as cubic crystals, and known by the name canfieldite.

ARGYROKASTRO (Albanian *Gjinokastër*), a town of southern Albania. Pop. (1930) 10,836, of whom nearly 75% were Muslims and the remainder Greek-speaking Orthodox Christians. It was practically depopulated by the plague in 1814. It is situated 1,060 ft. above sea-level on the Aoroceraunian mountains and possesses the ruins of a big fort, formerly headquarters of Muslim aristocracy. It was captured by the Turks in 1420 and held by them till the independence of Albania in 1913. At the close of the Balkan Wars (1912–13) the town was unsuccessfully claimed by Greece. Occupied by Italy in 1939, it was captured Dec. 8, 1940 by the Greeks, who held it until Germany's Balkan campaign the following April. It has been identified both with the ancient Hadrianopolis and Antigonea.

ARGYROPULUS or **ARGYROPULO, JOHN** (1416?–1486), Greek humanist, a very active promoter of the revival of learning in the West, was born in Constantinople, and became a teacher there, Constantine Lascaris being his pupil. He was teaching in Padua in 1434, being subsequently made rector of the university. About 1441 he returned to Constantinople, but after its capture by the Turks, again took refuge in Italy. About 1456 he was invited to Florence by Cosimo de' Medici, and was there appointed professor of Greek in the university. In 1471, on the outbreak of the plague, he removed to Rome, where he continued to act as a teacher of Greek till his death. Among his scholars were Angelus Politianus and Johann Reuchlin. His principal works were translations of the following portions of Aristotle,—*Categoriae, De Interpretatione, Analytica Posteriora, Plzysica, De Caelo, De Anima, Metaphysica, Ethica Nicomachea, Politica;* and an *Expositio Ethicorum Aristotelis.* Several of his writings exist still in manuscript.

See Humphrey Hody, *De Graecis Zllustribus,* 1742, and Smith's *Dictionary of Greek and Roman Biography, s.v.* Joannes.

ARIA, a musical term, equivalent to the English "air," signifying a melody apart from the harmony, but especially a musical composition for a single voice or instrument, with an accompaniment of other voices or instruments.

The classical aria developed from the expansion of a single vocal melody, generally on the lines of what is known as binary form *(see* SONATA and SONATA FORMS). Accordingly, while the germs of aria form may be traceable in advanced examples of folk-song, the aria as a definite art-form could not exist before the middle of the 17th century; because the polyphony of the 16th century left no room for the development of melody for melody's sake. When at the beginning of the 17th century the Monodists *(see* HARMONY and MONTEVERDI) dimly conceived the enormous possibilities latent in their new art of accompanying single voices by instruments, it was natural that for many years the mere suggestiveness and variety of their experiments should suffice, without coherent forms, to retain the attention of contemporary listeners. But, even at the outset, the most novel harmonies used with the most poignant rhetoric, were not enough in themselves to satisfy the pioneers. Accordingly, Monteverdi's famous lament of the deserted Ariadne is one of many early examples that appeal to a rudimentary sense of form by making the last phrase identical with the first.

As instrumental music grew, and the classical sense of key became strong and consistent (in the hands of Alessandro Scarlatti, *q.v.*) composers were driven to appeal to that sense of harmonically-solid melody which had asserted itself in folk-music before the history of harmonic music may be said to have begun.

By Scarlatti's time it was thoroughly established that an extended melody should normally modulate to the dominant after establishing its own key, and that the subsequent modulations should work through other related keys back to the tonic. Introduce the voice by an instrumental *ritornello,* containing the gist of the melody and recurring, in part or in whole, at every full close; and you have a form which can expand a melody so as to give ample scope both to the singer and to the accompanying players. The aria became the prototype of the CONCERTO (*q.v.*).

The addition of a middle section with a *da capo* results in the universal 18th century da *capo* form of aria. The possibilities of variety are greater than the description might suggest. The

voice may enter with a different theme from that of the ritornello; the ritornello may be stated in separate portions; the ritornello may have its own contrast between solo and tutti instruments; the vocal material may combine with it contrapunlally, etc., etc. All the arias and duets in Bach's B minor Mass and Christmas oratorio differ in these matters, and the differences well repay analysis, being often subtly suggested by the sense of the words. The middle section generally contributes no new element, except that it avoids the tonic. Gluck, who swept away the whole method as inherently anti-dramatic, points out, in the preface to Alceste, that the middle section is generally perfunctory, and that the sole object of the da capo is to enable the singer to display new ornaments. Nevertheless, the classical (or Neapolitan) aria is a composition of considerable length, in a form which cannot fail to be effective and coherent; and there is little cause for wonder in the extent to which it dominated 18-century music.

The aria forms are profoundly influenced by the difference between the sonata style and the style of Bach and Handel. But the scale of the form is inevitably small, and in any opera an aria is hardly possible except in a situation which is a tableau rather than an action. Consequently there is no such difference between the form of the classical operatic aria of Mozart and that of the Handelian type as there is between sonata and suite music. The scale, however, has become too large for the da capo, which was in any case too rigid to survive in music designed to intensify a dramatic situation instead of to distract attention from it. The necessary change of style was so successfully achieved that, until Wagner succeeded in devising music that moved absolutely *pari passu* with his drama, the aria remained as the central formal principle in dramatic music; and few things in artistic evolution are more interesting than the extent to which Mozart's predecessor, the great dramatic reformer Gluck, profited by the essential resources of his pet aversion the aria style, when he had not only purged it of what had become the stereotyped ideas of ritornellos and vocal flourishes, but animated it by the new sense of dramatic climax to which the sonata style appealed.

In modern opera the aria is almost always out of place, and the forms in which definite melodies nowadays appear are rather those of the song in its limited sense as that of a poem in formal stanzas all set to the same music. In other words, a song in a modern opera tends to be something that would be sung even if the drama had to be performed as a play without music; whereas a classical aria would in non-musical drama be a soliloquy.

In the later works of Wagner those passages in which we can successfully detach complete melodies from their context have, one and all, dramatically the aspect of songs and not of soliloquies. Siegmund sings the song of Spring to his sister-bride; Mime teaches Siegfried lessons of gratitude in nursery rhymes; and the whole story of the *Meistersinger* is a series of opportunities for song-singing. The distinctions and gradations between aria and song are of great aesthetic importance, but their history would carry us too far. The main distinction is obviously of the same importance as that between dramatic and lyric poetry.

The term aria form is applied, generally most inaccurately, to all kinds of slow cantabile instrumental music of which the general design can be traced to the operatic aria. Mozart, for example, is very fond of slow movements in large binary form without development, and this is constantly called aria-form, though the term ought certainly to be restricted to such examples as have some traits of the aria style, such as the first slow movement in the great serenade in B flat. At all events, until writers on music have agreed to give the term some more accurate use, it is as well to avoid it and its cognate version, Lied-form, altogether in speaking of instrumental music.

The air or aria in Bach's suites is a short binary movement in a flowing rhythm in not very slow common or duple time.

(D. F. T.)

ARIADNE, in Greek mythology, the daughter of Minos, king of Crete, and Pasiphae, the daughter of Helios the Sun-god. When Theseus landed on the island to slay the Minotaur (q.v.), Ariadne fell in love with him and gave him a clue of thread to guide him through the mazes of the Labyrinth. After he had slain the monster Theseus carried her off, but, according to Homer (Odyssey, xi. 322), she was slain by Artemis at the request of Dionysus in the island of Dia, near Knossos, before she could reach Athens with Theseus. In the later legend, while asleep on the island of Naxos, she was abandoned by Theseus. She was discovered by Dionysus on his return from India, who, enchanted with her beauty, married her when she awoke. She received a crown as a bridal gift, which was placed amongst the stars, while she herself was honoured as a goddess. (Ovid, *Metam.* viii. 152, Fasti, iii. 459). The name probably means "very holy" (ἁρι, ἁγνή).

Ariadne, originally a goddess of vegetation, is the personification of spring. Hence her festivals at Naxos present a double character; the one, full of mourning and sadness, represents her death or abandonment by Theseus, the other full of joy and revelry, celebrates her awakening from sleep and marriage with Dionysus. Thus nature sleeps and dies during winter, to awake in spring time to a life of renewed luxuriance. With this may be compared the festivals of Adonis and Osiris and the myth of Persephone.

The story of Dionysus and Ariadne was a favourite subject for reliefs and wall-paintings. Most commonly Ariadne is represented asleep on the shore of Naxos, while Dionysus, attended by satyrs and bacchanals, gazes admiringly upon her; sometimes they are seated side by side under a spreading vine. The scene where she is holding the clue to Theseus occurs on a very early vase in the British Museum.

ARIANISM: see ARIUS.

ARIANO, town and episcopal see, in the province of Avellino, Campania, Italy, 1,509 ft. above sea-level, on the railway between Benevento and Foggia, 24 mi. E. of the former by rail. The population in 1936 was 9,473 (town), 24,357 (commune). It lies in the centre of a fertile district, but has often been devastated by earthquakes; a considerable part of the population still dwells in caves. It occupies the supposed site of Aequum Tuticum, an ancient Samnite town, a Roman post-station on the Via Traiana; but this was probably at S. Eleuterio, 5½m. north.

ARIAS MONTANO, BENITO (1527–98), Spanish orientalist and editor of the *Antwerp* Polyglot, was born at Frejenal de la Sierra, in Estremadura. In 1562 he was appointed consulting theologian to the Council of Trent. He retired to Peña de Aracena in 1564, wrote his commentary on the minor prophets (1571), and was sent in 1568 to Antwerp by Philip II. to edit the polyglot Bible projected by Christopher Plantin. The work appeared in eight volumes folio, between 1568 and 1573. The last years of his life were spent in seclusion in Seville.

He is the subject of an *Elogio histórico* by Tomás Gonzalez Carvajal in the *Memorias de la Real Academia de la Historia,* vol. vii. **(1832).**

ARICA (SAN MARCOS DE ARICA), a town and port on the Chile-Peru border in the arid Chilean province of Tarapaca. Pop. (est.) 13,000. It is the port for Tacna. Peru, 39 mi. distant, with which it is connected by rail and highway, and the terminus of the Arica-La Paz (Bolivia) railway. The great earthquake of 1868, followed by a tidal wave, nearly destroyed the town and shipping. Arica was captured, looted and burned by the Chileans in 1880, and in accordance with the terms of the treaty of Ancon (1883) should have been returned to Peru in 1894, but this was not done. Late in 1906 the town again suffered severely from an earthquake. See TACNA-ARICA QUESTION.

ARICIA (mod. *Ariccia*), an ancient city in Latium, on the Via Appia, 16m. S E. of Rome. The nucleus of the old town, now the modern, lay high (1,350ft. above sea-level) above the circular Valle Aricciana, probably an extinct volcanic crater; remains of its walls are traceable. The lower town was situated on the north edge of the valley, close to the Via Appia, which descended into the valley from the modern Albano and reascended partly upon very fine substructions of opus quadratum, some 250yds. in length, to the modern Genzano. There are remains of the walls of the lower town, of the *cella* of a temple of the 2nd century B C. and also of later buildings connected with the post-station and baths. Aricia, one of the oldest cities of Latium, appears as a serious opponent of Rome at the transi-

tion from kings to republic. In 338 B.C. it was conquered by C. Maenius, but was soon given full civic rights. Its vegetables and wine were famous, and the district is still fertile.

See G. Florescu in Ephemeris Dacico-Romana, iii. (Rome, 1925).

ARICINI, the ancient inhabitants of Aricia (q.v), the form of the name ranking them with the Sidicini, Marrucini (q.v.), etc., as one of the communities belonging probably to the earlier or Volscian stratum of population on the west side of Italy, who were absorbed by the Sabine or Latin immigrants. Special interest attaches to this trace of their earlier origin because of the famous cult of Diana Nemorensis, whose temple in the forest close by Aricia, beside the *lacus* Nemorensis, was served by "the priest who slew the slayer, and shall himself be slain"; that is to say, the priest, who was called rex Nemorensis, held office only so long as he could defend himself from any stronger rival. This cult, which is unique in Italy, is picturesquely described in the opening chapter of Sir James Frazer's Golden *Bough* (3rd ed.) where full references will be found. The old-world custom was dying out in the 1st century A.D. It is a reasonable conjecture that this extraordinary relic of barbarism was characteristic of the earlier stratum of the population, who presumably called themselves Arici.

See also J. G. Frazer, Studies in the Early History of Kingship (1907).

ARIÈGE, a department in southern France, bounded on the south by Spain, west and north by Haute Garonne, north-east and east by Aude, south-east by Pyrénées Orientales. Area 1,893 sq.m. Pop. (1936) 155,134. The south includes the old folded rocks of the Pyrenean axis with snow peaks (P. de Montcalm, 10,512ft.) and several high passes, and the crestline is the international boundary but not a true economic one, for there are many communications between the hill pastures on both sides when the passes are open. The pass or col de Puymorens was specially important and a pilgrim way to Monserrat, and control of it was a basis of the power of the countship of Foix, which remained distinct till the Revolution of 1789, and now, with parts of Languedoc and Gascony, forms the department in the basin of the Ariège river. The hills furnish summer pasture and trackways for animals and muleteers who avoid the forested ravines; many flocks are driven down to the plains for wintering. The M. de Tabe and M. de Plantaurel are parallel ranges north of the main one; the steep slope down to the open lowland of tertiary rocks northwards has mainly calcareous rocks with gorges, caves and river tunnels. Tuc d'Audoubert and Trois Frères among caves and Mas d'Azil among tunnels are famed archaeologically The average temperature (sea level) in summer is 70°F.–72°F., in winter about 43°F., rainfall generally above 30in., over 40 in nearly all the highland, and over 60 on many heights.

Stock-raising is intensive in parts of the Ariège valley and small holdings abound, wheat, maize and potatoes being grown, with vines near Pamiers, etc. Minerals include iron, lead, copper, manganese, gypsum, talc, phosphates, salt (region of the River Salat), grindstones and building stones. Warm springs occur at Ax, Aulus, and Ussat. Iron foundries and forges exist at Pamiers, which is also the seat of a bishopric in the province of the archbishop of Toulouse. Mirepoix, an old bishop's seat, has a cathedral (15–16th cent.) with a fine spire. Foix is the capital and St. Girons capital of arrondissement. The department is in the educational division and under the court of appeal of Toulouse, and in the territory of the XVII. Army Corps.

ARIEL, the name of a Moabite mentioned in the Old Testament (II. Sam. 23; I. Chron. ii. R.V.). In Shakespeare's comedy The Tempest the spirit of the air delivered from captivity by Prospero, and henceforward his devoted familiar, is called Ariel. Milton used the name for one of the fallen angels in his Paradise Lost.

The word is generally interpreted as "lion (or altar) of God," and, although of Hebrew origin, the name has become familiar in English fairy-tale and folklore.

ARIES (the "Ram"), in astronomy, the first sign of the zodiac, denoted by the sign ♈, in imitation of a ram's head. According to a Greek myth, Nephele, mother of Phrixus and Helle, gave her son a ram with a golden fleece. To avoid the evil designs of Hera, their stepmother, Phrixus and Helle fled on the back of the ram, and reaching the sea, attempted to cross. Helle fell from the ram and was drowned (hence the Hellespont); Phrixus, having arrived in Colchis, sacrificed the ram to Zeus, who placed it in the heavens as the constellation.

The "first point of Aries," which is now far away from the constellation and is situated in Pisces, is the zero from which the right ascensions and longitudes of the stars are measured. It is at the crossing point of the equator and ecliptic on the celestial sphere.

ARIETTA (Ital.), diminutive of aria, an air, and hence signifying, in music, an aria of a shorter and simpler kind than one fully developed. (See ARIA.)

ARIKARA, a semi-sedentary Plains tribe of Indians, the northernmost offshoot of the Caddoans, combining maize farming with bison hunting. Traditionally and by speech they are a branch of the Pawnee. During the 19th century they were affiliated with the Siouan Mandan and Hidatsa, the three groups living in permanent settlements of earth-covered lodges on the Missouri river in North Dakota, and being known as "Village Indians" in distinction from the surrounding nomadic hunting tribes. The population has shrunk from two or three thousand to a few hundred. Maize rituals, mound burial, house type, organization on a village instead of band basis, indicate Arikara culture as basically of the type prevalent about the lower Mississippi, subsequently remodelled on the Plains. In fact, it may have been their example that led the Mandan and Hidatsa to adopt settled life.

ARIMASPI, an ancient people in the extreme north-east of Scythia (*q.v.*), probably the eastern Altai. All accounts of them go back to a poem by Aristeas of Proconnesus, from whom Herodotus (iii. 116, iv. 27) drew his information. They were supposed to be one eyed and to steal gold from the griffins that guarded it (the district is auriferous). In art they are usually represented as richly dressed Asiatics, picturesquely grouped with their griffin foes; the subject is often described by poets from Aeschylus to Milton. They are so nearly mythical that it is impossible to insist on the usual identification with the ancestors of the Huns.

ARIMINUM (modern Rimini), a city of Aemilia, N E. Italy, 6gm. S.E. of Bononia. Founded by Umbrians, in 268 B.C. it became a Roman colony. It was reached from Rome by the Via *Flaminia,* constructed 220 B.C., and became the bulwark of the Roman power in Cisalpine Gaul, to which province it even gave its name. Its harbour was of some importance, but is now silted up, the sea having receded. The construction of the *Via Aemilia* (187 B.C.) and the Via *Popilia* (132 B.C.) made it a road centre. In 82 B.C., having been held by the partisans of Marius, it was plundered by those of Sulla and a military colony settled there. Caesar occupied it in 49 B.C. after crossing the Rubicon. In 27 B.C. Augustus divided the city into seven vici, or quarters, after the model of Rome, from which the names of the vici were borrowed. He also restored the Via *Flaminia* from Rome to Ariminum. At the entrance to the latter the senate erected, in his honour, a triumphal arch which is still extant—a fine simple monument with a single opening. At the other end of the main street (3,000 Roman ft. in length) is a fine five-arched bridge over the Ariminus (modern Marecchia) built under Augustus and Tiberius. The present Piazza Giulio Cesare marks the site of the ancient forum, and the streets still follow the ancient lines. There are remains of the amphitheatre. In A.D. 69 the town was attacked by the partisans of Vespasian and was besieged for five months by the Goths in 538. It was one of the five seaports which remained Byzantine until the time of Pippin. (See RIMINI.)

See A. Tonini, Storia *della Città* di *Rimini* (Rimini, 1848–62).

ARIOBARZANES, the name of three ancient kings or satraps of Pontus, and of three kings of Cappadocia. Of the Pontic kings the most famous is Ariobarzanes I. He succeeded his father Mithridates in the satrapy in 363 B.C., revolted from Artaxerxes in 362, and founded the independent kingdom of Pontus. He and his three sons were made Athenian citizens. Of the Cappadocian kings, I. (Philo-Romaeus) reigned from 93–63 B.C., being

frequently driven out by Mithridates and restored by the Romans. He was finally established by Pompey, and soon after (c. 63) abdicated in favour of his son. 2. (Eusebes, Philo-Romaeus), grandson of the above, succeeded c. 51 B.C. He was friendly with Cicero during Cicero's proconsulate in Cilicia, and fought for Pompey in the Civil War. Caesar confirmed him in his kingdom, and protected him from Pharnaces of Pontus. In 42 B.C. Cassius accused him of conspiracy and put him to death.

ARION, (1) of Methymna, in Lesbos, a semi-legendary poet and musician, friend of Periander, tyrant of Corinth. He flourished about 625 B.C. He is said to have invented the dithyramb, *i.e.*, probably he gave it literary form. The name Cycleus given to his father indicates the connection of the son with the "cyclic" or circular chorus of the dithyramb. No genuine work of his survives. Of his life, only the following story in Herodotus (i. 23) and subsequent writers has come down. After a successful "tour" in Sicily and Magna Graecia he embarked at Taras (Tarentum) in a Corinthian vessel. The sight of his treasure roused the cupidity of the sailors, who resolved to possess themselves of it by putting him to death. Arion, as a last favour, begged permission to sing a parting song. The sailors, desirous of hearing so famous a musician, consented, and the poet, standing on the deck of the ship, in full minstrel's attire, sang a dirge accompanied by his lyre. He then threw himself overboard; but instead of perishing, he was miraculously borne up in safety by a dolphin, supposed to have been charmed by the music. Thus he was conveyed to Taenarum, whence he proceeded to Corinth, arriving before the ship. Periander, at first incredulous, eventually learned the truth by a stratagem. Summoning the sailors, he demanded what had become of the poet. They affirmed that he had remained behind at Tarentum; upon which they were suddenly confronted by Arion himself, arrayed in the same garments in which he had leapt overboard. The sailors confessed their guilt and were punished. Arion's lyre and the dolphin were translated to the stars. Herodotus and Pausanias (iii. 25, 7) both refer to a bronze figure at Taenarum which was supposed to represent Arion seated on the dolphin's back. But this is quite as likely to be, *e.g.*, Phalanthus, the founder (οἰκίστης) of Tarentum, on his dolphin. See Pausanias, x. 13, 10.

(2) ARION or AREION, a wonderful horse, offspring of Poseidon and Demeter Erinys (see *Denzeter),* which belonged to Adrastus (see OEDIPUS).

ARIOSO (Ital.), a musical term denoting a piece or passage of a melodious and song-like character, but lacking the design and form of a regular aria or air.

ARIOSTP, ATTILIO (c. 1660), operatic composer, was born at Bologna and brought out his first opera *Dafne* at Venice in 1686. Later he went to Germany and was Hofkapellmeister at Berlin in 1698. Subsequently he passed many years in London, producing there a number of operas, and becoming in 1720, with Handel and Bononcini, one of the first three joint directors of the London Academy of Music. He died in obscurity abroad, neither the date nor the place of his death being known.

See Alfred Ebert, *Attilio Ariosti in Berlin* (Leipzig, 1905).

ARIOSTO, LODOVICO (1474–1533), Italian poet, was born at Keggio, in Emilia, where his father was commander of the citadel. He showed a strong inclination to poetry, but was obliged by his father to study the law—a pursuit in which he lost five of the best years of his life. Allowed at last to follow his inclination, he applied himself to the study of the classics under Gregorio da Spoleto; but the early removal of his tutor to France deprived him of the opportunity of learning Greek, as he intended. His father dying soon after, he was compelled to forego his literary occupations to provide for his nine brothers and sisters, one of whom was a cripple. He wrote, however, about this time, some comedies in prose and a few lyrics, which attracted the notice of the cardinal Ippolito d'Este, who took the young poet under his patronage. This prince usurped the character of a patron of literature, whilst the only reward which the poet received for having dedicated to him the *Orlando Furioso,* was the question, "Where did you find so many stories, Master Ludovic?" The cardinal went to Hungary in 1518, and wished Ariosto to accompany him. The poet excused himself, pleading ill health, his love of study, the care of his private affairs and the age of his mother, whom it would have been disgraceful to leave. His excuses were not received, and even an interview was denied him. Ariosto then boldly said, that if his eminence thought to have bought a slave by assigning him the scanty pension of 75 crowns a year, he was mistaken and might withdraw his boon—which it seems the cardinal did.

The cardinal's brother, Alphonso, duke of Ferrara, now took the poet under his patronage. This was but an act of simple justice, Ariosto having already distinguished himself as a diplomatist, chiefly on the occasion of two visits to Rome as ambassador to Pope Julius II. The fatigue of one of these hurried journeys brought on a complaint from which he never recovered; and on his second mission he was nearly killed by order of the violent pope, who happened at the time to be much incensed against the duke of Ferrara. On account of the war, his salary of only 84 crowns a year was suspended, and it was withdrawn altogether after the peace; in consequence of which Ariosto asked the duke either to provide for him, or to allow him to seek employment elsewhere. A province, situated on the wildest heights of the Apennines, being then without a governor, Ariosto received the appointment, which he held for three years. The province was distracted by factions and banditti, yet it is said that Ariosto's government satisfied both the sovereign and the people confided to his care; and a story is added of his having been captured by a party of banditti, whose chief, on discovering that his captive was the author of *Orlando Furioso,* humbly apologized for not having immediately shown him the respect which was due to his rank. Although he had little reason to be satisfied with his office, he refused an embassy to Pope Clement VII. offered to him by the secretary of the duke, and spent the remainder of his life at Ferrara, writing comedies, superintending their performance as well as the construction of a theatre, and correcting his *Orlando Furioso,* of which the complete edition was published only a year before his death.

Ariosto was honoured and respected by the first men of his age, yet he lived and died poor. The epigram which he wrote over the entrance of his house, saying that, although small, it was suited to his needs and bought with his own money, serves to show the incorrectness of the assertion of flatterers, followed by Tiraboschi, that the duke of Ferrara built that house for him. The only man who seems to have given anything to Ariosto as a reward for his poetical talent was the marquess del Vasto, who assigned him an annuity of 100 crowns on the revenues of Casteleone in Lombardy; but it was only paid, if ever, from the end of 1531. That he was crowned as poet by Charles V. seems untrue, although a diploma may have been issued to that effect by the emperor.

The character of Ariosto seems to have been fully and justly delineated by Gabriele, his brother, who in some lines to his memory speaks of his piety and kindness, his humility and freedom from ambition.

In reading his satires, we are struck with the noble independence of the poet, who loved liberty with a most jealous fondness, and hence would never bind himself, either by going into orders or by marrying, till towards the end of his life, when he espoused Alessandra, widow of Tito Strozzi.

His Latin poems do not perhaps deserve to be noticed; in the age of Flaminio, Vida, Fracastoro and Sannazaro, better things were due from a poet like Ariosto. His lyrical compositions show the poet, although they do not seem worthy of his powers. His comedies, of which he wrote four, besides one which he left unfinished, are avowedly imitated from Plautus and Terence; and although native critics may admire in them the elegance of the diction, the liveliness of the dialogue and the novelty of some scenes, few will feel interest either in the subject or in the characters.

The most solid monument of his fame is the *Orlando Furioso.* An earlier poem on the same theme, *Orlando Innamorato,* by Boiardo (*q.v.*), had been left unfinished; many poets undertook the difficult task of its completion, but it was reserved for Ariosto

to provide a sequel that surpassed its model. He began to write his great poem about 1503, and after having consulted the first men of the age of Leo X. he published it in 1516, in only 40 cantos (extended afterwards to 46); and up to the moment of his death, he never ceased to correct and improve both the subject and the style. It is the magnificent style of this poem which won for him the name of *Divino Lodovico*. Even when he jests, he never compromises his dignity; and in pathetic description or narrative he excites the reader's deepest feelings. In his machinery he displays a remarkable vivacity of fancy; but he never lets his fancy carry him so far as to omit to employ, with an art peculiar to himself, those simple and natural pencil strokes which, by imparting to the most extraordinary feats a colour of reality, satisfy the reason without disenchanting the imagination. The death of Zerbino, the complaints of Isabella, the effects of discord among the Saracens, the flight of Astolfo to the moon, the passion which causes Orlando's madness, teem with beauties of every variety. The supposition that the poem is not connected throughout is wholly unfounded; there is a connection which, with a little attention, will become evident. The love of Ruggero and Bradamante forms the main subject of the *Furioso;* every part of it, except some episodes, depend upon this subject; and the poem ends with their marriage.

The immediate popularity of Ariosto's greatest work outside Italy is proved by the fact that about a dozen French translations of it appeared within 50 years of his death, not to speak of the Spanish version of Ieronymo de Urrea (1549), which was often reprinted and is quoted in *Don Quixote*. Men as different as Voltaire and Goethe have been fascinated by Ariosto; and in England his name will always be connected with that of Spenser, whose *Faerie Queene* was avowedly written to surpass the *Orlando Furioso* in its own style. Scott—"the Ariosto of the north," as Byron called him—learnt Italian as a boy, in order to read it; and Byron himself owed much to the poet whom he praises so highly in his *Prophecy of Dante* (iii. 110–119).

BIBLIOGRAPHY.—The first complete edition of the *Orlando Furioso* was published at Ferrara, in 1532, as noted above. The edition of Papini (Florence, 1903) gives a good text with useful notes. Of editions published in England, those of Baskerville (Birmingham, 1773) and Panizzi (1834) are the most important. The translations into English are all indifferent in quality. *See* also E. Gardner, *Ariosto, the Prince of Court Poets* (1906); J. S. Nicholson, *Life and Genius of Ariosto* (1914); and Benedetto Croce, *Ariosto, Shakespeare and Corneille* (Eng. tr. 1920).

ARIOVISTUS, a German chief who commanded the mixed force of German tribes which entered Gaul at the invitation of the Arverni and Sequani in 71 B.C. After years of warfare he defeated the Aedui at Admetobriga on the middle Rhine in 61, and reduced them to a client kingdom. His relations with Rome were at first friendly, the Romans apparently not appreciating the danger. By 58 Ariovistus had settled some 120,000 Germans on the left bank of the Rhine; the burden of the invaders was so heavy that in the spring of 58, when Caesar took over the Gallic provinces, a diet of the tribes of central Gaul decided to ask him for help. Caesar sent a courteous message to Ariovistus asking him to return the hostages of the Aedui, and bring no more Germans into Gaul. Ariovistus refused, and hostilities followed the same year. Caesar occupied Vesontio (Besançon), in the territory of the Aedui, and a campaign opened in which he had rather the worse of the preliminary manoeuvring. Ariovistus managed to split Caesar's army and attack one division of it, somewhere near Mulhouse. But a general engagement followed, doubtful at first, which was decided by the Roman reserve under P. Crassus. Ariovistus fled over the Rhine, and is not heard of again. Caesar seems to have left Ariovistus' settlements on the Rhine undisturbed.

See Caesar *B.G.*, I., 31–53. Dio Cas., XXXVIII., 34–50. For the topography of the battle, A von Goler, *Caesar's Gallische Krieg*, (1880); T. R. Holmes, *Caesar's Conquest of Gaul* (1911).

ARISTAENETUS, Greek letter-writer, flourished in the 5th or 6th century A.D. He was formerly identified with Aristaenetus of Nicaea, who perished in an earthquake at Nicomedia, A.D. 358, but internal evidence points to a much later date. Under his name two books of love stories, in the form of letters, are extant; the subjects are borrowed from the erotic elegies of Alexandrian writers, and the language is a patchwork of phrases from Plato, Lucian, Alciphron and others.

See: for text *Boissonade* (1822), Hercher, *Epistolographi Graeci* (1873). English translations: Boyer (1701); Thomas Brown (1715); R. B. Sheridan and Halked (1771 and later).

ARISTAEUS, a divinity whose worship was widely spread throughout ancient Greece, but concerning whom the myths are somewhat obscure. The name is derived from the Greek ἄριστος, "best." According to the generally received account, Apollo carried off the nymph Cyrene from Mount Pelion in Thessaly, and conveyed her to Libya, where she gave birth to Aristaeus. Having been brought up by the Ὧραι or by the centaur Cheiron, he left Libya and went to Thebes. Here he received instruction from the Muses in the arts of healing and prophecy and became the son-in-law of Cadmus and the father of Actaeon (*q.v.*). He is said to have visited Ceos, where, by erecting a temple to Zeus *Ikmaios* (the giver of moisture), he freed the inhabitants from a terrible drought. After travelling extensively, Aristaeus reached Thrace where he finally disappeared near Mount Haemus. While in Thrace he is said to have caused the death of Eurydice, who was bitten by a snake while fleeing from him.

Aristaeus was essentially a benevolent diety; he introduced the cultivation of bees (Virgil, *Georg.* iv., 315–558) and the vine and olive; he was the protector of herdsmen and hunters; he warded off the evil effects of the dog-star, and possessed the arts of healing and prophecy. He was often identified with Zeus, Apollo and Dionysus. In ancient sculptures and on coins he is represented as a young man, dressed like a shepherd, and sometimes carrying a sheep on his shoulders.

ARISTAGORAS (d. 497 B.C.), brother-in-law and cousin of Histiaeus, tyrant of Miletus. He acted as regent while Histiaeus was detained at the court of Darius. In 500 B.C. he persuaded the Persians to join him in an attack upon Naxos, but he quarrelled with Megabates, the Persian commander, who, according to Herodotus, warned the Naxians, and the expedition failed. Finding himself bankrupt and out of favour with Persia, Aristagoras, instigated by a message from Histiaeus, raised Ionia in revolt (*see* IONIA). He then went to Greece to secure help, and induced the Athenians to send the force which helped to burn Sardis. It was their intervention which led to Darius' invasion of Greece in 480.

After the failure of the revolt, Aristagoras emigrated to Myrcinus in Thrace, where he fell, in an attack on Ennea Hodoi (later Amphipolis), which belonged to a Thracian tribe.

See Herodotus, v. 30–51, 97–126; Thucydides iv. 102; Diodorus xii. 68; *see* also G. B. Grundy, *Great Persian War* (1901).

ARISTANDER, of Telmessus in Lycia, the favourite soothsayer of Alexander the Great.

See *Philopatris*, 21; Arrian, *Anabasis*, ii. 26, iii. 2, iv. 4; Plutarch, *Alexander;* Curtius iv. 2, 6, 15, vii. 7.

ARISTARCHUS, of Samothrace (*c.* 220–143 B.C.), Greek grammarian and critic. He settled early in Alexandria, where he studied under Aristophanes of Byzantium, whom he succeeded as librarian of the museum. On the accession of Euergetes II. he found his life in danger and withdrew to Cyprus, where he died. Aristarchus founded a school of philologists, called after him "Aristarcheans," which long flourished in Alexandria and afterwards at Rome. He is said to have written 800 commentaries alone, without reckoning special treatises.

He edited Hesiod, Pindar, Aeschylus, Sophocles and other authors; but his chief fame rests on his critical and exegetical edition of Homer, practically the foundation of our present text. In the time of Augustus, two Aristarcheans, Didymus and Aristonicus, undertook the revision of his work, and the extracts from these two writers in the Venetian scholia to the *Iliad* give an idea of Aristarchus's Homeric labours. He arranged the *Iliad* and the *Odyssey* in 24 books as we now have them.

See Lehrs, *De Aristarchi Stud. Homericis* (3rd ed., 1882); Ludwich, *Aristarchs homerische Textcritik* (1884); and especially Sandys, *Hist. of Class. Schol.* (ed. 1921), vol. i. with authorities; *see* also **HOMER**; ALEXANDRIAN SCHOOL.

ARISTARCHUS OF SAMOS, Greek astronomer, flourished about 270 B.C. He is famous for having been the first to maintain that the earth revolves round the sun. On this ground Cleanthes the Stoic declared that he ought to be indicted for impiety. His only extant work is a short treatise On the Sizes and Distances of *the Sun and Moon;* here he obtains, by elegant and rigorous geometry, certain results as regards sizes and distances which are only vitiated by the incorrectness of the assumptions, due to the imperfect state of knowledge at the time. The heliocentric hypothesis does not appear in the treatise, but a quotation in the *Arenarius* of Archimedes from another work of Aristarchus proves that he anticipated the great discovery of Copernicus. Moreover, Copernicus himself was clearly aware of the achievement of Aristarchus, for he mentioned it in a passage which he afterwards suppressed (see De revolutionibus caelestibus, ed. Thorun., 1873, p. 34 note). Aristarchus added $\frac{1}{1623}$ of a day to Callippus' estimate of $365\frac{1}{4}$ days for the length of the solar year. He is also said to have invented a hemispherical sun-dial (scaphe).

The Greek text of the extant treatise was first edited by Wallis (1688); for a new Greek text with English translation and notes see T. L. Heath, *Aristarchus* of Samos (1913).

ARISTEAS, a mythical personage in ancient Greece, said to have lived in the time of Cyrus and Croesus, or according to some c. 690 B.C. His poem *Arimaspeia* describes his travels in countries N. and E. of the Euxine; he visited the Hyperboreans, Issedonians and Arimaspians, who fought against the gold-guarding griffins. An important historical fact which seems to be indicated in his poem is the rush of barbarian hordes towards Europe under pressure from their neighbours.

Twelve lines of the poem are preserved in Tzetzes and Longinus. According to Suidas, Aristeas also wrote a prose theogony. The genuineness of his works is disputed by Dionysius of Halicarnassus.

See Tournier, De Aristea *Proconneso* (1863); Macan, Herodotus iv., 13, 14 (note), 15.

ARISTEAS, the pseudonymous author of a famous Letter in which is described, in legendary form, the origin of the Greek translation of the Old Testament known as the Septuagint (q.v.). Aristeas represents himself as a Gentile Greek, but was really an Alexandrian Jew who lived under one of the later Ptolemies. Though the Letter is unauthentic, it is now recognized as a useful source of information concerning both Egyptian and Palestinian affairs in the and and possibly in the 3rd century B C.

See modern editions of the Greek by H. St. J. Thackeray (in Swete's Introduction to *the* Old Testament in Greek, Cambridge, 1900), and by P. Wendland (Leipzig, 1900); and H. St. J. Thackeray, The Letter *of* Aristeas (1917), translation with critical introduction and bibliography.

ARISTEIDES (c. 530–468 B.C.), Athenian statesman called "the Just," was the son of Lysimachus, and a member of a family of moderate fortune. Of his early life we are told merely that he became a follower of the statesman Cleisthenes and sided with the aristocratic party in Athenian politics. He first comes into notice as strategus in command of his native tribe Antiochis at Marathon, and it was no doubt in consequence of the distinction which he then achieved that he was elected chief archon for the ensuing year (489–488 B.C.). In pursuance of his conservative policy, which aimed at maintaining Athens as a land power, he was one of the chief opponents of the naval policy of Themistocles (q.v.). The conflict between the two leaders ended in the ostracism of Aristeides, at a date variously given between 48; and 482 B.C.

Early in 480 B.C. Aristeides profited by the decree recalling the post-Marathonian exiles to help in the defence of Athens against the Persian invaders, and was elected strategus for the year 480–479 B.C. In the campaign of Salamis he rendered loyal support to Themistocles, and crowned the victory by landing Athenian infantry on the island of Psyttaleia and annihilating the Persian garrison stationed there (see SALAMIS). In 479 he was re-elected strategus, and invested with special powers as commander of the Athenian contingent at Plataea; he is also said to have judiciously suppressed a conspiracy among some oligarchic malcontents in the army and to have played a prominent part in arranging for the celebration of the victory. In 478 or 477 Aristeides was in command of the Athenian squadron off Byzantium, and the Ionian allies, after revolting from the Spartan admiral Pausanias, offered him the chief command and left him with absolute discretion in fixing the contributions of the newly formed confederacy (see DELIAN LEAGUE). His assessment was universally accepted as equitable, and continued as the basis of taxation for the greater part of the league's duration; it was probably from this that he won the title of "the Just." Aristeides soon left the command of the fleet to his friend Cimon (q.v.), but continued to hold a predominant position in Athens. At first he seems to have remained on good terms with Themistocles, whom he is said to have helped in outwitting the Spartans over the rebuilding of the walls of Athens. But in spite of statements in which ancient authors have represented Aristeides as a democratic reformer, it is certain that the period following the Persian wars during which he shaped Athenian policy was one of conservative reaction. His estate seems to have suffered severely from the Persian invasions, for apparently he did not leave enough money to defray the expenses of his burial, and it is known that his descendants even in the 4th century received State pensions. See ATHENS; THEMISTOCLES.

BIBLIOGRAPHY.—Herodotus viii. 79–81, 95, ix. 28; "Constitution of Athens" (Ath. Pol.), 22–24, 41; Plutarch, *Aristides;* Cornelius Nepos, Vita Aristidis. See also E. Meyer, Geschichte des *Altertums* (Stuttgart, 1901), iii. p. 481, 492. In the absence of positive information the 4th century writers (on whom Plutarch and Nepos mainly rely) wove round his surname of "Just" a number of anecdotes. Herodotus is practically our only trustworthy authority. (M. C.)

ARISTEIDES, of Miletus, generally regarded as the father of Greek prose romance (c. 150–100 B.C.). He wrote six books of erotic *Milesian* Tales (Μιλησιακά) which enjoyed great popularity, and were translated into Latin by Cornelius Sisenna (119–67 B.C.). They are lost, with the exception of a few fragments, but the story of the Ephesian matron in Petronius gives an idea of their nature.

See Plutarch, *Crassus,* 32; Ovid, Tristia, ii. 413, 443; Müller, *Fragmenta* Historicorum Graecorum, iv.

ARISTEIDES, AELIUS, surnamed Theodorus, Greek rhetorician and sophist (A.D. 117, or perhaps 129–189). After studying at Pergamum and Athens, he lived at Smyrna. In 178, when it was destroyed by an earthquake, he wrote an account of the disaster to Aurelius, and induced him to rebuild the city. His extant works consist of two small rhetorical treatises on political and simple speech, with Demosthenes and Xenophon as models (Spengel, Rhetores Graeci) and 55 declamations, of which only the Panathenascus and the Encomium of Rome were actually delivered. Of the others, The Sacred Discourses deal with his illness and with miraculous cures, and the rest are panegyrics or treat subjects from Greek history. Though they lack living interest, their style is correct, and they became school books and the subject of commentaries.

BIBLIOGRAPHY.—Editio princeps (52 declamations only) (1517); Dindorf (1829); Keil (1899); Schmid (1926). See Sandys, *Hist.* of Classical Scholarship, vol. i. (ed. 1920) and references there given.

ARISTEIDES, APOLOGY OF. Until 1878 our knowledge of the early Christian writer Aristeides was confined to the statement of Eusebius that he was an Athenian philosopher, who presented an apology "concerning the faith" to the emperor Hadrian. In that year, however, the Mechitharists of S. Lazzaro at Venice published a fragment in Armenian from the beginning of the Apology; and in 1889 Dr. Rendel Harris found the whole of it in a Syriac version on Mt. Sinai. While his edition was passing through the press, it was observed by Dr. J. Armitage Robinson that all the while the work had been extant in Greek, though in a slightly abbreviated form, as it had been embedded as a speech in a religious novel written about the 6th century, and entitled "The Life of Barlaam and Josaphat." Eusebius and the Armenian version quote its dedication to Antoninus Pius who reigned 138–161. The Syriac version quotes a dedication which confuses the names of Antoninus Pius and his predecessor Hadrian.

The Apology opens thus: "I, O king, by the providence of God came into the world; and having beheld the heaven, and the earth, and the sea, the sun and moon, and all besides, I marvelled at

their orderly disposition; and seeing the world and all things in it, that it is moved by compulsion, I understood that He that moveth and governeth it is God. For whatsoever moveth is stronger than that which is moved, and whatsoever governeth is stronger than that which is governed." Having briefly spoken of the divine nature in the terms of Greek philosophy, Aristeides proceeds to ask which of all the races of men have at all partaken of the truth about God. Here we have the first attempt at a systematic comparison of ancient religions. For the purposes of his enquiry he adopts an obvious threefold division into idolaters, Jews, and Christians. Idolaters, or, as he more gently terms them in addressing the emperor, "those who worship what among you are said to be gods," he subdivides into the three great world-civilizations—Chaldeans, Greeks, and Egyptians. He chooses this order so as to work up to a climax of error and absurdity in heathen worship. The direct nature worship of the Chaldeans is shown to be false because its objects are works of the Creator, fashioned for the use of men. They obey fixed laws and have no power over themselves. The gods of Olympus are challenged one by one, and shown to be either vile or helpless, or both at once. A heaven of quarrelling divinities cannot inspire a reasonable worship. These gods are not even respectable; how can they be adorable? "The Egyptians have erred worse than all the nations; for they were not content with the worships of the Chaldeans and Greeks, but introduced, moreover, as gods even brute beasts of the dry land and of the waters, and plants and herbs. . . ." Throughout the whole of the argument there is strong common-sense and a stern severity unrelieved by conscious humour. Aristeides is engaged in a real contest; he strikes hard blows, and gives no quarter. He cannot see, as Justin and Clement see, a striving after truth, a feeling after God, in the older religions, or even in the philosophies of Greece. He has no patience with attempts to find a deeper meaning in the stories of the gods. "Do they say that one nature underlies these diverse forms? Then why does god hate god, or god kill god? Do they say that the histories are mythical? Then the gods themselves are myths, and nothing more."

The Jews are briefly treated. After a reference to their descent from Abraham and their sojourn in Egypt, Aristeides praises them for their worship of the one God, the Almighty Creator; but blames them as worshipping angels, and observing "sabbaths and new moons, and the unleavened bread, and the great fast, and circumcision, and cleanness of meats." He then proceeds to the description of the Christians. He begins with a statement which, when purged of glosses by a comparison of the three forms in which it survives, reads thus: "Now the Christians reckon their race from the Lord Jesus Christ; and He is confessed to be the Son of God Most High. Having by the Holy Spirit come down from heaven, and having been born of a Hebrew virgin, He took flesh and appeared unto men, to call them back from their error of many gods; and having completed His wonderful dispensation, He was pierced by the Jews, and after three days He revived and went up to Heaven. And the glory of His coming thou canst learn, O king, from that which is called among them the evangelic scripture, if thou wilt read it. He had 12 disciples, who after His ascent into heaven went forth into the provinces of the world and taught His greatness; whence they who at this day believe their preaching are called Christians." This passage contains striking correspondences with the second section of the Apostles' Creed. The attribution of the Crucifixion to the Jews appears in several 2nd century documents; Justin actually uses the words "He was pierced by you" in his dialogue with Trypho the Jew.

"These are they," he proceeds, "who beyond all the nations of the earth have found the truth: for they know God as Creator and Maker of all things, and they worship no other god beside Him; for they have His commandments graven on their hearts, and these they keep in expectation of the world to come. . . . Whatsoever they would not should be done unto them, they do not to another. . . . He that hath supplieth him that hath not without grudging: if they see a stranger they bring him under their roof, and rejoice over him, as over a brother indeed, for they call not one another brethren after the flesh, but after the spirit. They are ready for Christ's sake to give up their own lives; for His commandments they securely keep, living holily and righteously, according as the Lord their God hath commanded them, giving thanks to Him at all hours, over all their food and drink, and the rest of their good things."

The style of the Apology is exceedingly simple. It is curiously misdescribed by Jerome, who never can have seen it, as "Apologeticum pro Christianis contextum philosophorum sententiis." Its merits are its recognition of the helplessness of the old heathenism to satisfy human aspiration after the divine, and the impressive simplicity with which it presents the unfailing argument of the lives of Christians.

See *The Apology of Aristides,* Syriac text and translation (J. R. Harris), with an appendix containing the Greek text, *Texts and Studies,* i. 1 (1891). There is an English tr. by Walford, 1909.

ARISTIDES, QUINTIEIANUS, the author of a treatise on music, who lived probably in the 3rd century A.D. According to Meibomius, in whose collection (*Antiq. Musicae Auc. Septem,* 1652) this work is printed, it contains everything on music that is to be found in antiquity. *(See* Pauly-Wissown, *Realencyk,* ii. 894.)

ARISTIPPUS (*c.* 435–356 B.C.), Greek philosopher, the founder of the Cyrenaic school. At an early age he came from Cyrene to Athens, and he became the pupil of Socrates. After travelling through a number of Grecian cities, he founded his school at Cyrene *(see* CYRENAICS). Starting from the two Socratic principles of virtue and happiness, he emphasized the second, and made pleasure the criterion of life. That he held to be good which gives the maximum of pleasure. In pursuance of this he indulged in all forms of external luxury. The five letters attributed to him are spurious. His daughter Arete, and her son Aristippus (μητροδίδακτος, "pupil of his mother"), carried on the school after his death. He comes very near to modern empiricism and especially to the modern Hedonist school.

See Aberweg's *Grundriss der Geschichte der Philosophie,* vol. i., Section 38 and Bibliography (1912).

ARISTO, of Pella, a Jewish Christian writer of the middle of the 2nd century, who like Hegesippus (q.v.) represents a school of thought more liberal than that of the Pharisaic and Essene Ebionites. He is cited by Eusebius (*Hist. Eccl.* iv. 6, 3) for a decree of Hadrian respecting the Jews, but is best known as the writer of a *Dialogue* on the witness of prophecy to Jesus Christ, which was defended by Origen against the reproaches of Celsus.

The literature is cited in G. Kriiger's *Early Christian Literature,* pp. 104 seq.

ARISTO or **ARISTON,** of Chios (*c.* 250 B.C.), a Stoic philosopher and pupil of Zeno, though he approximated more closely to the Cynic school. He considered only ethics worthy of study, and in that only general and theoretical questions. He rejected Zeno's doctrine of desirable things, intermediate between virtue and vice. There is only one virtue—an intelligent, healthy state of mind *(hygeia).* Aristo is frequently confounded with Ariston of Iulis, who became scholarch of the Peripatetics about 230 B.C. *See* STOICS.

ARISTOBULUS, of Cassandreia, Greek historian, accompanied Alexander the Great on his campaigns, of which he wrote an account, mainly geographical and ethnological. His work was largely used by Arrian.

BIBLIOGRAPHY. — Mueller, *Historicorum Graecorum Fragmenta;* Schoene, *De Rerum Alexandri Magni Scriptoribus* (1870).

ARISTOBULUS, of Paneas (c. 160 B.C.), a Jewish philosopher of the Peripatetic school. Gercke places him in the time of Ptolemy X. Philometor (end of 2nd century), Anatolius in that of Ptolemy II. Philadelphus; but the middle of the 2nd century is more probable. He was among the earliest of the Jewish-Alexandrian philosophers whose aim was to reconcile Greek philosophical conceptions with the Jewish religion. A few fragments of his work, apparently entitled *Commentaries on the Writings of Moses,* are quoted by Clement, Eusebius and other theological writers. He tried to prove that early Greek philosophers had borrowed from Scripture, but the passages quoted were obvious forgeries.

BIBLIOGRAPHY.—*See* E. Schürer, History of *the Jewish* People (Eng. trans., 1890–91), ii. 237 *seq.*; article ALEXANDRIAN SCHOOL: Philosophy, and *s.v.* "Aristobulus" in Jewish *Encyclopedia* (Paul Wendland).

ARISTOCRACY, a form of government variously defined at different times and by different authorities (Gr. ἄριστος, "best"; κράτος, "power"), In Greek political philosophy, aristocracy is the government of those who most nearly attain to the ideal of human perfection. Aristocracy is thus the government by those who are superior both morally and intellectually, and, therefore, govern directly in the interests of the governed, as a good doctor works for the good of his patient. Aristotle classified good governments under three heads—monarchy, aristocracy and commonwealth (πολιτεία), to which he opposed the three perverted forms—tyranny or absolutism, oligarchy and democracy or mob-rule. The distinction between aristocracy and oligarchy, which are both necessarily the rule of the few, is that whereas the few ἄριστοι will govern unselfishly, the oligarchs, being the few wealthy ("plutocracy" in modern terminology), will allow their personal interests to predominate.

Historically, aristocracy develops from primitive monarchy by the gradual progressive limitation of the regal authority. This process is effected primarily by the nobles who have hitherto formed the council of the king (for an excellent example in Athenian politics, see ARCHON), whose triple prerogative—religious, military and judicial—is vested, *e.g.*, in a magistracy of three. These are either members of the royal house or the heads of noble families, and are elected for life or periodically by their peers, *i.e.*, by the old royal council (*cf.* the Areopagus at Athens, the Senate at Rome [*qq.v.*]), now the sovereign power. From the earliest time, aristocracy became synonymous with oligarchy and the opposite of democracy.

The aristocracy of which we know most in ancient Greece was that of Athens prior to the reforms of Cleisthenes (*q.v.*), but all the Greek city-states passed through a period of aristocratic or oligarchic government. Rome, between the regal and the imperial periods, was always more or less under the aristocratic government of the senate, in spite of the gradual growth of democratic institutions (the Lat. optintates is the equivalent of ἄριστοι). The relations existing between his slaves and the ἄριστοι set up a philosophic doctrine, held even by Aristotle, that there were peoples who were inferior by nature (φύσει δοῦλοι) and adapted to submission; such people had no "virtue" in the technical civic sense, and were properly occupied in performing the menial functions of society, under the control of the ἄριστοι. Thus, combined with the criteria of descent, civic status and the ownership of the land, there was the further idea of intellectual and social superiority. These qualifications were naturally, in course of time, shared by an increasingly large number of the lower class who broke down the barriers of wealth and education. From this stage the transition is easy to the aristocracy of wealth, such as we find at Carthage and later at Venice, in periods when the importance of commerce was paramount and mercantile pursuits had cast off the stigma of inferiority (in Gr. βαναυσία).

At the present day the sovereign power of a state no longer resides in an aristocracy, and the word has acquired a social rather than a political sense, being practically equivalent to "nobility."

ARISTODEMUS (8th century B.C.), semi-legendary ruler of Messenia in the time of the first Messenian war. In the 13th year of the war, the Messenian king died childless, and Aristodemus was chosen as his successor. As a ruler he was mild and conciliatory. He was victorious in the pitched battle fought at the foot of Ithome in the fifth year of his reign, when the Messenians, reinforced by the entire Arcadian levy and picked contingents from Argos and Sicyon, defeated the combined Spartan and Corinthian forces. Shortly afterwards, however, led by unfavourable omens to despair of final success, he killed himself. Aristodemus may fairly be regarded as a historical character. His reign is dated 731–724 B.C. by Pausanias, and this may be taken as approximately correct, though Duncker (*History of Greece,* Eng. trans., ii. p. 69) inclines to place it eight years later.

Pausanias iv. 9–13 is practically our only authority. He followed as his chief source the prose history of Myron of Priene, an untrustworthy writer, probably of the and century B.C.; hence, a good deal of his story must be regarded as fanciful, though we cannot distinguish accurately between the true and the fictitious.

ARISTOGEITON: see HARMODIUS.

ARISTOLOCHIA, a genus of woody vines or herbs of the family Aristolochiaceae, found chiefly in the tropics. The flower forms a tube inflated at the base. The name (Gr. ἄριστος, best; λοχεία, child-birth) alludes to its repute in aiding parturition. The birthwort (*A. Clematitis*) is a central and south European species, found sometimes in England, apparently wild, on ruins and similar places, but not native. In the United States it rarely escapes from cultivation from New York to Maryland. The Dutchman's pipe or pipe vine (*A. durior*), native to rich woods in the eastern United States from Pennsylvania to Minnesota and south to Georgia and Kansas, is a vigorous climber widely planted in Europe and the United States as a porch-vine. The flower is of an odd shape and bent like a pipe. Some 10 other species are native to the United States. Among the best known of these are the Virginia snake-root (*A.* Serpentaria), called also sangree-root and serpentary, found in dry woods in the eastern United States, and valued medicinally for its aromatic-stimulant root; the woolly pipe vine (*A. tomentosa*), native to woods from North Carolina to Missouri and southward; and the western Dutchman's pipe (*A. californica*), native to California. Among the various species grown in greenhouses are the remarkable pelican-flower (*A. grandiflora*), a native of Jamaica, some varieties of which bear immense flowers often 20 in. across with a tail-like appendage 3 ft. or more long; and the showy calico-flower (*A. elegans*), native to Brazil, a graceful, free-blooming climber with solitary flowers having a yellow-green tube 1½ in. long and a purple and white blotched limb 3 in. across. The tropical kinds are often called goose-flowers.

ARISTOMENES of Andania, the semi-legendary hero of the second Messenian war. He was a member of the Aepytid family, the son of Nicomedes (or, according to another version, of Pyrrhus) and Nicoteleia, and took a prominent part in stirring up the revolt against Sparta and securing the co-operation of Argos and Arcadia. Under his leadership the Messenians won a victory at "the Boar's Barrow," but in the following year were defeated and had to retire to the mountain stronghold of Eira. When this was betrayed to the Spartans (668 B.C. according to Pausanias) Aristomenes took refuge in Arcadia. Thence he went to Rhodes, where he died. Though there seems to be no conclusive reason for doubting the existence of Aristomenes, his history, as related by Pausanias, following mainly the *Messeniaca* of the Cretan epic poet Rhianus (about 230 B.C.), is evidently largely interwoven with fictions. These probably arose after the foundation of Messene in 369 B.C. Aristomenes' statue was set up in the stadium there: his bones were fetched from Rhodes and placed in a tomb surmounted by a column (Paus. iv. 32. 3, 6); and more than five centuries later we still find heroic honours paid to him, and his exploits a popular subject of song (*ibid.* iv. 14, 7; 16, 6).

BIBLIOGRAPHY.—For further details see Pausanias iv.; Polyaenus ii. 31; G. Grote, History of Greece, pt. ii. chap. vii.; M. Duncker, History of Greece, Eng. trans., book iv. chap. viii.; A. Holm, History of Greece, Eng. trans., vol. i. chap. xvi.

ARISTONICUS of Alexandria, Greek grammarian, lived during the reigns of Augustus and Tiberius. His chief work was Περὶ Σημείων Ὁμήρου, in which he gave an account of the "critical marks" inserted by Aristarchus in his recension of the Iliad and Odyssey. Important fragments are preserved in the scholia of the Venetian Codex A of the Iliad.

Friedländer, Aristonici Περὶ Σημείων Ἰλιάδος reliquiae (1853); Carnuth, Aristonici Περὶ Σημείων Ὀδυσσείας *reliquiae* (1869).

ARISTOPHANES (c. 448–385 B.C.[1]), the great comic dramatist and poet of Athens. His birth-year is uncertain. He is known to have been about the same age as Eupolis, and is said to have been "almost a boy" when his first comedy (The *Banqueters*) was brought out in 427 B.C. His father Philippus

[1]The dates in the text, as given by Jebb, are retained. According to R. G. Kent (*Classical* Review, April 1905, April 1906), Aristophanes mas born in 455, and died in 375 B.C.

was a landowner in Aegina. Aristophanes was an Athenian citizen of the tribe Pandionis, and the deme Cydathene. The stories which made him a native of Camirus in Rhodes, or of the Egyptian Naucratis, had probably no other foundation than an indictment for usurpation of civic rights (ξενίας γραφή) which appears to have been more than once laid against him by Cleon.

The Old Comedy which lasted c. 470–390 B.C. was possible only for a thorough democracy. Its essence was a satirical censorship, unsparing in personalities, of public and of private life, of everything which had an interest for the city or which could amuse the citizens. At Athens the poet of the Old Comedy had an influence analogous, perhaps, rather to that of the journalist than to that of the modern dramatist. But the established type of Dionysiac comedy gave him an instrument such as no public satirist has ever wielded. The wildest flights of extravagance were permitted to him. Nothing bound him to a dangerous emphasis or a wearisome insistence. He could deal the keenest thrust, or make the most earnest appeal, and at the next moment vary the serious strain by burlesque. He had, in short, an incomparable scope for trenchant satire directed by sure tact.

Aristophanes is for us the representative of the Old Comedy. But his genius, while it includes, also transcends the genius of the Old Comedy. He can denounce the frauds of a Cleon, he can vindicate the duty of Athens to herself and to her allies, with a stinging scorn and a force of patriotic indignation which makes the poet almost forgotten in the citizen. He can banter Euripides with an ingenuity of light mockery which makes it seem for the time as if the leading Aristophanic trait was the art of seeing all things from their prosaic side. Yet his truest and highest faculty is revealed by those wonderful bits of lyric writing in which he soars above everything that can move laughter or tears, and makes the clear air thrill with the notes of a song as free, as musical and as wild as that of the nightingale invoked by his own chorus in The Birds. The speech of Dikaios Logos in The Clouds, the praises of country life in The Peace, the serenade in The Ecclesiazusae, the songs of the Spartan and Athenian maidens in the Lysistrata, above all, perhaps, the chorus in The Frogs, the beautiful chant of the Initiated—these passages, and such as these, are the true glories of Aristophanes.

Fifty-four[1] comedies were ascribed to Aristophanes. Forty-three of these are allowed as genuine by Bergk. Eleven only are extant. These 11 form a running commentary on the outer and inner life of Athens during 36 years. They may be ranged under three periods. The first, extending to 420 B.C., includes those plays in which Aristophanes used an absolutely unrestrained freedom of political satire. The second ends with the year 405 B.C. Its productions are distinguished from those of the earlier time by a certain degree of reticence and caution. The third period, down to 388 B.C., comprises two plays in which the transition to the character of the Middle Comedy is well marked, not merely by disuse of the parabasis, but by general self-restraint.

I. First Period.—(1) 425 B.C. The *Acharnians*.—Since the defeat in Boeotia the peace party at Athens had gained ground, and in this play Aristophanes sought to strengthen their hands. Dicaeopolis, an honest countryman, is determined to make peace with Sparta on his own account, not deterred by the angry men of Acharnae, who crave vengeance for the devastation of their vineyards. He sends to Sparta for samples of peace; and he is so much pleased with the flavour of the Thirty Years' sample that he at once concludes a treaty for himself and his family. All the blessings of life descend upon him; while Lamachus, the leader of the war party, is smarting from cold, snow and wounds.

(2) 424 B.C. *The* Knights.—Three years before, in his Babylonians, Aristophanes had assailed Cleon as the typical demagogue. In this play he continues the attack. The Demos, or State, is represented by an old man who has put himself and his household into the hands of a rascally Paphlagonian steward. Nicias and Demosthenes, slaves of Demos, contrive that the Paphlagonian shall be supplanted in their master's favour by a sausage seller. No sooner has Demos been thus rescued than his youthfulness and his good sense return together.

[1]Or "44" (reading μδ′ for νδ′ in Suidas)

(3) 423 B.C. The Clouds (the first edition; a second edition was brought out in 422 B.C.).—This play would be correctly described as an attack on the new spirit of intellectual inquiry and culture rather than on a school or class. Two classes of thinkers, or teachers, are, however, specially satirized under the general name of "Sophist" (v. 331)—1. The Physical Philosophers—indicated by allusions to the doctrines of Anaxagoras, Heracleitus and Diogenes of Apollonia. 2. The professed teachers of rhetoric, belles lettres, etc., such as Protagoras and Prodicus. Socrates is taken as the type of the entire tendency. A youth named Pheidippides (obviously meant for Alcibiades) is sent by his father to Socrates to be cured of his dissolute propensities. Under the discipline of Socrates the youth becomes accomplished in dishonesty and impiety. The conclusion of the play shows the indignant father preparing to burn up the philosopher and his hall of contemplation.

(4) 422 B.C. *The* Wasps.—This comedy, which suggested Les Plaideurs to Racine, is a satire on the Athenian love of litigation. The strength of demagogy, while it lay chiefly in the ecclesia, lay partly also in the paid dicasteries. From this point of view *The* Wasps may be regarded as supplementing The Knights. Philocleon (admirer of Cleon), an old man, has a passion for lawsuits—a passion to which his son, Bdelycleon (detester of Cleon) fails to check, until he hits upon the device of turning the house into a law-court, and paying his father for absence from the public suits. The house-dog steals a Sicilian cheese; the old man is enabled to gratify his taste by trying the case, and, by an oversight, acquits the defendant. In the second half of the play a change comes over the dream of Philocleon; from litigation he turns to literature and music, and is congratulated by the chorus on his happy conversion.

(5) 421 B.C.[1] The Peace.—In its advocacy of peace with Sparta, this play, acted at the Great Dionysia shortly before the conclusion of the treaty, continues the purpose of The *Acharnians*. Trygaeus, a distressed Athenian, soars to the sky on a beetle's back. There he finds the gods engaged in pounding the Greek States in a mortar. In order to stop this, he frees the goddess Peace from a well in which she is imprisoned. The pestle and mortar are laid aside by the gods, and Trygaeus marries one of the handmaids of Peace.

II. Second Period.—(6) 414 B.C. Tlze Birds.—Peisthetaerus, an enterprising Athenian, and his friend Euelpides persuade the birds to build a city—"Cloud-Cuckoo-borough"—in mid-air, so as to cut off the gods from men. The plan succeeds; the gods send envoys to treat with the birds; and Peisthetaerus marries Basileia, daughter of Zeus. Some have found in The Birds a complete historical allegory of the Sicilian expedition; others a general satire on the prevalence at Athens of headstrong caprice over law and order; others, merely an aspiration towards a new and purified Athens—a dream to which the poet had turned from his hope for a revival of the Athens of the past. In another view, the piece is mainly a protest against the religious fanaticism which the incident of the Hermae had called forth.

(7) 411 B.C. The *Lysistrata*.—This play was brought out during the earlier stages of those intrigues which led to the revolution of the Four Hundred. It appeared shortly before Peisander had arrived in Athens from the camp at Samos for the purpose of organizing the oligarchic policy. The Lysistrata expresses the popular desire for peace at any cost. As the men can do nothing, the women take the question into their own hands, occupy the citadel, and bring the citizens to surrender.

(8) 411 B.C. *The Thesmophoriazusae* (priestesses of Demeter).—This came out three months later than the Lysistrata, during the reign of terror established by the oligarchic conspirators, but before their blow had been struck. The political meaning of the play lies in the absence of political allusion. Fear silences even comedy. Only women and Euripides are satirized. Euripides is accused and condemned at the female festival of the Thesmophoria.

(9) 405 B.C. *The* Frogs.—This piece was brought out just when Athens had made her last effort in the Peloponnesian War,

[1]*See* E. Curtius, *Hist.* of Greece, iii. (Eng. trans., p. 275).

eight months before the battle of Aegospotami and about 15 months before the taking of Athens by Lysander. It may be considered as an attempt to distract men's minds from public affairs. It is a literary criticism. Aeschylus and Euripides were both lately dead. Athens is beggared of poets; and Dionysus goes down to Hades to bring back a poet. Aeschylus and Euripides contend in the under-world for the throne of tragedy; and the victory is at last awarded to Aeschylus.

III. Third Period.—(10) 393 B.C.[1] The *Ecclesiazusae* (women in parliament).—The women, disguised as men, steal into the ecclesia, and succeed in decreeing a new constitution. At this time the demagogue Agyrrhius led the assembly; and the play is, in fact, a satire on the general demoralization of public life.

(11) 388 B.C. *The Plutus* (Wealth).—The first edition of the play had appeared in 408 B.C., being a symbolical representation of the fact that the victories won by Alcibiades in the Hellespont had brought back the god of wealth to the treasure-chamber of the Parthenon. In its extant form the *Plutus* is simply a moral allegory. Chremylus, a worthy but poor man, falls in with a blind and aged wanderer, who proves to be the god of wealth. Asclepios restores eyesight to Plutus; whereupon all the just are made rich and all the unjust are reduced to poverty.

Among the lost plays, the following are the chief of which anything is known:

1. *The Banqueters* (Δαιταλεῖς), 427 B.C.—A satire on young Athens. A father has two sons; one is brought up in the good old school, another in the tricky subtleties of the new; and the contrast of the results is the chief theme.

2. *The Babylonians,* 426 B.C.—Under this name the subject-allies of Athens are represented as "Babylonians"—barbarian slaves, employed to grind in the mill. The oppression of the allies by the demagogues—a topic often touched elsewhere—was, then, the main subject of the piece, in which Aristophanes is said to have attacked especially the system of appointing to offices by lot. The comedy is memorable as opening that Aristophanic war upon Cleon which was continued in *The Knights* and *The* Wasps.

The Merchantmen, The Farmers, The Preliminary *Contest* (*Proagon*) and possibly the *Old Age* (*Geras*), belonged to the First Period. The Geras is assigned by Süvern to 422 B.C., and is supposed to have been a picture of dotage similar to that in the *Knights*. A comedy called *The* Island is conjectured to have dealt with the sufferings imposed by the war on the insular tributaries. The *Triphales* was probably a satire on Alcibiades; The Storks, on the tragic poet Patrocles.

In the *Aeolosicon*—produced by his son Araros in 387 B.C.—Aristophanes probably parodied the *Aeolus* of Euripides. The *Cocalus* is thought to have been a parody of the legend, according to which a Sicilian king of that name slew Minos.

A sympathetic reader of Aristophanes can hardly fail to perceive that, while his political and intellectual tendencies are well marked, his opinions, in so far as they colour his comedies, are too indefinite to reward, or indeed to tolerate, analysis. Aristophanes was a natural conservative. His ideal was the Athens of the Persian wars. He disapproved the policy which had made Athenian empire irksome to the allies and formidable to Greece; he detested the vulgarity and the violence of mob-rule; he clave to the old worship of the gods; he regarded the new ideas of education as a tissue of imposture and impiety. How far he was from a clear view of the intellectual revolution which was going forward, appears from The *Clouds,* in which thinkers and literary workers who had absolutely nothing in common are treated with sweeping ridicule as prophets of a common heresy. Aristophanes is one of the men for whom opinion is mainly a matter of feeling, not of reason. He had a warm love for the traditional glories of Athens; a horror of what was ugly or ignoble; a keen perception of the absurd. The broad preferences and dislikes thus generated were enough not only to point the moral of comedy but to make him, in many cases, a really useful censor for the city. The service which he could render in this way was, however, only negative. He could hardly be, in any positive sense, a political or a moral teacher for Athens. His rooted antipathy to intellectual progress must lower his intellectual rank. But as a mocker—to use the word which seems most closely to describe him on this side—he is incomparable for the union of subtlety with riot of the comic imagination. As a poet, he is immortal. And, among Athenian poets, he has it for his distinctive characteristic that he is inspired less by that Greek genius which never allows fancy to escape from the control of defining, though spiritualizing, reason, than by such ethereal rapture of the unfettered fancy as lifts Shakespeare or Shelley above it—

Pouring his full heart
In profuse strains of unpremeditated art.

[1] The date is uncertain; others give 392 and 389.

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ARISTOPHANES, of Byzantium, Greek critic and grammarian, was born about 257 B.C. Early in life he removed to Alexandria, where he studied under Zenodotus and Callimachus. At the age of 60 he was appointed chief librarian of the museum. He died about 185–180 B.C. Aristophanes produced a text of Homer which was an improvement on that of Zenodotus. He also edited Hesiod, Alcaeus, Anacreon, Pindar and the great dramatists; arranged Plato's dialogues in trilogies. His arguments to the plays of Aristophanes and the tragedians are in great part preserved. His works on Athenian courtesans, masks and proverbs were the result of his study of Attic comedy. He further commented on the *Pinakes* ("tablets") of Callimachus, a sort of history of Greek literature. As a lexicographer, Aristophanes compiled collections of foreign and unusual words and expressions, and special lists (words denoting relationship, modes of address). As a grammarian, he founded a scientific school, and in his Analogy systematically explained the various forms. He introduced critical signs—except the obelus; punctuation, prosodiacal, and accentual marks were probably already in use. The foundation of the so-called Alexandrian "canon" was also due to his impulse.

See A. Nauck, *Aristophanis Byzantii Grammatici Fragmenta* (1848); Sandys, History of Classical Scholarship (3rd ed. 1921, vol. i. ch. viii.).

ARISTOTELIANISM: see **ARISTOTLE.**

ARISTOTLE, philosopher, psychologist, logician, moralist, political thinker, biologist, the founder of literary criticism—was born at Stagira, a Greek colonial town on the north-western shores of the Aegaean, in 384 B.C. He was the son of Nicomachus, a doctor, belonging to the guild of the "sons of Aesculapius," who had acted as court physician to Amyntas II., the father of Philip of Macedon. We may perhaps attribute to this fact the interest which he afterwards showed in physiological and zoological studies—though it must be admitted that these studies belong to his later years, and were perhaps due less to heredity than to that

general passion for detailed enquiry in every direction which marks the later stages of his development. By race he was an Ionian. Stagira had been largely colonized from the Ionic district of Chalcis in Euboea; his mother was a native of that district; and to it he naturally retired at the end of his life. His Ionic blood has been called in evidence to explain his interest in the facts of nature. It was the Ionian philosophers of Asia Minor who had first investigated "Nature"; and Aristotle, it has been said, "was from first to last an Ionian, an observer of the facts of nature, a man for whom no problem was too detailed to whet his curiosity." But racial characteristics are at the best only dubious explanations; and the development of Aristotle's thought would, perhaps, have equally led him to detailed scientific enquiry if he had been born an Athenian or a Theban.

AFTER A CAST IN THE METROPOLITAN MUSEUM OF ART
ARISTOTLE, THE THINKER, WHOSE PHILOSOPHY HAS INFLUENCED THE WORLD FOR 2 000 YEARS

Life of **Aristotle.**—The life of Aristotle falls into three clearly marked periods. There is the period of work in the philosophic school of Plato, in the Academy at Athens, which covers the 20 years from the age of 17 to that of 37 (367–347 B.C.), and only comes to an end with the death of Plato. There is the period of his *Wanderjahre*—at Assus, in the south of the Troad; on the island of Lesbos opposite; and at the Macedonian court in Pella, some 80m. to the west of Stagira—which covers the dozen years from the age of 37 to that of 49 (347–335 B.C.), and ends with the majority and accession of his pupil Alexander. Finally, there is a second period of work in Athens—a period of work on his own account as the head of the Peripatetic school in the Lyceum—which covers, roughly, another dozen years of his life, from the age of 49 to that of 62 (335–322 B.C.), and ends with his retirement to Chalcis and his death. These periods are not only stages in the external course of a life. They are also—it has been contended by Prof. Jaeger in his work on Aristotle—stages in the internal development of a body of thought. The Aristotle of the first period differs from the Aristotle of the last; and it is thus of the first importance to follow the stages of his life in order to understand the stages, and the progress, of the development of his thought.

I. It must have been the greatest and the profoundest of factors in the life of Aristotle that he worked for 20 years by the side of Plato. He came as a disciple—a young disciple of 17—to sit at the feet of a master who had attained the age of 61; but in the course of years he must have become a fellow-worker in the studies of the Academy. The Plato of those years—the grey-haired Plato in the evening of a life which reached the age of 81—was no longer the Plato of the *Republic*; but he was still, and more than ever, the beloved master of a body of "friends" engaged together in the pursuit of truth and goodness. His school was now in the stage which is marked by the Theaetetus, the *Politicus*, and the other dialogues of this period: it had left the Socratic stage, and was occupied with the problems of "ideas" and with the division of "ideas," down and down, until the indivisible (or, as we say, the individual, by which Plato meant the *infima* species) was eventually reached. Here was the germ from which grew Aristotle's logic, and from which, again, his metaphysics took its beginning. But the Academy was also engaged in some measure of concrete and scientific study. Mathematics and astronomy were especially cultivated: the Laws of Plato, the work of his old age, presupposes a body of research in legal and constitutional questions; and the study of medicine seems also to have been in some measure pursued. We may guess that Aristotle took his part in these various studies. His sketch of an ideal State in the last two books of the *Politics*, which may be early, shows a close relation to Plato's *Laws*. He hardly shared, indeed, in Plato's passion for mathematics; and he was perhaps always more interested than Plato in biological study. Some scholars have drawn a distinction between Plato the mathematician and Aristotle the biologist. There is a truth in the distinction. Plato's interest in "ideas" found a natural basis in geometrical forms and the abstract rules of numbers: Aristotle's interest in the classification of genera and species led him naturally towards the world of organic nature; and the emphasis which he came to lay more and more on development (γένεσις) accentuated that tendency. Yet it may be contended that the mathematical knowledge of Plato went little deeper than that of Aristotle; and on the other hand it is easy to exaggerate the importance of the biological element in Aristotle's general system of thought. (See W. D. Ross, introduction to Selections from Aristotle.) What seems to be certain is that there is no proof of any serious division of opinion between Aristotle and Plato during the 20 years of their intercourse. Aristotle remained one of the circle of "friends" in the Academy throughout that period; he joined in its researches and possibly its teaching[1]; and the dialogues which he wrote during those years—dialogues now lost, but celebrated in antiquity alike for their style and their content—were largely modelled on the style of the later series of Platonic dialogues which begins with the *Theaetetus*. We may admit, indeed, that in his later dialogues, and particularly in that entitled De *Philosophia*, he diverged from the Platonic doctrine of "ideas" as "separable" from and existing "beyond" individual things; but there is no reason for thinking that this divergence ever approached the nature of a sharp contention, or was anything more than a friendly difference of opinion. The master and the pupil were undivided when Plato died in 347; and the noble words which Aristotle wrote, for an altar of friendship in memory of Plato, attest the depth of the pupil's feeling even after the master's death.

II. On the death of Plato his nephew Speusippus succeeded him as the head of the Academy. Aristotle and another of Plato's pupils, Xenocrates, thereupon left Athens, perhaps believing, as Professor Jaeger has said, that Speusippus was the heir not of the spirit, but only of the office of the master, and perhaps desiring to find a new place for the habitation of the spirit. The place they chose was Assus. There were interesting reasons for their choice. Two old pupils of Plato, Erastus and Coriscus, had taken his teaching back to their native town of Scepsis, on the slopes of Mt. Ida. Here they had come in contact with Hermias, a eunuch, who had perhaps been a banker's clerk, and had thriven sufficiently to buy mining property near Mt. Ida and eventually to acquire the title of prince from the Persians and establish himself as "tyrant" in Atarneus, a town to the south-east of Assus. The two Platonists and Hermias had studied together: Plato had written to them the sixth of his *Epistles* for their guidance; and Hermias, some time before the death of Plato, had given the town of Assus in gratitude to his two companions in study. To Assus, in this conjuncture of affairs, Aristotle and his fellow-pupil came in order to join the Platonic circle; and here Aristotle set up a school in which he taught for the next three years. Hermias was among his pupils; and Theophrastus came from the neighbouring islands of Lesbos to join the company. Two consequences followed. In the first place, Hermias gave his adopted daughter and niece, Pythias, in marriage to Aristotle. In the second place, perhaps on the suggestion of Theophrastus, Aristotle moved, about 344 B.C., to the island of Lesbos; and here, in what Prof. Wentworth Thompson has called a long honeymoon, he spent two years (344–342 B.C.) largely in the study of natural history, and especially in that of marine biology. But politics, as they had been present in his thought, and probably his teaching, from his first coming to Assus and joining the company of Hermias (we may attribute the beginning of the *Politics* to this date), continued to be present and pressing while he was at work in Lesbos. Hermias seems to have been negotiating about this time with Philip of Macedon, who was already thinking of the crusade against Persia, and might naturally desire a point *d'appui* on the south of the Dardanelles in the territory of the "tyrant" of Atarneus. It may have been in this way, and in consequence of these negotiations, that Aristotle, the son-in-law of Hermias, was

[1] Rhetoric was possibly the subject of his lectures; and we may perhaps date the beginning of the *Rhetoric* in this period.

invited by Philip to come to Pella and continue his teaching there for the benefit of the young Alexander. In 342 he accepted the invitation; and the next seven years of his life (342–335 B.C.) were spent in Macedonia. He had scarcely settled in Pella when he heard the news that Hermias had been seized by the Persians, taken to Susa, tortured and crucified, with the final words on his lips, "Tell my friends and companions that I have done nothing unworthy of philosophy." The news may have helped to inspire Aristotle (who wrote an ode celebrating Hermias, along with Achilles, as a follower of true valour) with anti-Persian feeling; and may have led him to inspire his pupil all the more to follow the way of Achilles[1] and, as the champion and leader of a united Greece, to lay low the great king of the East. Unfortunately, there is little evidence which bears on Aristotle's work and teaching in Macedonia. Possibly he had a little circle of "friends" (including Theophrastus) with whom he continued his general studies and teaching. We know that he formed a friendship with Antipater; and it is this friendship which is one of the chief factors in the last phase of his life.

III. Even before the death of Philip in 336 Alexander was more and more concerned in affairs, and Aristotle must have seen less and less of his pupil. After the accession of Alexander there was nothing to keep him in Macedonia, and he naturally returned to Athens, the intellectual centre of Greece, consecrated for him by the memory of Plato, where he could hope to work quietly under the protection of Antipater, now acting as regent in Macedonia and Greece after the departure of Alexander on his eastern campaign. His relations with Alexander were now practically at an end. True, his nephew Callisthenes accompanied Alexander to the East: true, he received scientific material from the scientific staff which accompanied the eastern expedition: true, again, he wrote a treatise, "Alexander or on Colonies," which seems to belong to the period of Alexander's foundation of colonial cities in Egypt and Asia. But Callisthenes was done to death by Alexander in 327; and even before that time Alexander had already departed widely from Aristotle's teaching, and had deserted anti-Persian feeling and notions of Greek supremacy for the plan of an empire resting on the equal and harmonious co-operation of Persians and Greeks. In any case the Aristotle of the last 13 years (335–322 B.C.) is an Aristotle immersed in pure science and investigation. Side by side with the Academy (now under Xenocrates, the fellow-pupil of Plato who had once followed him to Assus) he set up his own school in the Lyceum—a school which came to be known as the Peripatetic, from the περίπατος in its garden in which he walked and talked with his pupils. The school was a definite organization—a θίασος, somewhat like a college, which formed a society devoted to the cult of the Muses; and like a college it had its regular dinners and even its plate. It was furnished with maps and a library: it had something of a staff, and Theophrastus was among its lecturers. The great body of the extant Aristotelian treatises represents the lectures which Aristotle delivered in his school at Athens in the evening of his life—not that they were then all composed for the first time (on the contrary, many of them had grown during the years of wandering, and the extant forms still contain traces of earlier versions and earlier views), but that they were now reduced by Aristotle to the form in which we know them. The range of studies was catholic and indeed universal. It is now that Aristotle departs from his master Plato—not so much in altering his theory of "ideas," as in shifting the whole balance of his interest, and in turning from "the heavenly things that are the objects of the higher philosophy" to the detailed facts of historical and biological process. He leaves φιλοσοφία, we may say, for ἱστορία, in that wide sense of the word in which it means the sober registering of recorded fact; and here he shows himself more Baconian than the Bacon of the *Novum Organum*. The work of his last years is an encyclopaedia—an encyclopaedia of unique value, in that it proceeds from a single mind informed by a single set of controlling ideas. In the field of human history he produced, on the one side lists of the victors in the Pythian and Olympic games, and a chronology of the Athenian drama (which supplemented the *Poetics*); on the other, a record of 158 constitutions (which equally supplemented the *Politics*), an account of "the customs of barbarians," and a treatise on "cases of constitutional law." In the field of natural history the volume of his production was greater still. It included the *Historia Animalium*, a record of biological facts, in which the material furnished by Alexander's expedition seems to have been used (as it also seems to have been used in a treatise "on the rising of the Nile"); it included biological treatises based on these facts; it included a body of treatises which inaugurated the study of psychology; and it has been suggested that it also included both a scheme for the history of the sciences (physics—including metaphysics—mathematics and medicine) and researches in medical subjects such as anatomy and physiology. *Exegit monumentum . . . situ pyramidum altius;* and even if some of the steps of the monument are conjectural, we cannot but admire its height and its massive plan.

In 323, in the midst of all these activities, Aristotle received the news of the death of Alexander. Antipater had been summoned to the presence of Alexander and was absent from Greece; the nationalist party raised its head in Athens; and Aristotle fled to his mother's home in Chalcis, on the island of Euboea, where he died in 322 at the age of 62.[1] By his marriage with the daughter of Hermias he had a daughter, also called Pythias; by a later union he had a son, called according to Greek custom by the name of his grandfather Nicomachus. His personality is hidden behind his works. Tradition makes him speak with a lisp and pay attention to dress. The busts, which seem to be authentic, show firm lips and intent eyes. He was a man of affairs, versed in the ways of courts; and he had at its height the invincible and insatiable curiosity of the Greek mind. But there was something more in him than the light of a pure intellect. The study of his life leaves the impression of generous humanity. His will shows him concerned for every relative and dependant, and not least for the emancipation of his slaves. And there is a phrase in an Aristotelian fragment, which may come from a letter of his later years, which cannot be forgotten. "The more I find myself by myself and alone, the more I have become a lover of myth." "Myth may have meant to Aristotle a little of what revelation has meant to millions in later centuries; and for all his scientific labours he may yet have felt at the last—what indeed he suggests in passages of his own treatises—that there was a supreme consolation in the life of contemplation which might lead, at its highest moments, to visions of the Divine.

The Writings of Aristotle.—The writings of Aristotle fall into three main kinds. There are literary essays intended for publication, such as the early dialogues (now lost except for fragments); there are the set works of his later years, such as the *Constitution of Athens* (one of the 158 *Constitutions* which was rediscovered over 30 years ago); and above all there are what we may call treatises, intended for use in lectures or for the reading of the students of the Lyceum, of which we possess a large variety.

(1) The *dialogues*, written with a conscious art and a definite pursuit of style, were modelled on those of Plato; but they are said by ancient writers to have differed from Plato's dialogues in representing different persons as stating at length their different views on the subject treated. They were famed for their lucidity and the easy flow of their style; they belong to the period of Aristotle's discipleship in the Academy (367–347 B.C.); almost to the very last they followed the doctrine of Plato; and their

[1] One of the first acts of Alexander, after crossing the Dardanelles, was to place a garland on the tomb of Achilles.

[1] An archaeological discovery, which may bear on Aristotle, was made about 1890. Near Eretria, in Euboea, in an ancient cemetery in which non-residents as well as residents had been buried, there was exhumed from a rich tomb with marble foundations a number of object—seven gold diadems, two styluses, a pen, a signet ring and a terra cotta statuette of a man in an attitude like that which Christodorus (*Anth.* Pal., ii.) ascribes to a statue of Aristotle. On a sepulchral stone in the grave was found the inscription, in lettering of the early 3rd century B.C., [Β]ιοτη [Α]ριστοτελου. The grave may have been connected with the family of Aristotle (though Chalcis is over a dozen miles away from Eretria); the styluses, pen and statuette may, in that case, be connected with Aristotle himself; and a skull which was also discovered may have been his. (See *C.I.G.*, vol. xii., fasc. ix. under Eretria, where references are given to the literature on the subject.)

clear and stirring account of Platonic doctrine exercised a large influence in antiquity down to the days of St. Augustine. The two most famous and considerable of these dialogues were the *Protrepticus,* an exhortation to the philosophic life, which was a model for Cicero's *Hortensius* and was partly incorporated by Iamblichus (as Prof. Bywater first recognized in 1869) in a philosophic textbook for beginners, also called the *Protrepticus,* and the De *Philosophia,* perhaps the latest of all the dialogues, in which, as we have already seen, Aristotle first showed signs of a movement away from Plato's theory of "ideas." Generally, however, the dialogues of Aristotle were purely Platonic in the range and the substance of their thought; and several of them, such as the *Politicus* and the *Sophistes,* bear the same name and perhaps handled the same theme as Platonic dialogues. If only we could recover the lost dialogue "On Justice," which appears from its title to correspond to Plato's Republic (for the *Republic,* too, treats of justice, and indeed its alternative title is "On Justice"), it would be profoundly interesting to compare Aristotle's views in this dialogue both with those of his master and with his own later views on the doctrines of the Republic as they are expressed in the second book of the Politics.

(2) Midway between the dialogues and the treatises of Aristotle come a number of works which, like the dialogues, were set compositions in literary form intended for publication, but which, like the treatises, were mainly of the nature of scientific compilations. Apart from an essay *On* Monarchy, which may belong to the time of his residence at Pella, these works belong to the third and last period of his life, during which he was occupied in investigation and teaching in the Lyceum. They include the Alexander, or on Colonies; the accounts of 158 Constitutions; the compilations of "the Customs of *Barbarians"* and of "Cases of Constitutional Law"; the chronological tables of victors in the Pythian and Olympic games; and a list of the successful dramas produced at the festivals of Dionysus at Athens.

(3) The treatises, as we have seen, were in several cases begun in the period of *Wanderjahre* from 347 to 335, but in the form in which they have come down to us they belong to the final period between 335 and 322. They were all written by Aristotle in connection with his courses of lectures—not so much, probably, in the way of "notes," to be followed in the delivery of lectures (the actual lectures may have been more discursive and more of the nature of discussions or conversations with a class), but more in the way of "memoranda," which may have been written afterwards, to preserve a record of the main results attained in lectures and discussions.

The treatises may be grouped under some eight main heads, though we cannot for a moment say that each of these heads corresponds to a separate "course" of lectures, or that the classification is the same as Aristotle himself would have made. The first head is what Aristotle calls "analytics," or, as we should say, logic. Under this head we have some half-dozen treatises (the Categories, the de Znterpretatione, the Topics, the Sophistici *Elenchi,* and the Prior and Posterior Analytics) which came to be known, some centuries afterwards, as the *Organon,* or "instrument" of science and scientific reasoning. The second head we may call by the name of "physics," using that term in a wider sense than that in which we use it to-day, and taking it to mean the general study of inorganic "nature" (φύσις). Here we have to reckon the treatise on *Physics,* the De Caelo, the De *Generatione* et Corruptione and the Meteorologica. The third head may be termed psychology—of which (as also of logic) Aristotle was the inventor. Under it fall the De Anima and the *Parva* Naturalia —the latter a collection of essays on subjects such as sensation, memory, sleep and dreams. The fourth head may be called by the name of biology. We have seen that Aristotle was already interested in the study of this subject in his Lesbian days, about 344–342 B.C., and that he continued his interest and extended his studies in the final period of his life. His biological treatises are the *Historia Animalium* (a record of data corresponding, in the sphere of natural history, to the record of 158 constitutions in the sphere of politics), and a number of theoretical works, based on the data of the Historia, which include studies of the "parts," the "progression," the "motion" and the "reproduction" of animals. Whether or no we regard Aristotle as peculiarly biological in his general point of view and his general approach to the problems of knowledge, we must recognize that it was in the sphere of biology that he made one of his greatest contributions to the advancement of learning.

The remaining heads under which his treatises may be grouped are the metaphysical, the ethical, the political and the literary. Under the head of metaphysics, or "first philosophy," which is an enquiry into the nature of existence (οὐσία), and involves a discussion of the question whether universals exist as substances "separable" from their particulars, we have a composite treatise, containing different strata put together by later editors, which is called the *Metaphysics.* Under the head of ethics we have two treatises—the Eudemian Ethics (so called from Eudemus, one of Aristotle's pupils), and the *Nicomachean* Ethics (which derives its name from his son Nicomachus). It is now held that the former is a genuine work of Aristotle, belonging to the middle period of his life, which was subsequently edited by Eudemus, and that the latter is a statement, edited by his son, of his final views on ethics in the last period of his life. (We may remark, however, that even tht *Nicomachean* Ethics is somewhat simple, not to say elementary, in its psychological foundations, and that it shows little connection with the detailed study of the problems of psychology in the treatises which deal with that subject.) Under the head of politics we have the treatise called the Politics, which falls into three parts—a philosophical "theory of the State" in Books i.–iii.; a detailed study (running into practical suggestions) of the "forms and methods of government" in Books iv.–vi.; and a torso of a sketch of an ideal State in Books vii.–viii. Opinions differ in regard to the dates of the different parts; but it seems reasonable to believe that the last two books, which show a considerable dependence on Plato's Laws, are early, and that the three middle books, which go naturally with the collection of 158 Constitutions, and suggest in their method the biological studies of Aristotle's last period, are the latest. Finally, we have to count, under the head of literary criticism, the three books of the Rhetoric and the short treatise, Poetics.

More important than the classification of Aristotle's treatises is the chronology of their composition. Important as it is, it must also remain conjectural. We are justified, however, in saying that Aristotle seems to have moved from an earlier concern with logic and "the higher philosophy of heavenly things" (or, in other words, from the circle of Platonic interests) towards a later and more absorbing passion for the study and record of actual facts alike in the world of "nature" and in the world of political and literary "art." On this basis we may assign the first form of a number of treatises (which, it is true, must have been expanded later in connection with Aristotle's later lectures) to the period before 335. Among these we may count the *Organon,* the Physics, the third (and most general) book of the De Anima, the Eudemian Ethics, a considerable part of the Metaphysics, and probably the last two books (with perhaps also the first three) of the Politics. The rest of the treatises we may ascribe to the final period of Aristotle's life.

The Philosophy of **Aristotle.**—It is impossible, within the space of a brief article, to give any account of Aristotle's teaching on the many specific branches of knowledge with which he dealt; and the reader is referred to the articles on subjects such as Logic, Ethics and Metaphysics for a more adequate account of the contribution which he made to their development. Here we can only deal with the general development of Aristotle's thought, the general views which run through his treatises, and the particular opinions which have influenced subsequent thought most profoundly. Starting with a veneration for Plato and an acceptance of the Platonic tradition which lasted almost to the death of Plato and his own middle age, he followed more and more in the last 25 years of his life (347–322 B.C.) a peculiar and distinctive method of his own. Plato had studied reality as a whole, and the reality he had studied had been the super-sensible reality of "ideas." Aristotle divided reality into the several spheres of physics, biology, ethics, politics and psychology; and the reality

which he studied in these spheres was the observable facts (τὰ ὑπάρχοντα) of actual and concrete individual substances. The essence of his procedure in each field of "enquiry" was observation of the data (coupled, in biology at any rate, with experimental research in the way of dissection, with a view to determining the data more exactly); and the object of his study was to discover some general theory which, in the Greek phrase, "saved" —or, as we might say, explained without doing violence to them— the data which had been observed. ("The course of exposition," he lays it down in the *De Partibus Animalium,* "must be, first, to state the attributes common to whole groups of animals, and then to attempt to give their explanation.") Aristotle possessed in a remarkable degree the scientific habit of mind; on the one hand he distinguished the various '(sciences" (or, as he would have preferred to say, "enquiries"), drawing the lines of division between them and attaching to some of them the names they have since continued to bear; on the other hand he followed a scientific procedure in each of the subjects he treated, and within the limits of his technique (he had few instruments at his disposal, and he had to discover for himself the rules of reasoning) he observed the permanent canons of scientific enquiry. If the essence of his method and teaching had been followed, the fruit would have been a great period of scientific investigation and discovery. No nobler exordium to such a period could be furnished than the great passage in the *De Partibus Animalium* (642b *22 sqq.),* in which he propounds the programme and the justification of a study of Nature. But the essence of his teaching and method was not followed. The reason may partly be that his treatises seem to have been submerged from the time of his death for over a couple of centuries. According to a tradition of antiquity which may well be accepted, the library and the treatises of Aristotle passed at his death to Neleus, the son of that Coriscus of Scepsis whom he had left Athens to join in 347 B.C.; and they continued in the hands of the descendants of Neleus, apparently neglected and forgotten, until they were recovered for the learned world from the cellar of a house in Scepsis in the time of Sulla (80 B.C.). Destitute of the master's treatises, and rapidly forgetting his spirit, the Peripatetic school hardened into a logical tradition of its own; and even when the treatises were recovered, they were treated not as incentives to enquiry and further discovery but as a rounded body of complete knowledge (perhaps the last thing that Aristotle would have claimed for his tentative conclusions), on which commentators might write and lecture as if it contained the final word of perfection. As a spirit and an incentive, Aristotle was dead; he only lived, if indeed it can be called life, as a "master of those who knew" and a *corpus scientiae.* In this way the great researcher was made the enemy of research; and this continued to be his fate for century on century. The middle ages, as we shall see, inherited the Peripatetic cult of "the master"; they "made his torch," as Dryden said, "their universal light"; and thus the beginning of modern science in the 16th century took the form of a revolt against Aristotle—one of the most scientific spirits that ever lived. The life of Aristotle after his death has many of the elements of a tragedy.

But we must return to the real Aristotle who lived and worked in the 4th century B.C. He had a profound respect for given facts, and a deep passion for classifying these facts with a scrupulous respect for their exact character. He was no longer, when he reached the definitely scientific stage of his development, interested in "ideas" as they were conceived by Plato; but he was profoundly interested in "forms"—in the common attributes which can be observed in the same kind of things, and enable us to classify such things in terms of genera and species. "The principal object of natural philosophy," he wrote, "is not the material elements, but their composition, and the totality of the form." The aim of all science, we may say, is to form an intelligible universe by discovering the universal in the particulars—particulars which are the primary and only substances or existences, but which none the less have no existence independently of the universal which is their "form" and makes them the class or kind of existence which they are. Such universals are concepts formed by the intuitive reason on the basis of repeated "sensations," which rise to "memory," and then to "experience," of the same kind of thing. By making such concepts we make a world we can understand—the world of knowledge; and within that world we can reason and use the methods of valid argument. It is one of the greatest services of Aristotle to knowledge that he laid down, and was the first to lay down, these methods, and that he invented the science of logic. There was reasoning before Aristotle, and the dialogues of Plato abundantly imply its methods and rules. But Aristotle was the first to make them explicit; and the inventor of the syllogism, as he may justly be called, deserves to be celebrated in the annals of human thought.

One of the general views which runs through Aristotle's thought, if it is expressed more particularly in the *Physics,* is a view which we may call by the name of evolution or γένεσις. Whether this view was due to his study of biology, or his study of biology was a result and an application of a general view which he had formed on general grounds, we cannot pause to inquire. In any case, a pervading conception of growth is what chiefly distinguishes his thought from that of Plato. Plato had been more deeply interested in being than in becoming, which belonged in his view to the deceptive world of fallible sense; and he had tried to interpret true and permanent being in the light of the permanent truths of mathematics, making number the basis of the universe and identifying matter with space. His universe was thus a static universe. The universe of Aristotle is dynamic; his world is engaged in becoming; the "nature" of each thing is a potentiality which moves through a process of development (a process which is also "nature") to an actuality which is true and final and perfect "nature" —for "nature is the end," as he writes in the *Politics,* "and what each thing is when fully developed we call its nature." There is thus a teleological view behind Aristotle's conception of the nature of things. The movement which he sees incessantly at work is a movement towards an end immanent from the first in the subject of movement, and determining all its growth; "for the process of evolution is for the sake of the thing finally evolved, and not this for the sake of the process." This general conception is applied by Aristotle not only to developments in the sphere of organic nature, but also to constructions in the sphere of human art. The activity of man, whether in the building of a house or the making of a statue, in the putting together of a State or the composition of a tragedy, is the activity of realizing a plan or "form," and of causing a material which has the proper potentiality—be it wood and stone, or marble, or the human trend to association, or the human passion for imitation—to move towards the "form" which is also its "end." There is thus no distinction between "nature" and "art" in Aristotle's view. They move on parallel lines; they may co-operate. As he says of the State in the *Politics,* "by nature there is an impulse in all men towards political association, but he who first put them together (ὁ πρῶτος συστήσας) was the cause of the greatest of benefits."

Of all Aristotle's treatises it is perhaps those on ethics and politics (along with that on logic) which have exercised the deepest and most continuous influence on subsequent thought. There have been many who, like Archbishop Laud (St. Thomas Aquinas and Dante might equally have made the confession), have acknowledged Aristotle as their "master in *humanis."* The *Nicomachean Ethics* is one of the great books of the world. Its application of the doctrine of the mean to the various virtues; its theory of the relation between external goods and the inward happiness of the spirit; its doctrine of habits, and of the importance of the stage of habituation in moral development—all these are among the permanent possessions of human thought. We may reckon in the same category what Aristotle says of the life of contemplation (which is "a laying hold on immortality as far as is possible for men") and what he writes of the connection between "leisure" (an activity to be distinguished alike from "work" and from "amusement") and the contemplative life. The *Politics,* if it has not all the qualities of the *Ethics,* has furnished the generations with many of the great axioms of political truth. That "the State is by nature" (which does not prevent it from also being "by art"); that it exists for the good life, if it begins for the sake of life only; that law is the true sovereign of States, and

governments are servants of law; that there is a fundamental difference between the lawful monarch and the tyrant who governs by his arbitrary will; that there is a right inherent in the people, in virtue of their capacity of collective judgment, to elect their rulers and call them to account—these are some of the axioms on which men have argued from century to century. Here, and in this example, we can see a service which Aristotle—schematized and glossed and ossified as he might be in the teaching of the schools—none the less continued to render for generation on generation. He supplied the great "topics" of thought—the themes for discussion and the standard "commonplaces" on these themes; and he supplied, too, a terminology in the grooves of which thought could run. When thought had to be rebuilt after the collapse of classical civilization, and while the middle ages were toiling at the work, it was no small thing that men should have the tools of a terminology and the rules of accepted axioms.

The History of Aristotle's Writings and Philosophy.—The tradition of Aristotle was continued—and forgotten, perhaps, even more than it was continued—in the Peripatetic school. But it never affected classical antiquity so deeply as the tradition of Plato, which—whether it was fused, as by Posidonius of Apamea, into an eclectic philosophy which also included Stoic theory, or was exaggerated, as it was by the Neoplatonists, into a sort of mysticism—continued to be a magnet to ancient thought. It is in the thousand years that lie between the collapse of ancient civilization in the 5th century and the beginning of the classical Renaissance in the 15th that the influence of Aristotle is strongest and most diffused. It was the logic of Aristotle which for more than half of this period (from 500 to 1200 A.D) was alone known in the West; and not only so, but down to the beginning of the 12th century it was only the earlier and more elementary parts of the *Organon* which were known and studied. Even this was only studied in a Latin translation and commentary made by Boethius; and indeed the study of Aristotle through the whole of the middle ages was the study of Aristotle in a Latin version, and not in the original Greek. But the Latin version of the first half of the *Organon* was none the less a considerable instrument of education for many centuries. It was the staple of "dialectic," one of the three subjects of the mediaeval *Trivium;* and as dialectic was the subject of all others which set students effectively thinking, we may say that Aristotle was in this way the chief influence, outside theology, in the educational system of the early middle ages. His logical treatises were studied, century by century, in the chapter schools attached to cathedrals and in the schools of the Benedictine monasteries; and along with "grammar" and "rhetoric," the other two subjects of the *Trivium,* they were the discipline of thousands of students.

A new epoch begins in the 12th century. In the first place, the methods of dialectic, no longer studied merely as a discipline in schools, begin to be applied to problems of theology; and already in Berengar of Tours (*c.* 1070 A.D.) we find Aristotelian logic brought to bear on the problem of transubstantiation. The application of logic to theology became still more evident when Roscelin, William of Champeaux, and, above all, Abelard began to ventilate theories about the nature of universals and to draw their theories to theological consequences. The old difference between Platonic "ideas" and Aristotelian "forms" re-emerged in the field of theology; and conceptions of the nature of God were made to depend on the difference. In the second place, about 1130, the whole of the *Organon* became known to the West and began to be studied there; and before the middle of the 12th century Otto of Freising had come to Paris, as he tells us, to study the subtleties of Aristotelian logic in the later and profounder *Analytics* as well as in the earlier treatises of the *Organon.* Finally, somewhere about 1170, the University of Paris came into existence as an organized body; and with the foundation of the mediaeval university the great *cadre* was provided in which the whole body of Aristotelian writings might find a place, and in which, as soon as they had found their place, the great attempt might be made—the attempt which we call by the name of scholasticism—to reconcile their tenets and their secular wisdom with the revelation of the Bible and the divine wisdom of the Fathers of the Church.

In the course of the 13th century, between 1200 and 1270, the general body of the Aristotelian writings other than the *Organon* (the *Physics,* the *Metaphysics* and the *De Anima;* the *Politics* and the *Ethics*) began to be imported into the University of Paris, the University of Oxford, which had arisen at the same time, and the University of Cambridge, which had arisen a little later. It was from Cordova and Constantinople that the new knowledge of the works of Aristotle was derived; and the process of the transmission of his various writings to the Latin Nest is one of the curiosities, and one of the romances, of the history of learning.

Cordova in the 12th century was the great seat of Arabic learning. Arabic learning had included, since about 800 A.D., the study of the Aristotelian treatises, and especially of those which dealt with physics, metaphysics and psychology. The tradition of Aristotle hsd survived among the Syrians, and the Arabs had acquired the tradition in Syria when they conquered the country in the 7th century. Great Aristotelian commentators had arisen among the Arabs—especially Ibn-Sina (Avicenna, *q.v.*), who lived in the East and died at Hamadan in 1037, and Ibn-Roshd (Averroes), who lived in Arabic Spain and died at Cordova in 1198. The Arabic paraphrases and commentaries began to penetrate into the Latin Rest towards 1200, partly across the Pyrenees, and partly by way of Palermo, the half-Arabic capital of Sicily, in which the emperor Frederic II. was a patron of science and literature. They came in a curious form—the form of Latin translations (which sometimes sank to the level of transliterations, and sometimes were not even made directly, but only from an intervening Hebrew version) of Arabic exegesis, which itself was not based on the original Greek, but rested on Arabic versions of Aristotle, which might rest in turn on Syriac versions of the original text. Not only did they come in a curious form, but they also brought curious views of Aristotle's doctrines, which had suffered a change in the course of their wanderings; and Aristotle would hardly have recognized as his own the idea, which the Arabs had extracted from the De *Anima,* that the mortal soul of man was re-absorbed at death into the universal creative soul (*νοῦς ποιητικός*) of the Universe. With their curious form and their dubious views the Aristotelian treatises which the West received from the Arabs were at first suspect; their study was at one time prohibited by the Papacy, which frowned on the *fisica et metafisica;* but they won their way, and established their place in study. A school of "Averroists," which lasted until the 16th century, drew its inspiration from these nritings.

Constantinople supplied the West with a more sober and recognizable Aristotle. It had been captured by the Latins during the fourth Crusade (1204); and Latin clergy had settled in the Byzantine empire. They had learned Greek: they had found Greek manuscripts; and two of them (both Dominicans), William of Moerbecke in Flanders and Henry of Brabant, translated, under the impulse of the great Dominican scholar St. Thomas, and in collaboration with him, many of the writings of Aristotle (1260–1270). It was mainly in this way that St. Thomas learned the Aristotle on whom he wrote commentaries and whose views he sought to co-ordinate with Christian revelation in the great edifice of his *Summa.* In the writings of St. Thomas, Aristotle the encyclopaedist, 1,600 years after his death, was wrought upon by another great and massive encyclopaedist, who sought to inform the sum of ancient knowledge with the spirit of Christian faith; and the Pagan scholar, who had built his own great monument, was incorporated by a Christian thinker into another of the great and enduring monuments of human knowledge.

By 1300 Aristotle is the acknowledged "master of those who know." He is "the philosopher" of Dante, whose views run through the *De Monarchia,* appear in the exegesis of the poems of the *Vita Nuova,* and are part of the texture and framework of the *Divina Conzmedia.* The empire of Aristotle lasted for two centuries. It passed with the Italian Renaissance, which was Platonic rather than Aristotelian; it passed with the German Reformation, which, by the mouth of Luther, denounced the "Aristotelianism" of the schoolmen; it passed with the beginnings of modern science, which, seeking to escape from mediaeval tradition and dogma, in which Aristotle had been incorporated, left Aris-

totle aside, and neglected the deep and genuine science of his writings because it had been yoked with what they sought to escape. Only in the later 19th century, with the development of biological study, has Aristotle the scientist — the student of biology and the prophet, of growth — been once more recognized; and only in our own day is the development of his mind, and the growth of his philosophy of nature, beginning to be understood in terms of his own doctrine of "evolution."

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ARISTOTLE'S LANTERN, the name applied to the complex masticatory apparatus of sea-urchins. (See ECHINODERMATA.)

ARISTOXENUS of Tarentum (4th century B.C.), a Greek peripatetic philosopher and writer on music and rhythm. He studied under the Pythagoreans and later under Aristotle, and wrote on philosophy, ethics and music. The empirical tendency of his thought is shown in his theory that the soul is related to the body as harmony to the parts of a musical instrument. In music he held that the notes of the scale are to be judged, not as the Pythagoreans held, by mathematical ratio, but by the ear. The only work of his that has come down to us is the three books of the Elements of Harmony (ῥυθμικά στοιχεῖα), an incomplete musical treatise. Grenfell and Hunt's *Oxyrhynchus Papyri* (vol. i., 1898), contains a five-column fragment of a treatise on metre, probably this treatise of Aristoxenus.

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ARISUGAWA, the name of one of the royal families of Japan, going back to the seventh son of the mikado Go-Yozei (d. 1638). After the revolution of 1868, when the mikado Mutsuhito was restored, his uncle, Prince Taruhito Arisugawa (1835–94), became commander-in-chief, and in 1875 president of the senate, After his suppression of the Satsuma rebellion he was made a field-marshal, and he was chief of the staff in the war with China. His younger brother, Prince Takehito Arisugawa (b. Feb. 11, 1862), was from 1879 to 1882 in the British navy, serving in the Channel Squadron, and studied at the Naval College, Greenwich. In the Chino-Japanese War of 1894–95 he was in command of a cruiser, and subsequently became admiral-superintendent at Yokosuka. Prince Arisugawa represented Japan in England together with Marquis Ito at the Diamond Jubilee (1897), and in 1905 was again received there as the king's guest. He died July 10, 1913.

ARITHMETIC, originally the science or theory of numbers; at present, as commonly understood in the English language, the art of computation and the applications of this art (Gr. ἀριθμητική from ἀριθμός number). In certain other languages the word still retains some of its early meaning and applies not only to a certain amount of theoretical work with numbers, but to the study of the fundamental operations with polynomials, such words as *Rechnung* (German) and *calcul* (French) being used for calculation and its simple applications. In this article the word will be used with the common Anglo-American meaning. The subject will be treated in an elementary way with respect to its bearing upon the school curriculum. The advanced theory will be considered under special topics to which reference is hereinafter made.

NUMBER

Using the term in the sense already mentioned, arithmetic is little concerned with the genesis of the concept of number, this being a philosophical question. Arithmetic takes number as it is found, dividing it into the general classes of cardinal and ordinal. With regard to the numerical measure of a group, as the result of counting or of computing, the term *cardinal number* is used, as when we say that there are five persons in a room. With respect to number as designating position in a sequence, the term *ordinal number* is used, as when we speak of the third page of a book. The cardinal number is that upon which arithmetic turns (Lat. *cardo,* a hinge); it is the important type. (See NUMBER.)

Of an assemblage of objects, the number that can be told at a glance is very limited. Unless the eye is aided by having the objects arranged symmetrically in some familiar order or so as to be divided readily into sub-groups, the eye grasp is usually limited to four or five. Similarly in counting, the mind does not easily grasp the significance of more than a few numerical terms. For example, we may count up to ten or twelve, but by that time we find it desirable to combine the names of smaller numbers, as when we say thirteen (three ten), rather than invent a wholly new term. Similarly in writing numbers, the world finds it necessary, by grouping, to make a few selected characters serve to represent any number however large. At first the groups were small, and there are numerous evidences that the "couple," "pair," "brace," "span," and the like are relics of early groupings made in part for convenience in counting.

Notation. — Peoples who developed independent alphabets also tended to develop independent numerical notations. The spread of Greek culture and commerce, however, carried the Greek numerals of the pre-Christian period into all the leading ports of the Mediterranean sea, and the still more extensive development of the Roman civilization made the Roman numerals dominant in the Occident for many centuries. In the 10th century the entry into Europe of the Indo-Arabic numerals, 1, 2, 3 . . . g, together with the zero, was followed by a slow acceptance of the convenient system of place value by which, with only ten numerals but with an indzfinite number of "places" (units, tens, hundreds, etc.),

any number could conveniently be written. The symbols went by the Latin names characteres and *notae,* and at a later period by the English names figures, numerals and cyphers, and by similar names in other countries. From *nota* came notatio — notation, or the writing of numbers. Thus we have the Egyptian, Greek, Roman, Indian, Arabic and other notations, each of the early written languages tending to have its own numerals. (See NUMERALS.)

The grouping of objects for purposes of counting led to the use of the same device in the writing of numbers. A grouping by fives is called a quinary *system* and is said to be based upon the scale of five, or to have five as the radix. Since man has five fingers on each hand and five toes on each foot, he has a natural counting abacus (*q.v.*) arranged on a scale of five, ten or twenty. While there are traces of the early use of each of these and other scales, the predominant one has been the denary (or decimal) scale— the one with the radix ten. (See NUMERALS.) A familiar relic of grouping by twenties, for example, is seen in the English score, as in expressions like "seven score acres" in relatively late legal documents, and the French *quatre-vingts* (four twenty) for 80 and (formerly) other multiples like *quinze-vingts* (fifteen twenty) for 300, as in the Hospice des Quinze-Vingt in Paris, dating from the 13th century. On this system ninety-six appears in French as quatre-vingt-seize (four-twenty-sixteen). On the pure scale of ten the English counting proceeds as follows: one, two, three . . . nine, ten, *oneteen* (one and ten), *twoteen,* thirteen (three and ten) . . . *twenty* (two tens). The fact that twelve is scientifically a more convenient radix than ten (having its half, third, and fourth easily expressible), seems to have led to the use of "eleven" and "twelve" instead of "oneteen" and "twoteen," after which the denary scale was followed. The tendency to favour twelve as a radix appears in the number of inches (Lat. unciae, twelfths) in a foot, of lines in an inch, of ounces (also from *unciae*) in the Roman and Troy pounds, and of pence in a shilling. The scale of twenty seems to have had considerable standing in certain barefoot countries, the native Mexicans counting to "man finished" and then beginning again. One evidence of the tropical origin of the Greenlanders is that their system of counting also uses twenty as a radix.

A perfect decimal scale requires ten primary word-forms below "hundred" — "one," "two," "three," . . . "ten," the other numbers being named by combining these, as in "fifty-seven" (five-ten-seven). It also requires ten characters, 0, 1, 2 . . . 9. The numbers from 1 to 10 corresponding to the ten fingers, seem to have been called by the early Latins *digiti* ("fingers"), whence our digits. With the coming of the Indo-Arabic numerals, however, it became convenient to use the word to designate the numbers expressed by 1, 2, 3 . . . 9, and also to designate the characters (χαρακτῆρες) (numeral figures) themselves. Since "one" was, by various early writers, spoken of as the fons et origo *numerorum* ("source and origin of numbers"), this was often excluded, the digits being then considered as the eight numbers (or characters) 2, 3, 4 . . . 9.

Similarly, a scale of eight would need eight primary word-forms and eight characters (0, 1, 2 . . .), and so for other scales. On the scale of 2, the number designated by the English word "eleven" would be represented by 1011, that is, $1 \times 2^3 + 0 \times 2^2 + 1 \times 2 + 1$, where (in denary symbols) $8 + 0 + 2 + 1 = 11$. Evidently, therefore, the smaller the radix the more times the characters must be written to express a given number; the larger the radix the more basic number names must be memorized. Either ten or twelve is a medium radix and tradition is too powerful to admit of change from the former to the latter, even though the duodecimal (Lat. duodecim, two-ten, whence the French *douzaine* and the English dozen) has a slight advantage over the decimal.

Numeration and Classification of Numbers. — The Latin numeratio comes from numerus, a number, and refers to the names of numbers. These number names have little etymological significance; in fact. their original meaning is quite speculative.

The various kinds and properlies of numbers are considered elsewhere (see NUMBER; NUMBERS, THEORY OF). A brief reference will, however, be made to those used in elementary arithmetic. With the child as with the race, the first need is for the integer (Lat., "whole") or whole number in the domain limited by the number of his fingers. He learns that "three" is the word to be used with a certain group, just as he learns the names of objects. With a group that is beyond his eye grasp, like six, he learns how to find the number name by memorizing a sequence — "one, two, three, four, five, six," pointing to each object as he counts. He thus subconsciously combines cardinal numbers with ordinal numbers, and thenceforth uses each as the need arises, learning the words "first," "second," and so on, as part of his everyday vocabulary.

His next step leads him to such unit *fractions* as $\frac{1}{2}$ and $\frac{1}{4}$, and he subconsciously learns that $\frac{1}{2}$ has a variety of meanings, as $\frac{1}{2}$ of an object, $\frac{1}{2}$ of a group, $\frac{1}{2}$ of a weight, $\frac{1}{2}$ as large, $\frac{1}{2}$ as light, $\frac{1}{2}$ as loud, $\frac{1}{2}$ as good, and so on, some of which suggest precision, as in the case of an object, while others are merely rhetorical. It is a considerable step from the notion of $\frac{1}{4}$ to that of $\frac{3}{4}$, and the world probably required many centuries in which to take it, and thousands of years to devise a satisfactory symbol for the fraction itself. To broaden the concept so as to include among fractions such cases as $\frac{2}{2}$ and $\frac{3}{2}$, and especially such fraction forms as have fractions for numerator or denominator, did not occur to arithmeticians until modern times. (See FRACTIONS.)

The distinction between abstract *numbers,* like 4, and concrete numbers, like 4ft., is an inheritance that serves no important purpose. A number that has a label attached to it, indicating the unit of measure to which it refers, is called a denominate *number.* Formerly it included such cases as "3 fourths" (as in Trenchant's arithmetic, 1566), but it is now usually limited to such "concrete" numbers as 3ft. and 2 lb. 3 oz. Numbers with more than a single denomination, such as 53 6s. 4d. and 3yd. 27in., are sometimes called compound *numbers.*

Denominate Numbers. — Denominate numbers in general and compound numbers in particular trace their origin to the difficulty which the ancients had in developing a satisfactory notation for either integers or fractions. In the days when one of the ways of writing 7291ft. was MMMMMMMCCLXXXXI pedes, it became convenient to reduce the length of the written number. It was simpler to write this as 1mi. 2011ft.; and then as 1mi. 3fur. 21ft.; and then as 1mi. 3fur. 1rd. $4\frac{1}{2}$ft.; and then, to avoid the fraction, to write $4\frac{1}{2}$ft. as 1yd. 1ft. 6in. Different trades, modes of life, and languages, brought in different units, and so arithmetic inherited such a variety of units of length as the league, mile, stadium, furlong, rod, fathom, yard, cubit, ell, perch, foot, palm, hand, inch and line. The force of tradition kept all of them in the schools till the latter part of the 19th century. In the United States all but four or five have been generally discarded, and in Great Britain there is a tendency in the same direction.

The principal tables of denominate numbers needed for general information in the British empire and the United States, as distinct from those needed in special trades and industries, and in countries where the metric system is used, are indicated as follow: — length: inch, foot, yard, rod (agriculture chiefly), furlong (Great Britain), mile, metre (meter), kilometre; area: square units (inch, foot, yard, mile, meter, kilometer), acre; capacity and *volume:* cubic units (1cu.in., 1cu.ft., 1cu.yd., 1cu. metre), gill, pint, quart, gallon, peck, bushel, litre; time: second, minute, hour, day, week, month, year, decade, century; *value:* the British and American units, with some knowledge of the mark and the franc (lira, peseta, and other gold equivalents); weight: ounce, pound (avoirdupois), stone (Great Britain), hundredweight (Great Britain), ton, gramme (gram), kilogramme (kilogram). These tables are constructed upon *varying* scales; that is, although 12 inches make 1 foot, it does not follow that 12 feet make the next denomination; in fact, the next item changes the scale and states that 3 feet make 1 yard. (See MENSURATION.)

Partly to avoid the inconvenience of a varying scale and partly to establish an international standard, French scientists at the close of the 18th century developed a decimal system of measures, this being known as the *metric system.* It is based upon the stand-

ard metre. originally intended to be one ten-millionth of the distance from the equator to the pole, a degree of accuracy impossible of exact attainment. The legal International metre (meter) is the length of the standard kept in the Bureau International des Poids et Mesures at the entrance of the Parc de Saint-Cloud, Sèvres, near Paris, of which the various civilized countries have copies.

Rational and Irrational Numbers. — The nature of rational and irrational numbers is discussed in the articles on NUMBER; NUMBERS, THEORY OF; and ALGEBRA. With the transfer to algebra of the theory of and operations with these numbers, there was left in elementary arithmetic only the topic of roots (evolution), this being limited to square root and cube root. With the increased use of tables, of logarithms, and of the slide rule and other calculating machines (*q.v.*), even these two operations have recently tended to receive little attention. As a result, cube root has disappeared from most of the arithmetics in the United States and square root will probably do the same, the theory of each being given a moderate amount of attention in algebra, and the practical finding of roots being dependent upon tables or mechanical aids. In Great Britain there is a similar trend. This leads to the arithmetical treatment (finding of approximate values) of irrational numbers in connection with decimal fractions, the nature of such numbers being considered in algebra and the number theory.

OPERATIONS WITH INTEGRAL NUMBERS

It is at present the custom to refer to four fundamental operations with numbers — addition, subtraction, multiplication and division. This classification is convenient but arbitrary. Historically, the number was at one time given as nine; at other times, eight; and at others, seven, six or five. It is often asserted, however, that there is only one operation that is fundamental, and that this is counting. To count by two is to add two; to count three twos is to multiply two by three; to count backwards by two is to subtract twos; and to count backwards by two, beginning with 16 and ending with o, is to find how many twos are contained in 16. Amongst those who gave nine fundamental operations was Sacrobosco (c. 1250), who listed numeration, addition, subtraction, duplation (doubling), mediation (halving), multiplication, division, progressions and the finding (extraction) of roots. The Crafte of *Nombrynge* (c. 1300, ms. in the British Museum) gave seven, omitting numeration and roots; Glareanus (1538) gave six, omitting roots; most of the 16th century reduced this number to five, omitting progressions; Gemma Frisius (1540) reduced it to four, as is now the custom; and Elia Misrachi (c. 1500) gave only three.

Writing and Reading of Large Numbers. — Since the eye grasp renders it difficult to read a number like 207234698, it is the custom to separate such sequences of numerals into groups. If the Greeks had known such a number system, these groups would probably have been of four figures each, the Greeks having used ten thousand (myriad) as the large unit in counting. Since we commonly read numbers by thousands, or thousand thousands (millions), we usually, as an aid to this reading, separate the figures into groups of three or of six. The world, however, has no uniform symbol for use in making this separation. Certain writers have used a vertical bar (Gemma Frisius, 1540; Recorde, c. 1j42; and others); others have placed dots over the figures for thousands, millions, and so on; and some have used full stops (periods) in grouping the figures by threes, or superposed arcs (Fibonacci, 1202) or letters. In Great Britain it is the custom to separate into groups of six, using a comma; in the United States the separation is also by a comma (written) or by a space (printed), there being three figures in a group. The groups have been called "periods" (Ramus, 1569), "regions" (Santa-Cruz, 1594), and "ternaries" (Recorde, c. 1542). Spanish writers, especially in the 16th century, commonly placed U or a symbol resembling the Greek θ after the figure for thousands, and qs (quentos, *cuentos*) after the one for millions, as in 160U; 462qs009U621 (*e.g.*, Texeda, 1546).

The naming of large numbers is comparatively recent. The word "million" appeared in the 13th century but seems not to have been used by mathematicians till about 1340. Its meaning was not confined to 10^6 till much later, certain writers in the 16th century taking it to be 10^9. The word "billion" appeared in the 15th century (French, Jehan Adam, c. 1480, and Chuquet, 1484). It was at first taken to mean 10^{12}, and this usage still prevails in Great Britain. By the 17th century certain Dutch and French writers used it to designate 10^9, the latter taking "milliard" as an equivalent. In the American colonies the usage was the same as in England, but owing to the French influence in the early 19th century the word "billion" was afterwards taken to mean 10^9, and this usage still prevails. The higher number names have only an historical interest. The need for very large or very small numbers is confined to scientists, and these depend upon symbols rather than names as in writing 1.8×10^{16} or 3×10^{-12}.

Operations. — The operation of addition has made but few changes through the centuries. The Romans could have added more readily than we do, although the writing of the numbers took longer. This is seen in the following additions: —

DCCCCLXXXXVIIII	999
CC XX V	225
MCC XX IIII	1224

The Roman required the learning of no addition facts; the units (ones, fives, tens, fifties . . .) were seen at once, and the only difficulty was that of "carrying." In pointing to the figures, it is easier to "add up" than to add downwards, and therefore certain writers (*e.g.*, Maximus Planudes, *c.* 1340) suggested writing the sum at the top.

Subtraction has been the subject of various experiments. On the abacus or with counters (see ABACUS) the simplest plan of taking 46 from 423 was to change 423 to $300+110+13$, after which there was no difficulty. This is essentially the plan of borrowing used by most people to-day. With the advent of the Indo-Arabic numerals other devices were suggested. One of these, the complementary plan, was known in India in the 12th century. It is based upon the identity $a-b=a+(10-b)-10$; that is, $12-7=12+(10-7)-10=12+3-10=5$. It found a worthy use when the modern calculating machine became common, subtraction being performed by adding the complement of a number, $10-7$ being the complement of 7. The plan of borrowing 1 from the tens of the minuend and repaying it by adding 1 to the tens of the subtrahend appears in Borghi's arithmetic (1484), but was already old in Europe. It seems to have been of Arabic origin, for Fibonacci (*q.v.*, 1202), who was much indebted to the Muslim writers, used it. The "addition method," seen in "making change" and sometimes called the Austrian method, was suggested at least as early as 1559, but did not become widely known till the 19th century. No one of these methods has shown such points of superiority in actual practice as to make it generally accepted as the best, and with the coming of calculating machines (*q.v.*) it is not important that it should.

The Indian writer, Bhāskara (c. 1150), gave five methods of multiplication, and Pacioli (*q.v.*, 1494) gave eight. To these may be added the ancient one of repeated addition as developed with considerable skill by the Egyptians before 1700 B.C., numerous special methods developed by the Arabs, and the method of quarter squares (*q.v.*).

Although the primitive method of dividing may have been that of repeated subtraction, the earliest one of which we have definite record is that of duplation and mediation — finding (by doubling and halving) the number of times the divisor must be used to make the dividend. The only method that was for any length of time a rival to our present plan is the Galley Method here shown.

	1	1
5	54	54
1728 (1	1728 (14	1728 (144
12	122	1222
	1	11

The problem is to divide 1728 by 12. The successive steps are shown, the last being the only one written in actual practice. It requires, in general, fewer figures than our common method. The

latter is of Oriental origin, but was brought to its present form in the 15th century.

As with all initial steps in any branch of learning, the early work in arithmetic requires the tacit assumption of certain laws, and the mechanism of the operations is accepted with a minimum of explanation. The prime necessity is that the work should become mechanical as soon and as completely as possible. The child—who is quite unable to grasp the significance of radix, scale, place value, associative law and commutative law involved in the operation—should tacitly assume all this knowledge. *(See* NUMBERS, THEORY OF; ALGEBRA; ASSOCIATIVE LAWS; COMMUTATIVE LAWS; DISTRIBUTIVE LAW.)

FRACTIONS

The subject of fractions in arithmetic involves a consideration of the primitive notion of fraction, the growth of the concept, the types of fractions, the symbolism, the names of the parts and the operations. These are discussed in the article on FRACTIONS. So far as elementary arithmetic is concerned, there are three types to be considered: (1) *Vulgar fractions* (Great Britain) or *common fractions* (United States), the name referring to such fractions as $\frac{2}{3}$ (a *proper fraction*), $\frac{3}{3}$ and $\frac{5}{3}$ (both being *improper fractions*); (2) *Sexagesintal fractions,* being fractions with unwritten powers of 60 as denominators, as in the case of $27^\circ\ 10'\ 32''$, meaning $27^\circ+\frac{10^\circ}{60}+\frac{32^\circ}{60^2}$; and (3) *Decimal fractions,* generally spoken of as *decimals.* These types will also be considered in the article on fractions.

Operations with Fractions.— Before decimal fractions began to be used, in the 16th century, and indeed before this use became at all general some two centuries later, the operations with fractions having Iarge numerators and denominators were very difficult. It became desirable to reduce such fractions to lowest terms, a process requiring the finding of the greatest common divisor by the so-called Euclidean method of continued division. Even when this was done, addition and subtraction required the finding of the least common denominator, while multiplication and division required still more work in the reduction to lowest terms. With the growing use of decimal fractions the necessity for teaching the operations with any but the simplest numerical fractions disappeared. Operations with decimals involve no difficulties if they are limited to cases which the pupil will sometime need in daily life.

In Great Britain and to a large extent in the entire British Commonwealth of nations and on the Continent of Europe, the notion of per cent. is used in a somewhat different way from that in the United States. The European usage is the historical one, permitting of such an expression as £6 per cent., meaning £6 out of (or in) £100. In the United States such an expression is practically never used. The rate of income, expenditure, increase in value or population, and so on is stated abstractly as 6%, 10%, $2\frac{1}{2}$%, and the like. Instead of the symbol % being considered to mean "in" or "out of" a hundred, as in £6 in a hundred (pounds), it is looked upon as synonymous with "hundredths" ("hundredth," "of a hundredth"). This usage has led to looking upon the work with per cents. as part of decimals. Since 6% is considered as 0.06, there is no object in treating of the two separately. In any case, however, if the treatment of per cents. is confined to those problems which someone is likely to meet sometime, and is not given largely to impractical puzzles and inverse cases, the subject offers no difficulty where measures are decimalized, and but little where they are not.

APPLICATIONS

Since the applications of arithmetic reach every branch of trade, industry, commercial activity and science, it is evident that an arbitrary limit must be placed upon what the schools can offer. It is also evident that, so far as the subject matter is concerned, this limit must vary with the world's needs and business customs. A further boundary is fixed by the abilities of the pupils in the elementary schools, this being a fairly measurable constant, at least in selected geographical and racial areas.

Each business application found in a textbook on arithmetic represents what is, or was at one time, a need. The problem of the pipes filling a cistern was a useful one in the days when the Romans established public fountains in every important town; partnership involving time was once as important as any problem involving corporations at the present time; the problem of the couriers was a real one when communication from place to place depended upon human endurance and fidelity; and the banker's draft was known even in Babylonian times. The schools always tend to be conservative.

The study of child psychology, which had its scientific beginning in the latter part of the 19th century, has established certain rather definite limits as to the nature of the arithmetic offered from year to year. This study does not concern the nature of problems so much as it does the pupil's ability to do the computation and to master the reasoning involved; it relates to the applied problem to the extent of seeing that its meaning is fairly within the mental grasp of the child This phase of the subject is at present attracting more attention than the actual practicability of the applied problems. It has resulted in an improvement in the course of study and has assisted in eliminating certain cases of computation (as in the division of unusable fractions and decimals) that are beyond the needs and the ready grasp of elementary pupils. The result has not been the standardization of topics or of applications, but the fixing of limits of difficulty for pupils of various degrees of ability. The chief problem of the schools is to find, from the wide range of applications, those that the great majority of people will sometime need to use and that psychology shows are within the mental reach of the pupils at the time they are introduced. In each of these respects the schools are making progress that is definite and is probably as rapid as circumstances permit. Among the present applications which have replaced those which are now obsolete are the following: personal and household accounts, budgeting, household inventory, sales slips, bills and invoices, transportation problems, pay-rolls, community problems (how money is raised and how it is spent), thrift and investments, business graphs, and government income and expenses.

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ARIUS (d. 336), name celebrated in church history, not so much on account of the personality of its bearer as of the "Arian" controversy which he provoked (Gr. Ἄρειος). Our knowledge of Arius is scanty, and nothing certain is known of his birth or of his early training. We first hear of him as a deacon in Alexandria. After some controversy he was ordained presbyter by Achillas the Bishop. in 311, and discharged his duties with apparent faithfulness and industry under Achillas, and afterwards under Alexander his successor. The cause of the controversy with which the name of Arius is associated lay not in any personalities but

in a fundamental difference of doctrine which had far-reaching religious and philosophical implications. "Is the Divine," says Harnack, "which appeared on earth and made its presence actively felt, identical with the supremely Divine that rules heaven and earth? Did the Divine which appeared on earth enter into a close and permanent union with human nature, so that it has actually transfigured it and raised it to the plane of the Eternal?"

Arius had received his theological education in the school of the presbyter Lucian of Antioch, a learned man, and distinguished especially as a biblical scholar. The latter was a follower of Paul of Samosata, bishop of Antioch, who had been excommunicated in 249, but his theology differed from that of his master in a fundamental point. Paul, starting with the conviction that the One God cannot appear substantially (οὐσιωδῶς) on earth, and, consequently, that he cannot have become man in Jesus Christ, had taught that God had filled the man Jesus with his Logos (σοφία) or Power (δύναμις). Lucian, on the other hand, persisted in holding that the Logos became man in Christ. But since he shared the above-mentioned belief of his master nothing remained for him but to see in the Logos a second essence, created by God before the world, which came down to earth and took upon himself a human body. In this body the Logos filled the place of the intellectual or spiritual principle. Lucian's Christ, then, was not "perfect man," for that which constituted in him the personal element was a divine essence; nor was he "perfect God," for the divine essence was a created being. It is this idea which Arius took up and interpreted. His doctrinal position is explained in his letters to his patron Eusebius, bishop of the imperial city of Nicomedia, and to Alexander of Alexandria, and in the fragments of the poem in which he set forth his dogmas. From these writings it can even nowadays be seen clearly that the principal object which he had in view was firmly to establish the unity and simplicity of the eternal God. However far the Son may surpass other created beings, he remains himself a created being, to whom the Father before all time gave an existence formed "out of nothing" (ἐξ οὐκ ὄντων). Arius was quite unconscious that his own monotheism was hardly to be distinguished from that of the pagan philosophers, and that his Christ was a demi-god.

For years the controversy may have been fermenting in the college of presbyters at Alexandria. Sozomen relates that Alexander only interfered after being charged with remissness in leaving Arius so long to disturb the faith of the Church. According to the general supposition, the negotiations which led to the excommunication of Arius and his followers among the presbyters and deacons took place in 318 or 319. Arius was not without adherents, even outside Alexandria. Those bishops who, like him, had passed through the school of Lucian were not inclined to let him fall without a struggle, as they recognized in the views of their fellow-student their own doctrine, only set forth in a somewhat radical fashion. Eusebius of Nicomedia, a comrade of Arius in the school of Lucian, entered the lists energetically on his behalf. But Alexander, too, was active; by means of a circular letter he published abroad the excommunication of his presbyter, and the controversy excited more and more general interest.

It reached even the ears of Constantine. Now sole emperor, he saw in the one Catholic Church the best means of counteracting the movement in his vast empire towards disintegration; and he at once realized how dangerous dogmatic strife might prove to its unity. Constantine had no understanding of the questions at issue; and no course was left but to summon a general or oecumenical council, which was convened in Nicaea (q v.) in 325. After various turns in the controversy, it was finally decided, against Arius, that the Son was "of the same substance" (ὁμοούσιος) with the Father, and all thought of his being created or even subordinate had to be excluded. Constantine accepted the decision of the council and resolved to uphold it. Alexander returned to his see triumphant, but died soon after, and was succeeded by Athanasius (*q.v.*), his deacon, with whose indomitable fortitude and strange vicissitudes the further course of the controversy is bound up.

It only remains for us here to sketch what is known of the later career of Arius and the Arians. Although defeated at the council of Nicaea, the Arians were by no means subdued. Constantine, while strongly disposed at first to enforce the Nicene decrees, was gradually won to a more conciliatory policy by the influence especially of Eusebius of Caesarea and Eusebius of Nicomedia, the latter of whom returned from exile in 328 and won the ear of the emperor, whom he baptized on his death-bed. Athanasius was banished in 335. In 336, while awaiting readmission to the church, Arius was suddenly taken ill while walking iri Constantinople, and died in a few moments. His death seems to have exercised no influence worth speaking of on the course of events. His theological radicalism had in any case never found many convinced adherents. It was mainly the opposition to the Homoousios, as a formula open to heretical misinterpretation, and not borne out by Holy Writ, which kept together the large party known as Semiarians, who carried on the strife against the Nicenes and especially Athanasius. Under the sons of Constantine Christian bishops in numberless synods cursed one another turn by turn. In the western half of the empire Arianism found no foothold, and even the despotic will of Constantius, sole emperor after 351, succeeded only for the moment in subduing the bishops exiled for the sake of their belief. In the east, on the other hand, the Semiarians had for long the upper hand. They soon split up into different groups, according as they came to stand nearer to or farther from the original position of Arius. The actual centre was formed by the Homoii, who only spoke generally of a likeness (ὁμοιότης) of the Son to the Father; to the left of them were the Anomoii, who, with Arius, held the Son to be unlike (ἀνόμοιος) the Father; to the right, the *Homoousians* who, taking as their catchword "likeness of nature" (ὁμοιότης κατ' οὐσίαν), thought that they could preserve the religious content of the Nicene formula without having to adopt the formula itself. Since this party in the course of years came more and more into sympathy with the representatives of the Nicene party, the *Homoousians,* and notably with Athanasius, the much-disputed formula became more and more popular, till the council summoned in 381 at Constantinople, under the auspices of Theodosius the Great, recognized the Nicene doctrine as the only orthodox one. Arianism, which had lifted up its head again under the emperor Valens, was thereby thrust out of the state Church. It lived to flourish anew among the Germanic tribes at the time of the great migrations, but here too as a distinctive national type of Christianity it perished before the growth of mediaeval Catholicism, and the name of Arian ceased to represent a definite form of Christian doctrine within the Church, or a definite party outside it.

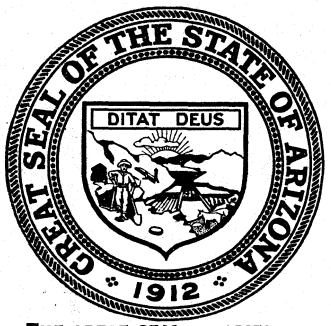
See H. M. Gwatkin, Studies of *Arianism* (2nd ed., 1900); Harnack, *History of Dogma,* Eng. tr., vol. iv.; Hastings, *Encyclopaedia* of *Religion and Ethics,* art. "Arianism." The religious and philosophical aspect of the question is discussed in Mellone, *The Price of Progress* (1924), ch. iv.

ARIZONA, the "Apache State," is a State situated in the southwestern part of the United States of America, between 31° 20′ and 37" N. and 109° 2′ and 114° 45' W. It is bounded north by Utah, east by New Mexico, south by Mexico and west by California and Nevada, the Colorado river separating it from California and in part from Nevada Of its total area of 113,909 sq mi. (water surface, 329 sq.mi.), approximately 39,000 are less than 3,000 ft. above sea level, 27,000 are from 3,000 to 5,000 ft., and 47,000 are above 5,000 feet. The popular name "Apache State" was given it because it is the home of the most of the Apache Indians.

Physical Features. — Three characteristic physiographic regions are distinctly marked: first, the great Colorado plateau, some 45,000sq m. in area, in the north part of the State; next, a broad zone of compacted mountain ranges with a southern limit of similar trend; and, lastly, a region of desert plains, occupying the south-western quarter of the State. The plateau is not a plain. It is dominated by high mountains, gashed by superb canyons of rivers, scarred with dry gullies and washes, the beds of intermittent streams, varied with great shallow basins, sunken deserts, dreary levels, bold buttes, picturesque mesas, forests and rare verdant bits of valley. The surface in general is rolling and drains through the Little Colorado (or Colorado

Chiquito), Rio Puerco and other streams into the Grand Canyon. Along the Colorado is the Painted Desert, remarkable for the bright colours—red, brown, blue, purple, yellow and white—of its sandstones, shales and clays. Within the desert is a petrified forest of Mesozoic time, the most remarkable in the United States. The marks of volcanic action, particularly lava-flows, are abundant and widely scattered.

Separating the plateau from the mountain region is an abrupt transition slope, often deeply eroded, crossing the entire State. In localities the slope is a true escarpment falling 150 and even 250ft. per mile. The mountain region has a width of 70 to 150m. and is filled with short ranges parallel to the plateau escarpment. Many of the mountains are extinct volcanoes. The south-eastern corner of Arizona is a region of greatly eroded ranges and gently sloping valleys. This mountain, zone has an average elevation of not less than 4,000 ft., while in places its crests are 5,000ft. above the plains below. These plains, the third or desert region of the State, have their mountains also, but they are lower, and they are not compacted; the plains near the mountain region slope toward the Gulf of California across wide valleys separated by isolated ranges, then across broad desert stretches traversed by rocky ridges, and finally there is no obstruction to the slope at all.



THE GREAT SEAL OF ARIZONA

The design in the centre represents a mountain range, a reservoir, and the two chief industries, mining and agriculture

Climate.—Arizona has a wide variety of local climates. In general it is characterized by clear air and low humidity. The scanty rainfall is distributed from July to April, with marked excess from July to September and a lesser maximum in December. Very little rain comes from the Pacific or the Gulf of California, precipitation being diminished by the mountains and the desert, as well as the adverse winds. Rain and snowfall usually come from clouds blown from the Gulf of Mexico and not wholly dried in Texas. The mean annual rainfall varies from 2 to 5·5in. at various points in the lower gulf valley and on the western border to 25 to 30in. in the mountains. Local thunderstorms and cloudbursts are a characteristic phenomenon, inundating limited areas and transforming dried-up streams into muddy torrents carrying boulders and débris. Often in the plateau country the dry under-air absorbs the rain as it falls; and rarely in the Moqui country do flooded gullies "run through" to the Little Colorado. The country of the cliff-dwellers in the north-east is desert-like. Only points high in altitude catch much rain. Mountain snows feed the Gila, the Little Colorado and the Colorado rivers. The floods come in May and June, and during the wet season the rivers, all with steep beds in their upper courses, wash along detritus that lower down narrows, and on smaller streams almost chokes their courses. These gradients enable the inconstant streams tributary to the Colorado to carve their canyons, some of which are in themselves very remarkable, though insignificant beside the Grand Canyon. From the Gila to the southern boundary the parched land gives no water to the sea, and the international boundary runs in part through a true desert. In the hot season there is almost no surface water. Artesian wells are used in places, as in the stock country of the Baboquivari valley.

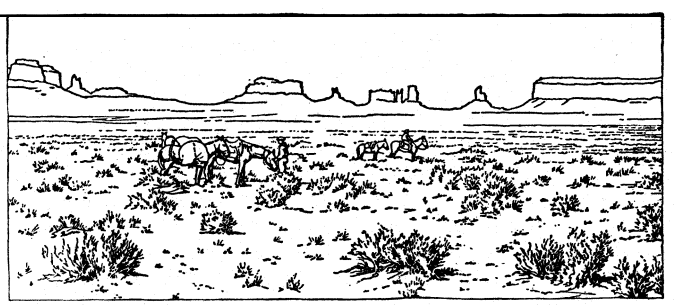
The temperature of Arizona is somewhat higher than that of points of equal latitude on the Atlantic and Gulf of Mexico coasts. In the mountains on the plateau it ranges from that of the temperate zone to that of regions of perpetual snow; south of the mountains it ranges from temperate heats in the foothills to semi-tropic heat in the lower valleys of the Gila and Colorado. The average annual temperature over the region north of 34° is about 55°; that of the region south is about 68 degrees. The warmest region is the lower Gila valley. The daily variation (not uncommonly 60°) is of course greatest in the most arid regions, where radiation is most rapid. And of all Arizona it should be said that, owing to the extreme dryness of the air, evaporation from moist surfaces is very rapid, so that the high temperatures are decidedly less oppressive than much lower temperatures in a humid atmosphere. Intense heat prevails in July, August and September. In lowness of humidity and clarity of atmosphere, southern Arizona rivals Cpper Egypt and other famous arid health resorts.

Fauna and Flora.—Within the borders of Arizona are areas representative of every life zone save the humid tropical. From the summit of the San Francisco mountains one may pass rapidiy through all these down into the Painted Desert. In the highlands coyotes are very common; wild cats and mountain lions are fairly plentiful, but animal life in general is rather scant. Jaguars occasionally stray into Arizona from Mexico. Lizards and toads are conspicuous in the more desert areas. Snakes are not numerous. The Gila monster, tarantula and scorpion occur in come localities in the rainy season. A narrow belt along the lower Colorado river, with a short arm extending into the valley of the Gila, is so arid that it supports only desert birds and mammals.

The general conditions of distribution of the fauna of Arizona are shown even more distinctly by the flora. There are firs and spruces on the mountains, pines farther down, and piiion juniper, greasewood and sagebrush in the north, extending as far south as Flagstaff. In southern and western Arizona the giant cactus grows in groves, attaining a height of 40 and even 50 feet. In many localities the mesquite is the only important native tree. It is easy to exaggerate greatly the barrenness of an arid country. There are fine indigenous grasses that spring up over the mesas after the summer rains, furnishing range for live-stock; some of these grasses are extraordinarily independent of the rainfall. The cliff-dweller country supports a scant vegetation —a few cottonwoods in the washes, a few cedars on the mesas.

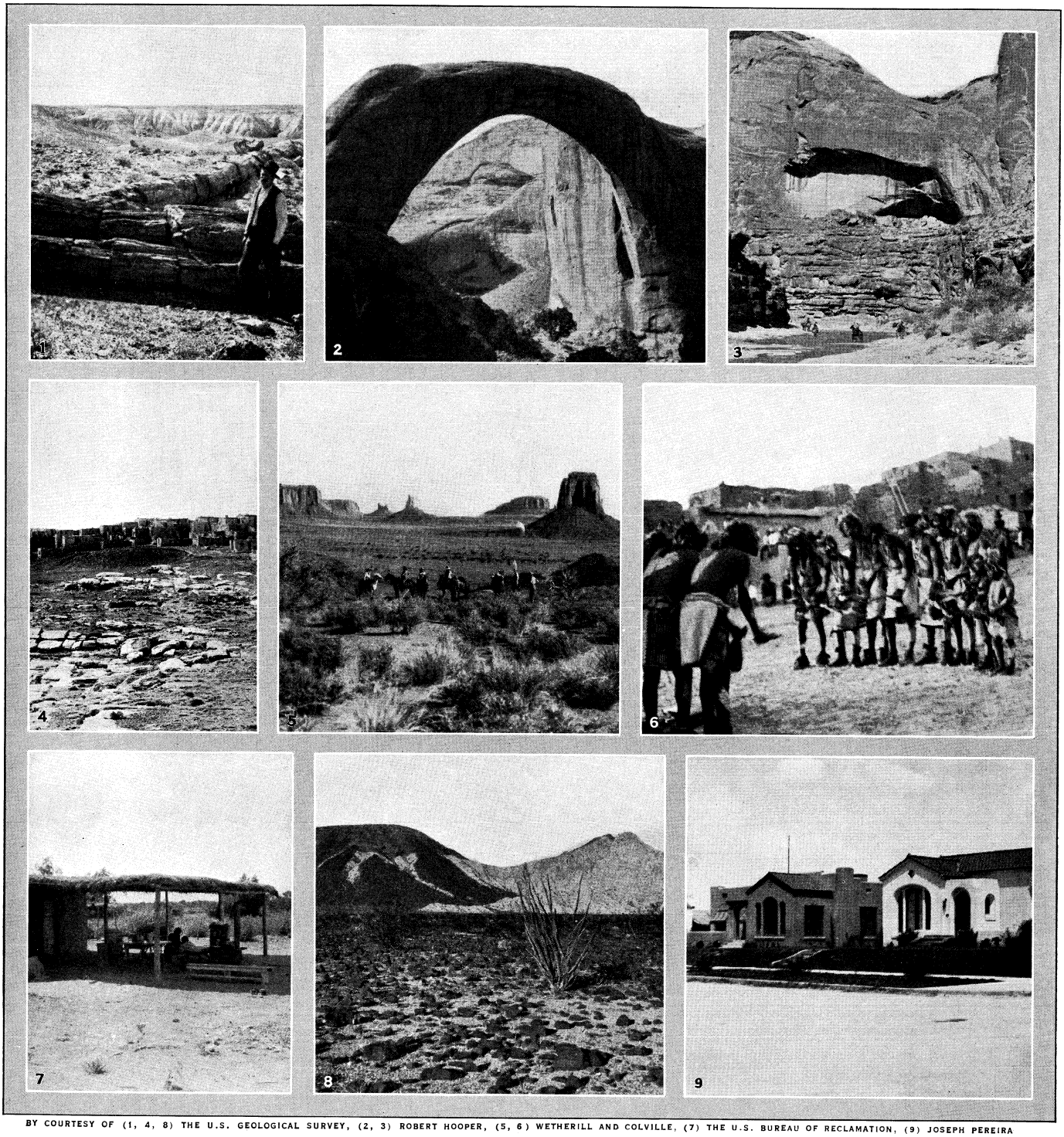
Continuous forest areas are few. A fair variety of trees—cotton-wood, sycamore, ash willow, walnut and cherry—grow in thickets in the canyons, and each mountain range is a forest area. Rainfall varying with the altitude, the lower timber line, below which precipitation is insufficient to sustain a growth of trees, is about 7,000ft., and the upper timber line about 11,500 feet. Since 1898 about 86% of the wooded lands have been made reservations, and work has been done also to preserve the forest areas in the mountains in the south-east, from which there are few streams of permanent flow to the enclosing arid valleys.

Soils and Irrigation.—The soils in the southern part of Arizona are mainly sandy loams, but vary from light loam to heavy close adobe. They are rich enough but lack water. For the reservation of the water partings, the increase of the forest areas and the creation of reservoirs, much has been done by the national Government. A reservoir below the junction of the Tonto and the Salt irrigates more than 1,000,000 acres. An East Indian weir dam across the Colorado near Yuma and levees on both sides of the Gila and the Colorado conserve the water supply. The Colorado river problem is the chief one. In 1919 Arizona adopted a comprehensive code of water laws but was unable to solve the international, interstate, financial and administrative difficulties of the Colorado river problem. The Colorado River Compact,



BY COURTESY OF THE ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY

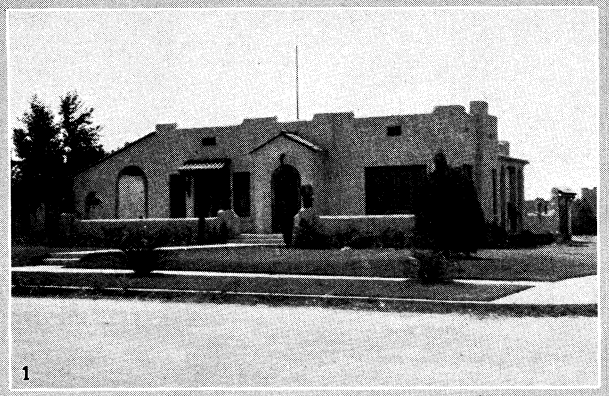
NATURE HAS CARVED THE ROCK MASSES OF ARIZONA INTO FORMS THAT ARE, SOMETIMES, STARTLING IN THEIR RESEMBLANCE TO WORKS ENGINEERED BY THE HUMAN HAND. MONUMENT VALLEY, WITH ITS RIDGE SUGGESTING A CITY SKYLINE, IS THE SCENE OF SUCH A PHENOMENON

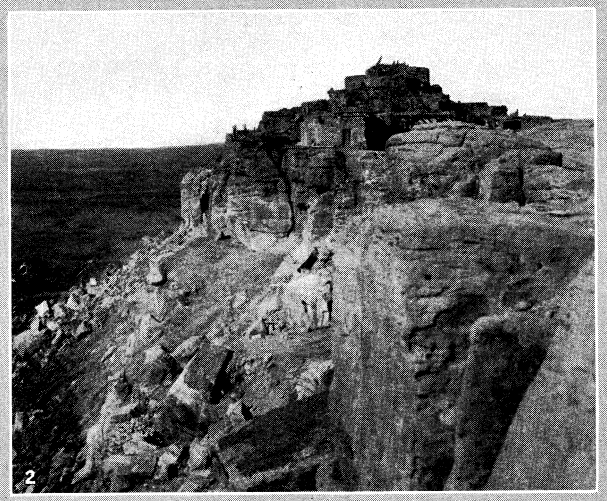


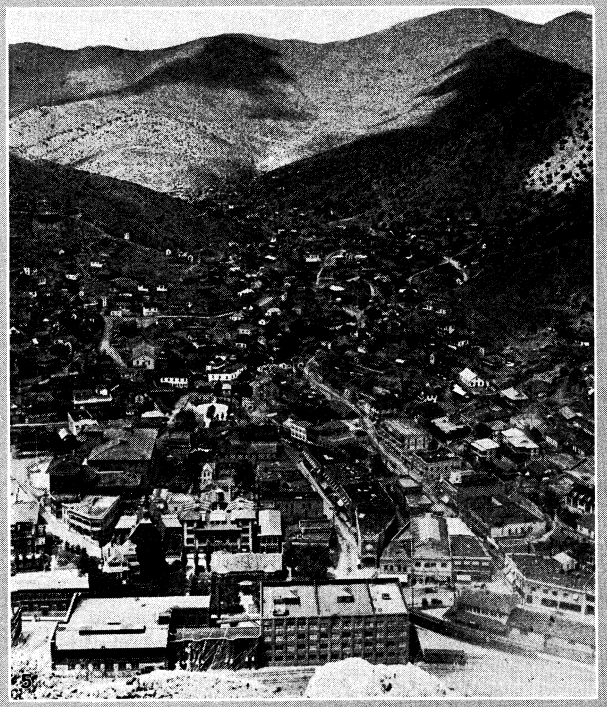
BY COURTESY OF (1, 4, 8) THE U.S. GEOLOGICAL SURVEY, (2, 3) ROBERT HOOPER, (5, 6) WETHERILL AND COLVILLE, (7) THE U.S. BUREAU OF RECLAMATION, (9) JOSEPH PEREIRA

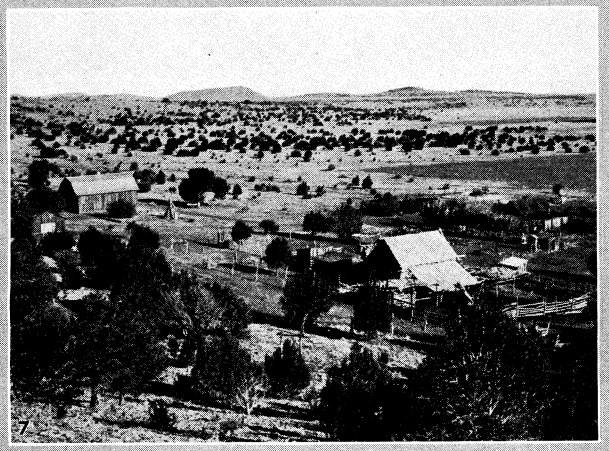
MOUNTAIN, DESERT AND URBAN SCENERY IN ARIZONA

1. The "Twin Sisters," in the Petrified Forest National Monument, south of Adamana
2. Rainbow bridge, a natural rock formation, discovered in 1909, spanning a deep chasm in the Navajo Mountains in Utah, a few miles north of the Arizona border. Striking examples of erosion, similar to this bridge, are characteristic of the Navajo region, which includes extensive areas in Arizona and Utah
3. View of another natural arch (see fig. 2) in the Navajo Mountains
4. Oraibi, one of the seven villages of the Hopi Indians. The buildings are on the top of a plateau
5. View across a section of Monument Valley, in the northeastern part of Navajo county, showing, in the distance, rock formations that have been shaped by erosion into monument-like forms
6. Hopi Indians shown in one of their religious dances. The Hopi festivals are generally considered the most remarkable of the American Indian pageants
7. An Indian earth-covered home in Yuma district
8. Lava-capped mountains, looking northeast over Lechuguiila Desert
9. Homes in Tucson, in the centre of one of the oldest farming asd ranching districts in the State









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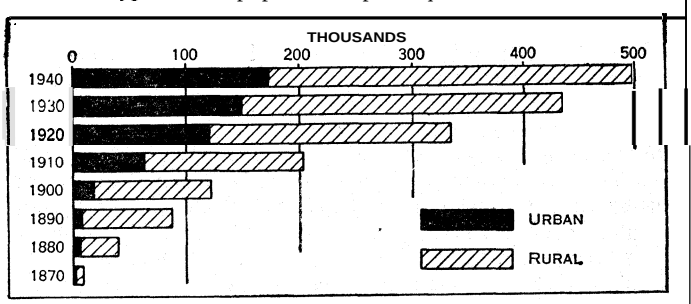
HOMES AND INDUSTRIES IN ARIZONA

1. A home in Tucson
2. View of the pueblo of Walpi
3. Walpi, from another angle
4. A Navajo winter home or "hogan"
5. General view of Bisbee, a copper-mining town
6. Interior view of San Xavier Mission near Tucson
7. View of a ranch near Flagstaff
8. Tumacacori Mission, midway between Tucson and the Mexican border

formed in 1922, was rejected by the Arizona legislature in 1923, and even when revised and accepted by the legislature was vetoed by the governor, who was disinclined to surrender rights to water and power to the other six states in the agreement. In 1925 a conference of states interested broke up because of the uncompromising attitude taken by all. The number of acres irrigated in Arizona was 185,000 in 1900, 320,051 in 1910, 467,565 in 1920 and 1,085,627 in 1930.

Government. — Arizona became a territory of the first (or practically autonomous) class in 1863. Her organic law thereafter until 1910 consisted of various sections of the revised statutes of the United States. From the beginning she had a territorial legislature. Congress retained ultimately direct control of all government, administration being in the hands of resident officials appointed by the president and senate. Special mention must be made of the secret police, the Arizona rangers, organized in 1901 to police the cattle ranges; they are "fearless men, trained in riding, roping, trailing and shooting," a force whose personnel is not known to the general public. The legislature repealed the law licensing public gambling in 1907 and provided for juvenile courts and probationary control of children. The state constitution adopted in 1910 provides for the initiative and referendum and that no child under 16 may work "underground in mines, or in any occupation injurious to health or morals or hazardous to life or limb, nor in any occupation at night, or for more than eight hours in any day." By amendment to the constitution articles were added providing for the recall of judges (1912), for woman suffrage (1912) and for prohibition (1914, 1916). The death penalty, abolished in 1916, was restored in 1918, and in 1933 there was ratified the constitutional amendment making lethal gas the state's mode of capital punishment. In 1934 a system of old-age pensions was created. A state convention voted repeal of national prohibition in September, 1933.

Population. — The population of Arizona in 1870 was 9,658; in 1890 it was 88,243; in 1910, 204,354; and in 1940, 499,261. This last figure represents an increase of 14.6% over the population in 1930. The population per square mile was 4.4, as



BY COURTESY OF THE U S BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF ARIZONA, 1870–1940

compared with 44·2 for the United States as a whole. Of the 1940 population, 173,981, or 34·8%, lived in urban places, that is, in cities and towns of 2,500 or more. The rural population, occupying the remainder of the state, thus constituted 65.2% of the total. The population of the state and of its principal cities is summarized for recent censuses in the following table:

Ares	Population			Percent of increase	
	1940	1930	1920	1930–40	1920–30
The State	499,261	435,573	334,162	14 6	30 3
Urban	173,981	140,856	117,527	16 1	24 1
Rural	325,280	285,717	216,635	13 8	33 0
Percent urban	34 8	34 4	35 2		
Principal cities					
Phoenix	65,414	48,118	29,053	35 9	65 6
Tucson	36,818	32,506	20,292	13·3	60·2

The number of occupied dwelling units returned in the housing census of 1940 was 131,189, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4 1 in 1930 to 3.8 in 1940. The white population of Arizona (including Mexicans) formed 85 6% of the total in 1940, as compared with 86·9% in 1930, about four-fifths of the nonwhite population being Indians and most of the remainder Negroes, with appreciable numbers of Chinese and Japanese. The number of males per 100 females in the entire population of the state was 108·3, though there was a slight excess of females in the urban population, the sex ratio being 98.9 for the urban population and 113·7 for the rural population. There were about 24,000 persons 65 years old and over in Arizona in 1940, as compared with 15,768 in 1930.

BY COURTESY OF THE BUREAU OF RECLAMATION

PAPAGO INDIANS ENGAGED IN DOMESTIC WORK OUTSIDE THEIR HOMES
While auartered on government reservations and provided with mission schools, many of the Indian tribes still follow the primitive customs of their forefathers

The Indians, organized in over 30 tribes, form an ever decreasing proportion of the population, representing only 10% in 1920. The more important are the Hualapaic or Apache-Yumas; the Mohaves; the Yavapais or Apache-Mohaves; the Yumas, whose lesser neighbours on the lower Colorado are the most primitive Indians of the U.S. in habits; the Pimas and Papagoes, who figure much in early Arizona history, and who are superior in intelligence, adaptability, application and character; the Hopis or Moquis, possessed of the same good qualities and famous for their prehistoric culture (Tusayan); and the Navahos and kindred Apaches, perhaps the most relentless and savage of Indian warriors. The Pimas and Papagoes, converted by th]
tain a tt of Christianity, plentifully alloyed with paganism. Apaches, Pimas and Papagoes have been employed by the federal government on irrigation works and have proved industrious and faithful. Since 1900 a few hundred Yaquis, because of difficulties with the Mexican government, have crossed into southern Arizona and settled there They have rapidly acquired American customs and make good labourers.

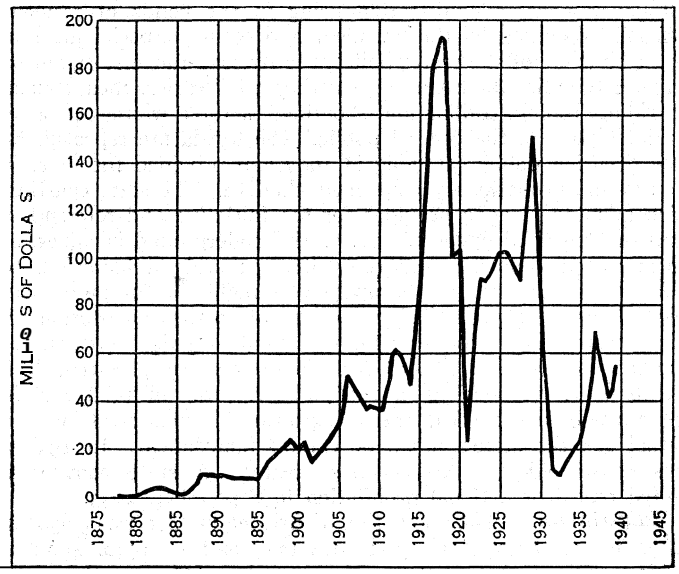
Finance and Taxation. — The total revenue of the state for the fiscal year ending June 30, 1940 was $26,906,810, slightly over 70% of which was raised by taxation. The chief sources of taxation were property, fuel and sales taxes, these three sources contributing over $4,000,000 each. The total governmental costs for the same period were $24,760,896, the largest items being highways, $7,550,971; welfare and correction, $7,299,351; and education, $4,486,202. The state cost of education promises to be higher in the future, since the voters at the general election in 1940 authorized the shifting of local school costs to the state. Previous to 1941 there were several futile attempts to free homes under $5,000 from taxation. The bonded debt of the state, June 30, 1940, was $3,092,275 of which $1,884,000 was indebtedness of state educational institutions and designated as self-liquidating.

Education. — The public school system mas established in 1871. A compulsory attendance law (1921) applies to children betueen 8 and 16 years of age, but it is not generally obeyed by the Mexican element. In 1939–40 the enrolment in elementary schools was 87,960 with an average daily attendance of 67,845; in high schools the enrolment was 22,245, with an average daily attendance of 17,722. Included in the elementary enrolment were 33 443 Mexicans, Negroes and other foreign races; in the high schools, 3,275 of the same races. The average salary of

teachers was $1,395 a year; of principals, $2.465; of superintendents, $3,982. There were 32 private and federal Indian schools with 7,208 pupils in 1939–40. In addition, there were 934 Indians in the state public schools. The Arizona State Industrial School for Boys, opened in territorial days at Benson (1903), was removed a decade later to Fort Grant, its present location. Over half its inmates were Mexicans and 35%, white. Tucson and Phoenix are noted for private schools attended by pupils from the north desiring a mild climate and outdoor life. Of the 60 accredited high schools, 45 were members of the North Central Association of Colleges and Secondary Schools in 1941. The Arizona State School for the Deaf and the Blind has been located at Tucson since its organization in 1910. The two junior colleges are the Gila Junior college and the Phoenix Junior college, the latter located since 1940 on a new and enlarged campus. Two state teachers' colleges are at Flagstaff and at Tempe. The University of Arizona is located at Tucson with an enrolment of 2,922 in 1940–41. The institution is composed of eight colleges: graduate college; college of agriculture; college of education; college of engineering; college of fine arts; college of law; college of liberal arts and college of mines. The agricultural experiment station, the Stewart observatory, the Arizona bureau of mines, the state pure food laboratory and the state museum are also on the campus. In 1916 the University of Arizona was admitted to the North Central Association; in 1919 it became a member of the Association of American Colleges, and in Nov 1924 the Association of American Universities added it to the list of approved institutions.

Agriculture.—Farming in Arizona is varied and intensive. The crops include strawberries, dates, cotton, alfalfa, hay, wheat, sorghum, oranges, olives, sweet potatoes, yams and sugar beets. Crop follows crop in quick succession, alfalfa producing from four to seven cuttings in a year. In 1940, 190,000 ac. yielded 427,500 tons of hay. Stock raising is a leading occupation, but it has probably attained its full development. The number of sheep and cattle, pastured mostly on public domain, is now limited by the extension of the national forest reserves (11,389,714 ac. in Arizona in 1939) and the regulations enforced by the U.S. government for the preservation of the ranges. The five-year average for beef cattle shipments (1935–39) was 343,000 head; for slaughtering in Arizona, 116.000 head. The number of sheep Jan. 1. 1941 was estimated at 805,000, over half of which were owned by Indians. The number of dairy cattle was estimated at 50,000. Truck farming furnishes large shipments to colder sections. In 1940 the 14,000 ac. of spring lettuce produced 7,300 carloads, and 9,880 ac. of cantaloupes, 3,823 carloads For over 20 years cotton has been an important product. In 1940 there were 155,000 ac. of short-staple, a decrease in acreage and production as compared with 1937; 64,000 ac. of American-Egyptian produced 35,000 bales. The total cash income for the year to cattle raisers and farmers was estimated at $58,000,000.

Minerals. — Mining is the leading industry of Arizona. Contrary to venerable traditions there is no evidence that mining was practised except to a very inconsiderable extent by aborigines, Spanish conquistadores, or Jesuits. In 1738 an extraordinary deposit of silver nuggets, quickly exhausted (1741), was discovered at Arizonac. At the end of the 18th century the Mexicans considerably developed the mines in the southeast. The second half of the 19th century witnessed several great finds: first, of gold placers on the lower Gila and Colorado (1858–69); later, of lodes at Tombstone, which flourished from 1879 to 1886, then decayed, but in 1905 had again become the centre of important mining interests; and still later, of copper at Jerome and around Bisbee. Several of the Arizona copper mines are among the greatest of the world. The Copper Queen at Bisbee from 1880–1902 produced 378,047,210 lb. of crude copper, which was then practically the total output of the territory, other valuable mines having been developed later; the Ajo, Morenci and Jerome districts arc secondary to Bisbee. Important mines of gold and silver, considerable deposits of wolframite, valuable ores of molybdenum and vanadium, and quarries of onyx marble, are also worked. Low-grade coal deposits occur in the east central part of the state and near the junction of the Gila and San Pedro rivers. Some fine gems of peridot, garnet and turquoise have been found. The total value of metal from Arizona mines in 1939 was $72,616,408; of this $54,519,296 was the value of copper; $11,075,855, of gold; $5,310,839, of silver and $1,012,474, of lead. Arizona in 1939 mined more copper than any other state, producing 32·9% of the total for the United States. Since 1910 the tendency has been toward the development of low-grade deposits. Similar to the stripping of Sacramento hill near Bisbee in 1920, was the removal of material in 1939 at Morenci to uncover an estimated reserve of 230,000,000 tons averaging 1·06% copper. The United Verde mine was reopened in 1935. In



GRAPH SHOWING VALUE OF COPPER PRODUCED IN ARIZONA, 1877–1939

1939 it ranked second in the state in production of gold and silver, and third in copper.

Manufactures. — The manufactures of Arizona are based chiefly upon the minerals in the state. In 1937 there were 290 establishments in the state employing 7,193 workers whose wages for the year amounted to $8,602,418. The value of the products increased from $20,438,987 in 1900 to $118,355,981 in 1937. The smelting and refining of copper is the principal industry, producing 518,000,000 lb. in 1939. Lumber and timber products are also important, 113,167,000 ft. (board measure) were shipped from the state in 1939 and 68,692,000 ft. were consumed within the state. Meat packing and the handling of cottonseed products are also important.

The Navaho and Moqui Indians make woollen blankets and rugs, and the Pimas make baskets. Onyx marbles of local source are polished at Phoenix.

Railways.—Two trans-continental railway systems, the Southern Pacific and the Santa Fe, were built across Arizona in 1878–83. They are connected by one line, and various branches have been built. The railway mileage on Jan. 1, 1938, was 2,271.

History. — The history of the southwest is full of interest to the archaeologist. A prehistoric culture widely distributed has left abundant traces. Pueblo ruins are plentiful in the basins of the Gila and Colorado rivers and their tributaries. Geographical conditions and a hard struggle against nature fixed the character of this "aridian" culture and determined its migrations; the onslaughts of nomad Indians determined the sedentary civilization of the cliff-dwellers. A co-operative social economy is evidenced by the traces of great public works, such as canals many miles in length. The pueblos of the Gila valley are held to be older than those of the Colorado. Casa Grande, 1 j mi. S.E. of a railway station of the same name on the Southern Pacific railway, is the most remarkable of plains ruins in the southwest, the only one of its type in the United States. It resembles the Casa Grande rain of Chihuahua, Mexico, with its walls of sun-dried earth and its area of rooms, courts and plazas, surrounded by

a wall. It was already a ruin when discovered in 1694 by the Jesuit Father Kino.

John Russell Bartlett described it in 1854, and in 1889 Congress voted that it be protected as a government reservation; in 1892 it was set apart by the Government. Excavations were made there in 1906–07 by Dr. J. Walter Fewkes. The valleys of the Salt river and its affluents, the Agua Fria, Verde and Tonto, are strewn with aboriginal remains; but especially important in the northward migrations of culture was the Little Colorado. A very considerable population must have lived once in this valley. It is possibly represented to-day by the still undeserted habitats of Zuñi (in New Mexico) and Tusayan; the Moquis, after the Zuiiis, are in customs and traditions the best survival of the ancient civilization.

Arizona north of the Gila, save for a very limited and intermittent missionary effort and for scant exploring expeditions, was practically unknown to the whites until well after the beginning of American rule. The Santa Cruz valley, however, has much older annals of a past that charms by its picturesque contrasts with the present. Arizona history begins with the arrival in Sonora in 1536 of Alvaro Nuñez Cabeza de Vaca, who, although he had not entered Arizona or New Mexico, had heard of them. and by his stories incited the Spaniards to explore the unknown North in hope of wealth. Marcos de Niza, a Franciscan friar to whom the first reconnaissance was entrusted, was. in 1539, the first Spaniard to enter the limits of Arizona. Members of Coronado's expedition explored the Moqui country and reached the Grand Canyon, and after this a succession of remarkable and heroic explorations followed through the century. All this has left traces in still living myths about the early history of the south-west. Early in the 17th century considerable progress had been made in Christianizing the Pimas, Papagoes and Moquis. Following 1680 came a great Indian revolt in New Mexico and Arizona, and thereafter the Moquis remained independent of Spanish and Christian domination. although visited fitfully by rival Jesuits and Franciscans. In 1732 regular Jesuit missions were founded at Bac and Guevavi. The region south of the Gila had already been repeatedly explored. In the second half of the century there were a *presidio* at Tubac and some half dozen *pueblos de visita,* including the Indian settlement of Tucson.

A few errors should be corrected and some credit given with reference to this early period. The Inquisition never had any jurisdiction whatever over the Indians; compulsory labour by the Indians was never legalized except on the missions, and the law was little violated; the Indians were never compelled to work mines; of mining by them for precious metals there is no evidence; nor by the Jesuits (expelled in 1767, after which their missions and other properties were held by the Franciscans), except to a small extent about the *presidio* of Tubac, although they did some prospecting. Persistent traditions have greatly exaggerated the former prosperity of the old south-west. The Spaniards probably provoked some intertribal intercourse among the Indians and did something among some tribes for agriculture. Their own farms and settlements. confined to the Santa Cruz valley, were often plundered and abandoned, save in the immediate vicinity of the *presidio.* From about 1790 to 1822 was a period of peace with the Apaches and of comparative prosperity for church and State. The fine Indian mission church at Bac. long abandoned and neglected, dates from the last decade of the 18th century.

BY COURTESY OF THE ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY

A TRADING POST, THE INDIAN'S CONTACT WITH CIVILIZATION

Here he brings the products of his handicraft, such as baskets and blankets, and exchanges them for food and wearing apparel

The establishment of a *presidio* at Tucson in 1776 marks its beginning as a Spanish settlement.

The decay of the military power of the *presidios* during the Mexican war of independence, the expulsion of loyal Spaniards —notably friars—and the renewal of Apache wars led to the temporary abandonment of all settlements except Tubac and Tucson. The church practically forsook the field about 1828.

American traders and explorers first penetrated Arizona in the first quarter of the 19th century. As a result of the Mexican war, New Mexico, which then included all Arizona north of the Gila, was ceded to the United States.

California gold discoveries drew particular attention to the country south of the Gila, which was wanted also for a transcontinental railway route.

This strip, known as the "Gadsden Purchase" *(see* GADSDEN, JAMES), was bought in 1853 by the United States, which took possession in 1856.

This portion also was added to New Mexico. The Mexicans. pressed by the Apaches, had, in 1848, abandoned even Tubac and Tumacacori, first a visita of Guevavi, and after 1784 a mission. The progress of American settlement was interrupted by the Civil War, which caused the withdrawal of the troops and was the occasion for the outbreak of prolonged Indian wars.

Meanwhile a convention at Tucson in 1856 sent a delegate to Congress and petitioned for independent territorial government. This movement and others that followed were ignored by Congress owing to its division over the general slavery question, and especially the belief of northern members that the control of Arizona was an object of the pro-slavery party. By act of Feb. 24, 1863, Congress organized Arizona Territory as the country west of 109° W. longitude. In December an itinerant government, sent out complete from Washington, crossed the Arizona line and effected a formal organization. The territorial capital was first at Prescott and finally at Phoenix (since 1889), where the State capital now is.

There have been boundary difficulties with every contiguous State or territory. The early period of American rule was extremely unsettled. The California gold discoveries and overland travel directed many prospecting adventurers to Arizona. For some years there was considerable sentiment in favour of filibustering in Sonora. Mexico.

The Indian wars, breeding a habit of dependence on force, and the heterogeneous elements of cattle thieves, Sonora cowboys, mine labourers and adventurers led to one of the worst periods of American border history.

Agitation for statehood, which began as early as 1872, seemed on the point of success in 1891, when a Constitution was drafted, submitted to the people of the State and ratified. The U.S. Senate objected to this Constitution because it seemed to repudiate certain contracts and set up a double monetary standard. The Senate continued to reject bills providing for statehood until the State sent up a new Constitution in 1910.

This Constitution raised a question of national importance in the form of a provision for the recall of judges by popular vote. After much argument President Taft and the Congress finally agreed on a resolution granting statehood on condition that the provision for recall be struck out. This was done, and on Feb. 14, 1912, the President signed the proclamation admitting Arizona as a State. After admission the people of the State promptly inserted by amendment the original provision for the recall of judges.

Another issue of national interest was the Alien Labour law enacted by the voters of the State in 1914. The act provided that when any corporation, company, partnership or individual employed more than five workers, 80% of them should be qualified electors or native born citizens.

The ambassadors of Great Britain and Italy averred that the law violated existing treaties, and the Federal courts ruled that the law was unconstitutional because it denied equal protection to aliens.

Protest was made in 1934 by both the Japanese embassy in Washington and British consulate in Phoenix to the action of several hundred white farmers who had warned Japanese and Hindu farmers in the Salt river valley to leave, in view of a threatened enforcement of the state law prohibiting Orientals from owning or leasing land.

The election of Nov. 1916 resulted in a situation that aroused high party feeling. Previously Gov. Hunt, supported by a Democratic assembly, had been elected for two terms. In 1916 he was a candidate for the third time. On the face of the returns. Campbell, the Republican candidate, was elected; but Hunt, after being compelled to give up the office to Campbell, was restored by the State supreme court. The bitter political struggle reflected a tense industrial situation that culminated in a number of strikes, the most important of which was the one at Clifton and Morenci, beginning in Sept. 1915. The Bisbee deportation incident in July 1917, when more than a thousand members of the organization called the Industrial Workers of the World were deported summarily to Columbus, N.M., produced an even more critical situation. President Wilson at once warned the governor of the danger of such a precedent and appointed a committee to investigate and adjust the dispute. The committee found that any adjustment between employers and labour organizations was impossible and recommended a law making future deportation a Federal offence.

One of the major problems which confronted the State during the period from 1920 to 1935 was that of the future supply of water in the Colorado river for purposes of irrigation and hydroelectric power. This problem was rendered critical by the position of Arizona at the lower end of the river and by its own failure to develop hydro-electric power plants as extensively as its neighbours. Because of the fear that they might suffer from a lack of sufficient water for future irrigation projects if they were forced by any agreement to let Mexico have a large supply, the people of the State stood solidly behind their governors in the fight against the Colorado river compact and the construction of Boulder dam and afterwards against the building of the Parker dam to serve the Metropolitan Water District of Los Angeles, California.

In 1931 Arizona lost the suit, based on its contention that the Boulder dam act was unconstitutional and that the Secretary of the Interior was invading the state's rights by proceeding to construct the dam. In dismissing the case, the United States Supreme Court held that, since the Colorado river was once navigable, "commercial disuse resulting from changed geographical conditions and a congressional failure to deal with them does not amount to an abandonment of a navigable river or prohibit future exertion of Federal control."

Twice during 1934, in connection with the construction of Parker dam, Gov. Moeur called out the state's National Guard to prevent work on Arizona's side of the Colorado river.

When the matter was referred to the United States Supreme Court, that body supported the governor's course; the state, therefore, felt its position strengthened in obtaining from the Colorado river 7,500,000 acre-feet of water a year instead of the previously demanded 2,800,000.

The balance of parties in Arizona has been fairly close. In State politics the Republicans were successful in 1916, 1918, 1920 and 1928 whereas the Democrats carried the polls in 1922, 1924, 1926, 1930, 1932, 1934, 1938 and 1940.

Almost the reverse order prevailed in national elections, the State's vote going to the Democrats under Wilson in 1912 and 1916 but thereafter consistently to the Republicans cntil 1932. In that election, as well as in 1936 and in 1940, Roosevelt won by large popular majorities.

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ARJUNA, in post-Vedic Hindu mythology son of Indra, a hero of the *Mahābhārata;* and the central figure in the part of that epic called the *Bhagavadgita.* In modern Hinduism he is unimportant.

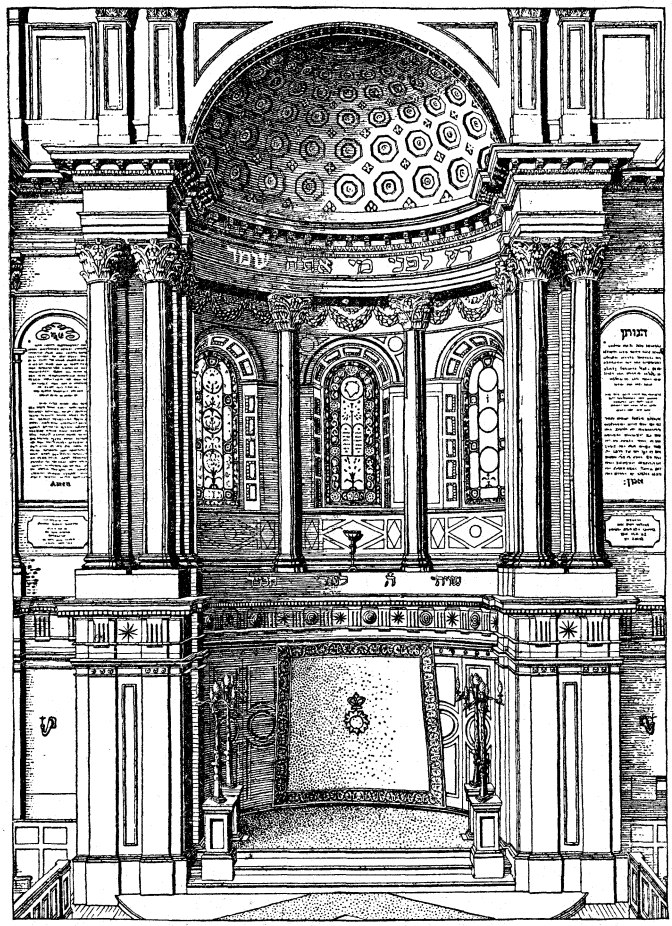
See E. Washburn Hopkins, *Epic Mythology,* Strasbourg (1915).

ARK, a word meaning properly a chest or box, is used in the English Bible to translate two different Hebrew words.

(a) Heb. *tēbah,* probably an Egyptian loan-word meaning a box or coffin. It is used of (1) the reed basket or boat in which Moses was exposed by his mother. This is described as made of papyrus stems and rendered waterproof with bitumen. It was provided with a cover or lid, and was clearly intended to protect the child against wild animals, especially, perhaps, crocodiles. (2) The vessel in which Noah saved himself, his family and specimens of all living animals. (See DELUGE; NOAH.) In the older of the two narratives which have been combined to form our present text (the "Yahwist"), it is represented as large enough to contain seven specimens of every sacrificial animal and two each of all the rest. There is a window, made by Noah himself, and a covering which he is able to remove, though it seems that it had to be placed on the ark by Yahweh. The later account (the "priestly") gives a number of details, in a manner characteristic of the priestly writings. The material is "gopher" wood; it is divided into compartments and covered all over with bitumen; it has three decks with a window in the roof over the highest, and its dimensions are roughly 450 ft. by 75 ft. by 45 feet. One pair only of each species is taken into the ark, for animal food is only permitted after the Flood according to "P," and there is, therefore, no need of extra "clean" animals for sacrifice.

(b) Heb. *'arōn,* meaning a box, used in Gen. 1. 26 of the coffin in which Joseph's body was preserved, but more commonly applied to the "Ark of the Covenant" or "Ark of Testi-

mony," the most sacred religious symbol of early Israel. Though it is a familiar object in J and E (the "Yahwist" and "Elohist" sources) no account of its construction has survived. D (the "Deuteronomist") speaks of its material as being acacia wood, and in P there is an elaborate account of its structure, including a description of the lid, which was of pure gold and included two cherubs, one at each end, with their wings meeting in the



BY COURTESY OF THP REV. S. LEVY

THE ARK OF THE LAW IN THE NEW SYNAGOGUE. GREAT ST. HELEN'S. LONDON, A REPLICA OF WHICH IS IN THE NEW SYNAGOGUE AT STAMFORD. CONNECTICUT

The actual ,Ark, which contains the Scrolls of the Law, is the built-in-cupboard in the centre. The doors are partly concealed by the velvet curtain. The Hebrew inscription on the frieze of the Corinthian order above the Ark means "Know in Whose presence thou standest"

middle. This cover was of special importance in the religious thought of Israel, for it was there, on the "mercy-seat," that Yahweh's presence might most certainly be found.

Whilst some of the details supplied by P may be of later origin, there can be little doubt that the possession of the ark goes far back beyond the conquest of Palestine, and that when Israel entered Canaan it was the centre of the national worship. Thus the early narratives give it an important place in the crossing of the Jordan and the capture of Jericho. After the settlement it is first found at Shiloh, under the care of Eli, but was captured by the Philistines at the battle of Aphek. Taken by them into their own territory it proved a dangerous possession, and was eventually returned to Israel. For a time it remained forgotten, or at least unnoticed, but was brought by David to Jerusalem when he made that city his capital. It was placed in the temple by Solomon, and probably remained there throughout the period of the monarchy. When it disappeared we do not know, but a late passage in Jeremiah (iii. 16) mentions it in terms which imply that it has ceased to exist.

The ark is held to be par *excellence* the home of Yahweh, and the earlier references leave no doubt as to the belief that He dwelt within it. Thus the formula used when it was taken into battle was "Arise, O Yahweh, and let thine enemies be scattered" (Num. x. 35, *cf.* ver. 36). It is true that, when taken into battle by Hophni and Phineas (I. Sam. iv. 4 ***seq.),*** it was captured by the Philistines, but the sequel shows that this was deliberately permitted by its Inhabitant. Set in the temple at Ashdod, it showed the presence of great power by the treatment of Dagon, and by the plagues which befell the Philistines. Most significant is the story of its return to Israel (I. Sam. vi.). Two cows have their calves removed from them and are harnessed to the cart on which the ark is placed. Then, though no human hand is placed upon them, instead of seeking their calves they take the straight road for Israelite territory, without deviating, though lowing in protest. Clearly they are being driven by a mighty force in the ark itself. Yet later, an accidental desecration is swiftly and terribly avenged (II. Sam. vi. 6), and there are other references which indicate that the ark was venerated as the divine dwelling. (T. H. R.)

ARKADELPHIA, a city of Arkansas, U.S.A., on the Ouachita river, about 75 mi. S.W. of Little Rock; the county seat of Clark county. It is on federal highway 67, and is served by the Missouri Pacific railroad. The population in 1930 was 3,380; in 1940, 5,078, federal census. Arkadelphia is picturesquely located among rolling hills. It has one of the largest flour mills in the state, cotton gins, tile plants, sawmills, and a cottonseed-oil mill. Abundant power is available from the hydro-electric development of the Ouachita. Arkadelphia is the seat of Ouachita college (Baptist; established 1888) and of Henderson State Teachers college (established 1890), both coeducational institutions. The first settler was John Hemphill in 1811. He set up a salt works, the first manufacture in the state. The manufacture of salt was continued until the Civil War, and was the cause of fighting for the possession of the city.

ARKANSAS (ahr'kăn-saw), popularly known as the "wonder state," is one of the south-central states of the United States of America. It is situated between 33° and 36° 30' N. lat. and 89° 40' and 94° 42' W., and its boundaries are north, Missouri, east, the Mississippi river, separating it from Tennessee and Mississippi, south, Louisiana and west, Texas and Oklahoma. Its area is 53,102 sq.mi., of which 377 are water surface. Arkansas was given the name "wonder state" by an act of the general assembly in 1923, because of its remarkable natural resources.

Physical Features.—Arkansas lies in the drainage basin of the lower Mississippi and has a remarkable river system. The Arkansas river bisects the state from west to east. Nine other large streams drain the state; the Red, the Ouachita, the White and the St. Francis being the most important. There are a number of swamps and bayous in the eastern part.

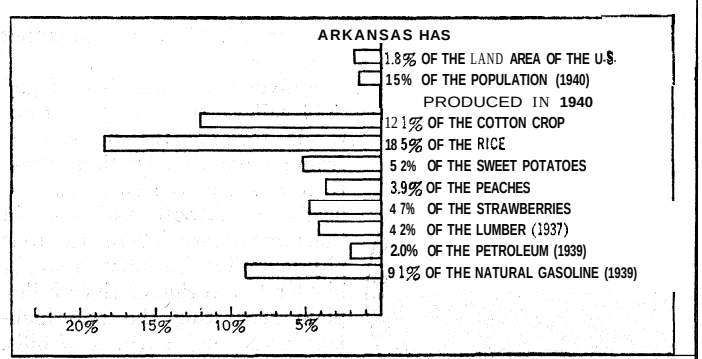
The surface of Arkansas is more diversified than that of any other state in the central Mississippi valley. It rises, sloping upwards towards the north-west, from an average elevation of less than 300ft. in the south-east to heights of 2,000ft. and more in the north-west. There are four physiographic regions: two of highlands, a region of river valley plain separating the two highland areas, and a region of hills, lowlands and prairie. This fourth region covers the eastern half of the state and is part of the gulf or coastal plain of the United States. If a line were drawn from the point where the Red river cuts the western boundary to where the Black cuts the northern, east of it would be the gulf plain and west of it the highlands (over 500ft.) and the mineral regions of the state. They are divided by the valley of the Arkansas river into two regions, which are structurally different. South of the river are the Ouachita mountains, and north of it are the Boston mountains. The Ouachita mountains are characterized by close folding and faulting. Their southern edge is covered with cretaceous deposits, and their eastern edge is covered as well

SEAL OF THE STATE OF ARKANSAS

with the tertiary deposits of the gulf plains. The Arkansas valley is marked by wide and open folding. The Boston mountains are substantially a continuation of the Ozark dome of Missouri. Their northern border is marked by an escarpment 500 to 700ft. in height. The trend is from east to west between Batesville (Ark.) and Wagoner (Okla.). The entire region is very much dissected by streams, and the topography is of a terrace and escarpment type. In the highlands north of the Arkansas the country is irregularly broken; south of the river the hills lie, less capriciously, in short, high ranges, with low, fertile valleys between them. The Ouachitas extend zoom., from within Oklahoma (near Atoka) to central Arkansas (near Little Rock). They are characterized by long, low ridges bearing generally west to east with wide, flat valleys. Near the western boundary of the state they attain a maximum altitude of 2,800ft. above the sea and 2,000ft. above the valleys of the Arkansas and Red rivers, falling in elevation eastward (as westward) to 500–700ft. Five peaks rise above 2,000 feet. Magazine and Blue mountains, each of 2,800ft. altitude are the highest points in the state. The streams are swift, and in their lower courses flow in gorges 500 to 1,000ft. deep, almost deserving the name of canyons. The main streams are tortuous, and their tributaries have cut the region into ridges. Along the upper course of the White river in the Bostons, and in the country about Hot Springs is the most beautiful scenery.

The climate of the state is "southern," owing to the influence of the Gulf of Mexico. The mean temperatures for the different seasons are normally about 41·6°, 61·1°, 78.8' and 61·9° for winter, spring, summer and autumn respectively. The normal mean precipitations are about 11·7, 14·5, 10·5 and 10·2in. for the same seasons. The extreme range of the monthly isotherms crossing the state is from about 35° in winter to about 81° in summer. and the range of annual isotherms from about 54 to about 60 degrees. The variation of mean annual temperatures for different parts of the state is, then, only six degrees. Precipitation varies from 34 to 64in. according to locality. Winter cold is seldom severe, and there is no summer drought. Sheltered valleys in the interior produce spring crops three or four weeks earlier than is usual in this latitude. The climate is generally healthy.

The state possesses a rich fauna and flora. The forest lands of the state include one-fourth of its area, with most of it actually covered by standing timber. Valuable trees are of great variety; cotton-wood, poplar, catalpa, red cedar, sweet gum, sassafras, persimmon, ash, elm, sycamore, maple, a variety of pines, pecan, locust, dogwood, hickory, various oaks, beech, walnut and cypress

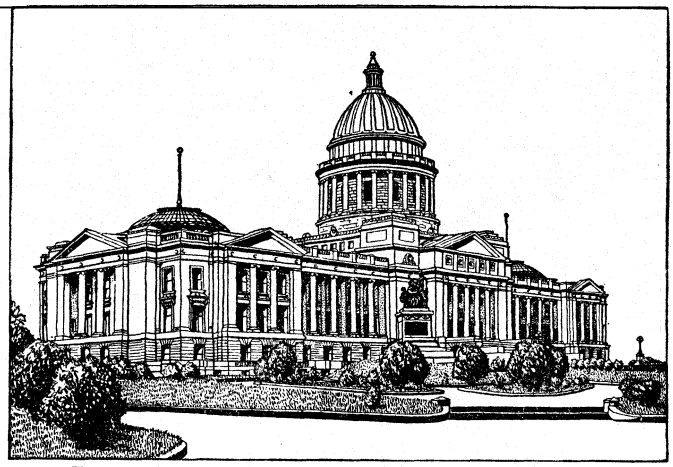


GRAPH SHOWING LAND AREA. POPULATION AND PRODUCTION OF ARKANSAS

are all abundant. There are 129 native species of trees The yellow pine, the white oak and the cypress are the most valuable growths. The northern woods are mainly hard, the yellow pine is most characteristic of the heavy woods of the south-central counties, and magnificent cypress abounds in the north-east. Hard woods grow even on the alluvial lands. "The hard-wood forests of the state are hardly surpassed in variety and richness, and contain inestimable bodies of the finest oak, walnut, hickory and ash timber" (U.S. census) The growth on the alluvial bottoms and the lower uplands in the east is extraordinarily vigorous. There are two Federal forest reserves (963,287 acres).

The soils of Arkansas are of peculiar variety. That of the highlands is mostly but a thin covering, and the larger portion is poorly fitted for agriculture. The uplands are generally fertile. The poor soils are distinctively sandy; the soils of the lowlands, clayey; but sand and clay are found combined in rich loams characterized by the predominance of one or the other constituent. The alluvial bottoms are of wonderful richness.

Government. — The present constitution, in an amended form, dates from 1874. Few features differentiate it from the usual type of such documents. The governor holds office for two years. He



THE STATE CAPITOL BUILDING AT LITTLE ROCK. ARKANSAS
The monument to the women of the Confederacy, in the foreground, suggests the important part Little Rock played as a Confederate centre during the first years of the Civil War

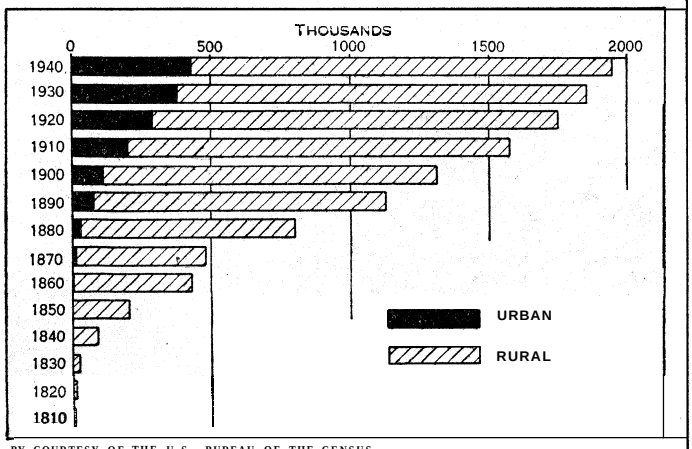
has the pardoning and veto power, but his veto may be over-ridden by a majority of the whole number elected to each house of the legislature.

The legislature is bicameral. Senators, 35 in number, hold office for four years; representatives, 100 in number, for two years. The length of the regular biennial session is limited to 60 days, but by a vote of two-thirds of the members elected to each house the length of any session may be extended 15 days. Special sessions may be called by the governor. A majority of the members elected to each of the two houses suffices to propose a constitutional amendment, which the people may then accept by a mere majority of all votes cast on the measure. Amendments may also be made by the use of the initiative and referendum. The supreme court has seven members elected by the people for eight years; they are eligible for re-election. Tbe state is divided into 18 judicial or circuit court districts and 14 chancery districts. The population of the state entitles it to seven representatives in the national house of representatives and to nine votes in the electoral college

An unusual provision of the constitution is that no law shall "be enacted whereby the right to vote at any election shall be made to depend upon any previous registration of the elector's name." An amendment of 1893 requires evidence of the payment of a poll-tax by every voter except those "who make satisfactory proof that they have attained the age of 21 years since the time of assessing taxes next preceding" the election. There is nothing in the constitution or laws of Arkansas with any apparent design to disfranchise the Negroes, though few vote. There are statutory provisions (1866–67) against intermarriage of the races and constitutional and statutory (1886–87) provisions for separate schools; a "Jim Crow" law (1891) requires railways to provide separate cars for Negroes, and also requires (1893) separate railway waiting rooms. The constitution provides that no county shall consist of less than 600 sq mi. of territory and 5,000 inhabitants. Lafayette, Pope and Johnson counties being excepted. New counties may be formed by the general assembly, provided the majority of the voters of the affected territory consent to the change. The county is divided into political townships, road districts, school districts and other groupings for administrative purposes. A homestead belonging to the head of a family and containing Po to 160 ac. (according to value) if in the country, or one-

fourth to one ac. (according to value) if in town, village or city, is exempt from liability for debts, excepting liens for purchase money, improvements or taxes. Homesteads up to $1,000 are exempt from state taxation.

Population. — The population of Arkansas in 1810 was 1,062; in 1830 it was 30.388; in 1850, 209,897; in 1880, 802.525; in 1910, 1,574,449; and in 1940, 1,949,387. This last figure represents an increase of 5·1% over the population in 1930. The population



BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF ARKANSAS: 1810 TO 1940

per square mile was 37·0 as compared with 44·2 for the United States as a whole. Of the 1940 population, 431,910, or 22·2%, lived in urban places; that is, in cities and towns of 2,500 or more. The rural population, occupying the remainder of the state, thus constituted 77·8% of the total. The number of occupied dwelling units returned in the housing census of 1940 was 495,841, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4.2 in 1930 to 3.9 in 1940. The white population of Arkansas formed 75·2% of the total in 1940, as compared with 74·2% in 1930, practically all the nonwhite population being Negro. The number of males per 100 females in the entire population of the state was 103·4, the sex ratio being 104·7 for the white and only 99.6 for the nonwhite population. The population of the state and of its principal cities is summarized in the table:

Area	Population			Percent of increase	
	1940	1930	1920	1930–40	1920–30
The State	1,949,387	1,854,482	1,752,204	5·1	5·8
Urban	431,910	382,878	290,497	12·8	31·8
Rural	1,517,477	1,471,604	1,461,707	3·1	0·7
Percent urban	22·2	20·6	16·6	..	
Principal cities:					
Little Rock	88,039	81,679	65,142	7·8	25·4
Fort Smith	36,584	31,429	28,870	16·4	8·9

Finance and Taxation. — The two outstanding expenditures in 1939–40 were for highways and education. In that period $8,642,822 was expended on rural highways under the supervision of the state highway department, and $14,023,914 on public schools, that sum being raised mainly through local and sales taxes. Important state funds are: the general fund. the common school fund, the highway improvement fund, the Confederate pension fund and the university fund. General property taxes, motor licences, gasoline and sales taxes and the income tax are chief sources of revenue. The state expenditures for 1939–40 amounted to $46,401,665. The total gross debt for the state amounted to $147,830,526. The assessed valuation of all property, subject to levies of the general property tax, was $436,197,282. The per capita assessed valuation increased from $257 in 1912 to $323 in 1922, but decreased to $224 in 1939. A law of 1927 authorized a large bond issue for highway construction, a $1,500,000 revolving fund for building schools, and $14,000,000 for Confederate pensions. In 1935 a 2 per cent tax on merchants' sales was enacted for welfare, tax reduction and public schools.

In 1940 there were 166 state and private banks and trust companies and 49 national banks, the resources of which have increased greatly in the last three years.

Education. — The legal beginnings of a public-school system date from 1843; in 1867 the first tax was imposed for its support. Only white children were regarded by the law before reconstruction days. Separate schools are maintained for Negro children. Of the current expense of the common schools, about three-fourths is borne by the localities; the state distributes its contribution annually among the counties. There is also a permanent school fund derived wholly from land grants from the national government. Before 1909 hardly half the school population attended; and in general the rural conditions of the state, the shortness of the school terms and the dependence of the schools primarily upon local funds made the schools inadequate and of varying excellence. In June 1906 there were 1,102 schoolhouses in the state valued at $100 or less. Many districts have been consolidated. Amendments adopted in 1906, 1912 and 1926 have made possible large increases in local taxation for schools, and education has made rapid progress during recent years. The percentage of total school population enrolled in 1939–40 was 75·5; in 1900, 71. Of the total number enrolled, 398.246 were in kindergarten and elementary schools, and 73,768 were in secondary schools. The average number of days attended per year per pupil enrolled had increased from 48.1 in 1900 to 12 5·5 in 1939. Free textbooks were provided in 1936; retirement for teachers in 1937. Expenditures for public elementary and secondary schools increased from $1,369,000 in 1900 to $14,023,914 in 1939–40; a per capita (for ages 5 to 17) of $2.93 and $22.45 respectively.

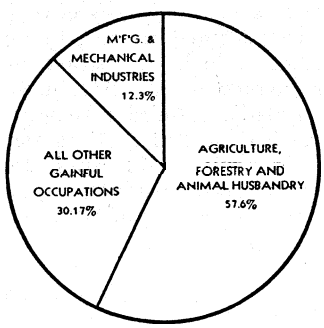
The University of Arkansas was opened at Fayetteville in 1872. Five colleges, one school, the experiment station and general extension are situated at Fayetteville, the medical school at Little Rock. A branch normal school, established in 1873 at Pine Bluff, provides courses for Negro students in literary subjects, agriculture, some of the mechanic arts and in teacher training. The university and the normal school are supported by state appropriations and the Morrill fund (see MORRILL, JUSTIN SMITH), the normal school getting three-elevenths of this fund. The agricultural experiment station, supported by the Hatch, Adams and Purnell funds, dates from 1887. In 1907 the legislature made an appropriation for the establishment of a normal school for white teachers; it was situated at Conway; in 1929 for another at Arkadelphia. Four agricultural high schools were provided for in 1911 and they mere situated at Jonesboro, Russellville, Magnolia and Monticello. In 1925 the legislature raised these schools and the normal school to the rank of colleges. A school for the deaf and one for the blind are maintained at Little Rock, where free board and tuition are given for ten years. Besides the state schools there are about a score of denominational colleges and academies, of which half a dozen are for Negro students. Among the larger of these colleges are Ouachita college, Arkadelphia; Hendrix college Conway; Arkansas college, Batesville; Little Rock college, Little Rock; College of the Ozarks, Clarksville; Centrai college for women, Conway; and Arkansas Baptist college (Negro), Little Rock.

Charities and Houses of Correction. — The penal system of Arkansas is excellent. The state maintains large penal farms near Tucker and Cummings. An effort is made to prevent convict production from competing with production by free labour. Delinquent boys under the age of 18 are cared for at the industrial school near Pine Bluff. There is also an industrial school for girls near Alexander, and a state farm for women near Jacksonville. Other institutions maintained by the state are the tuberculosis sanatorium near Booneville; the hospital for nervous diseases, which cares for the insane, and the Confederate soldiers' home, both near Little Rock. In all the state institutions Negroes and whites are kept separate. The legislature in the 1921 session levied a special tax of 1 2 mills to maintain the charitable institutions of the state after June 30, 1923, and 2 mills for ex-Confederate pensions.

Industry, Trade and Transportation. — Agriculture is still the leading industry, and cotton the chief crop. The variety of

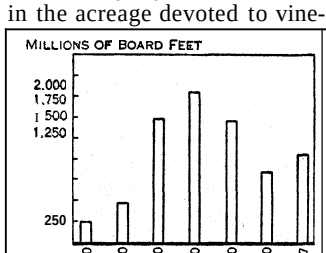
soils, a considerable range of moderate altitudes and favourable factors of heat and moisture, however, promote a rich diversity in agriculture. The farm area of 1900 was 49.5% of the whole area of the state; that of 1920 (17,457,000 ac.) was 51·9%. Since that time some farms have been abandoned, but there has been a slight increase in the total acreage, 18,046,542 in 1940.

The Civil War wrought a havoc from which full recovery was hardly reached by 1890. The economic evolution of the state since reconstruction, has been in the main that common to all of the old slave states developing from the plantation system, but somewhat diversified and complicated by the special features of a young and border community. The division of the old plantations to meet the new social order greatly increased the number of farms, but brought about a corresponding decrease in their size. This decrease has continued since 1900; in that year the average farm was 93·1 ac.; in 1940 it was 83.3 ac. The value of farm property had increased from $135,182,170 in 1900 to $456,848,156 in 1940. In 1940 the number of farms worked by tenants (163,108) exceeded the number worked by owners (100,636). The percentage of farms worked by tenants increased from 50 in 1910 to 63 in 1930. The share system of tenantry is in most common use. In actual numbers the white farmers heavily predominate: in 1940 there were 159,649 white farmers and 57,025 Negro farmers.



GRAPH SHOWING OCCUPATIONS OF THE 634,564 PERSONS ENGAGED IN GAINFUL EMPLOYMENT IN ARKANSAS IN 1930
Only one State has a higher proportion in agricultural pursuits

The cotton production for 1935 was 890,000 bales, valued at $50,062,000; for 1940, 1,545,000 bales, valued at $73,387,500 (1940 estimate). Cotton and cotton products account for over half the total value of agricultural crops. The total acreage given to cereals is hardly equal to that devoted to cotton culture. In 1940 the Indian corn crop was 42,462,000 bu., valued at $28,874,160. The only other cereals of great value are oats, which amounted to 2,244,000 bu., valued at $1,010,000; and rice, with a production of 10,047,000 bu., valued at $6,831,960. The rice industry has developed rapidly in Arkansas since its introduction in 1904. In 1935 the state ranked next to Louisiana in total production and was surpassed in yield per acre by California only. Potatoes and sweet potatoes had a farm value in 1940 of $5,978,250; 1,349,000 tons of tame and wild hay were valued at $10,255,420. Arkansas ranks high as a fruitgrowing state. Peaches, apples, pears, plums and grapes are cultivated extensively in the western and northwestern parts of the state. In the production of peaches the state was exceeded in 1935 only by California and Georgia. In 1920 it ranked fourth in the acreage devoted to vineyards, which since that time has been increased. More and more attention is being given to raising purebred livestock. The dairy industry, also, is developing. In 1940, 14,634,191 chickens were raised, and 38,594,353 doz. eggs produced. The broiler industry is growing rapidly. In 1939 there were in operation 1,178 manufacturing establishments giving employment to 36,454 wage earners and paying an annual wage of $24,577,234. The gross value of the manufactured products was $160,166,984. Lumber and timber products still held first place, with a gross production of about $51,243,344. Other leading industries in the order of their importance were: car and general construction and repair in steam railway shops; cotton-seed products; planing-mill products; printing and publishing; furniture; and smelting and refining. Cotton-seed products had previously held second place.



GRAPH SHOWING LUMBER CUT IN ARKANSAS IN 1880, 1890, 1900, 1910, 1920, 1930 AND 1937

Petroleum, first discovered in paying quantities in 1921, continued in 1940 to be the leading mineral industry. The industry centres around El Dorado and Smackover. The production in 1940 amounted to 25,758,367 bbl., giving Arkansas tenth place among the states, and was valued at $21,268,070. The first strong well of natural gas was opened in Crawford county in 1915; a well near El Dorado was opened in 1921. In 1939 wells were in operation in Crawford, Sebastian, Nevada, Ouachita and Union counties, their production amounting to 18,771,301 M.cu. ft., worth $545,936; natural gasoline 17,882,822 gal., worth $754,709. The output of coal rose rapidly until 1913; since then there has been a decline, due in part to labour troubles. The bauxite industry rose to 532,020 long tons in 1918 but declined to 475,507 long tons in 1940. The state ranks first in the production of whetstones and antimony ore. The clay found in Saline county is used for the making of pottery of an artistic type, called Niloak. Building stone and granite are found near Batesville. The only known diamond field in North America is in Arkansas.

BY COURTESY OF THE INTERNATIONAL NEWSREEL
LOADING ALUMINIUM ORE AT A REFINING PLANT IN CENTRAL ARKANSAS
Since the discovery of bauxite, an ore of aluminium, in Arkansas in 1887, its production has become one of the chief industries of the central section of the state

The popular income for 1940 was $510,000,000.

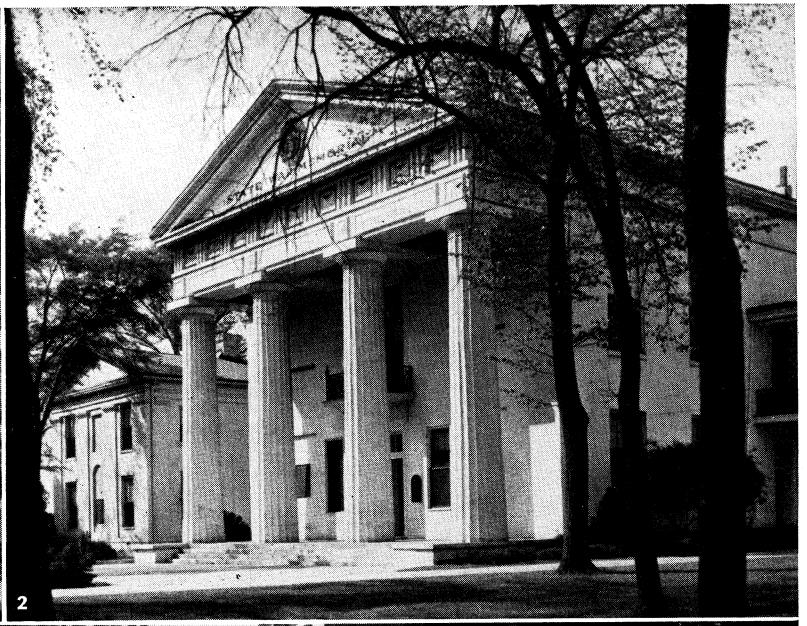
The rivers afford for light boats (of not over 3 ft. draught) about 3,000 mi. of navigable waters, a river system unequalled in extent by that of any other state. The U.S. government extended and very greatly improved this system, materially lessening the frequency and havoc of floods along the rich bottom lands through which the rivers plow a tortuous way in the eastern and southern parts of the state.

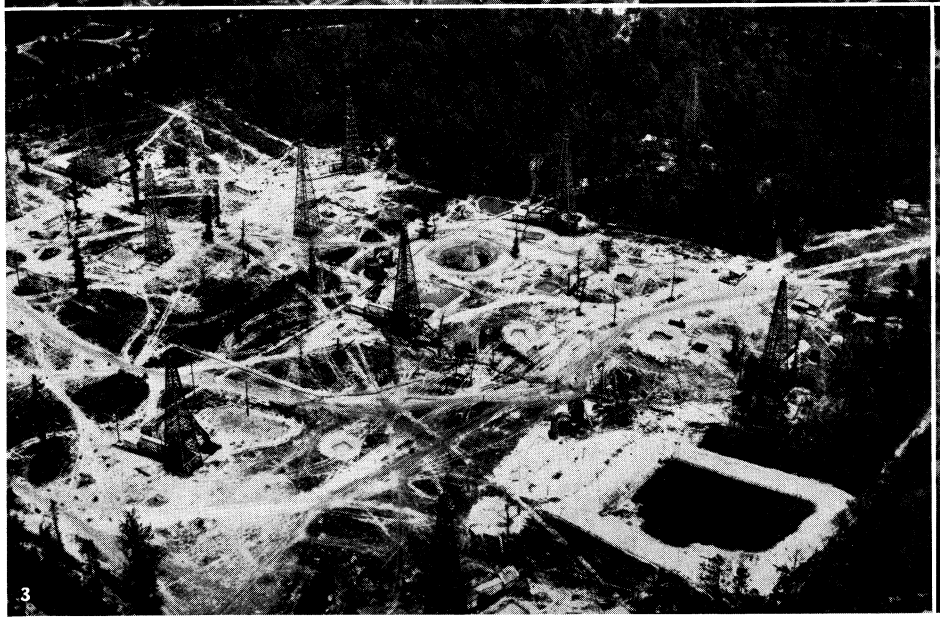
As a result of these improvements, land and timber values rose markedly; but the unprecedented flood in the spring of 1927 destroyed many miles of the levees and seriously damaged a large region.

River boats were formerly a means of transport for much of the state's production of cotton, lumber, coal, stone, hay and miscellaneous freight, but are now little used.

On Dec. 31, 1940, there were 74,866 mi. of roads of all types. Most of the early roads had been built by districts which soon found themselves heavily burdened. In 1927 the legislature adopted a state highway system, took over the roads already built and assumed the debts of the districts to over $50,000,000. It also issued bonds for the building of new roads and now has 9,469 mi., of which 1,729 are paved and 6,933 gravel. The fuel tax, motor licences and other fees amounted to $14,211,536 in 1940; the federal subvention, $4,232,037.

Arkansas is well supplied with railway facilities. In 1935 there were 4,741 mi. of main line trackage in operation, a decline from the 5,407 mi. in operation in 1915. The principal trunk lines operating in the state are: the Missouri Pacific, the Rock Island, the Cotton Belt, the St. Louis and San Francisco and the Kansas City Southern. Little Rock is the railway centre of the state. Transportation rates and rail-





BY COURTESY OF (1, 2) LITTLE ROCK CHAMBER OF COMMERCE, (4) HOT SPRINGS CHAMBER OF COMMERCE; PHOTOGRAPH, (3) INTERNATIONAL NEWSREEL

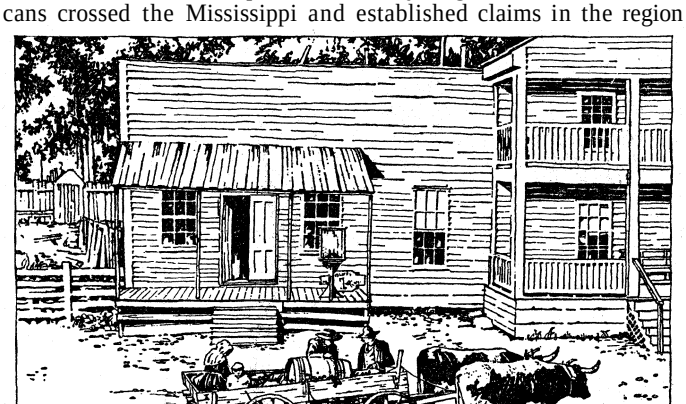
SCENES IN ARKANSAS

1. Business section of Little Rock, capital of Arkansas
2. War Memorial building, Little Rock, begun in 1833
3. Oil fields in the south central section of Arkansas
4. "Bath House Row" at Hot Springs, Federal-owned spa

way operations within the state are regulated by a state railroad commission.

History.—The Spanish explorer Hernando de Soto and his companions, in 1541, were the first Europeans to see and explore the region now known as the State of Arkansas. After quitting the villages of the Chickasaw Indians on the eastern bank of the Mississippi, de Soto and his party constructed rafts and crossed the river into Arkansas. They spent several months within the limits of the state, remaining there through the winter. After the death of de Soto the following spring, his companions built rude boats and departed for the Spanish colonies in Mexico. The region was not again visited by Europeans until 131 years later, when the Jesuit missionary Jacques Marquette and the fur trader Louis Joliet reached the country of the "Arkansea" Indians in June 1673. Nine years later La Salle with a few other adventurers visited the same region while they were on their way to the mouth of the Mississippi river. The first settlement grew out of a grant of land La Salle gave his trusted lieutenant Henri de Tonti in 1682. In the spring of 1686 de Tonti received orders to meet La Salle at the mouth of the Mississippi; but when after a long wait and careful searching he found no trace of him he returned to the Illinois country. On the return trip de Tonti explored his grant on the Arkansas river, and some of his companions became so impressed with the region that they asked permission to remain to open trade with the Indians. This event marked the beginning of Arkansas Post, the first settlement by Europeans in Arkansas. In 1718 an extensive grant on the Arkansas was made to John Law, and within the same year a colony was established. More colonists and some negro slaves arrived in 1719; but when the colonists learned of Law's failure (1720), they abandoned the settlement and went down the Mississippi. Their intention was to return to Europe, but many were persuaded to settle in Louisiana.

Early in the 18th century Bernard de la Harpe, acting under orders from the duke of Orleans, improved the stockade and placed a regular garrison at Arkansas Post. The post was maintained as a trading centre and Jesuit mission, even surviving an unexpected attack by the Chickasaw Indians in 1748. In 1762 the territory passed to Spain; in 1800, back to France; and in 1803, to the United States as a part of the Louisiana purchase. In the last decade of Spanish authority large numbers of Americans crossed the Mississippi and established claims in the region



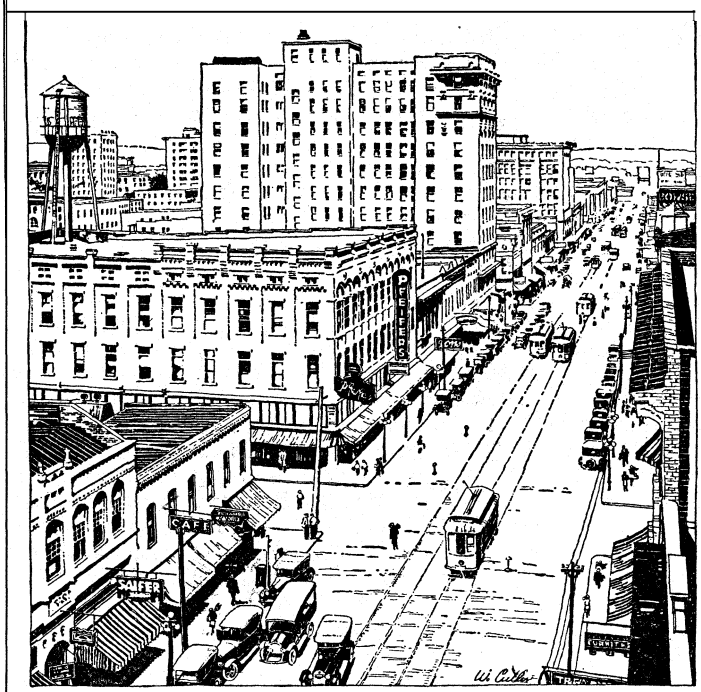
BY COURTESY OF THE U.S. NATIONAL PARK SERVICE

HOT SPRINGS. DURING THE EARLY DAYS OF EXPANSION. EARL HOUSE. ONE OF THE FIRST HOTELS. AND THE POST OFFICE

about Arkansas Post, and its importance as a trading station increased. After the United States took formal possession of the territory in 1804, emigration from the states east of the Mississippi continued; and when the territory was organized in 1819, the English-speaking inhabitants were in the majority. Arkansas Post, the former residence of the French and Spanish governors, was the first territorial capital, 1819–20.

From 1804 to 1812 what is now Arkansas was part of the district (and then the territory) of Louisiana, and from 1812 to 1819 part of the territory of Missouri, Its earliest county organizations date from this time. It was erected successively into a territory of the first and second class by acts of Congress of March 1, 1819 and April 21, 1820. By act of June 15, 1836 it was admitted into the Union as a slave state.

In Feb. 1861 the people of Arkansas voted to hold a convention to consider the state of public affairs. It assembled on March 4. Secession resolutions were defeated, and it was voted to submit



LITTLE ROCK, MAIN STREET. LOOKING NORTH

Modern Little Rock has few reminders of the original settlement founded in 1814. It transacts the business of the surrounding mineral and agricultural interests

to the people the question whether there should be "co-operation" with the other border states or "secession." The plan of holding a convention of the border slave states at Frankfort, Kentucky, May 27, to discuss a common policy was endorsed and delegates were elected, but the convention never met. Then came the fall of Ft. Sumter and President Lincoln's call for troops to put down rebellion. The governor of Arkansas curtly refused its quota. A quick surge of ill-feeling chilled loyalty to the Union. The convention reassembled on the call of its chairman, and on May 6, with only one dissenting vote, passed an ordinance of secession. It then repealed its former vote submitting the question of secession to the people. On May 16 Arkansas became one of the Confederate states of America.

In the years of war that followed a large proportion of the able-bodied men of the State served in the armies of the Confederacy; several regiments, four of coloured troops, served the Union. Union sentiment was strongest in the northern part of the state. In 1862 and 1863 various victories threw more than half the state, mainly the north and east, under the Federal arms. Accordingly, under a proclamation of the President, citizens within the conquered districts were invited to renew allegiance to the Union, and a special election was ordered for March 1864 to reorganize the state government. Meanwhile a convention of delegates, chosen mainly at polls, opened at the army posts, assembled in Jan. 1864, abolished slavery, repudiated secession and the secession war debt, and revised in minor details the constitution of 1836, but restricted the suffrage to whites. This new fundamental law was promptly adopted by the people; *i.e.*, by its friends, who alone voted. But the representatives of Arkansas under this constitution were never admitted to Congress.

During 1864 and the early part of 1865 the Federal and Confederate forces controlled different parts of the state, and for almost the whole period there were two rival governments; the Confederate capital was at Washington, in Hempstead county, while the Union capital was established at Little Rock. Chaotic

conditions followed the war. The 11th legislature (April 1864 to Nov. 1866) ratified the 13th amendment and passed laws against "bush-whacking," a term used in the Civil War for guerilla warfare, especially as carried on by pretended neutrals. Local militia, protecting none who refused to join in the common defence, and all serving "not as soldiers but as farmers mutually pledged to protect each other from the depredations of outlaws who infest the state," strove to secure such public order as was necessary to the gathering of crops, so as "to prevent the starvation of the citizens" (governor's circular, 1865). The governor in these years (1864–68) was Isaac Murphy, a republican, the delegate who cast the single Union vote in the convention of 1861; but the 16th legislature (1866–67) was largely democratic. It passed a law defining the rights of persons of African descent, which led to a few conflicts between the state authorities and officials of the Freedman's Bureau. The first reconstruction act having declared that "no legal state government or adequate protection for life or property" existed in the "rebel states," Arkansas was included in one of the military districts established by Congress. A registration of voters, predominantly whites, was at once carried through, and delegates were chosen for another constitutional convention which met at Little Rock in Jan. 1868. The secessionist element was decidedly in the minority. This convention framed the third constitution of the state, which was adopted in March 1868 by a small majority at a popular election marred by various irregularities. By its provisions negroes secured full political rights, and all whites who had been excluded from registration for the election of delegates to the convention were now practically stripped of political privileges. The constitution of Arkansas being now acceptable to Congress, a bill admitting the state to the Union mas passed over President Johnson's veto, and on June 22, 1868 the admission was consummated.

Arkansas was under the control of the republicans for several years and suffered considerably from the rule of the "carpet-baggers." The debt of the state was increased about $9,375,000 from 1868 to 1874, largely for railway and levee schemes; much of the money was misappropriated, and in a case involving the payment of railway aid bonds the action of the legislature in pledging the credit of the state was held nugatory by the state supreme court in 1877 on the ground that, contrary to the constitution. the bond issue had never been legally referred to popular vote. An amendment to the constitution approved by a popular vote in 1884 provided that the general assembly should "have no power to levy any tax, or make any appropriation, to pay" any of the bonds issued by legislative action in 1868, 1869 and 1871. The so-called "Halford" bonds, issued in connection with the state bank and the real estate bank (law of 1836), some of which had been sold in violation of the law, were also covered by this amendment. The current expenses of the state in the years of reconstruction were also enormously increased. The climax of the reconstruction period was the so-called Brooks-Baxter war.

Elisha Baxter (1827–99) was the regular republican candidate for governor in 1872. He was opposed by a disaffected republican faction led by Joseph Brooks (1821–77) and supported by the democrats. Brooks probably received a majority of the votes, but the republican legislature, which passed on returns for governor, declared Baxter elected. He soon showed a willingness to rule as a non-partisan, securing the re-enfranchisement of the whites and opposing corruption. After Baxter had been a year in office, Brooks obtained a writ of ouster against him from a circuit judge and got possession of the public buildings (April 1874). As a result of special elections to fill vacancies the democrats now controlled the legislature and they rallied to the support of Baxter, while the Brooks party assumed the name of "regulars" and received the support of the "carpet-bag" and negro elements. Both had armed forces, an ex-Confederate commanding for each. Both appealed to President Grant, but he, although favouring Brooks, directed the Federal troops to prevent fighting while the legislature was being reassembled. As this body was democratic it reaffirmed Baxter's election and then called a constitutional convention.

This convention, safely democratic, drew up (July to Oct. 1874) the present constitution. It provided a broad suffrage, forbade the passage of registration laws, reduced the patronage of the governor, shortened his term to two years, and allowed only the legislature to suspend the writ of habeas corpus—all this in an effort to guard against the evils of the reconstruction régime. The constitution was ratified by an overwhelming vote Oct. 13.

While this was going on a congressional committee was investigating the claims of Brooks and Baxter. After taking testimony in Washington and in Arkansas they reported (March 1875), with one dissenting vote, in favour of Baxter. There was considerable discussion, but Congress finally adopted the report by a large majority and President Grant acquiesced. Meantime a new governor, A. H. Garland, had been serving several months under the new constitution.

Levee construction and drainage operations were undertaken seriously after 1879, when the Arkansas legislature provided for the formation of levee districts. Through the co-operation of directors of the levee districts and the Mississippi river commission, large tracts of overflowed land were brought under cultivation.

The state has continued under the control of the democratic party since 1874. A new constitution was drafted in 1918 but was rejected in the election of that year by a vote of 23,782 for and 38,897 against. The 19th (woman suffrage) amendment to the Federal constitution was ratified by the state legislature in 1919. Down to 1924 only ten out of 39 proposed amendments to the constitution of 1874 had been declared adopted. This was due largely to a ruling of the supreme court that, even after the adoption of the new initiative and referendum measure in 1910, a majority of the total vote was necessary for adoption. In 1920 a new initiative and referendum measure, providing that only a majority of the votes cast on a measure was necessary for its adoption, forbidding all local acts by the legislature, and providing for the initiative and referendum in counties and municipalities, received a majority of the votes cast on it, but not a majority of the total vote.

Submitted again in 1922, it failed to receive a majority of the votes cast.

In 1924 three amendments received a majority of the votes cast, but not a majority of the total vote. A writ of *mandamus* was sought against the speaker to compel him to declare one of these adopted.

As all the amendments were in the same class, the supreme court judges declared themselves disqualified because one of the measures affected their salaries.

The governor accordingly appointed a special supreme court, which reversed the earlier decision and declared that only a majority of the votes cast on a measure was necessary for its adoption.

This decision was made retroactive and brought to life the new initiative and referendum measure which had been declared not adopted in 1920.

An attempt of the Arkansas legislature in 1933 to convert certain highway and toll-bridge bonds, bearing from 43 to 6 per cent interest, into 25-year bonds bearing only 3 per cent interest was fought and defeated by the bondholders, including the state of Pennsylvania and the Investment Bankers' association. In 1939 Gov. Carl E. Bailey got the legislature to pass another refunding bill.

This bill, however, was held up by a referendum and was defeated. Gov. Bailey also was drfeated for re-election. Gov. Homer M. Adkins secured from the legislature of 1941 another refunding act which was ratified at the polls.

The RFC bought the entire amount at 3·19% and sold immediately to banks $90,800,000, all available at that time, at 102·5, making a profit of $1,545,000.

Important legislation of recent years has included provision for a state farm for convicts, industrial schools for delinquent women and children, a compulsory education law, and measures giving women the right to hold office, legalizing cooperative marketing associations, and creating a warehouse and marketing bureau. In 1933 Arkansas voted reneal of national prohibition and in 1935

of its state law prohibiting traffic in liquor, establishing instead a local option law which is difficult to operate.

Arkansas has been unwavering in its Democratic loyalty, voting normally about 2 to 1 for the presidential candidates of that party until 1932 when the ratio was suddenly raised to over 6 to 1 in favour of Roosevelt. Heavy odds prevailed in 1940.

In the Centennial stadium in Little Rock, President Roosevelt delivered on June 10, 1936, the principal address in connection with Arkansas' celebration of a century of statehood.

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ARKANSAS CITY, a city of Cowley county, Kan., U.S.A., 200 mi. S.W. of Kansas City, on the north bank of the Arkansas river, just above the mouth of the Walnut. It is on federal highways 77 and 166 and is served by the Santa Fe, the Frisco, the Missouri Pacific and the Midland Valley railways It has a municipal airport. The pop, in 1940 (federal census) was 12,752.

The valley of the Arkansas and Walnut rivers is a fertile agricultural region, and within 50 miles of Arkansas City are many oil-fields and pools, and fields of natural gas. The city, a division headquarters of the Santa Fe, has a large wholesale and jobbing business, and several large oil refineries. It has flour-mills, foundries, creameries, a sand and gravel plant, overall factories and oil-field machine-shops. The Chillocco Indian school, established by the U.S. Government in 1884, is a few miles south of the city, in Oklahoma.

Arkansas City was settled as Creswell in 1870, and incorporated under it. present name in 1872. In 1880 the population was 1,012. When, following the Santa Fe, the Frisco (1885) and the Missouri Pacific (1886) built railway lines to the city, it had a "boom" which raised the population to 8,341 in 1890; but the opening to settlement of lands in Indian territory, just across the State line, drew- away some of this increase, and the census of 1900 showed only 6,140. Since then the development has been more normal. In 1910 the population mas 7,508; in 1920, 11,253.

ARKANSAS, a river of the United States of America, rising in the mountains of central Colorado, near Leadville, in lat. 39° 20' N., long. 106° 1j W., and emptying into the Mississippi, at Napoleon, Ark., in lat. 33° 40' N. Its total length is about 2,000m., and its drainage basin (greater than that of the Upper Mississippi) about 185,000 sq. miles. It is the greatest western affluent of the Missouri-Mississippi system. It rises in a pocket of lofty peaks at an altitude of 10,400ft. on a sharply sloping plateau, down which it courses as a mountain torrent, dropping 4,62 jft. in 120 miles. Above Canyon City it leaves the Rockies through the Grand Canyon of the Arkansas; then turning eastward, it flows with steadily lessening gradient and velocity in a broad, meandering bed across the prairies and lowlands of eastern Colorado, Kansas, Oklahoma and Arkansas, shifting its direction sharply to the south-east in central Kansas. The Arkansas ordinarily receives little water from its tributaries save in time of floods. In topography and characteristics and in the difficulties of its regulation, the Arkansas is in many ways typical of the rivers in the arid regions of the Western States. The gradient below the mountains averages 7·5ft. per mile between Canyon City and Wichita, Kan. (543m.), about 1·5ft. between Wichita and Little Rock (659m.), and 0·65 of a foot from Little Rock to the mouth (173m.).

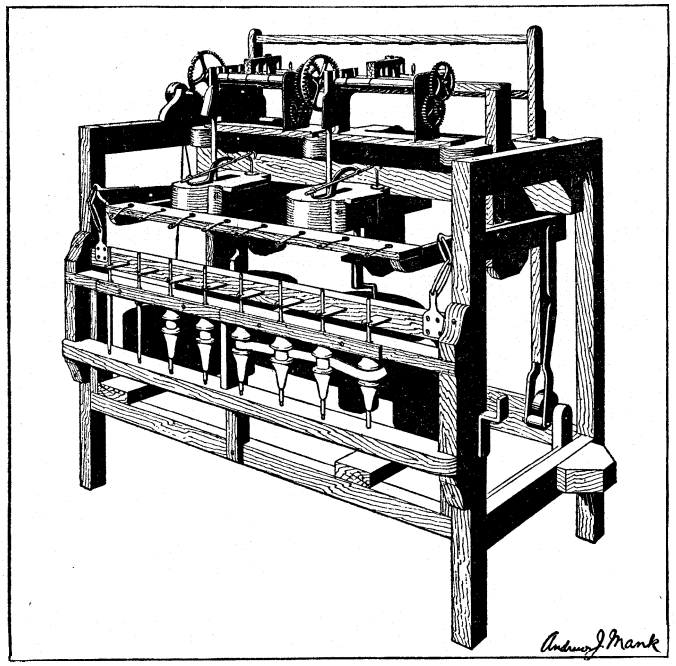
The shores are sand, clay or loam throughout some 1,300m., with very rare rock ridges or rapids, and the banks rise low above ordinary water. The waters are constantly rising and falling, and almost never is the discharge at any point uniform. Every year there are, normally, two distinct periods of high water; one an early freshet due mainly to the heavy winter rainfall on the lower river, when the upper river is still frozen hard; the other in the late spring, due to the setting in of rains along the upper courses also, and to the melting of the snow in the mountains. The lowest waters are from August to December. In the summer there are sometimes violent floods due to cloud-bursts. Everywhere along the course of the river there is never-ending transformation of the river's bed and contour. These changes become revolutionary in times of flood. All these characteristics are accentuated below Little Rock. The depth of water at this point has been known to vary from 2 jft. to only ½ft. and the discharge to fall to 1,1jo cu. ft. per second. In many places there are different channels for high and low water, the latter being partly filled by each freshet, and recut after each subsidence; and the river meanders tortuously through the alluvial bottom in scores of great bends, loops and cut-offs. It is estimated that the eating and caving of the shore below Little Rock averages 7·64ac. per mile every year (as against 1·99ac. above Little Rock). By way of the White river cut-off the Arkansas finds an additional outlet through the valley of that river in times of. high water, and the White, when the current in its natural channel is deadened by the backwaters of the Mississippi, finds an outlet by the same cut-off through the valley of the Arkansas. This backwater, where it meets and checks the current of the Arkansas, occasions the precipitation of enormous alluvial deposits and vast quantities of snags. The banks are disintegrated along this part of the river and built up again on the opposite side to their original height, in the extraordinarily short time of two or three years, the channel remaining all the while narrow. At the mouth of the White, the Arkansas and the Mississippi, the level of recurrent floods is 6 or 8ft. above the timber-bearing soil along the banks, and all along the lower river the country is liable to overflow; and as the land backward from the stream slopes downward from the banks heaped up by successive flood-deposits, each overflow creates along the river a fringe of swamps. Prior to the great flood of April and May 1927, much of the swamp area along the Arkansas had been reclaimed by means of levees built by local levee districts in co-operation with the U.S. Government. By the middle of May 1927, the whole Arkansas valley, from Ft. Smith to the Mississippi, had been flooded and much of the levees destroyed. Three breaks in the right levee near the mouth of the river, known as the Pendleton breaks, allowed the waters to race through south-eastern Arkansas, and to follow the valley of the Boeuf river into Louisiana. The damage caused by the flood, in common with other portions of the lower Mississippi valley, mounted into millions of dollars. U.S. army engineers believe that adequate flood protection will result from the $325,000,000 Mississippi Valley Flood Control act passed by Congress on May g, 1928.

After the advent of railways, traffic on the Arkansas decreased rapidly because of the hazards of navigation — snags, sandbars and the lack of a stable flow. However, traffic in 1920 was 30.568 tons valued at $177,000; in 1926 it was 87,720 tons valued at $367,260.

BIBLIOGRAPHY.—General descriptions of different portions of the river are indicated in the Icdex to the *Reports of tlze Chief of Engineers, U.S. Army* (1879 *seq.*). *See* also H. Gannett, "Profiles of Rivers in the U.S." (*U.S. Geolog. Survey,* 1901); Greenleaf, "Western Floods," in *Engin. Mag.* xii., 945–958; *U.S.* Geolog. Survey, *Bull.* 140; and I. C. Russell, *Rivers of North America* (1898).

ARKLOW, urban district. Co. Wicklow, Eire, 49 mi. S. of Dublin, by the Great Southern railway. Pop. (1936) 4,680. There are oyster-beds on the coast, but the oysters require to be freed from a peculiar flavour by the purer waters of the Welsh and English coast before they are fit for consumption. Copper and lead from the Vale of Avoca are shipped from the port. There are cordite and explosives works. In 1882 an act provided for improvement of the harbour and appointment of harbour commissioners. There are slight ruins of an ancient castle of the Ormondes, demolished in 2649 by Cromwell,

ARKWRIGHT, SIR RICHARD (1732–92), English inventor, was born at Preston, in Lancashire, on Dec. 23 1732, of parents in humble circumstances. He was the youngest of 13 children, and established himself as a barber at Bolton about 1750. This business he gave up about 1767 to devote himself to the construction of the spinning frame. The spinning jenny, which was not patented by James Hargreaves (d. 1778), a carpenter of



BY COURTESY OF THE SCIENCE MUSEUM

RICHARD ARKWRIGHT'S YARN SPINNING-FRAME, INFLUENTIAL IN THE INDUSTRIAL REVOLUTION WHICH. IN THE 18TH CENTURY, SUBSTITUTED MACHINE FOR HAND WORK AND WAS THE FOUNDATION OF BRITISH INDUSTRIAL SUPREMACY

Blackburn, Lancashire, until 1770, though he had invented it some years earlier, gave the means of spinning 20 or 30 threads with no more labour than had previously been required to spin a single thread. The thread spun by the jenny could not, however, be used except as weft, as it lacked the firmness or hardness required in the longitudinal threads or warp. Arkwright supplied this deficiency by the invention of the spinning-frame, which spins a vast number of threads of any degree of fineness and hardness.

The precise date of this invention is not known; but in 1767 Arkwright employed John Kay, a watchmaker at Warrington, to assist him in the preparation of the parts of his machine, and he took out a patent for it in 1769. The first model was set up in the parlour of the house belonging to the free grammar school at Preston. This invention having been brought to a fairly advanced stage, Arkwright removed to Nottingham in 1768, accompanied by Kay and John Smalley, of Preston, and there erected his first spinning mill, which was worked by horses.

But his operations were at first greatly fettered by want of capital, until Jedediah Strutt (*q.v.*), having satisfied himself of the value of the machines, entered with his partner, Samuel Need, into partnership with Arkwright and enabled him in 1771 to build a second factory, on a much larger scale, at Cromford in Derbyshire, the machinery of which was turned by a water-wheel. A fresh patent, taken out in 1775, covered several additional improvements in the processes of carding, roving and spinning. As the value of his processes became known, Arkwright began to be troubled with infringements of his patents, and in 1781 he took action in the courts to vindicate his rights. His patent was a source of prolonged litigation, but he was able to consolidate his position as a manufacturer in spite of all difficulties. He died at Cromford on Aug. 3, 1792.

ARLBERG TUNNEL, part of the Arlberg railway connecting the Vorarlberg (*q.v.*) with Innsbruck in the Tirol. It was opened in 1884, pierces the Arlberg Alp from Langen to St. Anton, is over 6m. long, and ascends as high as 4,300ft. It cost £1,500,000 to construct, and was electrified in 1923.

ARLES, south-east France, capital of an arrondissement in the department of Bouches-du-Rhône, 54 mi. N.W. of Marseille by rail. Pop. (1936) 19,137. A canal unites the town with the harbour of Bouc on the Mediterranean, Arles stands on the left bank of the Rhône where the river divides to form its delta. A tubular bridge unites it with the suburb of Trinquetaille on the opposite bank. The town is hemmed in on the east by the railway line from Lyon to Marseille, on the south by the Canal de Craponne.

Arelate was important at the time of the invasion of Julius Caesar. It was pillaged in A.D. 270 but restored and embellished by Constantine, who made it his principal residence, and founded Trinquetaille. Under Honorius it became the seat of the prefecture of the Gauls and one of the foremost cities in the western empire. Its bishopric, founded by St. Trophimus in the 1st century, was in the 5th century the primatial see of Gaul; it was suppressed in 1790. After the fall of the Roman empire the city passed into the power of the Visigoths, and rapidly declined. It was plundered in 730 by the Saracens, but in the 10th century became the capital of the kingdom of Arles (see ARLES, KINGDOM OF). In the 12th century it was a free city, governed by a podesfa and *consuls* after the model of the Italian republics, which it also emulated in commerce and navigation. In 1251 it submitted to Charles I. of Anjou, and from that time onwards followed the fortunes of Provence. A number of ecclesiastical synods have been held at Arles, as in 314 (see ARLES, SYNOD OF) 354, 452 and 475. Its streets are narrow and irregular. On the central Place de la République stand the *hôtel-de-ville,* the museum and the old cathedral of St. Trophime. Founded in the 7th century, St. Trophime has been several times rebuilt. Its chief portal, 12th century Romanesque, is a masterpiece. The choir opens into a beautiful cloister, two of the galleries of which are Romanesque, while two are Gothic. The *hôtel-de-ville* (17th century) contains the library. The museum, occupying an old Gothic church, is rich in Roman remains and early Christian sarcophagi; there is also a museum of Provençal arts and crafts founded by the poet Mistral. Arles possesses the ruins of an amphitheatre (the Arknes), capable of containing 25,000 spectators; a Roman theatre, in which the famous Venus of Arles was discovered in 1651; an ancient obelisk; the ruins of the palace of Constantine; the forum; the thermae; and the remains of the Roman ramparts and of aqueducts. There is, besides, a Roman cemetery known as the Aliscamps (*Elysii Campi*), consisting of an avenue bordered by tombs. The port of Arles is now of little importance. Sheep-breeding is a considerable industry in the vicinity.

ARLES, KINGDOM OF, the name given to the kingdom formed about 933 by the union of the old kingdoms of Provence (*q.v.*) or Cisjurane Burgundy, and Burgundy (*q.v.*) Transjurane, and bequeathed in 1032 by its last sovereign, Rudolph III., to the emperor Conrad II. It comprised the countship of Burgundy (*Franche-Comté*), part of which is now Switzerland (the dioceses of Geneva, Lausanne, Sion and part of that of Basel), the Lyonnais, and the whole of the territory bounded by the Alps, the Mediterranean and the Rhone; on the right bank of the Rhone it further included the Vivarais. It is only after the end of the 12th century that the name "kingdom of Arles" is applied to this district; formerly it was known generally as the kingdom of Burgundy, but under the Empire the name of Burgundy came to be limited more and more to the countship of Burgundy and the districts lying beyond the Jura. The authority of Rudolph III. over the chief lords of the land, the count of Burgundy and the count of Maurienne, founder of the house of Savoy, was already merely nominal, and the Franconian emperors (1039–1125), whose visits to the country were rare and brief, did not establish their power any more firmly. During the first 50 years of their domination they could rely on the support of the ecclesiastical feudatories, who generally favoured their cause, but the investiture struggle, in which the prelates of the kingdom of

Arles mostly sided with the pope, deprived the Germanic sovereigns even of this support. The emperors, on the other hand, realized early that their absence from the country was a grave source of weakness; in 1043 Henry III. conferred on Rudolph, count of Rheinfelden (afterwards duke of Swabia), the title of *dux et* rector *Burgundiae,* giving him authority over the barons of the northern part of the kingdom of Arles. Towards the middle of the 12th century Lothair II. revived this system, conferring the rectorate on Conrad of Zähringen, in whose family it remained hereditary up to the death of the last representative of the house, Berthold V., in 1218; and it was the lords of Zahringen who were foremost in defending the cause of the empire against its chief adversaries, the counts of Burgundy. In the time of the Swabian emperors, the Germanic sovereignty in the kingdom of Arles was again, during almost the whole period, merely nominal, and it was only in consequence of fortuitous circumstances that certain of the heads of the Empire were able to exercise a real authority in these parts. Frederick I., by his marriage with Beatrix (1156), had become uncontested master of the countship of Burgundy; Frederick II., who was more powerful in Italy than his predecessors had been, and was extending his activities into the countries of the Levant, found Provence more accessible to his influence, thanks to the commercial relations existing between the great cities of this country and Italy and the East. Moreover, the heretics and enemies of the church, who were numerous in the south, upheld the emperor in his struggle against the pope. Henry VII. also, thanks to his good relations with the princes of Savoy, succeeded in exercising a certain influence over a part of the kingdom of Arles. The emperors further tried to make their power more effective by delegating it, first to a viceroy, William of Baux, prince of Orange (1215), then to an imperial vicar, William of Montferrat (1220), who was succeeded by Henry of Revello and William of Manupello. In spite of this, the history of the kingdom of Arles in the 13th century, and still more in the 14th, is distinguished particularly by the decline of the imperial authority and the progress of French influence in the country. In 1246 the marriage of Charles, the brother of Saint Louis, with Beatrice, the heiress to the countship of Provence, caused Provence to pass into the hands of the house of Anjou, and many plans were made to win the whole kingdom for a prince of this house. At the beginning of the 14th century the bishops of Lyons and Viviers recognized the suzerainty of the king of France, and in 1343 Humbert II., dauphin of Viennois, made a compact with the French king Philip VI. that on his death his inheritance should pass to a son or a grandson of the French king. In 1349, being poor, he agreed to sell his possessions outright, and thus Viennois, or Dauphiné, passed into the hands of Philip's grandson, afterwards King Charles V. The emperor Charles IV. took an active part in the affairs of the kingdom, but without any consistent policy, and in 1378 he, in turn, ceded the imperial vicariate of the kingdom to the dauphin, afterwards King Charles VI. This date may be taken as marking the end of the history of the kingdom of Arles, considered as an independent territorial area.

See Leroux, *Recherches critiques sur les relations politiques de la France avec l'Allemagne* de 1292 à 1378 (1882); P. Fournier, *Le Royaume d'Arles et de Vienne* (1890). For the early history of the kingdom, L. Jacob, *Le Royaume de Bourgogne sous les empereurs franconiens* (1038–1129) (1906). The chief dissertations published concerning the rights of the Empire over the kingdom are indicated in A. Leroux, *Bibliographie des conflits entre la France et l'Empire* (1902). (R. P.)

ARLES, SYNOD OF. The first general council of the Western church, summoned in 314 at Arles by the emperor Constantine to settle the dispute between the Catholics and Donatists (see DONATISTS), after an assembly of referees meeting at Rome in 313 had failed to settle the questions at issue. Of these the most important was the eligibility for priestly office of *traditores* or those who had delivered up their copies of the Scriptures under the compulsion of the Diocletian persecution. Thirty-three bishops attended at Arles, three of whom were from Britain. The canons drawn up by the synod dealt with matters of ecclesiastical discipline, clerical and lay, and included a declaration that ordination was not invalid because performed by a traditor, if otherwise regular, thus condemning the principal contention of the Donatists.

See Smith and Cheetham, *Dictionary of Christian Antiquities*, art. "Arles"; W. Bright, *Chapters of Early English Church History* with references to other authorities given.

ARLINGTON, HENRY BENNET, EARL OF (1618–85), English statesman, son of Sir John Bennet of Dawley, Middlesex, was educated at Westminster School and Christ Church, Oxford. During the civil war he fought for the King, and after the King's execution, joined the Royal Family abroad. At the Restoration he was made keeper of the privy purse (1661), secretary of State (1662), and one of the postmasters-general in 1667. He was raised to the peerage as Baron Arlington in 1663. On the fall of Clarendon (1667), against whom he had intrigued, he became a member of the Cabal ministry, but did not obtain the predominant influence which he had expected, and was extremely jealous of Buckingham. Arlington was in charge of foreign affairs, and sought to undo the triple alliance arranged by Sir William Temple at The Hague, between England, Holland and Sweden, which led to the peace of Aix-la-Chapelle under which Louis XIV. agreed to make no more conquests on the northern frontier of France. In 1670 he and Clifford were the only two ministers to whom Charles confided the terms of the secret Treaty of Dover, concluded with Louis XIV., and he was largely responsible for the deception practised on the council. For his services Charles gave him an earldom and the Garter.

But Arlington was guided by personal considerations only, and on the appointment of Clifford to the treasurership, which he had always desired, he changed sides, and, in order to please his new allies, disclosed the terms of the Treaty of Dover to the staunch Protestants, Ormonde and Shaftesbury. But he had lost the confidence of all parties, and on Jan. 15 1674, was impeached by the House of Commons on charges of "popery," corruption and betrayal of his trust. Buckingham accused him of being the chief instigator of the pro-French and anti-Protestant policy, of responsibility for the Dutch war, and of embezzlement. The bill of impeachment was rejected, but Arlington resigned office and was appointed lord chamberlain. Although he continued to be employed in one capacity or another his influence was gone. He died on July 28 1685, and was buried at Euston, where he had bought a large estate and had carried out extensive building operations. His residence in London was Goring House, on the site of which was built the present Arlington street.

Arlington was a typical statesman of the Restoration, possessing outwardly an attractive personality, and according to Sir W. Temple "the greatest skill of court and the best turns of art in particular conversation," but thoroughly unscrupulous and self-seeking, without a spark of patriotism, faithless even to a bad cause, and regarding public office solely as a means of procuring pleasure and profit. His knowledge of foreign affairs and of foreign languages, gained during his residence abroad, was considerable, but long absence from England had also taught him a cosmopolitan indifference to constitutions and religions, and a careless disregard for English public opinion and the essential interests of the country. According to Clarendon, he "knew no more of the Constitution and laws of England than he did of China, nor had he in truth a care or tenderness for church or State, but believed France was the best pattern in the world."

He married Isabella of Beerwaert, daughter of Louis of Nassau, by whom he had one daughter, Isabella, who married Henry, Duke of Grafton, the natural son of Charles II. and Ladv Castlemaine.

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ARLINGTON, a township of Middlesex Co., Mass., U.S.A., immediately W. of Somerville and Cambridge, and 6–8m. N.W. of Boston. It is traversed by Massachusetts avenue, and by the Lexington branch of the Boston and Maine railroad, which

has stations at the villages of Arlington and Arlington Heights. Its area is 5½sq.mi. The population was 40,013 according to the federal census of 1940. It includes Spy pond, one of the prettiest bodies of water in the vicinity of Boston. Market-gardening is an important occupation, and there are factories which make piano-cases, boiler finishings, and picture frames. Arlington became a separate town in 1807 under the name of West Cambridge. The present name was adopted in 1867.

See B. and *W.* R. Cutter, *History of the Town of Arlington . . . 1637–1879* (Boston, 1880); and C. S. Parker, *The Town of Arlington, Past and Present* (Arlington, 1907).

ARLINGTON HOUSE, an historic mansion situated in Virginia, on the heights overlooking the Potomac river, opposite Washington, D.C. The property once belonged to George Washington and descended to his adopted son, Parke Custis, who began his residence there in 1802. Later it became the home of Robert E. Lee, the Confederate general, who in 1831 married the daughter of Custis. Seized by the Federal forces early in the Civil War, but later purchased, the house was occupied as a headquarters by the Union army and the large adjacent estate was used as a camp for troops. Subsequently the property was made into a national cemetery in which many distinguished generals and thousands of soldiers, both Union and Confederate, have been buried. The stately Lee mansion, with its noble portico, is one of the finest examples of colonial architecture.

See Karl Decker and Angus McSween, *Historic Arlington* (1892); John B. Osborne, *The Story of Arlington (1899)*; and John T. Faris, *Historic Shrines of America* (1918).

ARLINGTON NATIONAL CEMETERY occupies a beautiful site of 408ac. in Virginia on the banks of the Potomac, directly opposite Washington, District of Columbia. The central feature of the cemetery is the mansion, built in 1802 of stuccoed brick on the estate of 1,100ac. by George Washington Parke Custis, the adopted son of George Washington. The land was part of the original tract of 6,000ac. granted by Sir William Berkeley on October 21, 1669, as a reward of services, to Robert Howsen, who subsequently sold it for six hogsheads of tobacco. The Lee mansion, as it is now called, is said to have been modelled after the temple of Theseus in Athens. The great portico, with its eight massive white columns, is a striking landmark, visible from the city across the river (for illustration see Vol. 22, facing p. 788). The view from the house, which stands on tne brow of the hill 200ft. above the Potomac, has been famous for more than a century. Many famous Americans and foreigners, among them Lafayette, have been entertained at the Lee mansion. In the drawing room, where visitors now register their names, Mary Ann Custis in 1831 married Robert E. Lee, then a lieutenant in the United States Army, afterwards commander-in-chief of the Confederate Army. When on April 22, 1861, Lee left Arlington to take command of the Virginia troops, Federal soldiers took possession almost immediately, converting the mansion into a headquarters and the grounds into a camp. Later a hospital was established there and in 1864, other burial-grounds proving insufficient, Arlington became a military cemetery by order of the Secretary of War. The first soldier to be buried there was a Confederate who had died in the hospital. For years the title of the property was in dispute, but in 1883 the United States Government paid to the son of Gen. Lee $150,000 for the property. Soldier dead from every war in which the United States has participated, including a few officers of the Revolution, are buried there—numbering in all more than 25,000. Under a granite sarcophagus lie the bones of 2,000 unknown soldiers, gathered after the Civil War from the field of Bull Run and the route to the Rappahannock.

The best known memorial in the cemetery is the Tomb of the Unknown Soldier, which consists of a solid block of marble, on which is inscribed a tribute to all the unidentified American dead of the World War. Near at hand stands the memorial amphitheatre erected, through the efforts of the Grand Army of the Republic in memory of departed heroes, as a fitting place of assembly for the thousands who attend Memorial Day services in their honour. It was dedicated on May 15, 1920. The roofless, white marble structure, with its eastern façade overlooking the Potomac river and Washington encloses a natural amphitheatre. Copied after both the theatre of Dionysus at Athens and the Roman theatre at Orange, France, the proportions and distances convey the charm of an old Greek ruin. Crypts where especially distinguished soldiers, sailors and marines may be buried are placed under the colonnade, while within the entrance is a reception hall, a chapel and a muse'um. Covering an area of 34,000 sq.ft. and providing seating capacity for 5,000 people in the tiers of white marble benches within the theatre proper, the theatre can accommodate several thousand more in its colonnades and on its stage.

But the eyes of visitors—who may enter Arlington daily between sunrise and sunset—turn repeatedly to the Fields of Dead, with their endless lines of plain stones, of the pattern adopted in 1872 for use in all the National Cemeteries.

(J. T. F.)

ARLON, chief town, province of Luxembourg, southern Belgium, on a hill (1,240ft.) above the headwaters of the Semoise. Pop. (1930) 11,658. The Orolaunum of the Romans was a station on the Antoninian way connecting Reims and Trbves, and the name is probably Celtic. Extensive views are obtainable from the church of St. Donat, which crowns the hill. Vauban turned it into a fortress in 1671, damaging the old Roman wall, the foundations of which were practically intact. In the local museum are many Roman antiquities, including several large sculptural stones.

ARM, the human upper limb from the shoulder to the wrist, and the fore limb of an animal. (See ANATOMY: Superficial *and* Artistic, and SKELETON: Appendicular.) The word is also used of any projecting limb, as of a crane, or balance, of a branch of a tree, and so, in a transferred sense, of the branch of a river or a nerve. Arm in military language is a branch of the army whose primary duty is to fight, *e.g.,* infantry, artillery, used in contradistinction to a "service" whose duty is to supply or aid the fighting troops. In the plural, the word is applied to the soldier's weapons. "Arms" or "armorial bearings" are the heraldic devices displayed by knights in battle on the defensive armour or embroidered on the surcoat worn over the armour and hence called "coats of arms." These became hereditary and are borne by families; similar insignia are used by nations, cities, episcopal sees and corporations generally. (See HERALDRY.)

ARMADA, THE. The Spanish or Invincible Armada was the great fleet sent by Philip II. to assist in the attempted invasion of England in 1588. The idea was not a new one, but so far it had been prevented by the expense of providing an army to sail on board the fleet all the way from the Peninsula, in addition to the expense of maintaining an army in the Spanish Netherlands. The Marquis of Santa Cruz, the original commander-in-chief, having died, Philip II. appointed the Duke of Medina Sidonia, a nobleman who lacked sea experience and was unwilling to lead the expedition. By the new plan of campaign, his instructions were to fight his way up the Channel and to convoy to England the Spanish army already in the Netherlands under the Prince of Parma, at that moment blockaded in Dunkirk and Nieuport by a Dutch squadron under Justinus of Nassau.

During the year 1587, Sir Francis Drake had destroyed a great part of the Spanish shipping at Cadiz and had prevented the concentration of the outlying squadrons; but in the spring of 1588 the Armada assembled at Lisbon and, after many delays, began to sail on May 18. It consisted of 130 vessels, about half of which were transports and victuallers, and it was drawn from all parts of the Spanish Empire, there being no Spanish royal navy. It was manned by some 7,000 sailors and upwards of 17,000 soldiers. Heavy squalls, bad water, and bad provisions forced most of the fleet on June 9 to run into Coruña, though some maintained their course to the Scilly Isles, which was the first rendezvous. It was not till July 12 that the Armada again set sail, and it was sighted off the Lizard on July 19.

The English defence consisted of the Queen's ships and armed merchantmen, some 90 in all, collected at Plymouth under Drake, who was properly commander-in-chief, assisted by Sir John Hawkins and Sir Martin Frobisher, though Charles Lord Howard of Effingham, who was at the head of the admiralty administration in London, elected on this occasion to go to sea.

There was also a squadron in the Downs, under Lord Henry Seymour and Sir William Wynter, co-operating with the Dutch. A total of 197 English ships took part in the campaign, but many were so small that they were of little use, the fighting being almost entirely between the big ships of both sides. It is difficult to compare the fighting strength of the opposing fleets; the individual tonnage of the largest ships on each side was about the same, and the Spaniards possessed more of them, though the English were superior in weight, number and distribution of armament.

The Armada mas organized more like a land army than a fleet, the sailors and navigators occupying a very low status, while in the English fleet the sailors far outnumbered the soldiers and most of the captains had previous sea experience. The object of the English fleet was to prevent the junction of Medina Sidonia and Parma by getting to windward of the Armada, assuming south westerly winds, and so cutting it off from its base and driving it up the Channel and past Dunkirk.

The Operations.—Owing to bad weather and lack of provisions, no proper system of reconnaissance was maintained, and when the Armada appeared off Plymouth on July 20 the English were only just able to get to sea and avoid being blockaded. On July 21 the English worked to windward of the Spaniards and engaged them at long range for two hours, capturing Pedro de Valdez, the commander of the Andalusian squadron, whose ship was damaged. A change of wind gave the Spaniards the weather gage and on July 23 another action was fought off Portland, during which Frobisher became isolated in a sudden calm and was in danger of being captured by the Spanish galleasses. Next day the English fleet was re-inforced from the shore by fresh ships and many volunteers, and was re-organized in four distinct squadrons under Howard, Drake, Hawkins, and Frobisher. The chase continued up the Channel, and on July 25 another action took place off the Isle of Wight. So far the Spaniards had kept better order in a military sense than the English, but they were then completely demoralized and had lost several of their best ships. Crossing the Channel, they anchored in Calais roads on July 27. Medina Sidonia then sent a message to Parma vainly asking him to put to sea at once, which was of course impossible owing to the closeness of the blockade. Howard was joined by Seymour and Wynter, and on the night of July 28, after a council of war, fireships were sent against the Spaniards. No Spanish ships were touched, but the panic caused by this dreaded form of attack caused them to cut their cables and put to sea in great confusion, one large ship running aground. On July 29, while they were straggling up the coast of Gravelines, Drake led the English to the attack and the fiercest battle of the campaign took place, the English doing immense damage by keeping to windward and firing at long range with alternate broadsides. The Spaniards fought with great heroism; but with their poor gunnery and bad seamanship they were outmatched and were unable to close and board, which was their only possible chance of success. By the afternoon 16 Spanish ships were cut off and should have been made prizes; but a sudden squall drove them to leeward and stopped the action, and at the same time the English ammunition became completely exhausted. The sea increased in fury during the night, and by the morning of July 30 the Spaniards were well past Xieuport and in great danger of being driven on a lee shore, as they were unable to rig any spare anchors. At the most critical moment in the day, with only six fathoms below them and the English to windward, the wind suddenly shifted to the south-west and they were able to run north and so escape destruction. The English followed them as far as the Firth of Forth and then returned—seeing that the enemy were obviously not going back through the Strait of Dover, while they themselves had little food and no ammunition. The Armada became distressed through lack of fresh water and soon encountered strong westerly winds, which added to its troubles as it attempted to sail home round Scotland and the west coast of Ireland. Many ships were wrecked, and in Ireland their crews were massacred; many more sank in the open sea. Only half of the ships that left the Tagus returned to Spain or Portugal. and in those death and sickness were appalling.

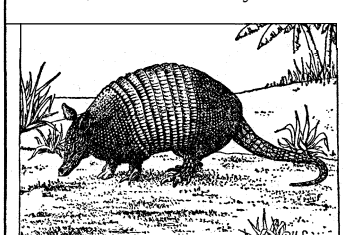
The complete failure of the invasion project was due to the English plan of keeping to windward and fighting at long range, which was followed throughout; and but for a fortunate change of wind and the failure of the English ammunition supply the whole Armada would certainly have been driven ashore on the Zealand banks.

Medina Sidonia acted with great courage throughout, but he was unable to control the provincial navies under his command and had neither the personality nor seamanship necessary for such a task. Philip II. foresaw the English methods of gunfire and warned him of what to expect, but at the same time he entirely failed to realize the difficulty which Medina Sidonia would encounter in trying to bring out Parma's army in the face of the Dutch blockading flotilla, which could sail closer inshore amongst the shoals than the great ships of Spain.

Queen Elizabeth had some difficulty in understanding Drake's plan of campaign and was greatly concerned that the English made no attempt to board the Spanish ships, though the accusations levelled at her of starving the fleet of ammunition and food can hardly be substantiated. More fighting took place than was foreseen by either side, and consequently supplies of all kinds proved insufficient. Although many of the Spanish commanders had worldwide sea experience, the Armada was greatly handicapped by its military and provincial organization, while the English fleet was naval and national in character and its personnel all spoke a common language. Moreover, the difficulty of convoying Parma's army was so great that the Armada had little chance of success, its whole strategic conception being at fault. Its failure checked the naval growth of Spain and assisted the Dutch to secure their independence.

BIBLIOGRAPHY.—The English side of the Armada campaign can be best studied in Sir Julian Corbett's *Drake and the Tudor Navy* (1898) and in the *State Papers relating to the defeat oj the Spanish Armada,* ed. by Sir John Laughton for the Navy Records Society (1894). The Spanish side will be found in *La Armada Invencible, by* Capt. C. F. Duro (1884). Froude summarized Duro's work in his *Spanish Story of the Armada* (1892). A popular account will be found in J. R. Hale, *Great Armada* (1913). (G. A. R. C.; W. C. B. **T.**)

ARMADILLO, a mail-clad mammal (order Edentata, family *Dasypodidae)* closely allied to the sloths and ant-eaters. Its armour consists of a bony case, partly composed of solid buckler-like plates, and partly of movable transverse bands. Armadillos are omnivorous, feeding on roots, insects, worms, reptiles and carrion, and are mostly nocturnal. They are harmless inoffensive creatures, their principal means of escape being the rapidity with which they burrow in the ground, and the tenacity with which they retain their hold in their subterranean retreats. Notwithstanding the shortness of their limbs they run with rapidity. Most of the species are esteemed good eating by the natives. They are all inhabitants of the tropical and temperate parts of South America, though a few species range farther north, the nine-banded armadillo being found from Argentina to southern Texas. The largest species is the giant armadillo (*Priodon gigas*), nearly a yard long, from Surinam and Brazil. For the distinctive characters of the genera see EDENTATA.



THE NINE-BANDED ARMADILLO (DASYPUS NOVEMCINCTUS), REMARKABLE FOR ITS COVERING OF HARD, BONY, BUCKLER-LIKE PLATES

ARMAGEDDON, Rev. xvi. 16 (A.V.), HAR-MAGEDON (R.V.). This is probably the Greek equivalent of the Hebrew har *megiddō* (often, but *megiddōn,* Zech. xii. 11), the mountain district of Megiddo, *see* various readings of the Septuagint (Josh. xvii. 11). The final destruction of the armies of Gog (understood to mean the forces of Antichrist) was to be on "the mountains of Israel" (Ezek. xxxix. 2, 4), here defined as near Megiddo, the scene of past battles (Judges iv. 13; II. Ki. xxiii. 29; II. Chron. xxxv. 22). Other suggestions are: (1) *har migdo,* "his fruitful mountain" (i *e.,* the mountain land of Palestine); (2) 'ir *Chemdah,* "the desirable city"; (3) *har mo'ed,* "the mountain where

the gods meet[n]—a hint of a myth of the battle of the gods. (See Charles, Revelation, ii. p. 50.) Armageddon is often used to-day of a great slaughter or final conflict.

The name is revived in the title of Field-Marshal Lord Allenby of Megiddo (cr. 1919).

ARMAGH, an inland county of Northern Ireland (Act of 1920), bounded north by Lough Neagh, east by County Down, south by Louth, and west by Monaghan and Tyrone. The land area is 489 sq.mi. Population (1937) 108,815. The northern low-lying area is made up of Tertiary basalts, Pliocene deposits and sandstones. It is very fertile and may formerly have been covered by the waters of Lough Neagh. To the south there is a gradual rise to the mountains of Ordovician and Silurian rocks, probably extensions of similar formations in the southern uplands of Scotland. Farther south, the granite mountain-core is revealed, whilst younger intrusive rocks form Slieve Gullion (1,893ft.).

Historical Survey.—During early neolithic times lakes and swamps covered large portions of the lowlands of Ulster, the drier districts being thickly wooded. The first settlements were, therefore, largely confined to the coasts. In the bronze age colonization of the lowlands developed, and at its end the country immediately south of Lough Neagh had considerable importance. The fortress of Emhain Macha was built *c.*300 B.C. about 1½m. W. of the modern city of Armagh and became in time the religious and political centre of the district. Later, however, iron-using people moved northward and drove some of the previous inhabitants of North Armagh into the mountains of county Antriin and county Down. To consolidate their conquests, they built an earth-work, erroneously known as the Dane's Cast, which follows approximately the modern boundary between county Armagh and county Down. From this time Emhain Macha declined, the later associations of the district being woven around Armagh (*q.v.*) near by, which became in the fifth century the ecclesiastical capital of Ireland, partly because of its connections with St. Patrick. Scandinavians sailed up the Bann and established a permanent fleet on Lough Neagh. They also had squadrons on the loughs of Belfast, Strangford and Carlingford. From these centres they raided the interior and during one such expedition they destroyed Armagh but, recognizing the advantages of the site, used it for several years as the Scandinavian capital of North Ireland.

The Normans experienced great difficulties when moving against the North and kept to coastal routes and lowlands. They thus had comparatively little influence in Armagh, particularly in the southern hilly portion. The county was made shire ground in 1586.

Economic Survey.—The lowlands of the northern half of the county are composed of recent rocks and are very fertile. Around Charlemont there is an area which remains boggy but this is said to be reclaimable. The southern portion of the county is rocky and barren with some bog in the neighbourhood of Newtown-Hamilton. The climate is temperate and rainfall comparatively light. Agriculture does not flourish. Oats and potatoes are the principal crops, but all grain crops are decreasing, whilst flax, formerly much grown, is now neglected. The numbers of cattle, sheep, pigs and poultry are increasing. Fruit cultivation is encouraged and the orchards of the county are justly famous. The principal industry is the manufacture of linen. This does not necessitate any unwholesome crowding of people into large towns but can be carried on successfully in villages and farm-houses. The spinning and reeling of the yarn and the bleaching process can be done after farm work and domestic duties. This development of rural industry may account for the relative neglect of the land. Whilst the condition of agriculture might indicate a poor region, the county is in fact a comparatively rich one and supplies other parts of Ulster with vegetables and fruits.

The chief towns are in the northern lowlands. Xrmagh (*q.v.*), with its religious associations, is a route centre and market town. Both Lurgan and Portadown have considerable manufactures, chiefly connected with linen. The latter is also an important railway centre. The county is poor in minerals though lead veins have been worked spasmodically. There are extensive granite quarries at Bessbrook. The scattered nature of the population of the mountains is shown by the fact that the railways enclose the area but send off no important branches. Along the east of the mountains is the line from Armagh to Newry and Carlingford; on the west, the line from Armagh to Castleblayney and Dundaik.

The county is divided into five urban districts, three rural districts and two Poor Law unions. It returns four members to the parliament of Northern Ireland and one member to the parliament of Great Britain and Northern Ireland.

ARMAGH, urban district and county town. Co. Armagh, Northern Ireland, 89½m. N.N.W. of Dublin by Great Northern railway, at junction of the Belfast-Clones line. Pop. 7.356. The city is of great interest because of its religious associations, some claiming that it was founded by St. Patrick in the 5th century. It was the seat of a flourishing college and early became the metropolis of Ireland, inheriting much of the importance of the old fortress of Emain Macha. which was destroyed in the 4th century. As a result of Danish incursions and the ravages of the English wars the settlement became much diminished and very dilapidated, its bishops moving to Drogheda, where they enjoyed the greater security of the coastal plain. With the more settled conditions of the 18th and 19th centuries, the fortunes of Armagh revived and it once again became a prosperous and well-built centre. As the seat of an archbishop in both the Protestant and Roman organizations, it possesses two cathedrals and two archiepiscopal palaces

ARMAGNAC, formerly a province of France and the most important fief of Gascony, now wholly comprised in the department of Gers (q *v.*). In the 15th century, when it attained its greatest extent, it included, besides Armagnac, the neighbouring territories of Fezensac, Fezensaguet, Pardiac, Pays de Gaure, Rivière Basse, Eauzan and Lomagne, and stretched from the Garonne to the Adour. Armagnac is a region of hills ranging to a height of 1,000ft., watered by the river Gers and other rivers which descend fanwise from the plateau of Lannemezan. On the slope of its hills grow the grapes from which the famous Armagnac brandy is made. In Roman Gaul this territory formed part of the diocese of Auch (*civitas Ausciorum*), which corresponded roughly with the later duchy of Gascony (*q.v.*). About the end of the 9th century Fezensac (*comitatus Fedentiacus*), was erected into an hereditary countship. This latter was in its turn divided, the south-western portion becoming, about 960, the countship of Armagnac (*pagus Armaniacus*). The domain of this countship continued steadily to increase, and about 1140 Count Gerald III. added the whole of Fezensac to his possessions. Under the English rule the counts of Armagnac were turbulent and untrustworthy vassals; and the administration of the Black Prince, tending to favour the towns of Aquitaine at the expense of the nobles, drove them to the side of France.

At the accession of Henry V. Count Bernard VII. was all-powerful at the French court; and Charles of Orleans, in order to be able to avenge his father, Louis of Orleans, who had been assassinated in 1407 by John the Fearless, duke of Burgundy, married Bonne, Bernard's daughter. This was the origin of the political party known as "the Armagnacs." With the object of combating the duke of Burgundy's preponderant influence, a league was formed at Gien, including the duke of Orleans and his father-in-law, the dukes of Berry, Bourbon, and Brittany, the count of Alençon, and all the other discontented nobles. The Peace of Hourges, which was confirmed at Auxerre, put an end to the war which followed. But in Aug. 1413 the Armagnacs in their turn became masters of the government and of the king, and the duke of Burgundy, besieged in Arras, only obtained peace on condition of not returning to Paris.

Several months later Henry V. declared war against France; and when, in Aug. 1415, the English landed in Normandy, the Armagnacs and Burgundians united against them, but were defeated in the battle of Agincourt (Oct. 25 1415). John the Fearless then began negotiations with the English, while Bernard VII., appointed constable in place of the count of Saint-Pol, who had been killed at Agincourt, returned to defend Paris. However, the excesses committed by the Armagnacs incensed the populace, and John the Fearless, who was ravaging the surrounding dis-

tricts, re-entered the capital on May 29 1418, in consequence of the treason of Perrinet Leclerc. On June 12 Bernard VII. and the members of his party were massacred. From this time onward the Armagnac party, with the dauphin, afterwards King Charles VII., at its head, was the national party, while the Burgundians united with the English. This division in France continued until the Treaty of Arras, on Sept. 21 1435.

In 1444–45 the emperor Frederick III. obtained from Charles VII. a large army of Armagnac adventurers to enforce his claims in Switzerland, and the war which ensued took the name of the Armagnac War (*Armagnakenkrieg*). In Germany the name of the foreigners, who were completely defeated in the battle of St. Jakob on the Birs, not far from Basel, was mockingly corrupted into *Arme Jacken,* Poor Jackets, or *Arme* Gecken, Poor Fools.

On the death of Charles of Armagnac, in 1497, the countship was united to the crown by King Charles VII., but was again bestowed on Charles, the nephew of that count, by Francis I., who at the same time gave him his sister Margaret in marriage. After the death of her husband, by whom she had no children, she married Henry of Albret, king of Navarre; and thus the countship of Armagnac came back to the French crown along with the other dominions of Henry IV. In 1645 Louis XIV. erected a countship of Armagnac in favour of Henry of Lorraine, count of Harcourt, in whose family it continued till the Revolution.

In 1789 Armagnac was a province forming part of the *Gouvernement-général* of Guienne and Gascony; it was divided into two parts, High or White Armagnac, with Auch for capital, and Low or Black Armagnac. At the Revolution the whole of the original Armagnac was included in the department of Gers.

See E. Wulcker, *Urkunden und Schreiben betreffend den Zug der Armagnaken* (1873); Kameau, "Guerre des Armagnacs dans le Mâconnais" (1418–35) in the *Rev. soc. lit. de l'Ain* (1884); Paul Dognon, "Les Armagnacs et les Bourguignons, le comte de Foix et le dauphin en Languedoc" (1416–20) in *Annales du Midi* (1889); Witte, *Die Armagnaken im Elsass, 1439–1445* (1889); U. Chevalier, *Repertoire des sources hist. du moyen âge,* s. Armagnac (1894).

ARMAMENTS: see AIR FORCES; ARMY; ARTILLERY; BATTLESHIP; CAVALRY; CRUISER; DESTROYER; MIKES; NAVY; TORPEDOES.

ARMATOLES, the name given to Greeks who discharged certain military and police functions under the Turkish government. When the Turks conquered Greece in the 15th century, many of the Greeks fled into the mountainous districts of northern Greece and maintained a guerrilla warfare. These men were called *Klephts* (Gr. κλέπτης, a brigand): the Turkish pashas came to terms with some of them, and these men were confirmed in the possession of certain districts, undertaking in return some duties, such as the custody of the highroads. They were called *armatoles,* and the districts in which they lived *armatoliks.* They rendered good service, but their power and independence were disliked by the Turks. After the peace of Belgrade the Turkish government sought to weaken their position, and towards the end of the 18th century their numbers were seriously reduced. They afforded valuable assistance to their countrymen during the Greek war of independence in 1830.

ARMATURE, a covering for defence. In zoology the word is used of the bony shell of the armadillo. In architecture it is applied to the iron stays by which the lead lights are secured in windows. (See STANCHION and SADDLE: *Saddle-Bars.*) In magnetism Dr. William Gilbert applied the term to the piece of soft iron with which he "armed" or capped the lodestone in order to increase its power. It is also used for the "keeper" or piece of iron which is placed across the poles of a horse-shoe magnet, and held in place by magnetic attraction, in order to complete the magnetic circuit and preserve the magnetism of the steel; and hence, in dynamo-electric machinery, for the portion which is attracted by the electro-magnet. The term is now applied to that member of an electric generator (*q.v.*) or motor (*q.v.*) in which currents are induced by the action of the field.

ARMAVIR, ruined capital of Armenia, on the slopes of the extinct volcano, Ala-Geuz. It was built, according to legend, by Armais in 1980 B.C., and was the capital of the Armenian kings until the 2nd century A.D. A village, Tapadibi, fills the site,

ARMAVIR. (1) A province in North Caucasian area of the Russian S.F.S.R. Area 21,13j sq.km. Population (1926) 926,851; urban 105.396, rural 821,455. It is a fertile black earth plain, but includes a part of the forested mountain slopes in the south. Wheat is the main crop, and rye, oats, barley, millet, maize, tobacco, flax, hemp and potatoes are grown. Vines and garden fruits are increasingly cultivated. (2) A town, the centre of the area, 45" N. and 41° 8' E., on the Black sea-Caspian railway with a branch to Tuapse on the Black sea. Pop. (1926) 74,370—a great increase since its foundation in 1848. It is a trading centre and has a grain elevator.

ARMED MERCHANT CRUISER: see FLEET AUXILIARY VESSELS.

ARMED NEUTRALITY: see NEUTRALITY.

ARMENIA, a Socialist Soviet Republic created in 1918, and united with Azerbaijan and Georgia (Gruzia) in 1922 to form the Transcaucasian S.F.S. republic with unification of the transport and economic system. Area 30,948sq.km. Pop. (1926) 879,872, urban 133,658, rural 746,214. It is divided for administrative purposes into nine districts, of which the most important are Leninakan (162,579), Erivan (175,816), Etchmiadzin (113,930) and Pambak-Loriisk (132,341). Its boundaries are: — North, the Georgian S.S.R., west and south-west, Turkey, south-west, the Nakhichevan A.S.S.R., south, the Araxes river and east, the Azerbaijan S.S.R. It thus in no sense coincides with the former Armenia, much of which is now in Turkey, though Etchmiadzin, the ancient seat of the Armenian patriarchs, is included in it. It has no seaport and is therefore economically dependent on Georgia and Azerbaijan. It is mainly a plateau region (6,000–8,000ft.), with short ridges and isolated volcanic mountains. Alagoz, 14,440 ft. was active in Tertiary times. Lake Gokcha (540sq.m.) is encircled by volcanic mountains and the neighbourhood of Leninakin is covered with volcanic débris. Leninakin and the surrounding district suffered severely from the earthquake of October 1926. The climate varies with altitude and aspect, but everywhere the winters are severe and the climate extreme and dry. At Leninakin (alt. 5,078ft.) the average temperature is, January, 12°F., July, 65°F.; yearly rainfall, 16·2in. The Aras (Araxes), with its tributary the Zanga river drains the republic and on the latter the Rykov hydro-electric station was opened 1926. The Aras river is a rapid, muddy, dangerous stream when snows melt, but fordable at other times. In its valley cotton, mulberry (for silk), vine, apricots, fruits, rice and tobacco are grown. The vines must be buried during winter frosts. Irrigation is extending under the direction of the Erivan department of agriculture and schemes are being carried out at Leninakan and Etchmiadzin and a tinned fruit (especially peach) industry is springing up, but cotton is the chief product. Cattle-rearing and forestry are important in the hilly districts and Lori is developing a dairy industry. Camels are bred and leeches are exported from the swamps. The Katara copper mines are productive and were reopened in 192;. Communications are poor, though a railway from Tiflis to Tabriz in Persia passes through Leninakan and Erivan, and from Leninakan there is a branch to Kars in Turkey. The chief towns are Erivan (*q.v.*) and Leninakan. The conditions of life are poor in many parts and mud huts are common in the hills. In spite of the destruction of school buildings during the World War, education is increasing, though the schools are mainly primary. New premises are being built and teachers are being trained. A university, a musical academy and trade technical schools have been established. The Armenian tongue is in use.

The people are Armenians, Russians and Turco-Tatars. The "Armenoid" type physically is tall, dark, broadheaded, with prominent nose, high head and flattened occiput: but here it is much modified by intermixture. (X.)

HISTORY

Modern research has very largely modified the ancient conceptions of the history and the political position of Armenia. The physical features of the country played some part in shaping the destinies of the people, for the isolation of the valleys especially in winter, encouraged a tendency to separation which

showed itself in the middle ages in weakening the central power. The hillsides have always been the home of hardy mountaineers jealous of their independence, and have served as a sanctuary to the lowland people in times of foreign invasions. The country stands as an open doorway between the East and the West. Through its fertile valleys run the roads that connect the Iranian plateau with the harbours of Asia Minor and for its temporary possession nations have contended from the remote past.

BY COURTESY OF THE NEAR EAST RELIEF

ARMENIAN VOLUNTEER SOLDIERS

Armed escort is necessary in parts of Armenia, especially the southern section inhabited by the Kurds, who are notorious robbers

Ethnology. — There is evidence to assume that about 1500 B.C. Armenia was inhabited by a non-Aryan people, the type of which is called "Armenoid" by modern ethnologists. The Hittites were the representatives of this type. These original inhabitants of Armenia called themselves Khaldini or Khaldians from the name of their chief god Khaldi. At a period not yet ascertained, but presumed to be about 710 B.C., an Indo-European race, either Phrygians from the West or Cimmerians from the Caucasus mountains, invaded the highlands of Armenia and imposed their language on the natives. Later, on the rise of Media and Persia, these formed the military aristocracy of the land. These two races soon amalgamated, thus forming the main type of the modern Armenian, except where in isolated districts one or other ethnic element still predominates. The Armenian Arshakuni (Arsacid) kings (190 B.C.–A.D. 428) brought also many Jewish and Greek artisans and colonists.

In the recesses of Mount Taurus the peasants are tall, handsome, agile and brave. In the valleys of Armenia and Asia Minor they are robust, thick-set and sometimes bearing the characteristics of the proto-Armenians, as depicted on their monuments, with straight black hair and often hooked noses. They are good cultivators of the soil and cattle breeders. Some still live in semi-subterranean houses as their ancestors did in the days of Xenophon. The townsmen have more regular features of the Aryan type. They are skilled artisans and merchants, remarkable for their industry, their quick intelligence, their aptitude for business and for their enterprising spirit, which led their ancestors to trade with Scythia, China and India. The upper classes are well-educated.

Ancient Kingdom. — The early history of Armenia, as recorded by the earliest historians of the country, is confirmed in many important aspects by the native and Assyrian inscriptions. It can now be stated that in the second millennium B.C. the Assyrian monarchs were trying hard to overcome the "Nairi" confederation, which consisted of the Armenians, the Kurds and other autochthonous peoples. There is evidence that these Nairi kings were often in alliance with the Hittite empire at Boghaz-Keui. At about 900 B.C., however, the Khaldian kingdom of Van acquired hegemony over all the Nairi lands. Called Ararat by the Bible, Urartu by the Assyrians and Alarodians (Ἀλαρόδιοι) by Herodotus (iii.-94) these proto-Armenian kings became a formidable foe to Assyria, until the downfall of both. The last Khaldian king, Rusas III., fought against the Lydians on the Halys, in 585 B.C. as an ally of Cyaxares. Its history and the recent discoveries are dealt with under URARTU.

In the Behistun inscription of Darius Hystaspes (521 B.C.) first appears the name of Armeniya or Armina. This Persian monarch represents Armenia as one of his satrapies, whereas his own records state that he had to send armies year after year to quell rebellions, and that five battles he mentions were fought in Media; yet Armenia was an almost independent unit in the Persian monarchy, governed by native dynasties, as we see them in 401 B.C. when Xenophon and the Ten Thousand passed through the country. These two dynasties, Tiribazus in the north and Erwant (Orontes, Ἀροάνδης) in the south-west, governed the country owing nominal allegiance at first to Persia and then to Seleucids until 191 B.C. when Artashes (Artaxias) made himself sovereign king of Armenia Major with his capital at Artashat (Artaxata) on the Arax and Zareh (Zariades) a descendant of the Erwant dynasty of Armenia Minor.

The Arshakuni Kingdom. — This dynasty became essentially Armenian under Tigranes the Great (94–56 B.C.) who united the country and conquered seventy valleys from Parthia, Northern Syria and Cappadocia, all this territory having been held by the Khaldians. He built a new capital at Tigranocerta, now identified by Prof. Lehmann Haupt with the ancient city of Farkin. In defiance of Rome he shielded Mithridates the Great, of Pontus, his father-in-law, who had fled to his court. This brought him into conflict with Lucullus, the Roman commander, who attacked Tigranocerta.

There are no records from the Armenian side, but modern research has greatly diminished the value of Roman boastings. (Kurt Eckhardt, "Die Armenischen Feldzüge des Lucullus" in *Klio* ix.–x. [1909–10].) Ultimately the Romans held the Euphrates frontier claiming "sovereignty" over Armenia and Kurdistan. The ethnical and cultural affinities fostered by Persia and Parthia, coupled with the influence of Zoroastrianism, has so profoundly shaped the outlook of all peoples living between the Caucasus and the Iranian plateau, that Hellenism scarcely penetrated beyond the Euphrates. The Romans considered Armenia as a "buffer State" but the Armenian rulers only at moments of struggle against Persia sought the friendship of Rome, just as more powerful nations do so even to-day. Under the rule of its own Arshakuni kings the Armenian people kept its complete political entity within the frame of Iran until A.D. 303, when King Tirdat (Tiridates) converted by St. Gregory *the* Illuminator, established Christianity as the religion of the State and set an example followed later by Constantine. This spiritual break-off from Iran produced religious wars with Zoroastrian Persia which considerably weakened Armenia during the 4th and 5th centuries. Persia and the Eastern Empire "divided" Armenia into zones of influence in 387, although both Pers-Armenia and further west Arshakuni kings and powerful princes (Nakharars) governed the country in their own way, bearing titles of Marzban (Margrave) and Curopalatii.

The establishment of a national Church in 303, followed later by the discontinuance of the Greek language in the Armenian Holy offices and a separation from the Council of Chalcedon; the invention of a national alphabet by St. Mesrop resulting in the translation of the Bible and the development of literature; and finally a "Holy war" led by Prince Vardan Mamionian against Persia in A.D. 451 which provided martyrs — these three events combined, in the course of a century and a half, stamped such an indelible national individuality on the Armenian people that it has stood the test of centuries of trials. The downfall of the Persian Sassanian Empire in 642 opened the way to the Arabs, who for the following two centuries organized occasional marauding expeditions from the Kurdish foothills up to the Caspian Sea.

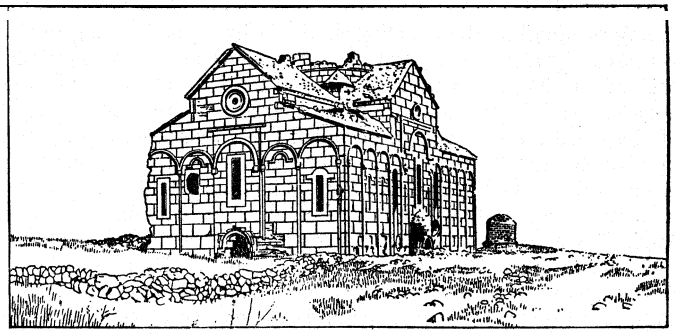
The **Bagratuni** Kingdom. — The Armenians constantly harassed the few Arab garrisons posted on some of the main roads. In 702 alone the Armenian *catholicos* (supreme head of the Church) intervened to make peace between the Armenian princes and the Arab Caliph. Armenian governors (Ostikans) were nominated by the Caliph. Under the leadership of the great Bagratuni (Bagratid) princes the country prospered so greatly that Ashot I. assumed the title of "Prince of Princes" and was recognized both by Basilius I. and the Caliph in 886, who made a treaty of friendship with King Ashot. The country developed and agriculture attained unusual prosperity. The magnificent cathedral of Ani, their capital on the Arpa-Chai, innumerable churches, monuments and irrigation works were built all over the country, the ruins of which stand out until to-day as a token of their constructive genius. A little later Prince Kagig Artsruni, another great Armenian family, crowned himself King of Vaspurakan (the province of Van). If Armenia failed under these Bagratuni and Artsruni kings to con-

solidate itself and become one of the powers of the region it is partly due to the constant Byzantine efforts to convert the Armenian church to orthodoxy, and partly to the Seljuk hordes which, after sweeping before them dozens of Arab and Persian Emiriates, appeared on the frontiers of Armenia. From 1020 onwards for about 40 years the Armenian kings fought and drove back wave after wave of Seljuk horsemen. But the Eastern Empire seized the opportunity to attack Ani and detain at Constantinople King Kagig I., who had gone there to discuss matters. Soon the empire paid the price of its treachery. The Seljuks overran the whole country and advanced into Greek Asia Minor. They established a united Government for Armenia and Kurdistan at Aklat. This Government, however, soon passed into the hands of Kurdish Shah-i-Armens (kings of Armenia) the first of whom was a cousin of the great Salaheddin, the Kurd. From 1240 onwards the Mongols occupied almost the whole of western Asia.

During these stormy times many Armenian families left their homes and went to Poland, Galicia and Byzantine lands; other families crossed the Taurus and established an independent kingdom in 1080 at Cilicia under Prince Rupen, a scion of the Bagratunis of Ani. This kingdom of Lesser Armenia had many dealings with the crusaders and made an alliance with the Mongols as against the Mamelukes of Egypt. It lasted until 1375 and the last King Leon VI. died in Paris and was buried at St. Denis. With the break-up of the rule of the Mongol Ilkhans in 1351, a large number of Kurdish, Armenian and Turkoman independent principalities arose all over the country, and the feudal lords of the valleys (Derebeys) reigned supreme over their small areas.

Turkish Occupation.— After the death of Timur in 1405, the Turkoman Ak-koyunlus established their rule at Diarbekir until they were overthrown by the Safavi Shah Ismail of Persia in 1502. This regeneration of Iran was however soon challenged by the Ottoman Turks, who in 1514–16 defeated Persia and within the next 40 years gradually established their rule over Armenia. In 1514, Sultan Selim I. entrusted Idris, a Kurdish Mollah "to reorganize" Armenia under the Turkish rule. Idris found the country bristling with castles of independent Derebeys of Kurdish and Armenian origin. Idris induced many Kurdish tribes south of Taurus to settle on Armenian lands in the north, and the Sultan gave them honours and administrative posts so as to use them against Persia. In spite of this organization of the country the sympathy of the people always remained with Persia.

In 1605 Shah Abbas transferred thousands of Armenians to New Julfa, near Isfahan, where they formed a prosperous colony in Central Persia, whence Armenian colonies expanded to India and the Far East, long before any European was allowed to trade. The periodic renewal of wars between Persia and Turkey in 1575, 1602 and under Nadir Shah partly devastated the frontier regions; but after the political troubles of the last centuries, the Ottoman rule accorded the country at least a certain measure of stability. The people suffered from a chronic anarchy; but after the capture of Constantinople 1453, Mohammed II. organized the Christian Communities of the Empire under their own ecclesiastical chiefs to whom he gave absolute authority in civil and religious matters and in criminal offences that did not come under the Muslim religious law. Under this system the Armenian Bishop Hovakim was appointed Patriarch of Constantinople by the Sultan and became practically not only the ecclesiastical but also the political leader of the Armenian nation (Ermeni Milleti) and a recognized officer of the Imperial Government. He was assisted by a council of clergy and was represented in each province by a bishop and his council. This practical self-government secured to the Armenians a recognized position before the law, the free enjoyment of their religion and national traditions, and the right to educate their children and manage their national and municipal affairs. It also encouraged the growth of a community life which eventually gave birth to a longing for national life. The leadership of the clergy, however, was bound to degrade the clergy itself, who often used unwarrantable methods for promotion to the detriment of their spiritual functions. After the issue, 1839, of the Hatti-i Sherif of Gulhaneh, the artisans and tradesmen asserted their rights to take part in the management of national affairs. The constitution approved by the Sultan in 1863 gave the Armenians in Turkey the status of a self-governing nation in a political sense under the sovereignty of Turkey. All real power passed into the hands of lay and clerical councils elected by the people. The national assembly at Constantinople consisted of 140 members representing about $2\frac{1}{2}$ million Armenians in Turkey. The education of the people received a fresh impetus at the hands of the representative councils. Early in the 18th century the Armenian Mekhitarist



THE RUINS OF THE CATHEDRAL AT ANI, ONE OF THE MANY FINE CHURCHES BUILT UNDER THE PRINCES OF THE HOUSE OF BAGRATIDES BETWEEN A.D. 702 AND 1060

Fathers had already established printing presses in Venice and Vienna, and had revived the Armenian and Greco-Roman classics. The more the reforming movement progressed in Turkey, the more the Armenians benefited by it.

Russia and the Armenians.— The Russians appeared in Transcaucasia and occupied Georgia in 1801. They gradually occupied also the Khanates of Shirvan and Sheki and by the war of 1828 against Persia they brought under their rule the whole plain of Erivan, including Echmiadzin, the seat of the Armenian catholicos. They assisted the Armenian Church to reorganize itself and as a modern State opened up great possibilities of economic and national progress. During 1829–77 the Armenians under the Russian rule increased and prospered considerably and played an important part in the economic development of Transcaucasia. Russia did not recognize an Armenian or any other question. She conquered territories, established order, and opened them up for enterprise.

"The Armenian Question."—When Abd-ul-Hamid came to the throne of Turkey in 1876 the conditions of Armenians both in Turkey and Russia were much better than they had been for centuries. But with the close of the Russo-Turkish war of 1878 came the "Armenian question" in consequence of British intervention. Russia occupied another slice of Georgia and Armenia including Batum, Kars, Ardahan, Erzerum and the upper Euphrates valley; but on the threat of war Great Britain demanded the evacuation of Erzerum, alleging that the safety of roads leading to India and commercial interests were being endangered. *(See* British Government Memo of April 1, 1878; Hertslet's Map of *Europe by Treaties,* vol. iv. p. 2,704.) Russia evacuated Erzerum and the upper Euphrates valley and as an alternative Turkey engaged to Russia by the Treaty of San Stephano to carry out reforms in the provinces "inhabited by the Armenians and to guarantee their security against the Kurds and the Circassians." Russia's aim was to attach permanently to her own interests some element in the population of the territory which she had been forced to evacuate; but it was a dubious piece of diplomacy to embroil the Armenians and the Kurds who had lived and defended themselves together from time immemorial when there were no European Powers.

By the Treaty of Berlin of July 1878, and owing to British insistence, a like engagement to the six signatory Powers was substituted for that of Russia. The same clause of "protection against the Kurds, etc." was again introduced. But before that Great Britain secretly concluded the convention of Cyprus with the Sultan for the "protection of the Christians and other subjects of the Porte" in Asia Minor. As a reward to Great Britain for defending the Asiatic frontiers of Turkey against Russia, and on condition that she should maintain the integrity of Turkey in Asia thereafter the Sultan authorized Great Britain to occupy Cyprus so long as

Kars, Ardahan and Batum remained in the hands of Russia. This British undertaking meant the prolongation of the oppressions of those peoples whom the Cyprus convention intended to protect, since Great Britain would not permit Russia to step in, and yet was not in a position to intervene effectively herself. It was generally admitted that this convention placed the Armenians under the special protection of Great Britain. But it seems that Lord Salisbury (Lady Gwendolen Cecil, *Life* of *the Marquess of Salisbury*, 1921, vol. ii. p. 321) did not then believe either in "reforms" or in any protection; the primary aim of British policy being to prevent Russia from occupying the Armenian fortresses. During a tour of the European capitals in 1877 Lord Salisbury found that none of the Great Powers took the slightest interest in the extent of the territory in Armenia occupied by Russia; therefore, when in 1880–82 the British Government was urging the Concert of Europe to common action, the Powers paid no attention. Thus the Armenian leaders, unwillingly and helplessly caught in the coils of Anglo-Russian rivalry, did nothing which might be interpreted as a deviation from the traditional loyalty to Turkey. Among the Armenians the common saying was that Turkey was their fatherland, and distinguished bishops and laymen expressed their unreserved mistrust of both Russia and Great Britain. But there were uninitiated Armenian teachers and poets who believed in the "Christendom and humanity" of Europe. The British and Russian ambassadors at Constantinople patronized Armenian charity balls and other social functions. British and Russian agents and press correspondents were interesting themselves greatly in the Armenian people and their conditions. Such courses are natural enough in Western countries, but in Turkey under the psychological conditions of those days, they struck an altogether different note.

Encouraged by these demonstrations, some Armenian teachers formed in 1885 a "revolutionary" society called Hunchak to educate and rouse the self-consciousness of the people. Another society called Daschnak was formed in 1890 in Tiflis with a more active programme, which consisted of writing songs, drilling the people in gymnastics and the use of arms. After the death of Patriarch Varjabedian who was involved in the Berlin Congress, the national assembly at Constantinople elected a new patriarch who declined to have any intercourse with foreign Powers. In Russia, Tsar Alexander II. was dead and the General Loris-Melikov, an Armenian nobleman who had conquered Kars and Erzerum in 1877, had lost his power. In accordance with her traditional policy, Russia after the war with Turkey concentrated her attention on Central Asia. Up to then Russia had been openly and unreservedly a friend to the Armenians, but concluding that the Armenian people in Turkey had been transformed into an instrument of British anti-Russian policy, she became hostile to the Armenians. By stages the use of the Armenian language was prohibited in Armenian schools in Transcaucasia; then the schools and institutions were closed, and finally all church properties were confiscated in 1903. In 1890 Russian frontier guards arrested and exiled to Siberia some 30 Armenians who wished to go to Erzerum to rescue their threatened compatriots. In face of this Russian hostility to Armenia, Great Britain did nothing to fulfil her obligations assumed by the Convention of Cyprus. After the occupation of Egypt in 1882 British interest towards the Armenians fluctuated, according as a political lever was required to bring pressure upon the Sultan. During 1887–88 Lord Salisbury both admitted and denied the British obligations regarding the Armenians. This ambiguity and the British friendship towards Bulgaria in 1886 encouraged the Armenian secret societies to believe that the more noise they made the more attention they would call upon their cause. The Sultan who up to then had still considered the Armenians as the "loyal nation," started persecutions and arbitrary imprisonments.

The Massacres.—Finally came the massacres. In the mountainous region of Sasun, in the Taurus, hardy Armenian and Kurdish communities had lived and defended themselves together from the days of Assyria. As throughout Armenia they had quarrelled over local matters, often a joint party of both races attacking another similar party. There had never been any race feeling or hatred. Some Armenian teachers had visited Sasun in the early '90s, but were not well received. In 1894 a party of Kurds attacked a party of Armenians and after a fight the quarrel seems to have been settled, when Abd-ul-Hamid fearing "revolutionary" activity sent regular troops to quell the "rebellion." About 300 Armenians were murdered and a few villages burnt by Turkish troops. In Nov. 1894 a Turkish commission of inquiry was sent to Armenia and was accompanied by the consular delegates of Great Britain, Russia and France. The latter two Governments had made no secret of their indifference in the matter, and Russia in particular was openly hostile. The commission elicited the fact that there had been no revolt, but did not state that it was merely a family quarrel. During the winter of 1894 the British Government with the lukewarm support of Russia and France, pressed for administrative "reforms" in the vilayets of Erzerum, Van, Bitlis, Diarbekir, Kharput, and Sivas. In May 1895 the three Powers presented to the Sultan an illusory scheme of "reforms" which was more calculated to broaden the breach between the Porte and its Armenian subjects than to achieve any results. Misguided young men, unaware of the political game of the contending Powers, renewed their activities in Constantinople in spite of the wise counsels of responsible Armenian leaders and clergy. Finally, the Sultan accepted the reform schemes in Oct. 1895, under British pressure. Simultaneously with the signing of the scheme the Sultan gave the signal for massacres. About 80,000 Armenians perished in the provinces. The American missionaries, who for the past sixty years had done a great educational work among the Armenians, and the French and Persian Consuls everywhere behaved in a chivalrous manner. In Van and Urfa, the townsmen offered armed resistance to the Turkish rabble. In Zeitun, in particular, the mountaineers held out against a regular Turkish siege, until the Powers intervened.

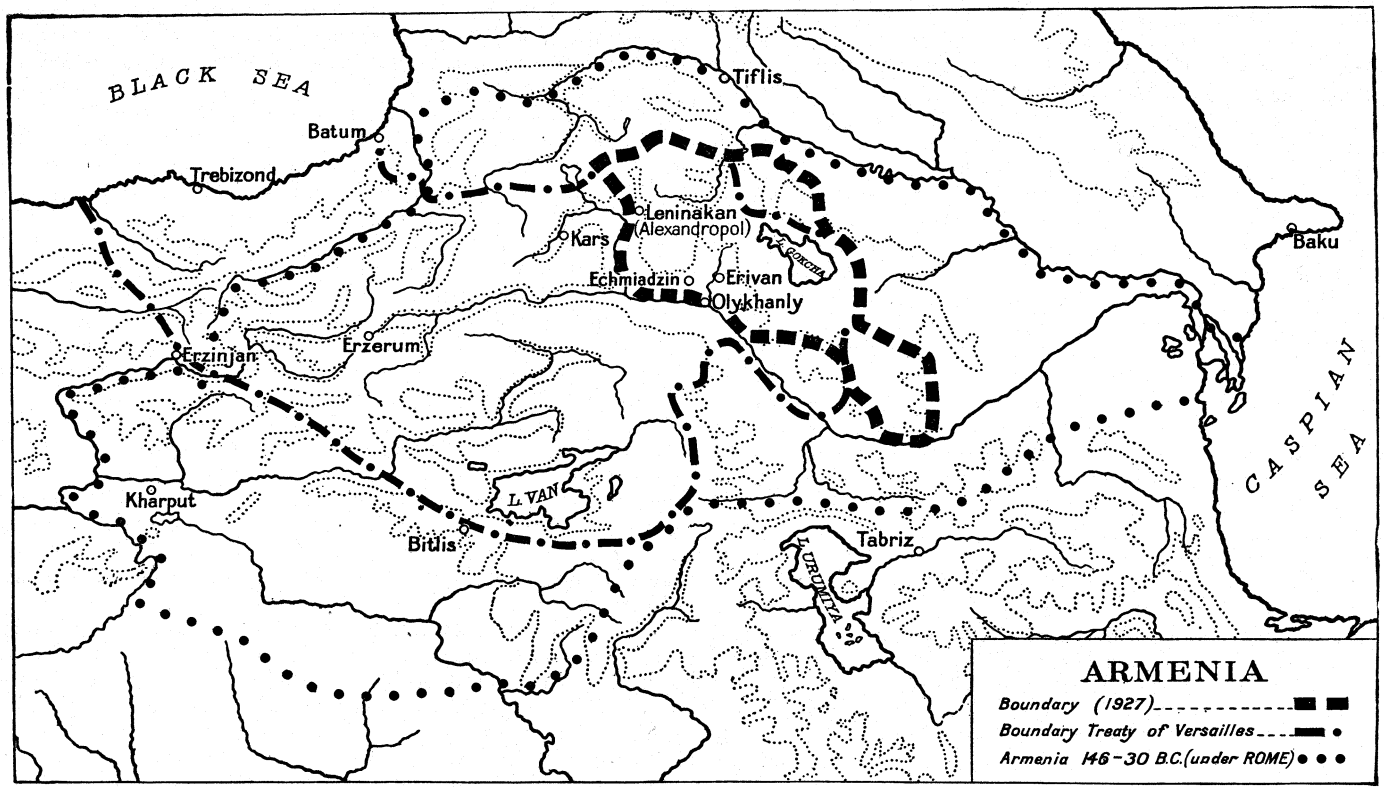
Exasperated at the massacres, some 20 Armenians attacked the Ottoman Bank in Constantinople in Aug. 1896. The European Ambassadors, however, instead of saving the innocent Armenians of the capital, secured the safety of those desperate "Nihilists" and sent them out of Turkey. In the following two days the organized Turkish mob murdered 6,000 people before the eyes of those Powers responsible for the protection of the Armenians.

In the same year the Armenians elected Mgr. Ormanian as patriarch. With the help of high Armenian officials of the Porte, the new patriarch conciliated the Sultan, who immediately proclaimed a general amnesty for Armenian political prisoners and set up *a* court to try some of the notorious murderers. Throughout the Ottoman Empire the Armenian element slowly recovered within the next decade and the "Dashnak" party started cultivating the traditional friendship with the Kurds and other neighbours.

The proclamation of the Turkish Constitution in 1908 was genuinely hailed by the Armenians as a new era of friendship. Notwithstanding the murders of Adana in 1909 the Young Turk administration produced noticeable improvement in the conditions of the Armenian people. Political refugees returned home and recovered their properties. Agriculture and trade made unusual progress resulting in great prosperity. Military service in the army and deputies in the chamber gave the Armenians a new status in Turkey.

The Armenian people in Transcaucasia under the Russian rule were in a not less favourable condition. Assisted by the Entente Powers Russia prepared a scheme of "reforms" for the Armenian vilayets under the supervision of European inspectors. Just as in 1878, no Armenian demanded reforms from the foreign Powers because in 1914, when the scheme was imposed on Turkey, the people on both sides of the frontier had never been more united and prosperous.

Armenians in the World War.—When the Turks entered the war, the Armenian leaders assured them of their loyalty. Harsh Turkish requisitions and ill-treatment of Armenian troops in the Turkish army caused racial friction. Armenian peasants in the war areas were driven from their homes and murdered. The successful self-defence of the Armenians of Van in April 1915, and Allied declarations of war aims induced the Turks to murder the Armenian people in Turkey. The scheme was carried out in June–July



MAP SHOWING THE FRONTIERS OF SOVIET ARMENIA. THE ANCIENT KINGDOM OF ARMENIA STRETCHED FROM THE BLACK SEA TO THE SHORES OF THE CASPIAN. THE AREA GIVEN AS THAT OF ROMAN ARMENIA IS OF COURSE ONLY APPROXIMATE. THE BOUNDARIES ALLOTTED TO ARMENIA UNDER THE VERSAILLES TREATY WERE NEVER OPERATIVE, AND THE FRAGMENT ENCLOSED IN HEAVY BORDER IS ALL THAT REMAINS

1915, with unparalleled barbarity: men, women and children were robbed and murdered indiscriminately and the remainder were deported to the desert to fend for themselves.

This "evacuation" of the Armenians produced a change in the attitude of the Entente Powers. The Grand Duke Nicholas conquered Armenia early in 1916, and proclaimed "the liberation of Armenia from the Turkish yoke"; but he tried to bar the surviving people from returning to their homes, because Russia had planned to colonize with Cossacks the fertile Armenian-Kurdish lands in the Arax and Euphrates valleys. In his Guildhall speech of 1916 the British Premier declared that his Government "was resolved to secure the liberation of this ancient (Armenian) people." Throughout the War many similar declarations and promises were made by British and partly also by French Premiers.

The Independence **of** Armenia. — After the Russian Revolution of 1917 the Armenians of Transcaucasia proclaimed their independence (with their capital at Erivan) under the auspices of German military leaders then in the Caucasus, and with the help of the Turks. On his accession to power Lenin proclaimed the union and independence of Armenian lands. But under the Brest-Litovsk Treaty of March 1918, Soviet Russia ceded the districts of Batum and Kars to the Turks, who advanced to capture them. After the armistice British and French authorities made some efforts to make Cilicia the home of Armenians, but it was abandoned by France in 1921.

At the peace conference at Paris 1919 Boghos Nubar Pasha and M. Aharonian, the Armenian delegates, were induced to demand "a great Armenia" extending from sea to sea. President Wilson was being urged to accept a mandate which the American senate did not want. Meanwhile, the Armenian delegates concluded an agreement with Kurdish delegates. In the conferences held in London and San Remo in the spring of 1920, the Armenian delegates pleaded their cause. But the Allied Powers were disingenuous towards Armenia as they had been before. In May 1920, Soviet Russia re-appeared in Transcaucasia. The Armenian delegates in Moscow were offered assistance if Armenia allowed transport of Russian troops over the Kars railway to go to the rescue of the Turks who were fighting the Greeks in Asia Minor. The Armenian Government rejected the Russian offer.

In August, 1920, the Armenian delegates signed the Treaty of Sèvres which recognized the de *jure* independence of the Armenian republic. Three months later, however, the Turks attacked Armenia and occupied Kars. After the Armenian Government had signed a treaty of peace with the Turks, Russia hurried troops to Erivan led by Armenian Communists and invited the Turks, by telegram, to stop any further advance.

S. S. Republic **of** Armenia. — A Soviet Armenian Government was established in Erivan in Dec. 1920. Since that time the Armenian Communist party, about 1,000 strong, has been governing the country. With the financial support of Soviet Russia, Georgia and Azerbaijan, the Armenian Government has established peace and a measure of prosperity. Barren lands and marshes have been reclaimed by a scientific system of irrigation and considerable encouragement is given to cotton and tobacco growing. Copper mines are in process of exploitation and schemes of generating electric power are in progress.

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ARMENIAN CHURCH. The earliest notice of an organized church in Armenia is in Eusebius, H. E. vi. 46, to the effect that Dionysius of Alexandria (*c.* 250) sent a letter to Meruzanes, bishop of the brethren in Armenia. There were many Christians

in Melitene at the time of the Decian persecution in A.D. 250, and two bishops from Great Armenia were present at the council of Nicæa in 325. King Tiridates (c. A.D. 238–314) had already been baptized some time after 261 by Gregory the Illuminator. The latter was ordained priest and appointed catholicus or exarch of the church of Great Armenia by Leontius, bishop of Caesarea in Cappadocia. This one fact is certain amidst the fables which soon obscured the history of this great missionary. Thus the church of Great Armenia began as a province of the Cappadocian see. But there was a tradition of a line of bishops earlier than Gregory in Siuniq, a region east of Ararat along the Araxes (Aras), which in early times claimed to be independent of the catholicus. Almost the earliest document revealing anything of the inner organization and condition of the Armenian church in the Nicene Age is the epistle of Macarius, bishop of Jerusalem, to the Armenian bishop, Verthanes, written between 325 and 33; and preserved in the Armenian language. Its genuineness has been unreasonably suspected. It insists on the erection of fonts; on distinction of grades among the ordained clergy; on not postponing baptism too long; on bishops and priests alone, and not deacons, being allowed to baptize and lay hands on or confirm the baptized; on avoiding communion with Arians; on the use of unleavened bread in the Sacrament, etc. The Armenians must, like the Georgians a little later, have set store by the opinion of the bishop of Jerusalem, or they would not have sent to consult him. It was equally from Jerusalem that they subsequently adopted their lectionary and arrangement of the Christian year; and a 9th century copy of this lectionary in the Paris library preserves to **us** precious details of the liturgical usages of Jerusalem in the 4th century. We can trace the presence of Armenian convents on the Mount of Olives as early as the 5th century.

Tradition represents the conversion of Great Armenia under Gregory and Tiridates as a sort of triumphant march, in which the temples of the demons and their records were destroyed wholesale, and their undefended sites instantly converted into Christian churches. The questions arise: how was the transition from old to new effected? and what was the type of teaching dominant in the new church? Armenian tradition, confirmed by nearly contemporary Greek sources, answers the first question. The old order went on, but under new names. The priestly families, we learn, hearing that the God preached by Gregory needed not sacrifice, sent to the king a deputation and asked how they were to live, if they became Christians; for until then the priests and their families had lived off the portions of the animal victims and other offerings reserved to them by pagan custom. Gregory replied that, if they would join the new religion, not only should the sacrifices continue, but they should have larger perquisites than ever. The priestly families then went over en *masse*. How far the older sacrificial rules resembled the levitical law we do not know, but in the canons of Sahak (c. 430), the priests already receive the levitical portions of the victims. The earliest Armenian rituals contain ample services for the conduct of an *agapē* (*q.v.*) or love feast held in the church off sacrificial meat. In the canons of the catholicus Sahak the priest is represented as eating the sins of the people in these repasts.

The mother church of Armenia was established by Gregory at Ashtishat in the province of Taron, on the site of the great temple of Wahagn, whose festival on the 7th of the month Sahmi was reconsecrated to John the Baptist and Athenogenes, an Armenian martyr and Greek hymn writer. The first of Kavasard, the Armenian new year's day, was the feast of a god Vanatur or Wanadur (who answered to Ζεὺς ξένιος) in the holy pilgrim city of Bagawan. His day was reconsecrated to the Baptist, whose relics were brought to Bagawan. The feast of Anahite, the Armenian Venus and spouse of the chief god Aramazd, was in the same way rededicated to the Virgin Bfary, who for long was not very clearly distinguished by the Armenians from the virgin mother church. The old cult of sacred stones and trees by an easy transition became cross-worship, but a cross was not sacred until the Christ had been, by priestly prayer and invocation, transferred into it.

Another survival in the Armenian church was the hereditary priesthood. None but a scion of a priestly family could become a deacon, elder, or bishop. Accordingly (except for an interregnum of 25 years) the primacy remained in the family of Gregory until the end of the 4th century, when it was transferred to another family. But by this time the autonomy of the Armenian church was thoroughly established. The right of saying grace at the royal meals, which was the essence of the catholicate, was transferred by the king, in despit of the Greeks, to the priestly family of Albianus, and thenceforth no Armenian catholicus went to Caesarea for ordination. The ties with Greek official Christendom were snapped for ever, and in subsequent ages the doctrinal preferences of the Armenians were usually determined more by antagonism to the Greeks than by reflection. If they accepted the Council of Ephesus in 430 and joined in the condemnation of Nestorius, it was rather because the Sassanid kings of Persia, who thirsted for the reconquest of Armenia, favoured Nestorianism, a form of doctrine current in Persia and rejected in Byzantium. But later on, about 480, and throughout the following centuries, the Armenians rejected the decrees of Chalcedon and held that the assertion of two natures in Christ was a relapse into the heresy of Nestor. From the close of the 5th century the Armenians have remained monophysite, like the Copts and Abyssinians, and have only broken the record with occasional short interludes of orthodoxy.

Monastic institutions were hardly introduced in Armenia before the 5th century, though Christian rest-houses had been erected along the high-roads long before. Out of these grew the monasteries. The monks were, strictly speaking, penitents wearing the cowl, and not allowed to take a part in church government. This belonged to the elders. At first there was no separate episcopal ordination, and the one rite of elder or priest sufficed. There were also deacons, half-deacons, and readers. Besides these there was a class of *wardapets* or teachers, answering to the didascalos of the earliest church, whose province it was to guard the doctrine and for whom no rite of ordination is found in the older rituals.

A few other peculiarities of Armenian church usage or belief deserve notice. In baptism the rubric ordains that the baptized be plunged three times in the font in commemoration of the entombment during three days of the Lord. In the West trine immersion was generally held to be symbolic of the triune name of "Father, Son, and Holy Ghost." This name the Armenians have used, at least since the year 700; before which date their fathers often speak of baptism into the death of Christ as the one essential. As late as about 1300 a traveller hostile to the Armenians reported to the pope that he had witnessed baptisms without any trinitarian invocation in as many as 300 parish churches.

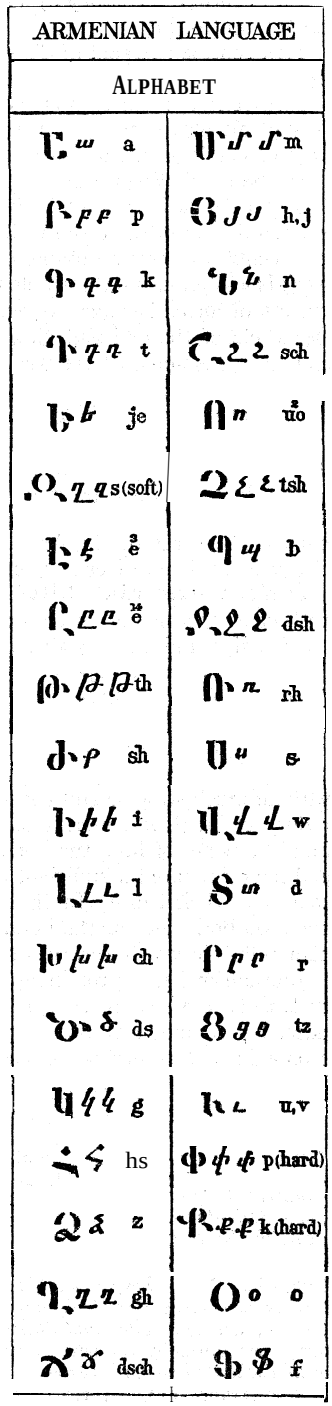
There were abortive attempts to unite the Armenian Church with the Byzantine in the 9th century under the patriarch Photius, and again late in the 12th under the emperor Manuel Comnenus, when a joint council met at Romkla, near Tarsus, but ended in nothing (A.D. 1179). Neither could the Armenians keep on good terms even with the Syriac Monophysites. From the age of the crusades on, the Armenians of Cilicia, whose patriarch sat at Sis, improved their acquaintance with Rome; and more than one of their patriarchs adopted the Roman faith, at least in words. Dominican missions went to Armenia, and in 1328, under their auspices, was formed a regular order called the United Brethren, the forerunners of the Uniats of the present day, who have convents at Venice and Vienna, a college in Rome, and a numerous following in Turkey. They retain their Armenian liturgies and rites, pruned to suit the Vatican standards of orthodoxy, and they recognize the pope as head of the church.

The recent history of the Armenian Church is inseparable from the history of the Armenian people during and after the World War. Previous to the World War, and after the settlement (if such it can be called) following the Balkan War of 1913, the Armenian population of over 3,000,000, between the Euphrates and the Kura, constituted a strong and healthy nationality. But from the year 1915 onwards the greater part of the population of Turkish Armenia was expelled from its territory. Large numbers were massacred or perished in their wanderings on the mountains. In 1921, the Armenian Republic of Erivan, in Russian

Transcaucasia, adopted the Soviet régime and became part of the Federated Union of Socialist Soviet Republics. Hundreds of thousands of Armenian refugees have fled to Syria, Mesopotamia, Transcaucasia, as well as to Greece and Russia. The disintegration of national religious customs and traditions, involved in these events, needs no comment.

See the articles ARMENIA; ARMENIAN LANGUAGE and ARMENIAN LITERATURE, with the references there given; also (pre-war) articles ARMENIA, ARMENIANS, in Hastings' *Encyclopaedia of Religion and Ethics*, vol. i., **and** Conybeare, *Rituale Armenorum* (Oxford, 1905).

ARMENIAN LANGUAGE. The Armenian language is an independent member of the Indo-European family of languages (*q.v.*) which, spoken in a mountainous region, has never spread widely or permanently. It possesses great vitality despite many persecutions. It was not reduced to writing until the spread of Christianity in Armenia when, according to tradition, in the 5th century, an alphabet was drawn up to suit it. In the language as then written were composed translations of the Bible and other pious works as well as original compositions such as that by Bishop Eznik. This language-is still preserved as the ritual language of the Gregorian or Armenian Church, and up to the 19th century was the language used by Armenian scholars.



The spoken language meanwhile evolved independently and in all parts of the country differed widely from the literary language. Lay writers used the forms current in their region, so that from the time of the Crusades we have historic tents in the vulgar speech of the Armenian Kingdom in Cilicia as then constituted. When in the 19th century modern literary languages appeared, there was great diversity in form. Some Armenians were then Russian subjects, others under Ottoman rule, yet others under Persia. One literary language developed at Erivan under Russian rule and was used by the numerous Armenians settled at Tiflis. Another was formed at Constantinople, where from the days of the Byzantine emvire there had been an important Armenian colony. Both these languages deliberately eliminated words brought in under Islamic and Turkish domination and replaced them by true Armenian words largely taken from the old written language, and thus in vocabulary both agree in many points. Pronunciation and grammar have diverged considerably though true to the general linguistic type. Thus in Erivan Armenian, Jacob is pronounced Hakob and in Turkish Armenian is *Hagop*.

Armenian is the continuation of a group of Indo-European languages intermediate between Indo-Iranian (Aryan) and Greek but distinct from both. As a result of contact with other languages, Armenian has developed in its own way and is widely removed from the early Indo-European type.

The consonantal system coincides largely with that of the southern group of Caucasian languages, represented by Georgian. The so-called occlusive consonants, *p, t*, k, and b, d, g, have undergone complete mutation, so that where Indo-European has a d, there is a *t*, thus the numeral tasn for ten corresponds to the ancient form decem as in Latin, cf. Armenian *hayr*=father, Gothic fadar and Latin *pater*. The changes from the original form have been considerable as in the numerals two and three, which in Latin are *duo* and fre and in Armenian are erku and erekh.

The grammatical forms are traceable to Indo-European origins but assumed new shapes. Thus grammatical gender had disappeared from Old Armenian. A good number of old words has been preserved, such as *kev*=cow, showing the mutation of g to k. The old form had a g as in the Sanskrit gav. Words of higher culture are mainly borrowed since Armenian has always been exposed to foreign influence. From the 3rd century B.C. to the 3rd century after Christ the country was ruled by a Parthian aristocracy, so that the language has many Iranian words. The terminology of Christianity came with the spread of the Syrian and Byzantine Churches, and there are Greek words and from the time of the Crusades French words.

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ARMENIAN LITERATURE. The Armenians had a temple literature of their own which was destroyed in the 4th and 5th centuries by the Christian clergy so thoroughly that barely 20 lines of it survive in the history of Moses of Khoren (Chorene). Their Christian literature begins about A.D. 400 with the invention of the Armenian alphabet by Mesrop. The alphabet once perfected, the catholicus Sahak formed a school of translators who were sent to Edessa, Athens, Constantinople, Alexandria, Antioch, Caesarea in Cappadocia, and elsewhere, to procure codices both in Syriac and Greek and translate them. From Syriac were made the first version of the New Testament, the version of Eusebius' History and his Life of Constantine (unless this be from the original Greek), the homilies of Aphraates, the Acts of Gurias and Samuna, the works of Ephrem Syrus (partly published in four volumes by the Mechitharists of Venice). They include the commentaries on the *Diatessaron* and the Paulines, Laboubna and History of Addai, the Syriac canons of the Apostles.

From the original Greek were rendered in the 5th century many authors and works including Eusebius' Chronicon, and Josephus on the Jewish War.

An asterisk (*) is prefixed to the names of works which have been printed.

The Armenians were so busy in this century translating Greek and Syriac fathers that they have left little that is original. Still a number of historical works survive: *Faustus of Byzantium relates the events of the period A.D. 344–392 in a work instinct with life and racy of the soil. It was perhaps first composed in Greek, but it gives a faithful picture of the court of the petty sovereigns of Armenia, of the political organization, of the blood feuds of the clans, of the planting of Christianity. Procopius preserves some fragments of the Greek. The "History of *Taron*, by Zenobius of Glak, is a somewhat legendary account of Gregory the Illuminator, and may have been written in Syriac in the 5th, though it was only Armenized in a later century.

*Elisaeus Wardapet wrote a history of Wardan (Vardan), and of the war waged for their faith by the Armenians against the Sassanids. He was an eye-witness of this struggle, and gives a good account of the contemporary Mazdaism which the Persians tried to force on the Armenians. *Lazar of Pharp wrote a history embracing the events of the 5th century up to the year 485, as a continuation of the work of Faustus.

*A history of St. Gregory and of the conversion of Armenia by Agathangelus is preserved in Greek, Armenian, and Arabic.

The *History of Armenia by Moses of Khoren (Chorene) relates events up to about the year 450. Some critics put down the date of composition as low as about 700, and it was certainly retouched in the late 6th century.

*A long volume of rhetorical exercises, based on Aphthonius, is also ascribed to Moses of Khoren, and appears to be of the 5th century. The *geography which passes under his name may belong to the 7th century. Various homilies of Moses survive, as also of Elisaeus.

Goriun wrote in this century a *Life of Mesrop, and Eznik a *Refutation of the Sects, based largely on antecedent Greek works. The sects in question are Paganism, Mazdaism, Greek Philosophy, and Manichaeism.

Of the 6th and 7th centuries few works survive. To the late 7th century belong the *calendarial works of Ananiah of Shirak, who also has left a **chronicon* compiled from Eusebius, Andreas of Crete, Hippolytus, and other sources. The chief literary monument of the 7th century is the "history of the wars of Heraclius and of the early Mohammedan conquests in Asia Minor, by the bishop Sebeos, who was an eye-witness. The *history of the Albanians of the Caucasus, by Moses Kalankatuatzi, also belongs to the end of this century. To this century also seems to belong the Armenian version of a "history of the Iberians, by Djuansher, a work full of valuable information.

The early 8th century was a time of great literary activity. Gregory Asheruni wrote an important "commentary on the Jerusalem Lectionary, and his friend *John the catholicus (717–728) commentaries on the other liturgical works of his church; he also collected all existing canon law, Greek or Armenian, respected in his church, wrote *against the Paulicians and Docetae, and composed many beautiful hymns. *Leoncius the priest has left a history of the first caliphs.

In the 9th century Zachariah, catholicus, the correspondent of Photius, wrote many eloquent homilies for the various church feasts. Shapuh Bagratuni wrote a history of his age, now lost. Mashtotz, catholicus, collected in one volume the Armenian rituals.

In the 10th century (*c.* 925) the catholicus John VI. issued his "history of Armenia, and Thomas Artsruni a *history of his clan carried up to the year 936. Ananias of Mok (943–965) wrote a great work against the Paulicians, unfortunately lost. Chosroes wrote a *commentary on the eucharistic rites and breviary, *Mesrop a history of Nerses the Great; *Stephen of Asolik wrote a history of the world, and a commentary on Jeremiah; *Gregory of Narek his famous meditations and hymns.

In the 11th century John Kozerhn wrote a history, now lost, as well as a work on the Armenian calendar; Stephen Asolik a *history of Armenia up to the year 1004; *Aristaces of Lastiverd a valuable history of the conquest of Armenia by the Seljuk caliphs.

The 12th century saw many remarkable writers mostly in Cilician Armenia, viz., Nerses the Graceful (d. 1165), author of an *Elegy on the taking of Edessa, of *voluminous hymns, of long "Pastoral Letters and Synodal orations of value for the historian of eastern churches. *Samuel of Ani composed a chronicle up to 1179. Nerses of Lambron, archbishop of Tarsus, left a *Synodal oration, a *Commentary on the liturgy, etc., and his contemporary Gregory of Tlay an *Elegy on the capture of Jerusalem and various *dogmatic works. In this century the *history of Michael the Syrian was translated; Ignatius and Sargis composed *commentaries on Luke and *the catholic epistles, and *Matthew of Edessa a valuable history of the years 952–1136, continued up to 1176 by Gregory the priest. Mechithar (Mekhitar) Kosh (d. 1207) wrote an elegant *Book of Fables, and compiled a *corpus of civil and canon law (partly from Byzantine codes).

In the 13th century the following works or authors are to be noticed:—*history of Kiriakos of Ganzak, which contains much about the Mongols, Georgians, and Albanians; *Malakia the monk's history of the Tatars up to 1272; "Chronicle of Mechithar of Ani (fragmentary); *Vahram's rhymed chronicle of the kings of Lesser Armenia; *history of the world, by Vartan, up to 1269.

14th century: "history of Siunik, by Stephen Orbelian, archbishop of that province (1287–1304); *Sempat's chronicle of Lesser Armenia (952–1274), carried on by a continuator to 1331; *Mechithar of Airivanq, a chronography; *Hethoum's account of the Tatars, and chronography of the years 1076–1307. John of Orotn (d. 1388) compiled commentaries on John's gospel and the Paulines, and wrote homilies and monophysite works; his disciple Gregory of Dathev (b. 1340) compiled a **Summa* theologiae called the Book of Questions, in the style of the Summa of Aquinas, which had been translated into Armenian (c. 1330), as were a little later the *Summa of Albertus and works of other schoolmen.

15th century: "History of Tamerlane, by Thomas of Medsoph, carried up to 1447.

17th century: Araqel of Tabriz wrote a "history of the Persian invasions of Armenia in the years 1602–1661.

18th century: the catholicus Abraham of Crete wrote the history of his own times (1734–1736), and his relations with Nadir, shah of Persia, at whose coronation he was an eye-witness.

In the above list are not included a number of medical, astrological, calendarial, and philological or lexicographic works, mostly written during or since the Cilician or crusading epoch. Since the 15th century a certain number of profane poets have arisen, whose work is less jejune on the whole than that of the hymn and canticle writers of an earlier age. Gregory Magistros (d. 1058) abridged the whole of the Old and New Testaments in a *rhyming poem, and set a fashion to later writers. Such works as *Barlaam and Josaphat, the *History of the Seven Sages, the *Wisdom of *Ahikar,* the *Tale of the City of Bronze, were freely turned into verse in the 13th and following centuries.

The 16th century saw the first books printed in Armenian. The press which has done most in printing Armenian authors is that of the Mechitharists of Venice. There in 1836 was issued a magnificent thesaurus of the Armenian language, with the Latin and Greek equivalents of each word.

Modern Armenian Literature.— About the middle of the 19th century a modern school of literature came into existence in the Russian and Turkish districts of Armenia. The new literary language was based respectively on the modern dialects of Ararat (*q.v.*) and Constantinople, differing considerably in grammar, but not in vocabulary, from ancient classical Armenian, which had been almost unintelligible to the people since the middle ages. The change from the old school to the new naturally did not take place without much struggle and controversy, but the modern school can rightly claim three generations of new writers who have worked in all branches of literature — poetry, novels, drama, satire, etc.— and have produced a sufficient number of valuable literary works to justify their cause. In the meantime great efforts have been made on both sides of the boundary to collect and publish Armenian folk-lore which deserves special attention.

Journalism has a prominent place in modern Armenian literature, to such an extent that, in spite of the present scattered and unsettled condition of the people, and notwithstanding the great economic and numerical loss during and after the World War, there are more than 70 newspapers and periodicals published in various parts of the world in the modern literary language.

(F. C. C.; S. T.)

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ARMENOID, a term devised by Deniker to indicate one of the three brunette sub-types of the broad-headed complex of white races. The Armenoid sub-type is very peculiar; it has the head abruptly flattened behind, especially in the Ararat mountain-region peoples. The head is characterized by a very lofty vault with outward-drooping orbits, and the abrupt flattening of the

back of the head has been erroneously ascribed to artificial deformation by both ancient and modern writers.

ARMENTIÈRES, a town of France, department of Nord, on the Lys, 13 mi. W N.W. of Lille by rail. Pop. (1936) 22,446. Before its complete destruction (1914–1918) it was important for spinning and weaving of flax and cotton, bleaching, dyeing and the manufacture of machinery. Its association with textiles goes back to the woollen industry of the middle ages. Two miles behind the British lines during most of World War I, it was lost in the German advance of April 1918. Before World War II, it had recovered from these devastations. There is a board of trade arbitrators and a chamber of commerce.

ARMET, a form of helmet which was developed out of existing forms in the latter part of the 15th century (diminutive of Fr. *arnte).* It was round in shape, and often had a narrow ridge or comb along the top, It had a pivoted or hinged vizor and nose-piece, and complete chin, neck and cheek protection, closely connected with the gorget. It was distinguished from the basinet by its roundness, and by the fact that it protected the neck and chin by strong plates, instead of a "camail" or loose collar of mail; from the salade and heaume by its close fit and skull-cap shape; and from the various forms of vizored burgonets by the absence of the projecting brim. It remained in use until the final abandonment of the complete closed head-piece.

ARMFELT, GUSTAF MAURITZ, COUNT (1757–1814), son of Charles II.'s general, Carl Gustaf Armfelt, was born in Finland March 31 1757. Gustavus III. of Sweden employed him in the negotiations with Catherine II. (1783) and with the Danish Government (1787), and during the Russian war of 1788–90 he was one of the king's most trusted and active counsellors. He displayed great valour in the field. In 1788 when the Danes unexpectedly invaded Sweden and threatened Gothenburg, it was Armfelt who, under the king's directions, organized the Dalecarlian levies and led them to victory. He remained absolutely faithful to Gustavus when nearly the whole of the nobility fell away from him; brilliantly distinguished himself in the later phases of the Russian war; and was the Swedish plenipotentiary at the conclusion of the Peace of Verelā. During the last years of Gustavus III. his influence was paramount, though he protested against his master's headstrong championship of the Bourbons.

On his death-bed Gustavus III. (1792) committed the care of his infant son to Armfelt and appointed him a member of the council of regency; but the anti-Gustavian duke-regent Charles sent Armfelt as Swedish ambassador to Naples to get rid of him. From Naples Armfelt communicated with Catherine II., urging her to make a military demonstration in favour of the Gustavians The plot was discovered by the regent's spies, and Armfelt only escaped from the man-of-war sent to Naples to seize him with the assistance of Queen Caroline. He now fled to Russia. When Gustavus IV. attained his majority, Armfelt was completely rehabilitated and sent as Swedish ambassador to Vienna (1802), but was obliged to quit that post two years later for sharply attacking the Austrian Government's attitude towards Bonaparte. From 1805 to 1807 he was commander-in-chief of the Swedish forces in Pomerania, where he retarded the conquest of the duchy as long as it was humanly possible.

Armfelt was the most courageous of the supporters of the crown prince Gustavus. and was expelled from Sweden. He found refuge in Russia, where he obtained great influence over Alexander I. He contributed more than anyone else to the erection of the grand-duchy into an autonomous State. and was its first and best governor-general. The plan of the Russian defensive campaigns is, with great probability, also attributed to him, and he gained Alexander over to the plan of uniting Norway with Sweden. He died at Tsarskoe Selo, Aug. 19, 1814.

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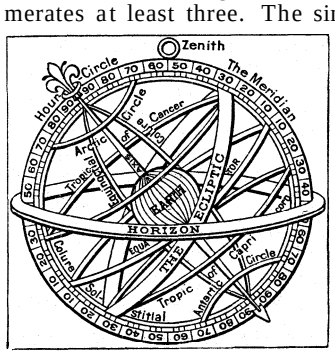
ARMIDALE, a town in Sandon county, is situated on the New England plateau towards the north-east corner of New South Wales. The undulating upland surfaces afford space for settlement, and Armidale is a typical New England town. It is situated at a height of 3,313ft.—an elevation which, in spite of the latitude (30° 32' S.), gives it a cool and bracing climate and a sufficient rainfall (mean annual 31–32in) derived mainly from the Pacific side. Armidale is the centre of a thriving agricultural and pastoral area. Mining (tin, gold, antimony) is carried on in the surrounding areas (though the mines are mostly small) and the streams of the south-eastern gorges and valleys (Gara, Chandler, Okey, Styx) are capable of yielding hydro-electric power, the development of which is projected. Climate, attractive scenery, and a convenient position on the main Northern line (Sydney–Brisbane) have helped to make Armidale an educational and ecclesiastical centre. It possesses several fine schools, besides two cathedrals (Anglican and Roman Catholic). It has been a municipality since 1863 and has grown steadily in population (1891: 3,826; 1933: 6,794), though the population of the district served is considerably greater.

ARMIGER: *see* ESQUIRE.

ARMILLA or **ARMILLARY SPHERE,** an astronomical model representing the great circles of the heavens, including in the complete instruments, the equator, meridian, ecliptic, and tropics. It is a skeleton celestial globe, with circles divided into degrees for angular measurement. In the 17th and 18th centuries such models, either suspended, rested on a stand. or affixed to a handle, were used to show the difference between the Ptolemaic theory of a central earth, and the Copernican theory of a central sun.

The earliest known complete armillary sphere with nine circles is believed to have been the *meteoroskopion* of the Alexandrine Greeks (C. A.D. 140), but earlier and simpler types of ring instruments were also in general use. Ptolemy in the Almagest, enumerates at least three. The simplest of all was the *Equinoctial Armilla,* a ring of bronze fixed in the plane of the equator. At Rhodes and elsewhere the arrival of the equinoxes was noted by observing when the shadow of the upper half of the ring exactly covered the lower half. Similarly, the *Solstitial Armilla,* a double ring erected in the plane of the meridian with a rotating inner circle was used for measuring solar altitudes, and probably by Eratosthenes (276–196 B.C.) for measuring the obliquity of the ecliptic. Hipparchus (160–125 B.C.) is stated to have used a sphere of four rings and in Ptolemy's instrument *astrolabon* (A.D. 139) there were diametrically disposed tubes upon the graduated circles, the instrument being kept vertical by a plumb line.



AFTER BLUNDERVILLE, "A PLAINE TREATISE OF COSMOGRAPHIE 1594

AN ARMILLARY SPHERE

The earth is equipped with a visible axis, and the imaginary circles of astronomy are represented by metal rings

The Arabs employed similar instruments with diametric sight rules or alidades, and it is likely that those made and used in the 12th century by Moors in Spain were the prototypes of all later European armillary spheres. One large Chinese armillary sphere in Pekin is said to date from 1274, but another belongs to the period of 17th century Jesuit astronomers. **(R. T. G.)**

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ARMIN, FRIEDRICH SIXT VON: *see* SIXT VON ARMIN.

ARMINIUS, the Latinized form of the name HERMANN, or more probably ARMĪN (17 B.C.–A.D. 21), the German national hero. He was a son of Segimer, a prince of the tribe of the Cherusci (*q.v.*), and in early life served in the Roman armies. Returning to find his people chafing under the yoke of the Roman governor, Quintilius Varus, he fomented rebellion, and, in the autumn of A.D. 9. surprised Varus in the Teutoburger Wald, and utterly destroyed three legions. This disaster caused panic at Rome and forced the Romans to withdraw their frontier from the Elbe to

the Rhine. Then in A.D. 15, Germanicus Caesar led the Romans against Arminius, and captured his wife, Thusnelda. An indecisive battle was fought in the Teutoburger Wald, where Germanicus narrowly escaped the fate of Varus, and in the following year Arminius'was defeated. But the campaigns had been so costly that Germanicus was recalled, and the Romans gave up for ever the idea of the Elbe frontier. The hero's later years were spent in fighting against Marbod, prince of the Marcomanni, and in disputes with his own people. He was murdered in A.D. 21.

In 1875 a great monument to Arminius was completed. This stands on the Grotenburg mountain near Detmold. Klopstock and other poets have used his exploits as material for dramas.

Much discussion has taken place with regard to the exact spot in the Teutoburger Wald where the great battle between Arminius and Varus was fought. There is an immense literature on this subject, and the following may be consulted:—T. Mommsen, *Die Ortlichkeit der Varusschlacht* (1885); *E.* Meyer, *Untersuckungen über die Schlacht im Teutoburger Walde* (1893); A. Wilms, *Die Schlacht im Teutoburger Walde* (1899); F. Knoke, *Das Schlachtfeld im Teutoburger Walde* (1899); *E.* Diinzelmann, *Der Schauplatz der Varusschlacht* (1889); and P. Hofer, *Die Varusschlacht* (1888). For more general accounts of Arminius *see:* Tacitus, *Annals,* edited by H. Furneaux (Books I. and II.) (1884–91); O. Kemmer, *Arminius* (1893); F. W. Fischer, *Armin und die Romer* (1893); *W.* Uhl, *Das Portrait des Arminius* (1898); *F.* Knoke, *Die Kriegszüge des Germanicus in Deutschland* (1887); and W. A. Oldfather and H. V. Cantor, "The Defeat of Varus," in *Univ.* of *Illinois studies in the Social Sciences* (Urbana, Ill., 1915).

ARMINIUS, JACOBUS (1560–1609), Dutch theologian, author of the modified reformed theology that receives its name of Arminianism from him, was born at Oudewater, South Holland, Oct. 10 1560. Arminius is a Latinized form of his patronymic Hermanns or Hermansen. His father, Hermann Jakobs, a cutler, died while he was an infant, leaving a widow and three children. Theodorus Aemilius, a priest, who had turned Protestant, adopting Jakobs, sent him to school at Utrecht, but died when his charge was in his 15th year. Rudolf Snellius (Snel van Roijen, 1546–1613), the mathematician, a native of Oudewater, then a professor at Marburg, happening at the time to visit his early home, met the boy, saw promise in him and undertook his maintenance and education. He had just settled at Marburg when the news came that the Spaniards had besieged and taken Oudewater, and murdered its inhabitants almost without exception. Arminius hurried home, but only to find all his relatives killed. Arminius was then sent to study theology at the newly established University of Leiden. The six years he remained at Leiden (1576–82) were years of active and innovating thought in Holland. The War of Independence had started conflicting tendencies in men's minds. To some it seemed to illustrate the necessity that the State should tolerate only one religion, but to others the necessity that the State should tolerate all religions. Dirck Coornhert argued in private conferences and public disputations that it was wrong to punish heretics and his great opponents were as a rule the ministers, who maintained that there was no room for more than one religion in a State. Caspar Koolhaes, the heroic minister of Leiden—also its first lecturer in divinity—pleaded against a too rigid uniformity; for such an agreement on "fundamentals" as had allowed Reformed Lutherans and Anabaptists to unite. Leiden had been happy, too, in its first professors. There taught in theology Guillaume Feuguières or Feuguereius (d. 1613), a mild divine, who had written a treatise on persuasion in religion, urging that "men could be led, not driven" in religious matters; Lambert Danaeus, who deserves remembrance as the first to discuss Christian ethics scientifically, apart from dogmatics; Johannes Drusius, the orientalist, one of the most enlightened and advanced scholars of his day, settled later at Franeker; Johann Kolmann the younger, best known by his saying that high Calvinism made God "a tyrant and an executioner." Snellius, Arminius's old patron, now removed to Leiden, expounded the Ramist philosophy, and did his best to start his students on the search after truth, unimpeded by the authority of Aristotle. Under these men and influences, Arminius pursued his studies. In 1582 he went to Geneva, studied there awhile under Theodore Beza, but owing to his active advocacy of the Ramist philosophy, soon had to remove to Basel. After a short but brilliant career there, he turned to Geneva, studied for three years, travelled, in 1586, in Italy, heard Giacomo Zarabella (1533–89) lecture on philosophy in Padua, visited Rome, and, open-minded enough to see its good as well as its evil, was suspected by the stern Dutch Calvinists of leanings toward Catholicism. Next year he was called to Amsterdam, and there, in 1588, was ordained. In 1603 he was called, in succession to Franz Junius, to a theological professorship at Leiden, which he held till his death on Oct. 19 1609.

Arminius is the founder of the anti-Calvinistic school in Reformed theology, which created the Remonstrant Church in Holland (see REMONSTRANTS), and contributed to form the Arminian tendency or party in England. He was a man of mild and liberal spirit, broadened by varied culture, constitutionally averse to narrow views and enforced uniformity. He lived in a period of severe systematizing. Calvinism had become, towards the close of the 16th century, supreme in Holland, but the very rigour of the uniformity it exact'ed provoked a reaction. Coornhert could not plead for the toleration of heretics without assailing the dominant Calvinism, and so he opposed a conditional to its unconditional predestination. The two ministers of Delft, who had debated the point with him, had, the better to turn his arguments, descended from the supralapsarian to the infralapsarian position; *i.e.,* had made the divine decree succeed the Fall rather than to precede or determine it. This seemed to the high Calvinists of Holland a grave heresy. Arminius, fresh from Geneva, familiar with the dialectics of Beza, was simultaneously invited in 1589 by the ecclesiastical court of Amsterdam to refute Coornhert, and by Martin Lydius, professor at Franeker, to combat the two infralapsarian ministers of Delft. Thus led to confront the questions of necessity and free will, his own views became unsettled, and the further he pursued his inquiries the more he was inclined to assert the freedom of man. This change occasioned much controversy in the ecclesiastical courts where, however, he successfully defended his position. The controversy was embittered and the differences sharpened by his appointment to the professorship at Leiden. He had as colleague Franz Gomarus, a strong supralapsarian, perfervid, irrepressible; and their collisions, personal, official, political, tended to develop and define their respective positions.

Arminius died, worn out by uncongenial controversy and ecclesiastical persecution, without having developed any logical and consistent system such as that maintained by his successor, Simon Episcopius. His work was rather a criticism than a new logical creed. His position with regard to the supralapsarian and infralapsarian doctrines has been thus summarized by Dr. Fairbairn: "He held that it (the doctrine) made God the author of sin,. that it restricted his grace, that it left multitudes outside without hope, that it condemned multitudes for believing the truth; viz., that for them no salvation was either intended or provided in Christ, and it gave an absolutely false security to those who believed themselves to be the elect of God."

Arminius's works are mostly occasional treatises drawn from him by controversial emergencies, but they everywhere exhibit a calm, well furnished, undogmatic and progressive mind. He was essentially an amiable man who hated the zeal for an impossible orthodoxy that constrained "the church to institute a search after crimes which have not betrayed an existence, yea, and to drag into open contentions those who are meditating no evil." His friend Peter Bertius, who pronounced his funeral oration, closed it with these words: "There lived a man whom it was not possible for those who knew him sufficiently to esteem; those who entertained no esteem for him are such as never knew him well enough to appreciate his merits."

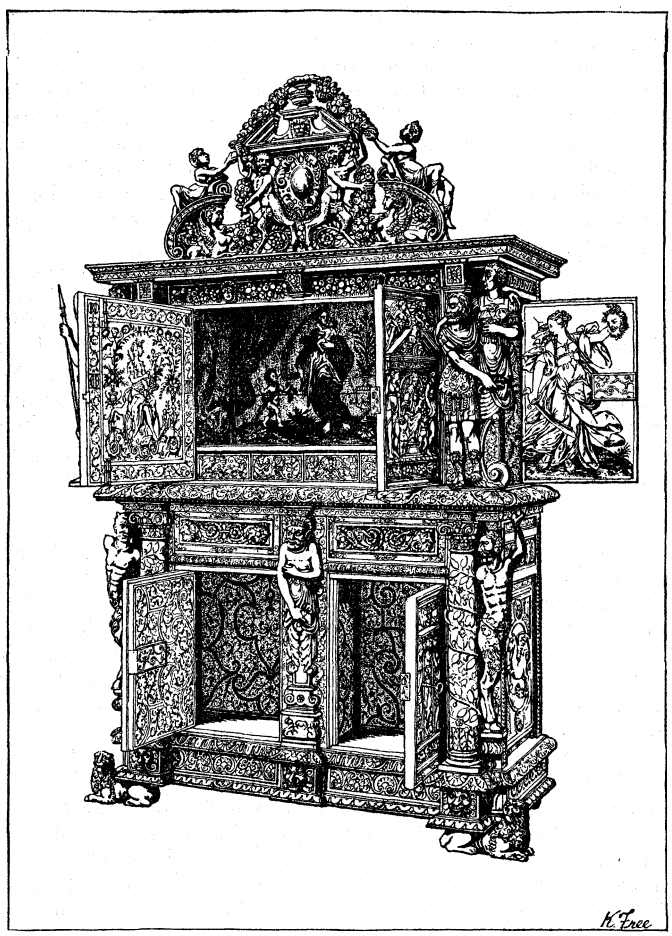
For the formal development of the ideas of Arminius, ***see*** EPISCOPIUS, SIMON.

BIBLIOGRAPHY.—The works of Arminius (in Latin) were published in a single quarto volume at Leiden in 1629, and at Frankfort in 1631 and 1635. Two volumes of an English translation, with copious notes, by James Nichols, were published at London, 1825–28; three volumes (complete) at Buffalo, 1853. A life was written by Caspar

Brandt, son of Gerard Brandt, the historian of the Dutch reformation, and was published in 1724; republished and annotated by J. L. Mosheim in 1725; and translated into English by the Rev. John Guthrie, 1854. James Nichols also wrote a life (London, 1843).

ARMISTICE, a suspension of hostilities by mutual agreement between two nations at war or their respective forces. An armistice may be either general or particular. In the first case there is a complete cessation of hostile operations in every part of the dominions of the belligerent powers; in the second there is merely a temporary truce between two contending armies, or between a besieged fortress and the force besieging it. Such a temporary truce, when for a very limited period and for a special purpose, *e.g.*, the collection of the wounded and the burial of the dead, is termed a *suspension* of arms. A general armistice cannot be concluded by the commanders-in-chief unless special authority has been previously delegated to them by their respective Governments; otherwise any arrangement entered into by them requires subsequent ratification by the supreme powers of the States. A partial armistice may be concluded by every commander of even the smallest detachment without any special authority from his Government or superior officer. The conduct of belligerent parties during an armistice is usually regulated in modern warrare by express agreement between the parties.

ARMISTICE DAY, the anniversary of the cessation of hostilities in the World War (Nov. 11, 1918), and of the signing of an armistice between the Allies and Germany. In London this anniversary is observed by a two minutes' silence in memory of the fallen, together with a special service at the Cenotaph (*q.v.*) in Whitehall. The two minutes' silence is generally observed throughout the British Empire. In the United States Nov. 11 is a legal holiday in 23 States and is observed in others by the Governor's proclamation. The day is marked by appropriate ceremonies, including parades and campaigns for the relief of war veterans



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

A BURGUNDIAN RENAISSANCE ARMOIRE, OR CUPBOARD. OF THE 16TH CENTURY, IN THE STYLE OF HUGUES SAMDIN

ARMOIRE, the French name (cf. ALMERY) given to a tall movable cupboard, or "wardrobe," with one or more doors. It has varied considerably in shape and size, and the decoration of its doors and sides has faithfully represented mutations of fashion and modifications of use. It was originally exceedingly massive and found its chief decoration in elaborate hinges and locks of beaten iron. The finer ecclesiastical armoires or aumbries which have come down to us—used in churches for the safe custody of vestments, eucharistic vessels, reliquaries and other precious objects—are usually painted, sometimes even upon the interior, with sacred subjects or with incidents from the lives of the saints. By the end of the 14th century, when the carpenter and the wood-carver had acquired a better mastery of their material, the taste for painted surfaces appears to have given place to the vogue of carving, and the rectangular panels gradually became sculptured with a simple motive, such as the linen-fold or parchment patterns. The 15th century armoire became less obviously and aggressively a thing of utility. Enriched with columns and pilasters, its panels carved with mythology, its canopied niches filled with sculptured statuettes, it was widely removed from the iron-mounted receptacle of earlier generations. During the 16th century the armoire relapsed into plainness. By the middle of the 18th century it was found in every French house and throughout a considerable part of Europe. About the beginning of the 19th century the armoire developed into the wardrobe, now in general use as a piece of bedroom furniture (*see* WARDROBE).

ARMORICA (AREMORICA), the Roman name, derived from two Celtic words meaning the "seaside" (*ar,* on, and *mor,* sea), for the land of the Armorici, roughly the peninsula of Brittany. At the time of Caesar's advance on Gaul there were five principal tribes in Armorica, among whom were the Veneti (q.v.), who were entirely destroyed by Caesar. Under the empire it formed part of the province of Gallia Lugudunensis. It contained hardly any towns and was perhaps less Romanized than the rest of Gaul. In and after the later part of the 5th century it received many Celtic immigrants from the British Isles, fleeing (it is said) from the Saxons; and the Celtic dialect which the Bretons still speak is thought to owe its origin to these immigrants. (See BRITTANY.)

ARMOUR, JONATHAN OGDEN (1863–1927), American merchant, was born in Milwaukee (Wis.), Nov. 11, 1863, the son of Philip D. Armour (*q.v.*). In 1883 he joined the business of Armour and Co. Made a partner the iollowing year, he became general manager and head of the company after the death of his father. Under his guidance the business became one of the largest in the United States. He died in London, August 16, 1927.

ARMOUR, PHILIP DANFORTH (1832–1901), American merchant and philanthropist, was born in Stockbridge, N.Y., May 16, 1833. He was educated at Cazenovia academy, Cazenovia, N.Y., worked for several years on his father's farm, and in 1852 ment overland to California, w-here he laid the foundations of his fortune. In 1856 he became associated with his friend, Frederick S. Miles, in a wholesale grocery and commission business at Milwaukee. In 1863 he became the head of the firm of Armour, Plankington and Co., pork packers. He also obtained a large interest in the firm of H. O. Armour and Co., which was founded by his brother, Herman Ossian Armour (1837–1901), and which, starting as a grain commission business, in 1868 established also a large pork-packing plant. Of this firm, the name of which was changed to Armour and Co. in 1870, he became the head in 1875. Besides contributing to many charitable enterprises, Armour founded the Armour Institute of Technology at Chicago in 1892 and the Armour flats in Chicago, built for the purpose of supplying at a low rental good homes for working men and their families. He died on Jan. 6, 1901.

ARMOUR AND COMPANY, one of the largest of meat-packing and slaughtering establishments, has its headquarters in Chicago, Ill. It prepares and distributes meats, live stock by-products, and various closely related products such as butter, eggs, cheese and poultry. Founded in Chicago in 1867 by Philip D. Armour, the capacity of its original plant was 30.000 hogs

per annum. Expansion was rapid and very shortly beef and lamb were added. In 1898 the first of many plants outside of Chicago was opened in Omaha, Neb. In 1900 there was a merger with the Armour Packing Company of Kansas City, Mo., a company organized and developed by Philip D. Armour's brothers—the new concern carrying on under the name of Armour and Company. The business continued to grow, many more plants were established, and in 1923 the physical properties, trade-marks and goodwill of Morris and Company, another long established packing concern, were purchased. This involved the reorganization of the financial structure of Armour and Company and an increase in its capital stock to an aggregate of some $235,000,000. In 1935 Armour and Company had some thirty packing plants, half a hundred produce plants, and some 300 branch houses which distributed its products throughout all the principal consuming centres.

In 1934 the Company's capital structure was reorganized. Total assets after reorganization were $295,782,508. The Company handles a volume of business ranging from $500,000,000 to $1,000,000,000, depending on the prevailing price levels. (G. A. E.)

ARMOURED CAR. Three types are recognized, viz.: (1) an armed and armoured, wheeled, military, motor vehicle capable of high road speed plus a moderate amount of cross-country mobility, (2) an enclosed, armoured truck for the safe transport of specie or other valuables, (3) a standard passenger automobile so modified by the installation of laminated (bullet-proof) glass and armour plate (concealed by upholstery) as to render occupants safe from small arms fire, while to the casual eye differing in no way from an unarmoured car of the same make.

The Military Armoured Car.—This had its genesis in the U.S.A. in 1898 when Major (later Colonel) R. P. Davidson, Illinois National Guard, caused to be constructed by the Duryea Corporation a three-cylinder, gasoline-driven motor car mounting a Colt machine gun behind a light steel shield. With a crew of four (seated back to back, in pairs) it carried 125 rounds of ammunition (enough for 15 seconds of automatic fire) and fuel sufficient for a trip of 200 miles. Travelling from Illinois to Washington with a message to Lt. General Nelson A. Miles, this strange vehicle so impressed that officer that he promptly recommended that five regiments of American horse cavalry be provided with similar equipment and trained in special reconnaissance duties—in short, mechanized. Thirty years later his advice was adopted, in part.

But the ice was broken, and within a relatively short space England produced her first armoured car—the Pennington, and France hers—the Charron. Thereafter, evolution was both rapid and intense, and even prior to 1914 this new instrument had received its baptism of fire in actual military operations, being employed by the Italians in their campaign against Tripoli and Cyrenaica (1913). But its importance appears to have been best appreciated in Germany, that country entering the World War of 1914–18 equipped with no less than 700–800 light, armoured vehicles, and 200–300 of a heavier type.

The conventional armoured car of 1940 (U.S.A.) is primarily a high speed, road vehicle which makes small effort to ape the cross-country mobility of the tank. Lightly armoured, it has a four-wheel drive, and carries two machine guns of ·30 calibre and one of ·50 calibre. Known as a "Scout Car" it is present in considerable numbers in the new Armoured Division whose tables of organization call for 588 of these vehicles distributed among a force of 1,011 officers and 18,267 men. As in the past, it is employed primarily for reconnaissance, though its arms and armour permit it to engage small enemy forces under favourable circumstances.

Armoured Truck.—This was developed in the United States, where the predations of hold-up gangs began, soon after the termination of the World War of 1914–18, to cause serious concern. Operated by armed crews of two or more, it exhibits a completely enclosed armoured body, and is employed in the transfer of valuables of all kinds between banks, mercantile establishments, etc.

Armoured Passenger Cars.—These, likewise an American phenomenon, are in use by law-enforcing agencies, also by individuals who have reason to fear for their personal safety. An interesting variation upon this type was the armoured passenger vehicle developed prior to the World War of 1914–18 by gangs of international smugglers operating across the Franco-Belgian boundary. Designed to permit steering from either end, road barricades erected by customs officials held few terrors for these illicit land cruisers.

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(C. GD.)

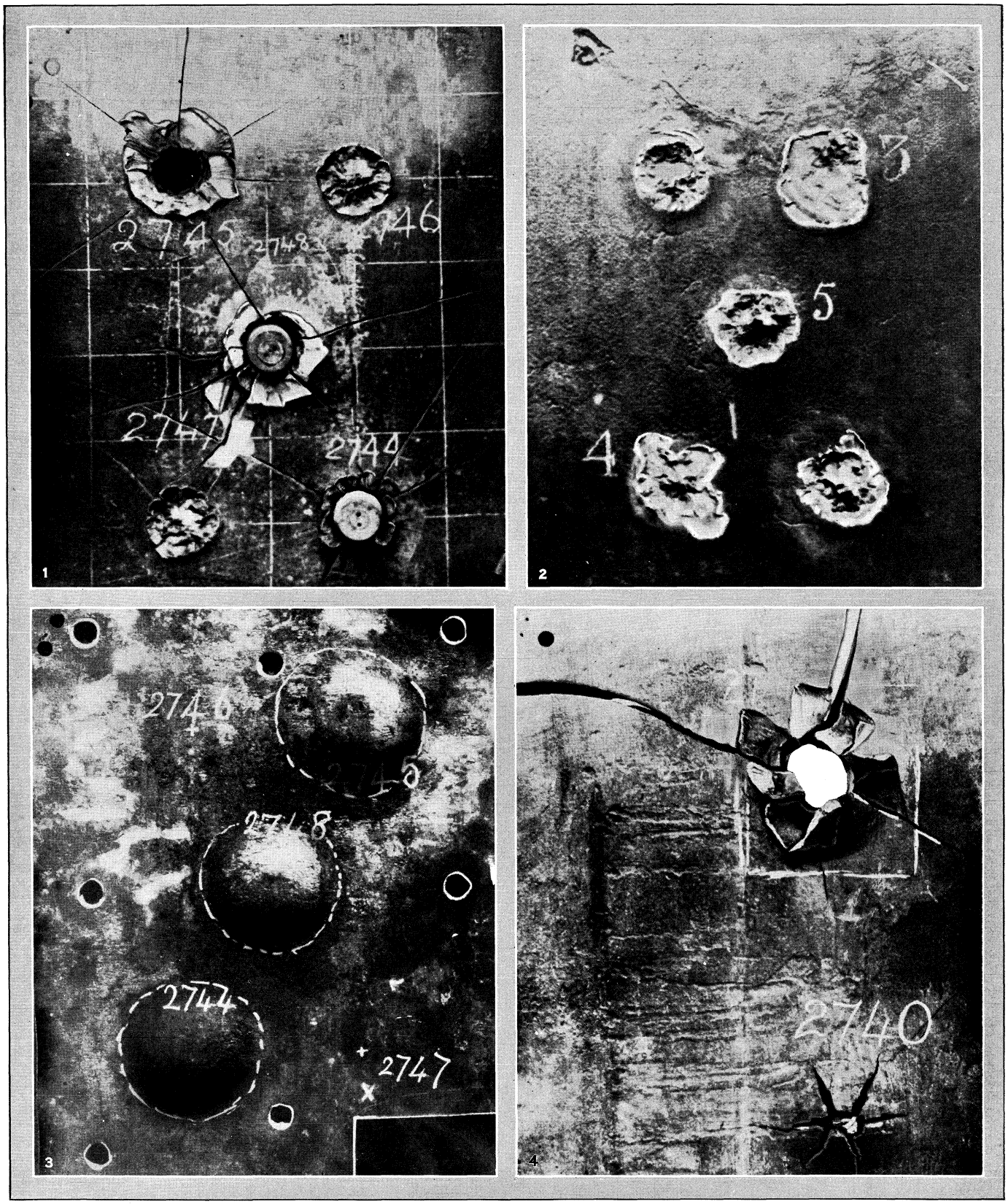
ARMOURED TRAINS. In the earliest days of the application of railways to war uses, the idea presented itself of utilizing the weight-carrying capacity of the railway and the pulling power of the locomotive for tactical as well as for strategic purposes. "Railroad batteries" figured in the American Civil War and in the war of 1870–71 and armoured trains have appeared thereafter sporadically in most wars, particularly in South Africa, 1899–1902. Their utility, though confined within narrow limits, was unquestionable until the development of mechanical road transport.

In countries where the rail system is sufficiently developed to give such trains real freedom of movement there exists an even fuller system of main roads on which armoured cars can operate, and in the World War period of 1914–18 the fighting train only figured in such theatres as those of the Russian civil wars, in which roads fit for heavy traffic are as a rule rarer than railways. As against the armoured car working on good roads the train must always suffer from being limited to certain tracks which are easily interrupted by raids, air bombing or artillery fire, and in the future, as cross-country cars of the six-wheeled or caterpillar types improve, the limitations of the armoured train will be accentuated in comparison.

On the other hand, the old railroad battery, considered as a form of gun-mounting, possesses many advantages over other forms of mounting heavy ordnance for field warfare. In the well-laid bed of a railway track, organized to distribute heavy strains equably, such mountings have their firing platform ready made, and the power of the locomotive gives heavy artillery a mobility that otherwise it would lack. In this form, then, the train represents the battery vehicles of horsed or motor artillery The central member is the heavy truck carrying the gun, and the others are arranged for ammunition and for the accommodation of the gun personnel. Light armour is frequently used for the protection of the vehicles against shrapnel bullets, and in some cases the gun itself is provided with a shield. (See ORDNANCE.)

ARMOUR PLATES. The idea of giving extra protection to the hulls and decks of war vessels is a very ancient one. Archimedes, in building the famous "Syracusan"—that most palatial of ancient ships—for King Hiero, around 250 B.C. provided for "mats composed of stout ropes suspended by brazen chains." No doubt these were a provision against ramming and missiles; and the cables that were made taut around the hulls of Greek ships served at least a part of the same purposes. The "Syracusan," too, was completely surrounded by an iron balustrade; we are not told its vertical dimensions. In Rome, there was an accepted technical distinction which divided all war vessels into apertae (with uncovered deck) and cataphracts such as the quinqueremes, wherein the wall of the ship was carried up beyond the gunwale to the deck as a protection to the rowers. In Byzantine times, when combustible—and perhaps explosive—missiles came into use. leather curtains were adopted or else saturated woollen sheaths. By the 11th century the Scandinavian sea-kings had vessels that were armoured in the modern sense. In the *Svarfdaela* we read: "Ljot the Pale is in the east in the Swedish isles; he has . . . a 'dragon' covered with iron above the sea; it goes through every ship." There mas another such owned by Fridthjof's father, Thorstein, "and its sides were sheathed with iron" (*Fridthjof's* Saga, I.). The iron hands over the prows of the mediaeval ramships are well known. A ms. of about 1430, describing the side-wheeler, mentions a "covered" ship of that type as in use by Catalonians; and there have come down other mentions of that formidable Catalonian ship.

Until the close of the Napoleonic wars ships-of-the-line were virtually armoured for their sides of almost two feet of oak were



COMPOUND ARMOUR AND NICKEL-STEEL PLATING PRODUCED BY BRITISH AND AMERICAN FIRMS

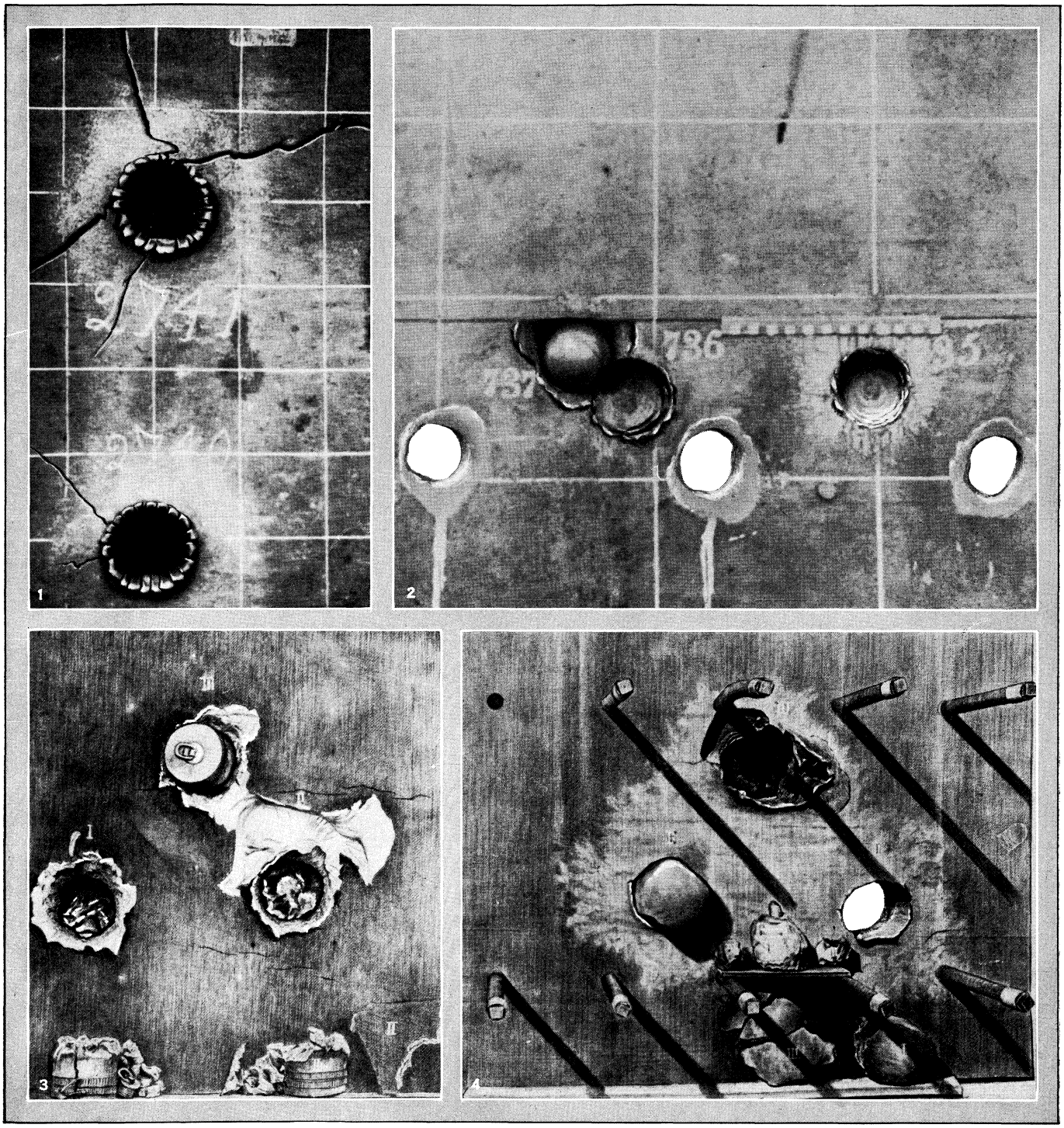
1. Front view of the face of a ten and a half inch Cammell compound plate with armour-piercing shot embedded in it. Compound armour with a steel face and wrought-iron back was first introduced to combine the advantages of greater resistance offered by steel with the toughness associated with wrought iron in order to prevent the plate from cracking badly if repeatedly struck

2. Front view of Harveyized nickel steel plate. Comparison of this illustration with fig. 1, Plate II., shows the improvement in steel-plate resistance brought about by the Harvey process of hardening. The test was made in 1892, and the five shots fired were broken up in each case after ineffective penetration

3. Back view of compound armour-plating. Three of the five armour-piercing shot whose effects are shown in the front view of this compound armour plate, fig. 1, penetrated the steel, and the three areas ringed show the effect of shot penetration on the wrought-iron back. In no case was a hole made in the back

4. Back view of Vickers nickel steel armour plate. The damage done indicates that the back of the plate was insufficiently tough. The face was comparatively soft, judging by the impression made by the head of shot in the plate, fig. 1. Plate II. Comparison with Plate 1, fig. 2, shows the correction made in this defect by later developments

ARMOUR PLATES



HAMMERED IRON PLATES FITTED TO THE FIRST BRITISH ARMOURED WARSHIP, AND IMPROVED ARMOUR DEVELOPED FOR MODERN WARFARE

1. Front view of Vickers 14% inch nickel-steel armour plate which threw back two 9.2 armour-piercing shots with a striking velocity of eighteen hundred feet per second when tested, in 1893. The first shot was thrown back whole, and the second was broken into three pieces, although it holed the plate as shown in fig. 4, Plate I.
2. Four and a half inch hammered iron-plate armour of the first British ironclad, a warship built in 1861. This type of iron armour was fitted in subsequent ships up to 1881, and the illustration shows an eight inch steel round shot, fired from a 68-pounder gun, embedded in the metal
3. Front view of Krupp face-hardened plate. The effects shown in the picture were produced by 12-inch armour-piercing shells on a 14.4 inch Krupp face-hardened plate, tested in 1896. In each case the damage was at the point of impact only, and, while two of the shells were broken up, the third remained embedded
4. Back view of Krupp face-hardened plate. The toughness of the plate is shown by the fact that no cracking resulted after it was struck by three 12-inch armour-piercing shells, although clean plugs were punched out. A comparison with fig. 4, Plate I., shows the great advance made against shell penetration

nearly shot-proof to naval artillery of the day at all but short ranges. The increase of gun powder towards the middle of the 19th century made metal armour indispensable.

Historically, the earliest of modern proposals to employ armour for ships of war (for body armour, etc., *see* ARMS ASD ARMOUR) appears to have been made in England by Sir William Congreve in 1805. In *The Times* of Feb. 20 of that year reference is made to Congreve's designs for an armoured floating mortar battery which the inventor considered would be proof against artillery fire. Among Congreve's unpublished papers there is also a suggestion for armour-plating the embrasures of casemates. Nothing, however, seems to have come of these proposals, and a similar lack of appreciation befell the next advocate of armour, John Stevens of Hoboken, N.J., who submitted the plans of an armoured vessel to Congress in 1812. The Stevens family, however, continued to work at the subject, and by 1841 had determined by actual experiment the thickness of wrought-iron armour which was proof against the projectiles then in use.

In 1827 a proposal to apply iron for defensive purposes was put forward by Major General Ford, R.E., who suggested iron bars as a protection for the face of masonry in forts, but the result of the experiment was not encouraging. In 1840 experiments were conducted by the British Admiralty to ascertain the effect of shot on iron plates backed with various soft and elastic substances. These experiments were instituted not so much for the purpose of testing the value of defensive armour against shot as to ascertain the value of iron as a material of construction for ships of war. The employment of thick iron plates as an external casing for the protection of ships of war appears first to have been carried out by the French, who in the Russian War employed three iron-cased floating batteries in the attack upon Kinburn on Oct. 17, 1855. These batteries were exposed to a heavy fire at a distance of 700 yards for about three hours, unsupported by the fleet, and although some casualties occurred from shell and shot entering the large old-fashioned portholes yet the floating batteries themselves were practically uninjured. Early in the American Civil War the value of protective armour was again conclusively proved in the battle, March 9, 1862, between the "Monitor" and the "Merrimac" (*q.v.*), both armoured vessels. In the Civil War railroad iron was sometimes used for side armour, and turret-armour was built up of laminated one-inch plates. Thenceforth the utility of iron armour in protecting ships of war became apparent, and the present article describes the successive steps by which modern armour has been evolved.

In 1857 experiments were made at Woolwich with a set of 4 in. plates, some of iron and some of steel, and it was found that in some cases the plates offered a good resistance at 600 yards to 68-pdr. solid shot, but that with a repetition of blows the plates were broken up. Wrought-iron shot appeared much more destructive than cast iron, and as a defensive material steel plates were far inferior to wrought iron in point of resistance.

Tests were also made in 1857 at Woolwich on the resistance of blocks of cast iron. These blocks were 8 ft. long, 2 ft. broad and $2\frac{1}{2}$ ft. thick, fitted together by tongues and grooves. They were fired at from a 68-pdr. with cast-iron solid shot, and wherever the shots struck radiating cracks were formed sometimes extending through the block, and the block was more or less displaced. With wrought-iron shot a greater effect was produced, these shot recoiling unbroken whereas the cast-iron shot always broke up.

For the purpose of investigating thoroughly the application of iron to defensive purposes of war a special committee on iron was appointed in 1861 by the Secretary of State for War with the concurrence of the Admiralty. The committee consisted of Captain Dalrymple Hay, R.N. (Chairman), Major Jervois, R.E., Brevet-Colonel W. Henderson, R.A., Dr. Percy of the Museum of Geology, W. Fairbairn, Esq., and W. Pole, Esq., with Captain A. Harrison, R.A., as Secretary. This committee sat until 1864 and conducted a large series of investigations and experiments.

The committee came to the conclusion that a steel material, either alone or in combination with iron, was objectionable, and the most suitable material was simple wrought iron, the best kind of iron being that which combined in the greatest degree the qualities of softness and toughness. In order to allow the energy of the shot to be absorbed in indenting and battering the plates without producing further fracture, rolled iron plates were on the whole found to be better than hammered plates, as hammered plates generally had the tendency to be hard and unequal, though at the same time rolled plates were frequently affected by unsoundness of welding.

Great interest had always attached to the question of backing most suitable for ship armour plates. When armour plates were first used they were fixed directly upon the hull of timber ships, and when first applied to iron ships it was thought expedient to imitate the former condition by placing a backing of wood between the armour plate and the hull of the vessel. Many objections were raised to this, among them being the liability of the wood to decay and to be destroyed by fire and shells, but the committee were unable to recommend that wood backing could be dispensed with, as it appeared to perform important functions for which no thoroughly efficient substitute could be found. The wood backing was finally thinned down until its use was confined to fairing the surface of the ship so that the armour could be really fitted to it.

Iron Armour.—The earliest armour was therefore made of iron; both rolled and hammered plates being used. The French ship "Gloire," a wooden frigate protected by a complete belt of iron armour 4Q in. in thickness, completed in 1859, was the first armour-clad ship of war. The British ship "Warrior," completed in 1861, was the first armour-clad warship to be built entirely of iron, the armour belt consisting of iron armour 43 in. thick. The increase in calibre of guns, and the use of steel shot, necessitated an increase in thickness of armour, and in the "Bellerophon," completed in 1866, a thickness of 6 in. of armour was fitted. The introduction of Palliser's ogive-pointed chilled-iron shot and further improvements in size and penetrative power of naval ordnance were met by further increases in thickness of armour, resulting in the "Inflexible," completed in 1881, carrying a belt of 24 in. in thickness, worked in two thicknesses of 12 in.

Plate II, fig. 2, shows a $4\frac{1}{2}$ in. hammered iron armour plate, on a target with 18 in. of wood backing, representing the side of H.M.S. "Warrior." The plate, which was 8 ft. long by 4 ft. wide, was made by the Thames Iron Works. It was tested at Shoeburyness on Jan. 8, 1864. Round 735 was an 8 in. solid cast-iron shot, weight 66 lb., and rounds 736 and 737 were 8 in. solid forged steel shot, weight 75 lb., all fired from a 68-pdr. gun, the striking velocity of the iron shot being about 1,400 ft. per second and the steel shot about 1,300 ft. per second. The steel shot penetrated 4.8 in. and the cast-iron shot 1·75 in., showing the superiority of steel over iron shot. The steel shot at round 736 remained bedded in the plate, and when knocked out by the subsequent round was found to measure $8\frac{1}{2}$ in. by 7 in.

Compound Armour.—In the meantime, however, important experiments were being carried out in the use of steel for armour plates, among the most important being the Spezia trials in 1876 on a Schneider steel armour plate. Steel plates were harder than wrought iron, and offered greater resistance. but the steel was not tough enough and consequently cracked badly when struck two or three times. This defect in steel armour led to the adoption of compound armour, this armour consisting of a steel face with a wrought-iron back. As early as 1867 some experimental armour plates were made by welding steel-face plates to wrought-iron backs. The object of welding the steel and iron together was to prevent fissures extending through the armour, and as the ductility of the iron was superior to that of steel it was supposed that the welding of the plates would also hold the outer face of steel in its place after being broken by impact of projectiles. The first trial of this compound armour, however, showed that the welding of the two metals was imperfect and that they separated under impact. Satisfactory compound armour plates were, however, introduced by the two Sheffield firms, Cammell and Brown, the processes being known as the "Wilson" and "Ellis" respectively. In the Wilson process a wrought-iron plate, while red hot. was placed in a mould, and liquid steel was run in. The temperature of the liquid steel being much in excess of the welding heat of iron, the surface of the iron plate became partially fused by the liquid steel, and

thus a complete union between the two metals was obtained. In this case, the weld is not limited to a simple line of junction between the iron and steel, but the change from iron to steel is gradual. When the steel became solid, the plate was removed from the mould, and after reheating was rolled down to the thickness required. In Cammell's plate 18.9 in. thick, tested at Spezia in 1882, the plate was rolled down from 30 in. thick, the final hard-steel face being about six inches.

In the Ellis process a steel plate for the face and a wrought-iron plate for the back were united by running molten steel between them, the combined plate being subsequently rolled down to the correct thickness. In Brown's 18.9 in. plate tested at Spezia in 1882 the final hard face was about 3 in. thick, the total thickness of steel being about six inches. As a result of trials, a proportion of about one-third steel and two-thirds iron was found to give the best results.

Compound armour was first used on the turrets of the "Inflexible" and continued in general use in the British Navy up to the "Royal Sovereign" class (1892), in which ships the belt was of compound armour 18 in. thick, The superiority of compound armour over iron mas computed to be in the proportion of about three to two.

The introduction about 1886 of the Holtzer and other forged steel-armour piercing shot, which could not be shattered as the Palliser shot had been, presented fresh problems. The compound plate relied upon breaking up the shot, but if the shot pierced the hard face without breaking up, the soft iron back could not offer much resistance. Plate I. fig. 1, shows the face and Plate I, fig. 3, the back of a 10½ in. compound plate manufactured by Messrs. Cammell and Co., tested in 1893. Rounds 2,744, 2,745 and 2,748 were Firth's 6 in. armour-piercing shot, and rounds 2,746 and 2,747 were Palliser 6 in. shot, all rounds being fired at 10 yards range. The considerably increased penetrating power of the later armour-piercing shot compared with the earlier Palliser shot is apparent from the photographs. It will be observed that the Firth shot perforated the steel face and caused considerable cracking, while the Palliser shot simply splashed on the face and broke up. It will be seen from fig. 3 that the wrought-iron back was not pierced by any of the rounds. The Firth shot caused considerable bulging, which was entirely absent in the case of the Palliser shot.

Steel Armour. — Considerable improvements in solid steel armour were made by the French firm of Schneider, and in 1888 the Sheffield firm of Vickers produced a very good all-steel armour plate. From 1882 to 1890, several international trials took place at which various makes of compound and all-steel armour were tested, and although compound armour was generally adopted in Great Britain, yet on the Continent the superiority of this armour over all-steel armour was not universally acknowledged, and French ships of this period were protected by steel and compound armour in about equal proportions.

The attention of makers who favoured compound armour was thus directed to the necessity of increasing the hardness of the steel face, and in 1887 Captain T. J. Tresidder patented a method of rapidly chilling the steel face by means of jets of water under pressure. This method of chilling the face of armour plates is in general use at the present day.

The progress made in steel armour resulted in its adoption in 1891 for the secondary defence of battleships in Great Britain, the main belt being of compound armour. In the "Royal Sovereign" class the upper belt consisted of four inches of steel armour.

Pl. II, fig. 1 shows the face, Pl. I, fig. 4 the back of a 14½ in. nickel steel armour plate manufactured by Messrs. Vickers, tested in 1893. The plate was tested with Firth's 9.2 in. armour-piercing shot, with a striking velocity of 1,800 ft. per second. The first shot, round No. 2,740, penetrated the plate and made a star-shaped crack at the back, the shot being thrown back whole. The second shot holed the plate and caused cracking as shown, the shot being thrown back broken in three pieces.

Harveyed Armour. — The next important improvement was the introduction in 1891 of Harveyed armour. Mr. Harvey, in America, having obtained considerable success in water-hardening cemented steel in the case of small articles, turned his attention to the manufacture of armour plates by the same process. The method consisted in carburizing or cementing the face of a steel armour plate by keeping it at a high temperature in contact with finely divided charcoal, so that the heated surface absorbed a certain amount of carbon, which penetrated to some considerable depth. After cementation, the plate was allowed to cool to a dull red heat and mas then chilled by the application of water, but by a less perfect method than that employed by Tresidder. Steel plates treated by the Harvey and Tresidder processes combined possessed about twice the resisting power of wrought iron, and about one and a half times the resisting power of the former steel armour and compound armour. The best American results had been obtained with Harveyed nickel steel, but there was considerable difference of opinion as to the value of introducing nickel, and its adoption was not universal in England. Harveyed armour was first used in the British Navy in the "Renown," laid down in 1893, where the belt armour was 10 in. thick.

Plate I, fig. 2 is a 10½ in. nickel Harveyed plate, made by Messrs. Vickers, tested in 1892. Rounds 1, 2 and 5 were 6 in. Holtzer armour-piercing shot, and rounds 3 and 4, 6 in. Palliser shot. The striking velocity in each case was 1,973 ft. per second The shot was broken up in each case, with only a slight bulge at the back of the plate. The Holtzer shot penetrated about four inches into the plate, and the Palliser shot about three inches This plate on further trial stopped and broke up the 9.2 in. Holtzer armour-piercing shot at velocities of 1,698 and 1,808 it. per second.

Krupp Armour. — The basic invention in all modern armour was Harvey's discovery as to carbonizing the front face of the plate, but the Harvey plate suffered from the defect that the back was not sufficiently tough, and after various experiments with steel of different composition Krupp, of Germany, produced Krupp cemented plate in 1894, based on Harvey's invention. This was a nickel-chrome alloy. The addition of chromium permitted the carburization or cementation to extend deeper into the armour plate and increased the toughness of the entire plate. The outstanding development in Krupp cemented plate was the introduction of differential heating. This consisted in heating the carburized face to a temperature sufficient to produce a glass-hard surface when water-quenched, at the same time keeping the back to a much lower temperature, in order to produce a tough and fibrous back. Both face and back were water-quenched simultaneously. This process, with slight variations, brought about as a result of the development of more scientific principles in the casting and treatment of steel, is that usually adopted in modern armour making. Krupp cemented plates gave results which indicated that they were equal to wrought-iron plates of about two and a half times their thickness. Krupp armour was first fitted in the "Canopus" class laid down in 1896. The Krupp method of differential heating was also applied to thinner plates which were not carburized. These were known as Krupp non-cemented plates.

Plate II, figs. 3 and 4, shows the face and back of a 14·4 in. Krupp face-hardened plate tested in 1896. Round 1 was a 12 in. St. Chamond armour-piercing steel shell, weight 716 lb., striking velocity 2,159 ft. per second. The shell was broken up and punched a cylindrical plug out of the plate. Round 2 was with a similar shell at 2,157 ft. per second. The shell punched back a cylindrical plug to a depth of 9.4 in. but the plug remained fast in the plate. the shell being broken up. Round 3 was a 12 in. Krupp armour-piercing shell with a striking velocity of 2,152 ft. per second. The shell punched a piece out of the plate and remained stuck in the hole. It will be observed that the back of the plate is free from cracks.

Manufacture. — The manufacture of cemented armour is a specialized process, involving great care in the selection of materials, and the subsequent casting and heat treatments. The details of composition and manufacture vary to some extent between different makers, but an average composition is 0·35 to 0·5% C, 3·5 to 4% Ni, 1·5 to 2·5% Cr, 0·4% Mn, 0·15% Si. A general description is as follows:

The ingot is slabbed down in the press and is then rolled to approximately the finished thickness required, with an allowance for machining and for wastage due to oxidation which takes place

during the subsequent operations. In some cases, the plate is rolled direct from the ingot. The plate is then annealed, cooled and straightened, and is ready for carburizing. For this operation plates are usually taken in pairs, the two plates being placed face to face with a layer of finely divided charcoal between. The plates are then placed in the carburizing furnace, and are kept at a high temperature for a period of two to three weeks. After carburization the plate is tempered by oil or water cooling, or sometimes by both, to give the required tensile strength and ductility. At this stage any holes required in the hard face are drilled. The plate is then subjected to the differential heat treatment for hardening, the face being brought to a high temperature while the back is kept to a comparatively low temperature. When the plate has reached the required temperatures on face and back, it is mithdrawn and cooled rapidly by being water-sprinkled on face and back simultaneously which prevents warping. An armour plate for a battleship may be as large as 12 ft. 6 in. by 10 ft., and 14 in. thick, weighing when finished about 30 tons.

Deck Armour. — During the war of 1914–18 naval engagements occurred at long ranges with the consequent result that the decks of naval ships had to be protected against plunging fire of heavy guns. The increasing threat of aircraft attack further emphasized the need for deck armour. The attack from heavy projectiles striking at oblique angles, could best be resisted by an armour having great strength and toughness which would be capable of suffering considerable deformation without rupture and thereby deflect the projectile. This armour should also be capable of detonating aircraft bombs and when fitted on more than one deck level, should prevent or restrict the entry of bomb splinters into the vitals of the ship. A hard, brittle, face-hardened armour, similar to Krupp armour would be unsuited for this purpose, as it would tend to crack before the attacking projectile was deflected.

A non-cemented armour has been developed for this purpose. This material is a nickel-chrome alloy, the composition of which varies with the different manufacturers. Its ballistic properties result from the heat treatment to which the plate is subjected during manufacture. Specimens subjected to tensile tests have shown ultimate tensile strength as much as 120,000 lb. per square inch with an elongation in two inches of 18%.

As a result of World War (1914–18) experiences that have been further emphasized in the war beginning in Europe in 1939, a thin armour has been developed to resist penetration of machine gun bullets and aircraft bomb splinters. The plate had to be sufficiently soft in the untreated condition to permit machining, and hard enough after treatment to resist perforation by bullets or bomb splinters. Although strength was important, the necessity for good ductility was predominate. Various alloys, including nickel, chromium cobalt, manganese and vanadium have been tested, but a nickel-chrome alloy has given the best results

Laws of Resistance. — The case of shell perforating armour plates involves so many unknown factors, both as regards the shell and the armour, that it cannot be regarded as an exact science. Many formulae have been evolved from time to time based on various theoretical considerations, the general form of the equation being $V = C.T^{t}.D^{d}.W^{w}$, V being the striking velocity of the shell, T the thickness of plate, D the diameter of projectile, W the weight of the shell, C a constant usually determined from actual trial results, and t, d and w indices, the numerical value of which varies somewhat in different formulae. From theoretical considerations of similitude, there are grounds for supposing that the indices should be so related to one another that $t+d+3w=0$. In the formulae which follow, the units adopted are V in feet per second, T and D in inches, and W in lbs.

The committee on iron, to which reference has been made, endeavoured to investigate the laws of resistance of plates of different thicknesses to projectiles of different weight and with different velocities. They arrived at the inference that mith plates of equally good quality the resisting power might be approximately considered as proportional to the square of the thickness, but in attempting to compare this with the damaging power of the projectile. found the latter to depend so much on the material of which it was made that they were unable to deduce any rule.

Fairbairn, in 1861, derived from results of cast-iron shot on wrought-iron plates the formula for perforation $V = 1300\ T.D^{\frac{1}{2}}/W^{\frac{1}{2}}$. The form of the expression is arrived at by considering the work done in punching a hole in a plate to be equal to the kinetic energy of the projectile. Experiments show that the force required to punch a hole in a plate varies as the plate's thickness if the diameter of hole is constant, and as the diameter of hole if the thickness of plate is constant. The force is therefore proportional to the product of thickness and diameter. The distance through which the force must act to remove the plug of metal is proportional to the thickness of plate and consequently the work done is proportional to T^2D. The kinetic energy of the shell is proportional to $W.V^2$. From the assumption made, therefore, $T^2D \propto W.V^2$, or $V \propto TD^{\frac{1}{2}}/W^{\frac{1}{2}}$ Fairbairn's law, even over the restricted range of velocities in use at the time, required some variation in the value of the constant for any substantial change of velocity. A list of suitable values was tabulated and fairly satisfactory results were obtained, within the limits of velocity then in use, but the formula failed on application to the higher velocities obtained later.

On the assumption that in high speed punching, such as is the case with a projectile perforating a plate, the force required to punch a hole in a plate is proportional to the product of the thickness of plate and diameter of hole and inversely proportional to the velocity of punching. Tresidder obtains the formula for perforation of wrought iron $T^2 = WV^3/cD$, c being a constant given by $\log c = 8.8410$. This formula may be applied to the perforation of hard faced armour plates by introducing a numerical co-efficient to T. This co-efficient is called the "figure of merit," and under any given attack is the ratio between the thickness of wrought iron and the thickness of the particular armour under consideration which will be perforated at that attack. The "figure of merit" of an armour plate will vary with the quality of the plate, the relation between thickness of plate and diameter of projectile, the quality of the projectile, and whether capped or uncapped. Experimental firing showed that a soft steel cap on the end of hard pointed armour-piercing projectiles held the point together on impact and gave deeper penetration. For a 6 in. cemented plate and a 6 in. uncapped projectile the figure of merit might be 2·7, for the same plate with the same projectile capped 2, and for a 12 in. cemented plate with the same projectile capped and uncapped 1·8 and 2·3 respectively.

The Krupp formula for wrought iron is $T^{4/3} = \frac{WV^2}{c.D^{5/3}}$, $\log c = 5.7776$. With similar projectiles the weight will vary as the cube of the diameter, and in this case the Krupp formula is in agreement with Tresidder's.

The formula of Commandant Jacob de Marre for wrought iron is $T^{.65} = \frac{W^{.5}V}{c.D^{.75}}$, $\log c = 2.9616$.

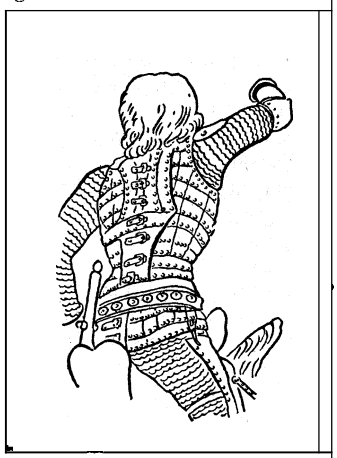
A later formula adopted by Krupp for hard faced plates is $T^2 = \frac{WV^2}{c.D}$, $\log c = 6.3532$. It is curious to note that on the assumption that W varies as D^3, this formula agrees in form with Fairbairn's formula for wrought iron. For any particular projectile and striking velocity, the thickness of wrought iron perforated according to Fairbairn's formula would be about twice the thickness of hard-faced armour given by the Krupp formula.

A method of measuring the performance of armour and shell which is largely used is based on de Marre's later formula for perforation of ordinary steel. This formula is $T^{.7} = \frac{W^{.5}V}{c.D^{.75}}$, $\log c = 3.00945$. The criterion of performance is the ratio between the velocity required to perforate any given armour plate and the velocity calculated from the formula as being required to perforate an ordinary steel plate of the same thickness. This ratio is known as the "de Marre co-efficient." The numerical value of this co-efficient is not constant for any particular type of armour or projectile, but is affected by the same factors as have been referred to in the case of the figure of merit. As an example, a 12 in. shell perforating a 12 in. plate at a velocity of 2,000 ft. per

second has a de Marre co-efficient of 1·56, and a 9·2in. shell perforating a gin. plate of the same quality at a velocity of 1,950ft. per second a co-efficient of 1·51.

The various formulae for perforation may be used to obtain a rough comparison of performance between shell and plates of varying dimensions, provided the factors involved in the cases considered do not differ too widely. (W. J. B.)

ARMS AND ARMOUR. In considering the history of defensive armour in the middle ages it is essential that some notice should be taken of the armourer on whose skill depended the lives of his patrons and with them often the security of kingdoms and empires, for the early battles were won to a large extent by the prowess of individuals, and a gap in the joints of the harness of a leader might well spell defeat for the whole army. In all craftsmanship there are certain essential rules which must be observed and without which the productions of the craftsman are valueless. These are: (1) suitability, (2) convenience in use, (3) recognition of material, (4) soundness of constructional methods, (5) subservience of decorations to the preceding rules. In Greek and Roman armour we have defences which, being practical, finely constructed and convenient in use, achieve their object in the best possible manner, and indeed after experiments for many centuries the armourer reverted to very similar designs in the middle of the 17th century.



FROM FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUEN)

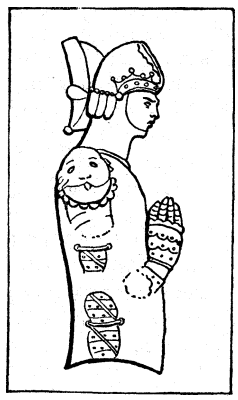
STATUE OF ST. GEORGE, PRAGUE, 1375

With the conquest of Europe by barbarians, however, the armour of the Roman legionary disappeared and the evolution of a practical defence had to begin all over again. At first armour was composed of leather, or quilted fabrics, and, in the case of wealthier fighting men, interlaced chain mail brought from the East. The only details of plate armour were the shield, which as often as not was toughened leather or wood, and the helmet and helm. The Normans adopted a very satisfactory headpiece, conical in shape and provided with a nasal, or nose guard; its shape was practical in the extreme, for it provided that essential quality of all the best armour: a "glancing surface" from which blows from sword or axe would slide. For some unknown reason in the 13th century this helmet gave place to the barrel helm with a flat top which was about as unpractical a defence as it was possible to devise, for not only did it oppose a flat surface to the weapon but it so completely enclosed the head and was so supported by a padded cap which covered the head, that a blow on the side would place the wearer hors de combat.

FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUEN)

13TH CENTURY GARMENT OF BANDED MAIL

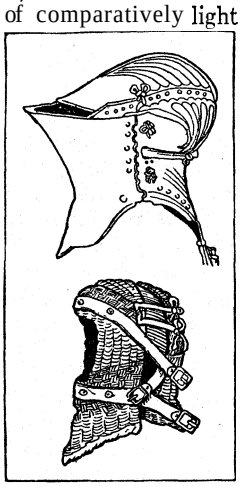
The padded and quilted defences were no doubt sufficient defence against the crude weapons in use in the earlier periods, but, by degrees, piece by piece, small portions of plate were added—first to the knees, then to the shins and then to the arms—until by the year 1400 the knight was encased entirely in plate metal with articulated joints. It is unnecessary to point out that this fabrication of plate armour was only evolved by slow degrees, for it required very considerable skill to forge the various pieces so that they not only defended the wearer adequately but also gave him as far as possible freedom of movement. In 1300 there was a gild of linen armourers in London, at a later date the merchants Taylor's Company, and these supplied defences of fabric. In 1347 we find a gild of heaumers, who dealt solely in helms and helmets, a clear proof that the armourers as such did not exist at that time. It is not till 1453 that the armourers company received its charter and absorbed the heaumers. It is one of the mysteries in the history of armour how the crusaders can have fought under the scorching sun of the East in thick quilted garments covered with excessively heavy chain mail for this equipment was so cumbersome to take on and off that it must have been worn frequently night and day, and the very nature of the fabric made it almost impossible to move the sword arm with more than a wide swinging cut. A practical experiment with a thick padded garment or a shirt of mail, or better still with both, will show that the whole weight of the defence is borne by the shoulders alone and that the action of raising a sword collects folds in the bight of the arm and is further hampered by the dragging weight from the waist upwards. One of the principal drawbacks of the 14th century armour must have been that the superimposed small plates of metal were attached to the mail or the fabric by laces or thongs of leather which if cut laid the wearer open to attack or hampered his movements very considerably. The complete armour of mail appears definitely at the end of the 13th century though it is probable that it was worn as early as the Norman Conquest. Under the mail was worn a gambeson of leather or quilted fabric and this was added to early in the 14th century when a pourpoint, similar to the gambeson, but lighter, was worn over the mail and over all a surcoat, known also as the cyclas or jupen.



FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUEN)

EFFIGY AT ASH CHURCH, KENT, 14TH CENTURY

But little of the early 15th century armour survives, for most of it was remade to suit new fashions, but what there is shows that the material was light and the methods of construction simple, with none of the exaggerations which are such a notable feature of the armour of the later part of the century. At this period the flat-topped helm had been discarded in favour of the conical basinet, from which hung the camail, or mail defence for the neck. Under the plate defence a shirt of comparatively light mail was worn which protected the parts of the body, not covered by plate, such as the armpits and forebody. In later years the complete shirt was given up in favour of a leather jerkin to which small pieces of mail were attached. Towards the end of the 15th century the armourer began to experiment, taking his cue from the tailor who at this period produced civilian costumes which were extravagant in the extreme. As an example we may cite the solleret or steel shoe which almost invariably followed the design of the civilian footwear. In the middle of the 15th century sollerets of absurd length were worn, and as it was impossible for the wearer to use them when on foot, the toe was added with a turning pin after he was mounted. This form of defence was changed again in the 16th century and the wide-toed solleret, known as the bear paw was adopted, again copying the civilian fashion. We learn from monumental brasses, *e.g.*, that in Thame church, Oxfordshire, that the elbow cops, or defences for the elbow, were of enormous size and must have made easy movement almost an impossibility; and we also see in the delightful painting of St. George and St. Anthony in the National Gallery, London, by Pisanello, that the pauldrons, or defences for the shoulder, were equally cumbersome. It is more than probable that the fighting man blindly followed fashions in armour precisely as do his descendants of the present day in



FFOULKES, "THE ARMOURER AND HIS CRAFT (METHUEN)

PADDED "HARNISCH-KAPPE"

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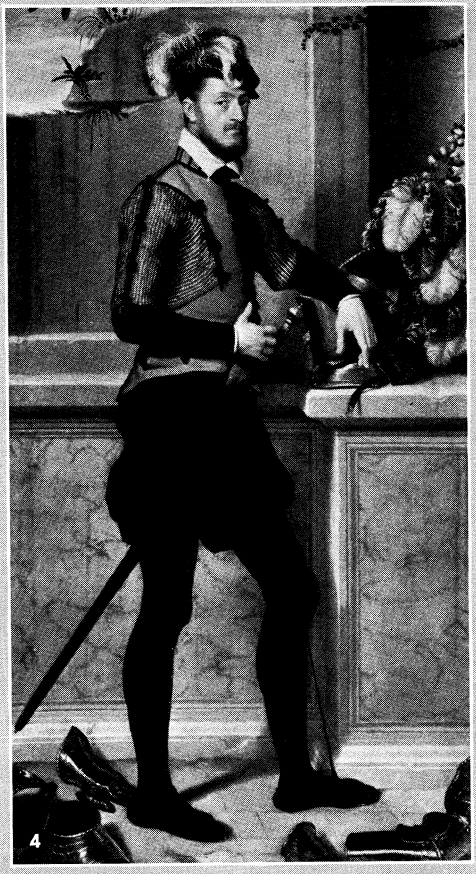

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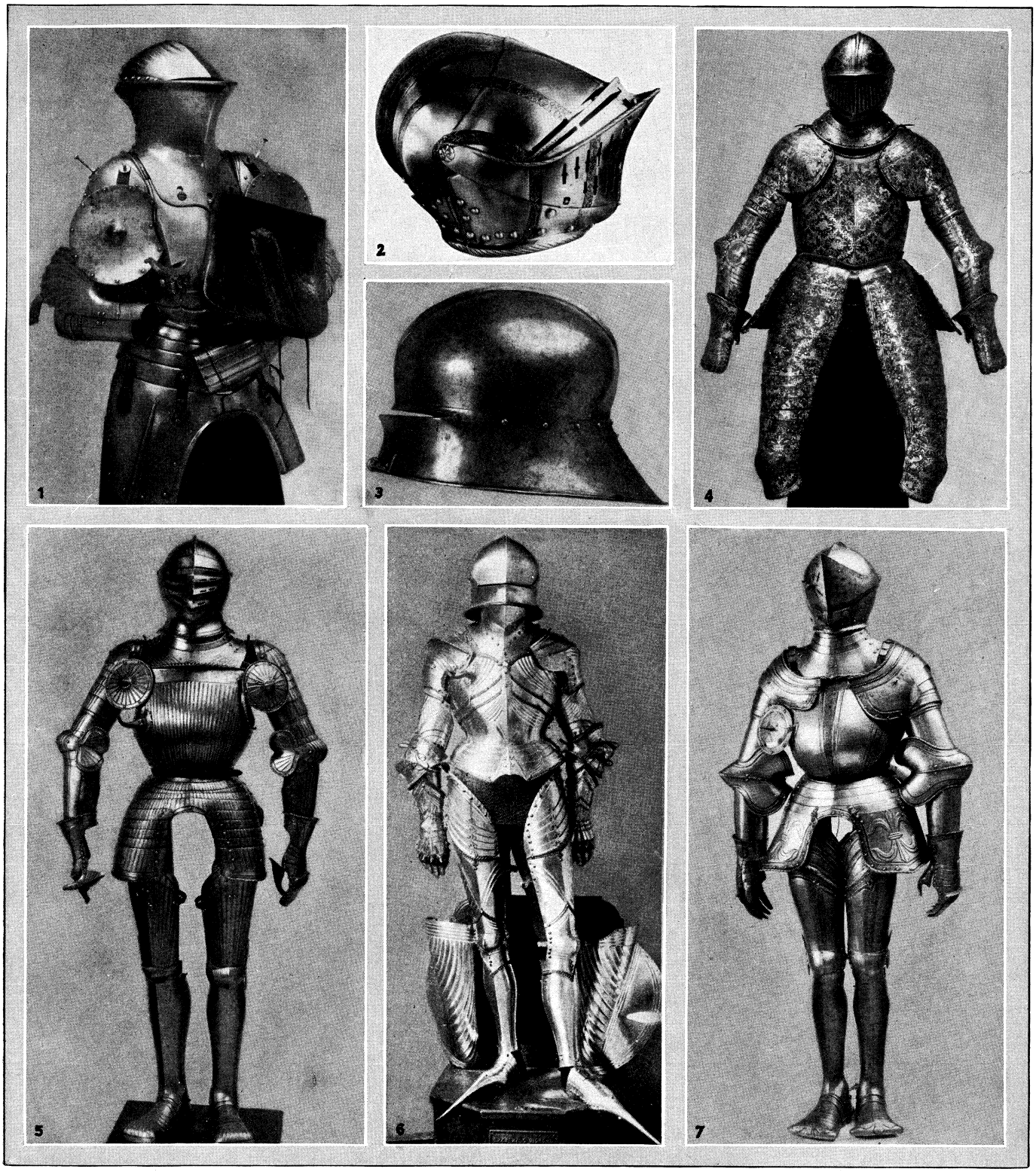
BY COURTESY OF (1) THE SOCIETY OF ANTIQUARIES OF LONDON, (2) THE WALLACE COLLECTION, (3, 5) HIS MAJESTY THE KING OF SPAIN, (4) THE TRUSTEES OF THE NATIONAL GALLERY, LONDON

MILITARY AND CIVILIAN STYLES OF THE FOURTEENTH AND SIXTEENTH CENTURIES

1. The jupon or surcoat of the Black Prince (1330–1376)
2. German armour of the "puffed and slashed" type, about 1520
3. Pageant armour of Charles the Fifth (1500–1558)
4. Portrait of an unknown nobleman by Moroni (1510–1578)
5. Parade suit of King Sebastian of Portugal, now in the Armeria Real, Madrid

ARMS AND AKMOUR

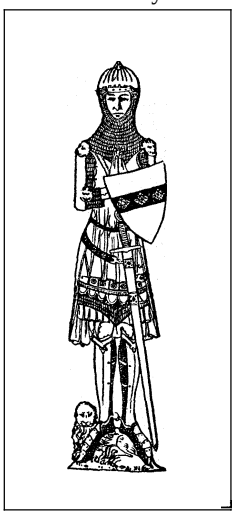


BY COURTESY OF (1, 3, 4, 5, 7) THE WALLACE COLLECTION, (2) THE IMPERIAL WAR MUSEUM (CROWN COPR.), (5, 6) KUNSTHISTORISCHES MUSEUM, VIENNA

ARMOUR AND HELMETS WORN BY EUROPEAN KNIGHTS DURING THE MIDDLE AGES

1. Heavy armour, often distinguished by large overlapping plates with fluted edges and great elbow-caps as well as by the high standing collar and loosely fitting cap, worn by the knights in Germany for the Stechzeug, or German joust
2. The closed helmet or "armet" worn by Sir Henry Lee. This type was provided with a movable visor which could be locked or opened as desired and was one of the best head defences evolved during the middle ages. It appeared towards the end of the fifteenth century
3. A salade belonging to the Negroli family, a style of helmet distinguished by its lightness and graceful lines. This head defence was evolved about the middle of the fifteenth century and was worn very loosely, with the result that it was as easily displaced as the flat topped helmet
4. Suit of cuirassier's armour of the seventeenth century, close fitting and fairly graceful — acting as a protection to all the vital parts of the body without hampering its movements unnecessarily
5. "Maximilian" armour, named from the Emperor Maximilian and said to have been invented by the armourer Seusenhofer. The fluted work distinguished this particular style, which was worn in the early part of the sixteenth century
6. Armour of Count Sigismund of Tirol (1427–1496). The fantastic style of the foot covering, as well as some of the other affectations, is characteristic of this period, when the armourers are believed to have attempted to follow the lines of the civilian styles
7. Plate armour about 1540, when the skill of the craftsmen had reached its height

civilian dress irrespective of his practical needs; but that the expert man-at-arms had his own ideas on the subject we may be sure from the fact that the Emperor Maximilian I., in discussing a new suit of armour with his armourer Conrad Seusenhofer, is recorded to have said; "You shall arm me according as I wish, for it is I and not you who have to take part in the tournament." By the middle of the 11th century a light and graceful helmet appeared called the salade. This when worn with the chin piece was of certain practical value, but it had the same disadvantages as the flat-topped helm in that it was loose on the wearer's head and a smart blow would displace it. Towards the end of the 15th and through the 16th century a new helmet appears called the armet or close helm and this in its finest form, about the year 1540, is the best possible defence for the head, for it is provided with a movable visor and face defence, or mezail, which can be locked when in use or opened as required. The later pattern is further fitted with an embossed rim which engages a smaller rim on the gorget, thereby protecting the head and neck entirely and making it impossible for the helmet to be displaced. It has been found that if all the joints of the movable parts of the suit, such as elbows and knees, are measured exactly to the wearer, there is little inconvenience experienced except in the actual weight of the metal, but this is so well distributed that a comparatively heavy suit can be worn without much discomfort.



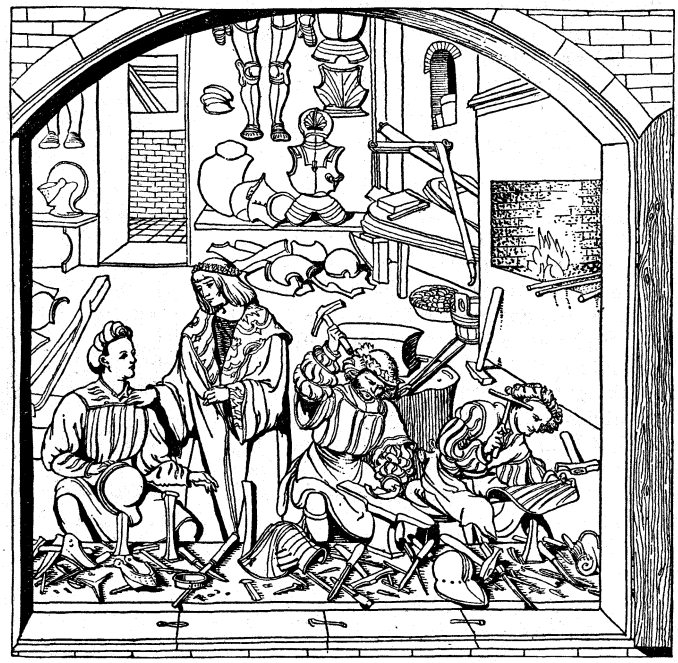
FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUEN)
SIR JOHN DE CREKE

Again referring to the Emperor Maximilian I., it is to him and his armourer Seusenhofer that is credited the invention of the fluted or channelled armour, now commonly known as Maximilian. Here the craftsman had discovered that increased strength and rigidity could be obtained by fluting the metal without adding to the weight, a principle which has been adopted at the present day not only in the case of corrugated iron and girders, but also in cars for racing craft. Another advantage of this fluted armour was that it provided to the fullest extent possible the glancing surface, for wherever the weapon, which in the 16th century was principally the lance, struck the armour it was deflected up or down the fluting until it glanced harmlessly from the wearer's body.

FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUEN)
AN UNKNOWN KNIGHT AT LAUGHTON

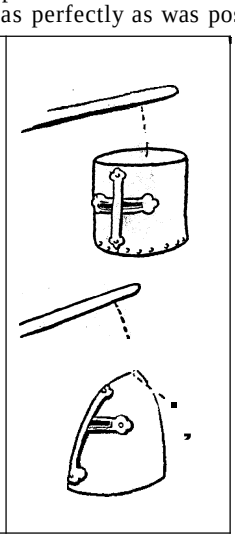
The armour for the joust exemplifies this glancing surface to the fullest possible extent, the wearer being heavily armed on the left side, which was opposed to the lance of the adversary, all the pieces being smooth and curved so that the lance would find but little hold on them. Perhaps the finest suit which was ever designed from a constructional point of view was that made for Henry VIII. as a young man for fighting on foot in the lists, preserved in the Tower armouries. This completely covers the wearer back and front, under the arms, at the back of the legs and every part of his body, with lames or narrow plates working easily on rivets.

Armour for Horses.—From the 13th to the middle of the 16th centuries the horse, like his rider, was overloaded with defences which protected the head, neck and body but left the vital parts unprotected. The legs were entirely at the mercy of the foot soldier, and the added weight of metal appreciably diminished that mobility which is the essential quality of the mounted man in action. In the 13th century the horse was covered by a trapper of heavy fabric, down to his hocks, a useful defence, it is true, but so inconvenient as to bring the level of efficiency of his rider down to that of the slowest footman. At the battle of Nueva Croce in 1237 it is recorded that 6,000 mail-clad horses were in action, and a wall painting, formerly in the painted chamber, Westminster, suggests that this mail must have been chain-mail, which was almost insupportable, even when lined with fabric or leather. In the 16th century horse armour was generally made to match that of his rider, of solid plate reaching to his quarters and often weighing as much as 80 pounds.



FROM FFOULKES, 'THE ARMOURER AND HIS CRAFT" (METHUEN)
THE EMPEROR MAXIMILIAN WITH HIS ARMOURER

Effects of the Renaissance.—By the middle of the 16th century the craft of the armourer suffered as did all the other crafts, under that influence generally known as the Renaissance. The craftsman had learned all there was to be known about the practical side of defensive armour; he had defended his patron as perfectly as was possible; he had given him freedom of movement; he had dealt respectfully with his material. Skill, indeed, could go no further, and his reputation was second to none in all the crafts of Europe. His successors, however, were not content merely to carry on these fine traditions and looked for some new way of emphasizing their skill. This being the age of extravagance and personal advertisement the arts and crafts began to be debased; decoration was added by degrees to their fine and splendid simplicity. At first it was restrained and did not destroy the utility of the defence, as it consisted of etching, engraving or inlaying with gold, but this afterwards became more extravagant, and such craftsmen as Negroli, Cellini, the Picinini and the mysterious Louvre school were pressed into service and designed richly embossed armour which entirely destroyed the glancing surface and turned what was once a magnificent example of craftsmanship into a piece of jewellery. So far did this craze for extravagance go that actually the puffed and slashed civilian dress was copied in steel, even down to minute reproductions of the stitches. These over-elaborated armours are mostly to be found in Germany, Italy and Spain; the English craftsmen, of whom Jacobe Holder of Greenwich, and William Pickering are the chief masters, avoided excessive ornamentation and consistently produced work which though splendid in appearance, had all



FFOULKES, "THE ARMOURER AND HIS CRAFT" (METHUEN)
THE "GLANCING SURFACE"

the practical advantages of the earlier examples. But the blight of the Renaissance had done its work and as the craftsman employed himself more and more in decorating his productions so by degrees he lost the constructive skill of his forefathers till in the 17th century the rudiments of construction are lost and armour such as that of Charles I. in the Tower, or of Louis XIV. in the Musée d'Artillerie in Paris are simply arrangements of stove-piping of little technical value and of no grace whatsoever.

By the 17th century fire-arms began to be practical weapons and the armourer who had previously been only concerned with providing a defence against sword, spear, axe or arrow was called upon to increase the weight of the armour and was obliged to test his material by musket or pistol shot. This he did in a fairly satisfactory manner but as the efficiency of the fire-arm increased he was obliged to increase the weight of the metal, for steel as we know it to-day was in its infancy, and the race continued between the musketeer and the armourer in precisely the same manner as the contest raged between gun and armour plate in the navies of the world during the 19th century. Still the armourer held his own for a time and it was only because the weight of his defences was so great that they were eventually discarded.

SIR JOHN D'AUBERNOUN, SURREY, 1277

We have noted the graceless forms of the armour of the mounted man of the middle of the 17th century, but the same cannot be said of the armour of the foot soldier, which, following very closely the lines of Greek and Roman armour, defended the vital parts of the body without unduly hampering the movements of the wearer; but in the end the fire-arm was triumphant and piece by piece the metal defences were abandoned. They were entirely discarded until the World War, when the British adopted a helmet of somewhat similar type to the sallade of the 15th century, and the German army produced bullet-proof body armour very similar to that of the pikeman of Oliver Cromwell.

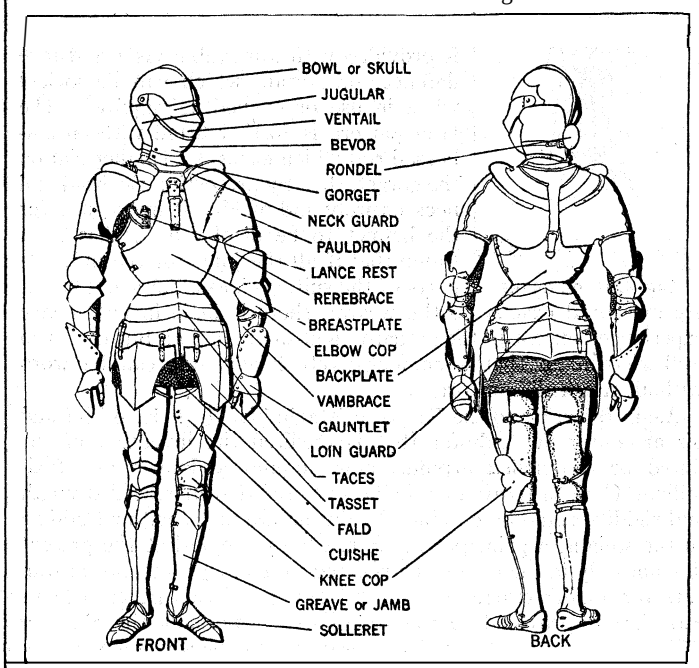
Weapons.—The weapons in use from the 13th century were the sword, axe, mace, lance, halberd and long pike. Both axe and mace were essentially practical weapons, especially so when one remembers that their function was to break up defensive armour of metal, but the sword has ever been of unpractical design. Up to the 15th century it was heavy and badly balanced with merely a cross-guard and, though pointed, of little use for the thrust. When the gauntlet was discarded the rapier with complex guard came into favour—a better weapon, but still, on account of its length, badly balanced. It was not till modern times that we get the fine cutting sword of the light cavalry, 1784, and the well nigh perfect thrusting sword of the cavalry, 1908, both admirably adapted for the purpose for which they were designed. The lance and pike were practical as thrusting staff weapons, hut the inordinate length of the latter in Cromwellian times (18ft.) became a source of grave inconvenience in an organized army and it was soon discarded. The halberd with its offshoots, the bill, gisarmé and glaive. are useful only in their early and simpler forms. The later halberd and the gisarmé with their hooks, and projections must have been seriously inconvenient as weapons for fighting at close quarters. (*See* METAL **WORK.**) (C. FF.)

THOS. QUARTREMAYNS, ESQUIRE, ABOUT 1460

BIBLIOGRAPHY.—A. Demmin, *Guide des Amateurs des Armes*, (Eng. trans., *Weapons of War by* C. C. Black, 1870); C. J. Ffoulkes, *Armour and Weapons* (1909) and *The Armourer and His Craft, front the XIth to the XVIth Century* (1912); J. Hewitt, *Ancient Arntour and Weapons in Europe*, 3 vols. (1855–60); Sir Guy F. Laking, *A Record of European Armour and Arms Through Seven Centuries*, 5 vols (1920–22); *Catalogues* of Windsor and Tower Armouries and Wallace Collection.

ARMSTEAD, HENRY HUGH (1828–1905), English sculptor, was first trained as a silversmith, and achieved excellence in the "St. George's Vase" and the "Outram Shield." His chief works are the external sculptural decorations of the Colonial Office in Whitehall, the sculptures on the southern and eastern sides of the podium of the Albert Memorial, the large fountain at King's college, Cambridge. He was elected associate of the Royal Academy in 1875 and a full member in 1880.

ARMSTRONG, ARCHIBALD (d. 1672), court jester, called "Archy," was a native of Scotland or of Cumberland, and according to tradition first distinguished himself as a sheep-stealer; afterwards he entered the service of James VI., with whom he became a favourite. When the King succeeded to the

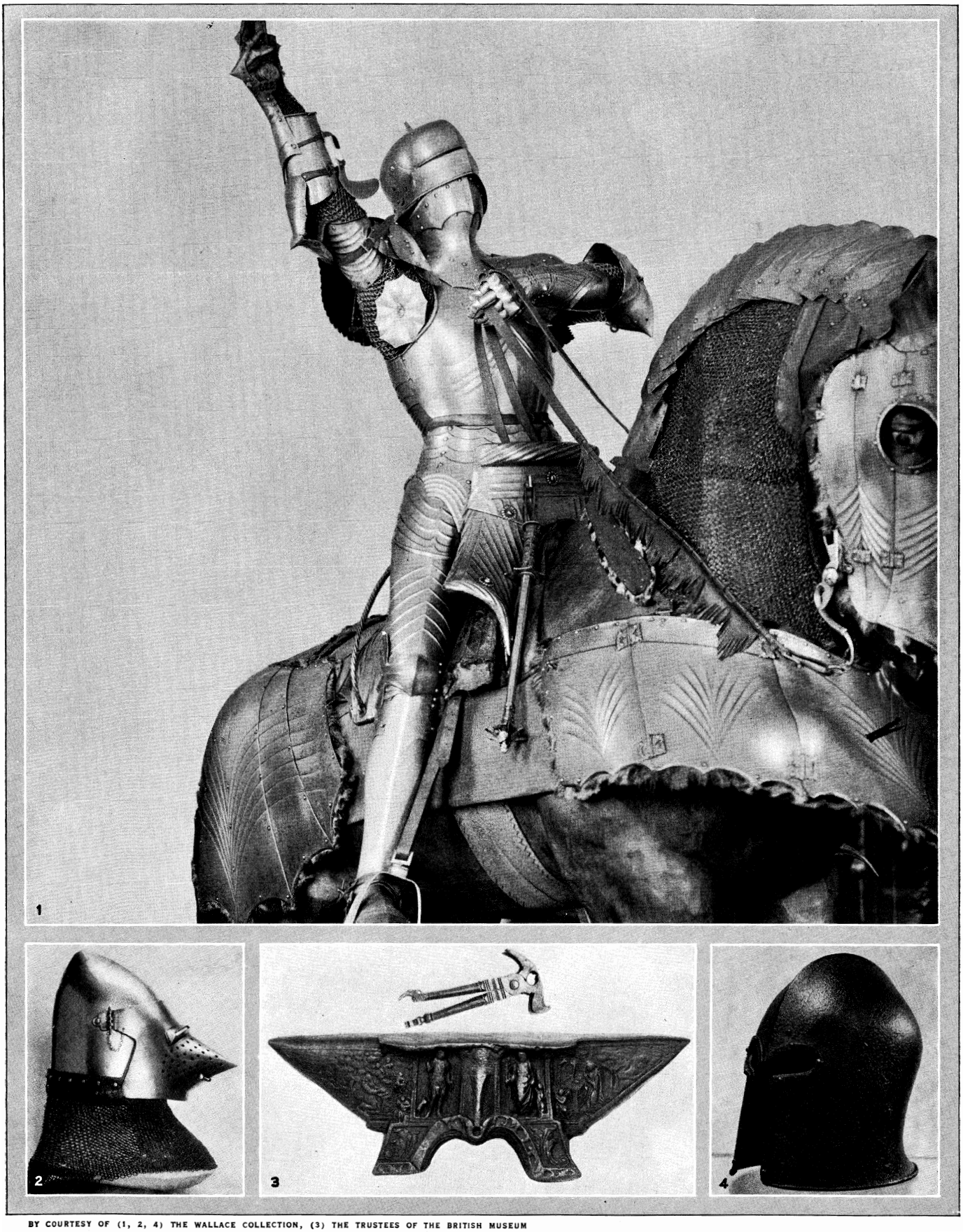


BY COURTESY OF THP METROPOLITAN MUSEUM OF ART

A COMPLETE SUIT OF EUROPEAN ARMOUR OF THE SECOND HALF OF THE 15TH CENTURY

English throne, Archy was appointed court jester. He became presumptuous, insolent and mischievous, excited foolish jealousies between the King and Henry, Prince of Wales, and was much disliked by the members of the court. In 1623 he accompanied Prince Charles and Buckingham in their adventure into Spain, where he was much caressed and favoured by the Spanish court and, according to his own account, was granted a pension. His conduct here became more intolerable than ever. He rallied the infanta on the defeat of the Armada and censured the conduct of the expedition to Buckingham'~face. Buckingham declared he would have him hanged, to which the jester replied that "dukes had often been hanged for insolence but never fools for talking." He retained his post on the accession of Charles I., and accumulated a considerable fortune, including the grant by the King of 1,000 ac. in Ireland. After the death of Buckingham in 1628, whom he declared "the greatest enemy of three kings," the principal object of his dislike and rude jests was Laud, whom he openly vilified and ridiculed. He died at Arthuret, Cumberland, 1672, and was buried on April 1. *A Banquet of Jests: A Change* of *Cheare,* published about 1630, a collection chiefly of dull, stale jokes, is attributed to him, and with still less reason probably *A* choice *Banquet of Witty Jests . . . Being an addition to Archee's Jests, taken out of his Closet but never published in his Lifetime* (1660).

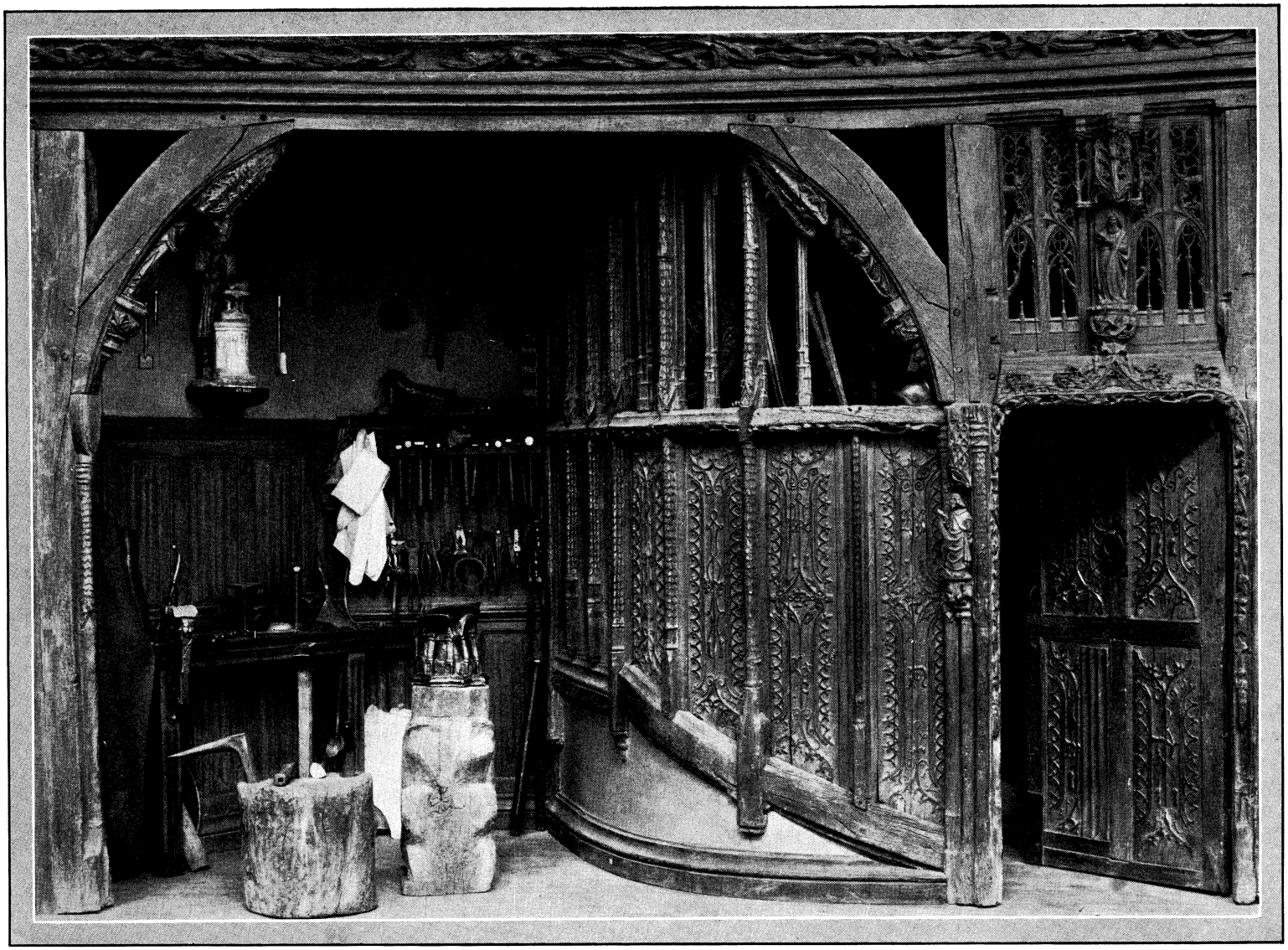
ARMSTRONG, HENRY EDWARD (1848–1937), British chemist born May 6, became professor of chemistry at South Kensington in 1874 Elected F.R.S. in 1876, he served on the council



BY COURTESY OF (1, 2, 4) THE WALLACE COLLECTION, (3) THE TRUSTEES OF THE BRITISH MUSEUM

ARMOUR AND ARMOURERS' TOOLS OF THE FIFTEENTH AND SIXTEENTH CENTURIES

1. Fluted German suits of the "late Gothic" pattern, about 1480. The throat of the horse is protected by chain mail
2. Visored or pig-faced basinet worn about 1400
3. Armourer's anvil and pincers, sixteenth century
4. Venetian salade, 1460, moulded on the ancient Greek pattern



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK

RESTORATION OF SIXTEENTH CENTURY ARMOURER'S SHOP AT ABBEVILLE, FRANCE

This view is taken from the rear of the courtyard of an early 16th century Abbeville house and shows the front of the stairway. Some of the panels are original. The woodwork of the bench is modern, while the bench vise at the left is an example of north Italian workmanship of the period, boldly decorated with foliation and mascaron. The rack on the wall holds several kinds and sizes of hammers needed by the craftsman, as well as the pincers calipers, punches for leather, clippers for metal plates, a die for cutting screws and an ancient hacksaw. Numerous anvil-like stakes are in the sockets of the bench, and near them are files, punches, chisels, matrices and patterns for armour plates. Between typical 16th century horse-shoeing irons on the wall above the bench and tools, hangs a small statue of St. Eloi, the patron saint of hammer-workers

of the Royal Society 1888–90, 1900–02 and was vice-president in 1901–02. He achieved considerable success in his researches on organic and general chemistry, particularly in his work on the terpenes, the naphthalene and benzene series and on physical chemistry. He died July 13, 1937.

ARMSTRONG, JOHN (1758–1843), American soldier, diplomatist and political leader, born at Carlisle (Pa.) on Nov. 25, 1758. His father, also named John Armstrong (1725–95), a native of the north of Ireland, who had emigrated to the Pennsylvania frontier between 1745 and 1748, served as a brigadier general and was a member of the Continental Congress in 1779–80 and again in 1787–88. The son studied for a time at the college of New Jersey (now Princeton university), and served as a major in the Revolutionary War. In March 1783, while the continental army was stationed at Newburgh (*q.v.*) (N.Y.), he wrote and issued, anonymously, the famous "Newburgh Addresses." In 1784 he led a force of Pennsylvania militia against the Connecticut settlers in Wyoming valley, and treated them in such a high-handed manner as to incur the disapproval even of the Pennsylvania legislature. In 1789 he married the sister of Chancellor Robert R. Livingston of New York, and removed to New York city, where his own ability and his family connection gave him great political influence. In 1801–02 and again in 1803–04 he was a member of the U.S. Senate. From 1804 to 1810 he was the U.S. minister to France, and in March 1806 he was joined with James Bowdoin as a special minister to treat through France with Spain concerning the acquisition of Florida, Spanish spoliations of American commerce and the "Louisiana" boundary. During the War of 1812, he was a brigadier-general in the United States army from July 1812 until Jan. 1813, and from then until August 1814 secretary of war in the cabinet of President Madison, when his unpopularity forced him to resign. "In spite of Arrnstrong's services, abilities and experience," says Henry Adams, "something in his character always created distrust. He had every advantage of education, social and political connection, ability and self-confidence; . . . but he suffered from the reputation of indolence and intrigue." Nevertheless, he "introduced into the army an energy wholly new," an energy the results of which were apparent "for half a century." He died at Red Hook (N.Y.), April 1, 1843. He published *Notices of the War of 1812* (1836; new ed., 1840), which is greatly impaired by its partiality.

The best account of Armstrong's career as minister to France and as secretary of war may be found in Henry Adams's *History of the United States, 1801–1817* (1889–90).

ARMSTRONG, SAMUEL CHAPMAN (1839–1893), American soldier, philanthropist and educator, was born on Maui, one of the Hawaiian islands, on Jan. 30, 1839, his parents Richard and Clarissa Armstrong, being American missionaries. He was educated at Oahu college, Honolulu, and at Williams college, Williamstown, Mass., where he graduated in 1862. He served in the Civil War, on the Union side, 1862–65, rising in the volunteer service to the regular rank of colonel and the brevet rank of brigadier general, and, after Dec., 1863, acted as one of the officers of the coloured troops commanded by Gen. William Birney. His experience as commander of negro troops had added to his interest, always strong, in the negroes of the south, and in March 1866 he became superintendent of the Ninth District of Virginia, under the Freedman's bureau, with headquarters near Ft. Monroe. While in this position he became convinced that the only permanent solution of the manifold difficulties which the freedmen encountered lay in their moral and industrial education. He remained in the educational department of the bureau until this work came to an end in 1872; though five years earlier, at Hampton, Va., near Ft. Monroe, he had founded, with the aid principally of the American Missionary Association, an industrial school for negroes, Hampton institute, which was formally opened in 1868, and at the head of which he remained until his death, there, on May 11, 1893. After 1878 Indians were also admitted to the institute, and during the last 15 years of his life Armstrong took a deep interest in the "Indian question." Much of his time after 1868 was spent in the northern and eastern states, whither he went to raise funds for the Institute.

See *Samuel Chapman Armstrong, a Biographical Study* (New York, 1904), by his daughter, Edith Armstrong Talbot.

His brother, WILLIAM N. ARMSTRONG, was attorney general in the cabinet of the Hawaiian king Kalakaua I. He accompanied that monarch on a prolonged foreign tour in 1881, visiting Japan, China, Siam, India, Europe and the United States, and in 1904 published an amusing account of the journey, called *Round the World with a King*.

ARMSTRONG, WILLIAM GEORGE ARMSTRONG, BARON (1810–1900), British inventor, founder of the Elswick manufacturing works, was born on Nov. 26, 1810, at Newcastle-on-Tyne, and educated at a school in Bishop Auckland. From 1833 to 1847 he was engaged in active practice as a solicitor in Newcastle. In 1841–43 he published several papers on the electricity of effluent steam, and the inquiry was followed by the invention of the "hydro-electric" machine, a powerful generator of electricity. The question of the utilization of water-power had engaged his attention even earlier, and in 1839 he invented an improved rotary water motor. Soon afterwards he designed a hydraulic crane, which contained the germ of all the hydraulic machinery for which he and Elswick were subsequently to become famous.

The Elswick works were originally founded for the manufacture of this hydraulic machinery, but it was not long before they became the birthplace of a revolution in gunmaking. Modern artillery dates from about 185j, when Armstrong's first gun made its appearance. This weapon embodied all the essential features which distinguish the ordnance of to-day from the cannon of the middle ages—it was built up of rings of metal shrunk upon an inner steel barrel; it was loaded at the breech; it was rifled; and it threw, not a round ball, but an elongated projectile with ogivai head. The guns constructed on this principle yielded such excellent results, both in range and accuracy, that they were adopted by the British Government in 1859. At the same time the Elswick Ordnance Company was formed to manufacture the guns under the supervision of Armstrong, who, however, had no financial interest in the concern; it was merged in the Elswick Engineering Works four years later. Defects in the breech mechanism led to the abandonment by the British Government of the new gun. For 17 years the government adhered to the older method of loading, in spite of the improvements which experiment and research at Elswick and elsewhere had during that period produced in the mechanism and performance of heavy guns. But at last Armstrong's results could no longer be ignored and wire-wound breech-loading guns were received back into the service in 1880. The use of steel wire for the construction of guns was one of Armstrong's early ideas.

Lord Armstrong, who was raised to the peerage in 1887, was the author of *A Visit to Egypt* (1873), and *Electric Movement in Air and Water* (1897), besides many professional papers. He died on Dec. 27, 1900, at Rothbury, Northumberland. His title became extinct, but his grand-nephew and heir, W. H. A. F. Watson-Armstrong (b. 1863), was in 1903 created Baron Armstrong of Bamburgh and Cragside.

ARMSTRONG (SIR W. G.) WHITWORTH AND CO., LTD. On Nov. 24, 1845, a solicitor, William George Armstrong, afterwards Lord Armstrong, proposed the application of the pressure of water in the street pipes to the working of the cranes upon the quayside, and, in 1846, the Newcastle Cranage Company was formed. In the following year the famous Elswick Works first came into being. The total share capital of the new company was only £22,500. This venture was successful and in 1882 became a public company. A further development led to the formation of the Elswick Ordnance Company. This was the result of Armstrong's successful experiments with rifled cannon, which culminated in 1858 in the production of an 18-pounder gun and its adoption, after extensive trials, by the British War Office. The Elswick Ordnance Company was formed therefore in 1859; and a year later Captain (afterwards Sir Andrew) Noble joined the firm. In 1862, the re-armament of the services being complete, the Government withdrew from the company which was then amalgamated as Sir W. G. Armstrong and Co., with a capital of £180,000. In 1882 there was further amalgamation and the

formation of a new company under the title of Sir W. G. Armstrong Mitchell and Company, Limited, with a capital of £2,000,000.

Soon afterwards a shipyard was started at Elswick. Thenceforward the Elswick Yard concentrated entirely on warship building, and the Walker Yard on mercantile ships. The fast and heavily armed Elswick cruisers (actually built at Walker) of which the "Esmeralda" was the first and most famous of a long line, attracted world-wide attention.

The next important development in the company's history was the readjustment of the capital account in 1896, followed in 1897 by the purchase of the Whitworth Works at Openshaw in Manchester, where shortly afterwards a large armour-plate plant was installed. The capital by this time was over £4,000,000, and the style of the company became, as it remained, Sir W. G. Armstrong, Whitworth and Company, Limited.

For the next 18 years steady progress and expansion continued. The increasing size of battleships led to the construction of the Armstrong naval yard at Walker-on-Tyne.

In 1900 Lord Armstrong died, and was succeeded in the chairmanship by Sir Andrew Noble, who continued to act as chairman until his death in 1915.

The subsequent history of the company, though of great interest, is on somewhat different lines. Throughout the War, when the peak of its greatness was reached, its activities were of incalculable value to the Allies, but the conditions under which it worked were changed, and it developed into what amounted to a national arsenal. After 1918 a new set of problems confronted it, culminating in the sale in 1927 of the Elswick and Openshaw Works to a new company called Vickers Armstrongs, Limited. In 1929 the name was changed to Armstrong Whitworth Securities Co., Ltd. When the Admiralty acquired in 1937 its last remaining engineering works (Scotswood works) the company ceased manufacturing and became an investment company in the course of a gradual liquidation. (See VICKERS **LIMITED.**) (L. C. M.; X.)

ARMY (from Fr. *armée*, Lat. *armata*), a considerable body of men armed and organized for the purpose of warfare on land (Ger. Armee), or the whole armed force at the disposal of a state or person for the same purpose (Ger. *Heer*=host). The application of the term is sometimes restricted to the permanent, active or regular forces of a state. The history of the development of the army systems of the world is dealt with in this article in sections 1 to 37, being followed by sections 38 to 51 on the characteristics of present-day armies. For the history and the existing condition of the principal armies of the world see under the country heading.

HISTORY UP TO 1870

1. Early Armies.—It is only with the evolution of the specially military function in a tribe or nation, expressed by the separation of a warrior-class, that the history of armies (as now understood) begins. Numerous savage tribes of the present day possess military organizations based on this system, but it first appears in the history of civilization amongst the Egyptians. By the earliest laws of Egypt, provision was made for the support of the warriors. The exploits of her armies under the legendary Sesostris cannot be regarded as historical, but it appears certain that the country possessed an army, capable of waging war in a regular fashion, and divided thus early into separate arms, these being chariots, infantry and archers. The systems of the Assyrians and Babylonians present no particular features of interest, save that horsemen, as distinct from charioteers, appear on the scene. The first historical instance of a military organization resembling those of modern times is that of the Persian empire.

2. Persia.—Drawn from a hardy and nomadic race, the armies of Persia at first consisted mainly of cavalry, and owed much of their success to the consequent ease and rapidity of their movements. The warlike Persians constantly extended their power by fresh conquests, and for some time remained a distinctly conquering and military race, attaining their highest power under Cyrus and Cambyses. Cyrus seems to have been the founder of a comprehensive military organization, of which we gather details from Xenophon and other writers. To each province was allotted a certain number of soldiers as standing army. These troops, formed originally of native Persians only, were called the king's troops. They comprised two classes, the one devoted exclusively to garrisoning towns and castles, the other distributed throughout the country. To each province was appointed a military commander, responsible for the number and efficiency of the troops in his district, while the civil governor was answerable for their subsistence and pay. This organization seems to have fully answered its original purpose, that of holding a vast empire acquired by conquest and promptly repelling inroads or putting down insurrections. But when a great foreign war was contemplated, the standing army was augmented by a levy throughout the empire. The extent of the empire made such a levy slow to assemble, and the heterogeneous and unorganized mass of men of all nations so brought together was a source of weakness rather than strength. Indeed, the vast hosts over which the Greeks gained their victories comprised but a small proportion of the true Persians. The cavalry alone seems to have retained its national character, and with it something of its high reputation, even to the days of Alexander.

3. Greece.—The Homeric armies were tribal levies of foot, armed with spear, sword, bow, etc., and commanded by the chiefs in their war-chariots. In historic times all this is changed. Greece becomes a congeries of city-states, each with its own citizen-militia. Federal armies and permanent troops are rare, the former owing to the centrifugal tendency of Greek politics, the latter because the "tyrannies," which must have relied very largely on standing armies to maintain themselves, had ultimately given way to democratic institutions. But the citizen-militia of Athens or Sparta resembled rather a modern "nation in arms" than an auxiliary force. Service was compulsory in almost all states, and as the young men began their career as soldiers with a continuous training of two or three years, Hellenic armies, like those of modern Europe, consisted of men who had undergone a thorough initial training and were subsequently called up as required. Cavalry, as always in the broken country of the Peloponnesus, was not of great importance, and it is only when the theatre of Greek history is extended to the plains of Thessaly that the mounted men become numerous. In the 4th century the mainstay of Greek armies was the *hoplite* (ὁπλίτης), the heavy-armed infantryman who fought in the corps de bataille; the light troops were men who could not provide the full equipment of the hoplite, rather than soldiers trained for certain special duties such as skirmishing. The fighting formation was that of the *phalanx*, a solid corps of hoplites armed with long spears.

4. **Sparta.**—So much is common to the various states. In Sparta the idea of the nation in arms was more thoroughly carried out than in any other state in the history of civilization. In other states the individual citizen often lived the life of a soldier, here the nation lived the life of a regiment. Private homes resembled the "married quarters" of a modern army; the unmarried men lived entirely in barracks. Military exercises were only interrupted by actual service in the field, and the whole life of a man of military age was devoted to them. Under these circumstances the Spartans maintained a practically unchallenged supremacy over the armies of other Greek states; sometimes their superiority was so great that, like the Spanish regulars in the early part of the Dutch War of Independence, they destroyed their enemies with insignificant loss to themselves.

5. Greek Mercenaries.—The military system of the 4th century was not called upon to provide armies for continuous service on distant expeditions. When, after the earlier campaigns of the Peloponnesian War, the necessity for such expeditions arose, the system was often strained almost to breaking point (*e.g.*, in the case of the Athenian expedition to Syracuse), and ultimately the states of Greece were driven to choose between unprofitable expenditure of the lives of citizens and recruiting from other sources. Mercenaries serving as light troops, and particularly as *peltasts* (a new form of disciplined "light infantry") soon appeared. The corps de bataille remained for long the old phalanx of citizen hoplites. But the heavy losses of many

years told severely on the resources of every state, and ultimately non-national recruits — adventurers and soldiers of fortune, broken men who had lost their possessions in the wars, political refugees, runaway slaves, etc.—found their way even into the ranks of the hoplites, and Athens at one great crisis (407) eniisted slaves, with the promise of citizenship as their reward. The Arcadians, like the Scots and the Swiss in modern history, furnished the most numerous contingent to the new professional armies. A truly national army was indeed to appear once more in the history of the Peloponnesus, but in the meantime the professional soldier held the field. The old bond of strict citizenship once broken, the career of the soldier of fortune was open to the adventurous Greek. Taenarum and Corinth became regular *entrepôts* for mercenaries. The younger Cyrus raised his army for the invasion of Persia precisely as the emperors Maximilian and Charles V. raised regiments of *Landsknechte*—by the issue of recruiting commissions to captains of reputation. This army became the famous Ten Thousand. It was a marching city-state, its members not desperate adventurers, but men with the calm self-respect of Greek civilization. On the fall of its generals it chose the best officers of the army to command, and obeyed implicitly. Cheirisophus the Spartan and Xenophon the Athenian, whom they chose, were not plausible demagogues; they were line officers, who, suddenly promoted to the chief command under circumstances of almost overwhelming difficulty, proved capable of achieving the impossible. The merit of choosing such leaders is not the least title to fame of the Ten Thousand mercenary Greek hoplites. About the same time Iphicrates with a body of mercenary peltasts destroyed a corps of Spartan hoplites (391 B.C.).

6. **Epaminondas.**—Not many years after this, Spartan oppression roused the Theban revolt, and the Theban revolt became the Theban hegemony. The army which achieved this under the leadership of Epaminondas, one of the great captains of history, had already given proofs of its valour against Xenophon and the Cyreian veterans. Still earlier it had won the great victory of Delium (424 B.C.). It was organized, as were the professional armies, on the accepted model of the old armies, viz., the phalangite order, but the addition of peltasts now made a Theban army, unlike the Spartans, capable of operating in broken country as well as in the plain. The new tactics of the phalanx, introduced by Epaminondas, embodied, for the first time in the history of war, the modern principle of concentration to obtain a local superiority of force, and suggested to Frederick the Great the famous "oblique order of battle." Further, the cavalry was more numerous and better led than that of Peloponnesian states. The professional armies had well understood the management of cavalry; Xenophon's handbook of the subject is not without value in the 20th century. In Greek armies the dearth of horses and the consequent numerical weakness of the cavalry prevented the bold use of the arm on the battlefield. (*See* CAVALRY.) But Thebes had always to deal with nations which possessed numerous horsemen. Jason of Pherae, for instance, put into the field against Thebes many thousands of Thessalian horse; and thus at the battle of Tegyra in 375 the Theban cavalry under Pelopidas, aided by the corps *d'élite* of infantry called the Sacred Band, carried all before them. At Leuctra Epaminondas won a glorious victory by the use of his "oblique order" tactics; the same methods achieved the second great victory of Mantineia (362 B.C.) at which Epaminondas fell. Pelopidas had already been slain in a battle against the Thessalians, and there was no leader to carry on their work. But the new Greek system was yet to gain its greatest triumphs under Alexander the Great.

7. Alexander. — The reforms of Alexander's father, Philip of Macedon, may most justly be compared to those of Frederick William I. in Prussia. Philip had lived at Thebes as a hostage, and had known Iphicrates, Epaminondas and Pelopidas. He grafted the Theban system of tactics on to the Macedonian system of organization. (See MACEDONIAN ARMY.) That the latter —a complete territorial system — was efficient was shown by the fact that Philip's blow was always struck before his enemies were ready to meet it. That the new Greek tactics, properly used, were superior to the old was once more demonstrated at Chaeronea (338 B.C), where the Macedonian infantry militia fought in phalanx, and the cavalry, led by the young Alexander, delivered the last crushing blow. On his accession, like Frederick the Great, Alexander inherited a well-trained and numerous army, and was not slow to use it. The invasion of Asia was carried out by an army of the Greek pattern, formed both of Hellenes and of non-Hellenes on an exceedingly strong Macedonian nucleus. Alexander's own guard was composed of picked horse and foot. The infantry of the line comprised Macedonian and Greek hoplites, the Macedonians being subdivided into heavy and medium troops. These fought in a grand phalanx, which was subdivided into units corresponding to the modern divisions, brigades and regiments, the fighting formation being normally a line of battalion masses. The arm of the infantry was the 18ft. pike (sarissa). The peltasts, Macedonian and Greek, were numerous and well trained, and there was the usual mass of irregular light troops, bowmen, slingers, etc. The cavalry included the Guard (ἄγημα), a body of heavy cavalry composed of chosen Macedonians, the line cavalry of Macedonia (ἑταιροι) and Thessaly, the numerous small contingents of the Greek states, mercenary corps and light lancers for outpost work. The final blow and the gathering of the fruits of victory were now for the first time the work of the mounted arm. The solid phalanx was almost unbreakable in the earlier stages of the battle, but after a long infantry fight the horsemen had their chance. In former wars they were too few and too poorly mounted to avail themselves of it, and decisive victories were in consequence rarely achieved in battles of Greek versus Greek. Under Epaminondas, and still more under Philip and Alexander, the cavalry was strong enough for its new work. Battles were now ended by the shock action of mounted men, and in Alexander's time it was noted as a novelty that the cavalry carried out the pursuit of a beaten army. There were further, in Alexander's army, artillerymen with a battering train, engineers and departmental troops, and also a medical service, an improvement attributed to Jason of Pherae. The victories of this army, in close order and in open, over every kind of enemy and on every sort of terrain, produced the Hellenistic world, and in that achievement the history of Greek armies closes, for after the return of the greater part of the Europeans to their homes the armies of Alexander and his successors, became gradually orientalized.

The decisive step was taken in 323, when a picked contingent of Persians, armed mainly with missile weapons, was drafted into the phalanx, in which henceforward they formed the middle ranks of each file of 16 men. But, like the third rank of Prussian infantry up to 1888, they normally fought as skirmishers in advance, falling into their place behind the pikes of the Macedonian file-leaders only if required for the decisive assault. The new method, of course, depended for success on the steadiness of the thin three-deep line of Macedonians thus left as the line of battle. Alexander's veterans were indeed to be trusted, but as time went on, and little by little the war-trained Greeks left the service, it became less and less safe to array the Hellenistic army in this shallow and articulated order of battle. The purely formal organization of the phalanx 16 deep became thus the actual tactical formation, and around this solid mass of 16,384 men gathered the heterogeneous levies of a typical oriental army. Pyrrhus, king of Epirus, retained far more of the tradition of Alexander's system than his contemporaries farther east, yet his phalanx, comparatively light and mobile as it was, achieved victories over the Roman legion only at the cost of self-destruction. Even elephants quickly became a necessary adjunct to Hellenistic armies.

8. **Carthage.**—The military systems of the Jews present few features of unusual interest. The expédient of calling out successive contingents from the different tribes, in order to ensure continuity in military operations, should, however, be noticed. David and Solomon possessed numerous permanent troops which served as guards and garrisons; in principle this organization was identical with that of the Persians, and that of Europe in the 16th and 17th centuries. Particular interest attaches to the Carthaginian military forces of the 3rd century B.C. Rarely has any army achieved such renown in the short space of 62 years (264–202 B.C.). Carthage produced a series of great generals, culminating

in Hannibal, who is marked out, even by the little that is known of him, as the peer of Napoleon. But Napoleon was supported by a national army, Hannibal and his predecessors were condemned to work with armies of mercenaries. For the first time in the world's history war is a matter with which the civil population has no concern. The merchants of Carthage fought only in the last extremity; the wars in which their markets were extended were conducted by non-national forces and directed by the few Carthaginian citizens who possessed military aptitudes. The civil authorities displayed towards their instruments a spirit of hatred for which it is difficult to find a parallel. Unsuccessful leaders were crucified, the mercenary soldiers were cheated of their pay, and broke out into a mutiny which shook the empire of Carthage to its foundations. But the magnetism of a leader's personality infused a corporate military spirit into these heterogeneous Punic armies, and history has never witnessed so complete an illustration of the power of pure and unaided *esprit de corps* as in the case of Hannibal's army in Italy, which, composed as it was of Spaniards, Africans, Gauls, Numidians, Italians and soldiers of fortune of every country, was yet welded by him into thorough efficiency. The army of Italy was as great in its last fight at Zama as the army of Spain at Rocroi; its victories of the Trebia, Trasimene and Cannae were so appalling that, **200** years later, its leader was still, to a Roman, the "dire" Hannibal.

In their formal organizations the Carthaginian armies resembled the new Greek model, and indeed they were created in the first instance by Xanthippus, a Spartan soldier in the service of Carthage, who was called upon to raise and train an army when the Romans were actually at the gates of Carthage, and justified his methods in the brilliant victory of Tunis (255 B.C.). For the solid Macedonian phalanx of 16,000 spears Xanthippus substituted a line of heavy battalions equal in its aggregate power of resistance to the older form, and far more flexible. The triumphs of the cavalry arm in Hannibal's battles excelled those of Alexander's horsemen. Hannibal chose his fighting ground whenever possible with a view to using their full power, first to defeat the hostile cavalry, then to ride down the shaken infantry masses, and finally to pursue *au fond.* At Cannae, the greatest disaster ever suffered by the Romans, the decisive blow and the slaughter were the work of Hannibal's line cavalry, the relentless pursuit that of his light horse. But a professional long-service army has always the greatest difficulty in making good its losses, and in the present case it was wholly unable to do so. Even Hannibal failed at last before the sustained efforts of the citizen army of Rome.

9. Roman Army Under the Republic. — The earliest organization of the Roman army is attributed to Romulus, who formed it on the tribal principle, each of the three tribes contributing its contingent of horse and foot. But it was to Servius Tullius that Rome owed, traditionally, the complete classification of her citizen-soldiers. For the details of the Roman military system, *see* ROMAN ARMY. During the earlier period of Roman history the army was drawn entirely from the first classes of the population, who served without pay and provided their own arms and armour. The wealthiest men *(equites)* furnished the cavalry, the remainder the infantry, while the poorer classes either fought as light troops or escaped altogether the privilege and burden of military service. Each "legion" of **3,000** heavy foot was at first formed in a solid phalanx. The introduction of the elastic and handy three-line formation with intervals (similar in many respects to Alexander's) was brought about by the Gallic wars, and is attributed to M, Furius Camillus, who also, during the siege of Veii, introduced the practice of paying the soldiers, and thus removed the chief obstacle to the employment of the poorer classes. The new order of battle was fully developed in the Pyrrhic Wars, and the typical army of the Republic may be taken as dating from the latter part of the 3rd century B.C. The legionary was still possessed of a property qualification, but it had become relatively small. An annual levy was made at Rome to provide for the campaign of the year. Discipline was severe, and the rewards appealed as much to the soldier's honour as to his desire of gain. A legion now consisted of three lines *(Hastati, Principes, Triarii),* each line composed of men of similar age and experience, and was further subdivided into **30** "maniples," each of two "centuries." The normal establishment of **300** cavalry, **3,000** heavy and **1,200** light infantry was still maintained, though in practice these figures were often exceeded. In place of the old light-armed and somewhat inferior *rorarii,* the new *velites* performed light infantry duties (211 B.C.), at the same time retaining their place in the maniples, of which they formed the last ranks (compare the Macedonian phalanx as reorganized in 323, § 7, p. 397). The 300 cavalry of the legion were trained for shock action. But both the offensive and defensive strength of the Roman army lay in the heavy legionary infantry — except for one brief period at the end of the second Punic War when Scipio Africanus, appreciating the decisive value of cavalry exemplified in Hannibal's battles, set out to forge a similar instrument, and at Zama triumphantly turned Hannibal's master-weapon against him. The lesson, like other of Scipio's innovations, was, however, lost sight of in succeeding generations. The **30** maniples of each legion stood in three lines of battle, but the most notable point of their formation was that each maniple stood by itself on its own small manoeuvre-area, free to take ground to front or flank. To the Roman legion was added a legion of allies, somewhat differently organized and possessing more cavalry, and the whole force was called a "double legion" or briefly a "legion." A consul's army consisted nominally of two double legions, but in the Punic Wars military exigencies rather than custom dictated the numbers of the army, and the two consuls at Cannae (216 B.C.) commanded two double consular armies, or eight double legions.

10. Characteristics of the Roman Army. — Such in outline was the Roman military organization at the time when it was put to the severe test of the Second Punic War. Its elements were good, its military skill superior to that of any other army of ancient history, while its organization was on the whole far better than any that had gone before. The handy formation of maniples at open order was unique in the ancient world, and it did not reappear in history up to the advent of Gustavus Adolphus. In this formation, in which everything was entrusted to the skill of subordinates and the individual courage of the rank and file, the Romans met and withstood with success every type of impact, from the ponderous shock of the Macedonian phalanx and the dangerous rush of Celtic savages to the charge of elephants. Yet there would have been danger in thus articulating the legion had it been composed of any but the most trustworthy soldiers. To swiftness and precision of manoeuvre they added a dogged obstinacy over which nothing but overwhelming disaster prevailed. It is, therefore, not unnatural to ask wherein the system which produced these soldiers failed, as it did within a century after the battle of Zama. The greatest defect was the want of a single military command. The civil magistrates of Rome were *ex officio* leaders of her armies, and though no Roman officer lacked military training, the views of a consul or praetor were almost invariably influenced by the programme of his political party. When, as sometimes happened, the men under their command sided in the political differences of their leaders, all real control came to an end. The soldiers of the republic hardly ever forgot that they were citizens with voting powers; they served as a rule only during a campaign; and, while there could be little question as to their patriotism and stubbornness, they lacked almost entirely that *esprit de corps* which is found only amongst the members of a body having a permanent corporate existence. Thus they had the vices as well as the virtues of a nation in arms, and they fell still further short of the ideal because of the dubious and precarious tenure of their generals' commands. The great officers were usually sent home at the end of a campaign, to be replaced by their elected successors, and they showed all the hesitation and fear of responsibility usually found in a temporary commander. Above all, when two armies, each under its own consul or praetor, acted together, the command was either divided or exercised on alternate days. Under a prolonged trial, such as the Punic Wars, this system was modified, yet even so the strength of its grip is well illustrated in the interference with, and attempted supersession of, Scipio during his African campaign which ended in the overthrow of Carthage.

11. **Roman** Empire.—The essential weakness of militia forces and the frequent changes in military commanders due to political considerations required the adoption of various expedients which for a time obviated the evils to which allusion has been made.

A change of far greater importance, however, followed the final exploits of the armies of the old system. The increasing dominions of the Republic, the spread of wealth and luxury, the gradual decadence of the old Roman ideas, all tended to produce an army more suited to the needs of the newer lime than the citizen militia of the 3rd century. Permanent troops were a necessity; the rich, in their newly acquired dislike of personal effort, ceased to bear their share in the routine life of the army, and thus the proletariat began to join the legions with the express intention of taking to a military career. The actual change from the old *régime* to the new was in the main the work of Gaius Marius. The urgent demand for men at the time of the Teutonic invasions caused the service to be thrown open to all Roman citizens irrespective of *census*. The new territories furnished cavalry, better and more numerous than the old *equites,* and light troops of various kinds to replace the *velites*. Only the heavy foot remained a purely Italian force, and the spread of the Roman citizenship gradually abolished the distinction between a Roman and an allied legion. The higher classes had repeatedly shown themselves unwilling to serve under plebeians (*e.g.,* Varro and Flaminius); Marius preferred to have as soldiers men who did not despise him as an inferior. Under all these influences for good or for evil, the standing army was developed in the first half of the 1st century B.C. The tactical changes in the legion indicate its altered character. The small maniples gave way to heavy "cohorts," ten cohorts forming the legion; as in the Napoleonic wars, light and handy formations became denser and more rigid with the progressive decadence in *moral* of the rank and file. It is more significant still that in the days of Marius the annual oath of allegiance taken by the soldier came to be replaced by a personal vow, taken once and for all, of loyalty to the general. *Ubi bene, ibi patria* was an expression of the new spirit of the army, and Caesar had but to address his men as *quirites* (civilians) to quell a mutiny. *Hastati, principes* and *triarii* were now merely expressions in drill and tactics. But perhaps the most important of all these changes was the growth of regimental spirit and tradition. The legions had come to be numbered throughout the army, and the Tenth Legion has remained a classic instance of a "crack" corps. The *moral* of the Roman army was founded no longer on patriotism, but on professional pride and *esprit de corps.*

With this military system Rome passed through the era of the Civil Wars, at the end of which Augustus found himself with 45 legions on his hands. As soon as possible he carried through a great reorganization, by which, after ruthlessly rejecting inferior elements, he obtained a smaller picked force of 25 legions, with numerous auxiliary forces. These were permanently stationed in the frontier provinces of the empire, while Italy was garrisoned by the Praetorian cohorts, and thus was formed a regular long-service army, the strength of which has been estimated at 300,000 men. But these measures, temporarily successful, produced in the end an army which not only was perpetually at variance with the civil populations it was supposed to protect, but frequently murdered the emperors to whom it had sworn allegiance when it raised them to the throne. The evil fame of the Italian cohorts has survived in the phrase "praetorianism" used to imply a venal military despotism. The citizens gradually ceased to bear arms, and the practice of self-mutilation became common. The inevitable *dénouement* was delayed from time to time by the work of an energetic prince. But the ever-increasing inefficiency and factiousness of the legions, and the evanescence of all military spirit in the civil population, made it easy for the barbarians, when once the frontier was broken through, to overrun the decadent empire. The end came when the Gothic heavy horse annihilated the legions of Valens at Adrianople (A.D. 378).

There was now no resource but to take the barbarians into Roman pay. Under the name of *foederati,* the Gothic mercenary cavalry played the most conspicuous part in the succeeding wars of the empire, and began the reign of the heavy cavalry arm, which lasted for almost 1,000 years. Even so soon as within six years of the death of Valens 20,000 Gothic horse decided a great battle in the emperor's favour. These men, however, became turbulent and factious, and it was not till Emperor Leo I. had regenerated the native Roman soldier that the balance was maintained between the national and the hired warrior. The work of this emperor and of his successors found eventual expression in the victories of Belisarius and Narses, in which the Romans, in the new rôle of horse-archers, so well combined their efforts with those of the *foederati* that neither the heavy cavalry of the Goths nor the phalanx of Frankish infantry proved to be capable of resisting the imperial forces. At the battle of Casilinum (553) Roman foot-archers and infantry bore no small part of the work. It was thus in the Eastern Empire the Roman military spirit was revived The Byzantine army evolved from the Justinian system and became eventually an outstanding example in mediaeval history of a thoroughly organized military service.

12. **The "Dark** Ages."—In western Europe all traces of Roman military institutions quickly died out, and the conquerors of the new kingdoms developed fresh systems from the simple tribal levy. The men of the plains were horsemen, those of marsh and moor were foot, and the four greater peoples retained these original characteristics long after the conquest had been completed. In organization the Lombards and Franks, Visigoths and English scarcely differed. The whole military population formed the mass of the army, the chiefs and their personal retainers the *élite*. The Lombards and the Visigoths were naturally cavalry; the Franks and the English were, equally naturally, infantry, and the armies of the Merovingian kings differed but little from the English *fyrd* with which Offa and Penda fought their battles. But in these nations the use of horses and armour, at first confined to kings and great chiefs, gradually spread downwards to the ever-growing classes of *thegns, contites,* etc. Finally, under Charlemagne were developed the general lines of the military organization which eventually became feudalism. For his distant wars he required an efficient and mobile army. Hence successive "capitularies" were issued dealing with matters of recruiting, organization, discipline and field service work. Very noticeable are his system of forts (*burgi*) with garrisons, his military train of artillery and supplies, and the reappearance of the ancient principle that three or four men should equip and maintain one of themselves as a warrior. These and other measures taken by him tended to produce a strong veteran army, very different in efficiency from the tumultuary levy, to which recourse was had only in the last resort. War still remained an art and the fighting had become the special function of men devoted to the profession of arms. After Charlemagne's time the typical feudal army. composed of extremely well equipped cavalry and ill-armed peasantry serving on foot, rapidly developed. Enemies such as Danes and Magyars could only be dealt with by mounted men who could ride round them, compel them to fight, and annihilate them by the shock of the charge; consequently the practice of leaving the infantry in rear, and even at home, grew up almost as a part of the feudal system of warfare. England, however, sought a different remedy, and thus diverged from the Continental methods. This remedy was the creation of a fleet, and, the later Danish wars being there carried out, not by bands of mounted raiders, but by large armies of military settlers, infantry retained its premier position in England up to the day of Hastings. Even the *thegns,* who there, as abroad, were the mainstay of the army, were heavy-armed infantry. The only contribution made by Canute to the military organization of England was the retention of a picked force of *hus carles* (household troops) when the rest of the army with which he had conquered his realm was sent back to Scandinavia. At Hastings, the forces of Harold consisted wholly of infantry. The English array was composed of the king and his personal friends, the *hus carles,* and the contingents of the *fyrd* under the local *thegns;* though better armed, they were organized after the manner of their forefathers. On that field there perished the best infantry in Europe, and henceforward for three centuries there was no serious rival to challenge the predominance of the heavy cavalry in the warfare of the middle ages.

13. The Byzantines *(see* **ROMAN EMPIRE, LATER**).—While the west of Europe was evolving feudalism, the Byzantine empire was acquiring an army and military system scarcely surpassed by any of those of antiquity and not often equalled up to the most modern times. The *foederati* disappeared after the time of Justinian, and by A.D. 600 the army had become at once professional and national. For generations, regiments had had a corporate existence. Now brigades and divisions also appeared in war, and, somewhat later, in peace likewise. With the disappearance of the barbarians the army became one homogeneous service, minutely systematized, and generally resembling an army in the modern sense of the word. The militia of the frontier districts performed efficiently the service of surveillance, and the field forces of disciplined regulars were moved and employed in accordance with well reasoned principles of war; their maintenance was provided for by a scutage, levied, in lieu of service, on the central provinces of the empire. Later, a complete territorial system of recruiting and command was introduced. Each "theme" (military district) had its own regular garrison, and furnished a field division of some 5,000 picked troopers for a campaign in any theatre of war. Provision having been made in peace for a depot system, all unfit men and horses could be left behind, and local duties handed over to second line troops; thus the field forces were practically always on a war footing. Besides the "themes" under their generals, there were certain districts on the frontiers, called "clissuras," placed under chosen officers, and specially organized for emergency service. The corps of officers in the Byzantine army was recruited from the highest classes, and there were many families (*e.g.*, that from which came the celebrated Nicephorus Phocas) in which soldiering was the traditional career. The rank and file were either military settlers or men of the yeoman class, and in either case had a personal interest in the safety of the theme which prevented friction between soldiers and civilians. The principal arm was, of course, cavalry, and infantry was employed only in special duties. Engineer, train and medical services were maintained in each theme. Of the *ensemble* of the Byzantine army it has been said that "the art of war as it was understood at Constantinople . . . was the only system of real merit existing. No western nation could have afforded such a training to its officers till the 16th or . . . 17th century." The vitality of such an army remained intact long after the rest of the empire had begun to decay, and though the old army practically ceased to exist aiter the great disaster of Manzikert (1071), the barbarians and other mercenaries who formed the new service were organized, drilled and trained to the same pitch of military efficiency. Indeed the greatest tactical triumph of the Byzantine system (Calavryta, 1079) was won by an army already largely composed of foreigners. But mercenaries in the end developed praetorianism, as usual, and at last they actually mutinied, in the presence of the enemy, for higher pay (Constantinople, 1204).

14. Feudalism.—From the military point of view the change under feudalism was very remarkable. For the first time in the history of western Europe there appears, in however rough a form, a systematized obligation to serve in arms, regulated on a territorial basis. That army organization in the modern sense—organization for tactics and command—did not develop in any degree commensurate with the development of military administration, was due to the peculiar characteristics of the feudal system, and the virtues and weaknesses of mediaeval armies were its natural outcome. Personal bravery, the primary virtue of the soldier, could not be wanting in the members of a military class the *métier* of which was war and manly exercises. Pride of caste, ambition and knightly emulation, all helped to raise to a high standard the individual efficiency of the feudal cavalier. But the gravest faults of the system, considered as an army organization, were directly due to this personal element. Indiscipline, impatience of superior control and dangerous knight-errantry, together with the absence of any chain of command, prevented the feudal cavalry from achieving results at all proportionate to the effort expended and the potentialities of a force with so many soldierly qualities. If such defects were habitually found in the best elements of the army—the feudal tenants and sub-tenants who formed the heavy cavalry arm—little could be expected of the despised and ill-armed foot-soldiery of the levy. The swift raids of the Danes and others had created a precedent which in French and German wars was almost invariably followed. The feudal levy rarely appeared at all on the battlefield, and when it was thus employed it was ridden down by the hostile knights, and even by those of its own party, without offering more than the feeblest resistance. Above all, one disadvantage, common to all classes of feudal soldiers, made an army so composed quite untrustworthy. The service which a king was able to exact from his feudatories was so slight (varying from one month to three in the year) that no military operation which was at all likely to be prolonged could be undertaken with any hope of success.

15. Mediaeval Mercenaries.—It was natural, therefore, that a sovereign who contemplated a great war should employ mercenaries. These were usually foreigners, as practically all national forces served on feudal terms. While the greater lords rode with him on all his expeditions, the bulk of his army consisted of professional soldiers, paid by the levy of *scutage* imposed upon the feudal tenantry. There had always been soldiers of fortune. William's host at Hastings contained many such men; later, the Flemings who invaded England in the days of Henry I. sang to each other—

"Hop, hop, Willeken, hop! England is mine and thine,"—

and from all the evidence it is clear that in earlier days the hired soldiers were adventurers seeking lands and homes. But these men usually proved to be most undesirable subjects, and sovereigns soon began to pay a money wage for the services of mercenaries properly so called. Such were the troops which figured in English history under Stephen. Such troops, moreover, formed the main part of the armies of the early Plantagenets. They were, as a matter of course, armed and armoured like the knights, with whom they formed the men-at-arms *(gendarmes)* of the army. Indeed, in the 11th and 12th centuries, the typical army of France or the empire contained a relatively small percentage of "knights," evidence of which fact may be found even in so fanciful a romance as *Aucassin and Nicolette*. It must be noted, however, that not all the mercenaries were heavy cavalry; the Brabançon pikeman and the Italian crossbowman (the value of whose weapon was universally recognized) often formed part of a feudal army.

16. Infantry in Feudal Times.—These mercenary foot soldiers came as a rule from districts in which the infantry arm had maintained its ancient predominance in unbroken continuity. The cities of Flanders and Brabant, and those of the Lombard plain, had escaped feudal interference with their methods of fighting, and their burgher militia had developed into solid bodies of heavy-armed pikemen. These mere very different from those of the feudal levy, and individual knightly bravery usually failed to make the slightest impression on a band of infantry held together by the stringent corporate feeling of a trade guild. The more adventurous of the young men, like those of the Greek cities, took service abroad and fought with credit in their customary manner. The reign of the "Brabançon" as a mercenary was indeed short, but he continued, in his own country, to fight in the old way, and his successor in the profession of arms, the Genoese crossbowman, was always highly valued. In England, moreover, the infantry of the old *fyrd* was not suffered to decay into a rabble of half-armed countrymen, and in France a burgher infantry was established by Louis VI. under the name of the *milice des communes*, with the idea of creating a counterpoise to the power of the feudatories. Feudalism, therefore, as a military system, was short-lived. Its limitations had always necessitated the employment of mercenaries, and in several places a solid infantry was coming into existence, which was drawn from the sturdy, and self-respecting middle classes, and in a few generations was to prove itself a worthy opponent not only to the knight, but to the professional man-at-arms.

17. The Crusades.—It is an undoubted fact that the long wars of the Crusades produced no substantial improvement in the feudal armies of Europe. In the East large bodies of men

were successfully kept under arms for a considerable period, but the application of crusading methods to European war was altogether impracticable. In the first place, much of the permanent force of these armies was contributed by the military orders, which had no place in European political activities. Secondly, enthusiasm mitigated much of the evil of individualism. In the third place, there was no custom to limit the period of service, since the Crusaders had undertaken a definite task and would merely have stultified their own purpose in leaving the work only half done. There were, therefore, sharp contrasts between crusading and European armies. In the latter, systematization was confined to details of recruiting; in the armies of the Cross, men were from time to time obtained by the accident of religious fervour, while at the same time continuous service produced a relatively high system of tactical organization. The statement that the Crusaders had a direct influence on the revival of infantry is hardly susceptible of convincing demonstration, but it is at any rate beyond question that the social and economic results of the Crusades materially contributed to the downfall of the feudal knight, and in consequence to a rise in the relative importance of the middle classes. Moreover, when "simple" and "gentle" both took the Cross there could be no question of treating Crusaders as if they were the mere feudal levy. But the little direct influence of the whole of these wars upon military progress in Europe is shown clearly enough by the fact that at the very close of the Crusades a great battle was lost through knight-errantry of the true feudal type (Mansurah).

18. The Period of Transition (1290–1490).—Besides the infantry already mentioned, that of Scotland and that of the German cities fought with credit on many fields. Their arm was the pike, and they were always formed in solid masses (called in Scotland, *schiltrons*). The basis of the mediaeval commune being the suppression of the individual in the social unit, it was natural that the burgher infantry should fight "in serried ranks and in better order" than a line of individual knights, who, moreover, were almost powerless before walled cities. But these forces lacked offensive power, and it was left for the English archers, whose importance dates from the latter years of the 13th century, to show afresh, at Creçy, Poitiers and Agincourt, the value of missile action. When properly supported by other arms, they proved themselves capable of meeting both the man-at-arms and the pikeman. The greatest importance attaches to the evolution of this idea of mutual support and combination. Once it was realized, war became once more an art, and armies became specially organized bodies of troops of different arms. It cannot be admitted, indeed, as has been claimed, that the 14th century had a scientific system of tactics, or that the campaign of Poitiers was arranged by the French "general staff." Nevertheless, during this century armies were steadily coining to consist of expert soldiers, to the exclusion of national levies and casual mercenaries. It is true that, by his system of "indents," Edward III. of England raised national armies of a professional type, but the English soldier thus enrolled, when discharged by his own sovereign, naturally sought similar employment elsewhere. This system produced, moreover, a class of unemployed soldiers, and these, with others who became adventurers from choice or necessity, and even with foreign troops, formed the armies which fought in the Wars of the Roses—armies which differed but slightly from others of the time. The natural result of these wars was to implant a hatred of soldiery in the heart of a nation which had formerly produced the best fighting men in Europe, a hatred which left a deep imprint on the constitutional and social life of the people. In France, where Joan of Arc passed like a meteor across the military firmament, the idea of a national regular army took a practical form in the middle of the 15th century. Still, the forces thus brought into existence were not numerous, and the soldier of fortune was yet to attain the zenith of his career.

19. The Condottieri.—The immediate result of this confused period of destruction and reconstruction was the condottiere, who becomes important about 1300. In Italy, where the *condottieri* chiefly flourished, they were in demand owing to the want of feudal cavalry. and the inability of burgher infantry to undertake wars of aggression. The "free companies" (who served in great numbers in France and Spain as well as in Italy) were "military societies very much like trade guilds," which (so to speak) were hawked from place to place by their managing directors, and hired temporarily by princes who needed their services. Unlike the older hirelings, they were permanently organized, and thus, with their experience and discipline, became the best troops in existence. But the carrying on of war "in the spirit of a handicraft" led to bloodless battles, indecisive campaigns, and other unsatisfactory results, and the reign of the condottieri proper was over by 1400, subsequent free companies being raised on a more strictly national basis. With all their defects, however, they were the pioneers of modern organization. In the inextricable tangle of old and new methods which constitutes the military system of the 15th century, it is possible to discern three marked tendencies. One is the result of a purely military conception of the now special art of war, and its exposition as an art by men who devote their whole career to it. The second is the idea of a national army, resulting from many social, economical and political causes. The third is the tendency towards a more minute organization and subdivision within the army. Whereas the individual feudatories had disliked the close supervision of a minor commander, and their army had in consequence remained always a loosely knit unit, the men who made war into an art belonged to small bands or corps, and naturally began their organization from the lower units. Herein, therefore, was the germ of the regimental system of the present day.

20. The Swiss.—The best description of a typical European army at the opening of the new period of development is that of the French army in Italy in 1494, written by Paolo Giovio. He notes with surprise that the various corps of infantry and cavalry are distinct, the usual practice of the time being to combine one lancer, one archer, one groom, etc., into a small unit furnished and commanded by the lancer. There were Swiss and German infantry, armed with pike and halberd, with a few "shot," who marched in good order to music. There were the heavy men-at-arms (gendarmes), accompanied as of old by mounted archers, who, however, now fought independently. There were, further, Gascon slingers and crossbo men, who had probably acquired, from contact with Spain, some of the lightness and dash of their neighbours. The artillery train was composed of 140 heavy pieces and a great number of lighter guns; these were then and for many generations thereafter a special arm outside the military establishment. (See ARTILLERY.) In all this the only relic of the days of Creçy is the administrative combination of the men-at-arms and the horse archers, and even this is no longer practised in action. The most important element in the army is the heavy infantry of Swiss and Germans. The Swiss had for a century past gradually developed into the most formidable troops of the day. The wars of Žižka (*q.v.*) in Bohemia (1420) materially assisted in the downfall of the heavy cavalry; and the victories of the Swiss, beginning with Sempach (1386), had by 1480 proved that their solid battalions, armed with the long pike and the halberd, were practically invulnerable to all but missile and shock action combined. By fortune of war they never met the English, who had shown the way to deal with the schiltron as early as Falkirk. It was natural that a series of victories such as Grandson, Morat and Nancy should place them in the forefront of the military nations of Europe. The whole people devoted itself thereupon to professional soldiering, particularly in the French service, and though their monopoly of mercenary employment lasted a short time only, they continued to furnish regiments to the armies of France, Spain and the Pope up to the most modern times. But their efficiency was thoroughly sapped by the growth of a mutinous and insubordinate spirit, the memory of which has survived in the proverb *Point* d'argent, *point* de *Suisse*, and inspired Machiavelli with the hatred of mercenaries which marks every page of his work on the art of war. One of their devices for extorting money was to appear at the muster with many more soldiers than had been contracted for by their employers, who were forced to submit to this form of blackmail. At last the French, tired of these caprices, inflicted on the Swiss

the crushing defeat of Marignano (*q.v.*), and their tactical system received its death-blow from the Spaniards at Pavia (1525).

21. The **Landsknechts.**—The modern army owes far more of its organization and administrative methods to the Landsknechts ("men of the country," as distinct from foreigners) than to the Swiss. As the latter were traditionally the friends of France, so these Swabians were the mainstay of the Imperial armies, though both were mercenaries. The Emperor Maximilian exerted himself to improve the new force, which soon became the model for military Europe. A corps of Landsknechts was usually raised by a system resembling that of "indents," commissions being issued by the sovereign to leaders of repute to enlist men. A "colour" (*Fähnlein*) numbered usually about 400 men, a corps consisted of a varying number of colours, some corps having 12,000 men. From these troops, with their intense pride, *esprit de corps* and comradeship, there has come down to modern times much of present-day etiquette, interior economy and "regimental customs"—in other words, nearly all that is comprised in the "regimental" system. Amongst the most notable features of their system were the functions of the provost, who combined the modern offices of provost-marshal, transport and supply officer, and canteen manager; the disciplinary code, which admitted the right of the rank and file to judge offences touching the honour of the regiment; and the women, who, lawfully or unlawfully attached to the soldiers. marched with the regiment and had a definite place in its corporate life. The conception of the regiment as the home of the soldier was thus realized in fact.

22. The Spanish Army.— The tendencies towards professional soldiering and towards subdivision had now pronounced themselves. At the same time, while national armies, as dreamed of by Machiavelli, were not yet in existence, two at least of the powers were beginning to work towards an ideal. This ideal was an army which was entirely at the disposal of its own sovereign, trained to the due professional standard, and organized in the best way found by experience to be applicable to military needs. On these bases was formed the old Spanish army which, from Pavia (1525) to Rocroi (1643), was held by common consent to be the finest service in existence. Almost immediately after emerging from the period of internal development, Spain found herself obliged to maintain an army for the Italian wars. In the first instance this was raised from amongst veterans of the war of Granada, who enlisted for an indefinite time. Probably the oldest line regiments in Europe are those descended from the famous *tercios*, whose formation marks the beginning of military establishments, just as the Landsknechts were the founders of military manners and customs. The great captains who led the new army soon assimilated the best points of the Swiss system, and it was the Spanish army which evolved the typical combination of pike and musket which flourished up to 1700. Outside the domain of tactics, it must be credited with an important contribution to the science of army organization, in the depot system, whereby the *tercios* in the field were continually "fed" and kept up to strength. The social position of the soldier was that of a gentleman, and the young nobles (who soon came to prefer the *tercios* to the cavalry service) thought it no shame, when their commands were reduced, to "take a pike" in another regiment. The provost and his gallows were as much in evidence in a Spanish camp as in one of Landsknechts, but the comradeship and *esprit de corps* of a *tercio* were the admiration of all contemporary soldiers. With all its good qualities, however, this army was not truly national; men soon came from all the various nations ruled by the Habsburgs, and the soldier of fortune found employment in a *tercio* as readily as elsewhere. But it was a great gain that corps, as such, were fully recognized as belonging to the Government, however shifting the *personnel* might be. Permanence of regimental existence had now been attained, though the universal acceptance and thorough application of the principle were still far distant. During the 16th century the French regular army (originating in the *compagnies d'ordonnance* of 1445), which was always in existence, even when the Swiss and *gendarmes* were the best part of the field forces, underwent a considerable development, producing amongst other things the military terminology of the present day. But the wars of religion effectually checked all progress in the latter part of the century, and the European reputation of the French army dates only from the latter part of the Thirty Years' War.

23. The 16th Century.— The battle of St. Quentin (1557) is usually taken as the date from which the last type of a purely mercenary *arm* (as distinct from *corps)* comes into prominence. "Brabançon" or "Swiss" implied pikemen without further qualification, the new term "Reiter" similarly implied mercenary cavalry fighting with the pistol. Heavy cavalry could disperse arquebusiers and musketeers, but it was helpless against solid masses of pikemen; the Reiters solved the difficulty by the use of the pistol. They were well armoured and had little to fear from musket-balls. Arrayed in deep squadrons, therefore, they rode up to the pikes with impunity, and fired methodically *dans le tas*, each rank when it had discharged its pistols filing to the rear to reload. These Reiters were organized in squadrons of variable strength, and recruited in the same manner as were the Landsknechts. They were much inferior, however, to the latter in their discipline and general conduct, for cavalry had many more individual opportunities of plunder than the foot, and the rapacity and selfishness of the Reiters were consequently in marked contrast to the good order and mutual helpfulness in the field and in quarters which characterized the regimental system of the Landsknechts.

24. Dutch System.— The most interesting feature of the Dutch system, which mas gradually evolved by the patriots in the long War of Independence, was its minute attention to detail. In the first years of the war, William the Silent had to depend, for field operations, on mutinous and inefficient mercenaries and on raw countrymen who had nothing but devotion to oppose to the discipline and skill of the best regular army in the world. Such troops were, from the point of view of soldiers like Alva, mere *canaille*, and the ludicrous ease with which their armies were destroyed (as at Jemmingen and Mookerheyde), at the cost of the lives of perhaps a dozen Spanish veterans, went far to justify this view. But, fortunately for the Dutch, their fortified towns were exceedingly numerous, and the individual bravery of citizen-militia, who were fighting for the lives of every soul within their walls, baffled time after time all the efforts of Alva's men. In the open, Spanish officers took incredible liberties with the enemy; once, at any rate, they marched for hours together along submerged embankments with hostile vessels firing into them from either side. Behind walls the Dutch were practically a match for the most furious valour of the assailants.

The insurgents' first important victory in the open field, that of Rymenant, near Malines (1577), was won by the skill of "Bras de Fer," de la Noue, a veteran French general, and the stubbornness of the English contingent of the Dutch army—for England, from 1572 onwards, sent out an ever-increasing number of volunteers. This battle was soon followed by the great defeat of Gembloux (1578), and William the Silent was not destined to see the rise of the Dutch army. Maurice of Nassau was the real organizer of victory. In the wreck of all feudal and burgher military institutions, he turned to the old models of Xenophon, Polybius, Aelian and the rest. Drill, as rigid and as complicated as that of the Macedonian phalanx, came into vogue, the infantry was organized more strictly into companies and regiments, the cavalry into troops or cornets. The cavalry followed the Reiter tactics of the pistol, the infantry fought with pikes, halberds and "shot." This form was generally followed in central Europe, as usual, without the spirit, but in Holland it was the greater trustworthiness of the rank and file that allowed of more flexible formations, and here we no longer see the foot of an army drawn up, as at Jemmingen, in one solid and immovable "square." In their own country and with the system best suited thereto, the Dutch, who moreover acquired greater skill and steadiness day by day, maintained their ground against all the efforts of a Parma and a Spinola. Indeed, it is the best tribute to the vitality of the Spanish system that the inevitable *débâcle* was so long delayed. The campaigns of Spinola in Germany demonstrated that the "Dutch" system, as a system for general use, was at any rate no

better than the system over which it had locally asserted its superiority, and the spirit, and not the form, of Maurice's practice achieved the ultimate victory of the Netherlanders. In the Thirty Years' War the unsuccessful armies of Mansfeld and many others were modelled on the Dutch system—the forces of Spinola, of Tilly and of Wallenstein, on the Spanish. In other words, these systems as such meant little; the discipline and spirit behind them everything. Yet the contribution made by the Dutch system to the armies of to-day was not small; to Maurice and his comrades we owe, first the introduction of careful and accurate drill, and secondly the beginnings of an acknowledged science of war, the groundwork of both being the theory and practice of antiquity. The present method of "forming fours" in the British infantry is ultimately derived from Aelian, just as the first beats of the drums in a march represent the regimental calls of the Landsknechts, and the depots and the drafts for the service battalions date from the Italian wars of Spain.

(C. F. A.; X.)

25. The Thirty Years' War.—Although in this period of almost constant strife various sovereigns kept such forces as they had on a perpetual war looting, gtnerally the size of the military establishments depended on the military, religious or political situation of the moment. The expense of maintaining armies at this period forbade any other system than this, called in German the *Werbe-system,* which may be roughly translated into English as an "enlistment" or '(levy" system. It made possible the rapid expansion of an army in time of need and its equally rapid contraction when the emergency passed. Spain, when temporarily at peace, maintained a relatively large regular army, but elsewhere a few personal guards, a few small garrisons and a small regular force sufficed for the peaceful interlude. Because of conditions which the Dutch confronted, their regiments under this system had a comparatively long life, but when the danger period for the Dutch passed, their army was quickly reduced. The British army from about 1740 to 1820 was an example of the *Werbe-system* in practice. On the Continent, however, the Thirty Years' War produced an unusual continuity of service in corps raised about 1620–30. Some 50 years later the principle of the standing army was universally accepted and the senior regiments of the Prussian and Austrian armies date from about 1630. At this time, too, Gustavus Adolphus of Sweden landed in Germany with an army better trained, equipped and organized than any which had preceded it. This army by its victory of Breitenfeld (1631) ushered in the era of "modern" war and it is to Gustavus that the student must turn for the initial point in the progressive development which has produced the armies of today. With his appearance the Spanish and Dutch methods became as obsolete as those of the Landsknechts.

26. The Swedish Army.—Although in the 16th century most of the fighting was done by mercenaries. Sweden had a national regular army based on a militia which supplied the regular establishment with replacements. The regulars were intended for wars abroad; the militia for home defence and for supplying replacements to the regulars. Troops were raised by a draft systemunder which all able-bodied males from 15 years of age upward were liable for military service. Eight cavalry and 20 infantry regiments of varying strengths composed the militia. Each of these units was raised in whole or in part in a given district and ranged in size from about 1,200 to about 3,000 men. The system had been in operation about a century when Gustavus Adolphus came to the throne in 1611. He reorganized the system thoroughly. standardized the size of the companies and regiments and drilled them thoroughly in his own ideas of tactics—ideas which marked the first step toward modern war. With his contemporaries placing their main reliance on massed pikemen, and regarding musketeers as fit only for scouting and outpost duty, Gustavus realized that firearms, properly handled, held the power to decide battles and developed his tactics accordingly. He improved the mobility of the musketeer and increased the percentage of musketeers in his army. By 1631 he was using entire regiments of musketeers. His military organization was based on a company of 150 men, formed in files six deep and deployed to a depth of three files for battle. Four companies made a squadron or a battalion, eight companies a regiment and three regiments a "great regiment" or brigade. It had been the practice of cavalry to ride toward the enemy at a leisurely pace with each rank delivering its fire when within range, wheeling and swinging back to the rear to give place to the succeeding lines which followed it and did likewise. Gustavus trained his cavalry to charge at a gallop, fire, and then press on with lance or sabre.

Artillery had been cumbersome—ranging in weight from 1,700lb. for a six-pounder to 6,000lb. for a 24-pounder—and consequently no attempt was made to shift it once it was set in place on the battlefield. Gustavus developed a light three-pounder which could be moved as needed by one horse or three men. It could be fired slightly faster than a musket and Gustavus utilized its fire-power to the fullest. Having improved his separate arms Gustavus developed them into a combat team.

In other armies, at the time Gustavus began forging his military machine, artillery, cavalry and infantry operated more or less independently, each without much regard to the activities of the others. Under Gustavus, their activities were co-ordinated. His artillery softened up the enemy forces; his cavalry cracked them up and his infantry mopped them up. The victorious career of Gustavus established a great military reputation for the Swedes. But it did not long survive his death at Liitzen in 1632. It had been due partly to his inspiring leadership and partly to his system. He had taught his system to his generals with great care. but in two decades of war his opponents had also learned it and had adopted enough of it to put them on equal footing with his pupils, if not with the master himself. (H. A. DR.)

27. The English **Civil War** *(see* GREAT REBELLION).—The armies on either side which, about the same time, were fighting out the constitutional quarrel in England were essentially different from all those of the Continent, though their formal organization was similar to that of the Swedes. The military expression of a national conscience had appeared rarely indeed in the Thirty Years' War, which was a means of livelihood for, rather than an assertion of principle by, those who engaged in it. In England, on the other hand, there were no mercenaries, and the whole character of the operations was settled by the burning desire of a true "nation in arms" to decide at once, by the arbitrament of battle, the vital points at issue. A German critic (Fritz Hoenig) has indicated Worcester as the prototype of Sedan; at any rate, battles of this kind invariably resulted in failure when entrusted to a "standing" army of the 18th century. But the national armies disappeared at the end of the struggle; after the Restoration, English political aims became, so far as military activity was concerned, similar in scope and execution to those of the Continent; and the example of Cromwell and the "New Model," which might have revolutionized military Europe, passed away without having any marked influence on the armies of other nations.

28. Standing Armies.—Nine years after Nordlingen, the old Spanish army fought its last and most honourable battle at Rocroi. Its conquerors were the new French troops, whose victory created as great a sensation as Pavia and Creçy had done. Infusing a new military spirit into the formal organization of Gustavus' system, the French army was now to "set the fashion" for a century. France had been the first Power to revive regular forces, and the famous "Picardie" regiment disputed for precedence even with the old *tercios* The country had emerged from the confusion of the past century with the foreign and domestic strength of a practically absolute central power. The Fronde continued the military history of the army from the end of the Thirty Years' War; and when the period of consolidation was finally closed, all was prepared for the introduction of a "standing army," practically always at nar strength, and entirely at the disposal of the sovereign. The reorganization of the military establishments by Louvois may be taken as the formal date at which standing armies came into prominence. *(See* historical sketch of the French army under FRANCE) Other Powers rapidly followed the lead of France, for the defects of enlisted troops had become very clear, and the possession of an army always ready for war was an obvious advantage in dynastic politics. The French proprietary system of regiments, and the general scheme

of army administration which replaced it, may be taken as typical of the armies of other great Powers in the time of Louis XIV.

29. Character of the Standing Armies.—A peculiar character was from the first imparted to the new organizations by the results of the Thirty Years' War. A well-founded horror of military barbarity had the effect of separating the soldier from the civilian by an impassable gulf. The drain of 30 years on the population, resources and finances of almost every country in middle Europe, everywhere limited the size of the new armies; and the decision in 1648 of all questions save those of dynastic interest dictated the nature of their employment. The best soldiers of the time pronounced in favour of small field armies, for in the then state of communications and agriculture large forces proved in practice too cumbrous for good work. In every country, therefore, the army took the form of a professional body, nearly though not quite independent of extra recruits for war, set apart entirely from all contact with civil life, rigidly restricted as to conduct in peace and war, and employed mostly in the "maintenance" of their superiors' private quarrels. Iron discipline produced splendid tenacity in action and wholesale desertion at all times. In the Seven Years' War, for instance, the Austrians stated that one-fifth of their total loss was due to desertion, and Thackeray's *Barry Lyndon* gives no untrue picture of the life of a soldier under the old *régime*. Further, since men were costly, rigid economy of their lives in action, and minute care for their feeding and shelter on the march, occupied the attention of their generals. Armies necessarily moved slowly and remained concentrated to facilitate supply and to check desertion, and thus, when a commander had every unit of his troops within a short ride of his headquarters, there was little need for intermediate general officers, and still less for a highly trained staff.

30. Organization in the 18th Century.—All armies were now almost equal in fighting value, and war tended to be reduced to a set of rules (not principles), since superiority was only to be gained by methods, not by men. Soldiers such as Marlborough, who were superior to these jejune prescriptions, met indeed with uniform success. But the methods of the 18th century failed to receive full illustration, save by the accident of a great captain's direction, even amidst the circumstances for which they were designed. It is hardly to be wondered at, therefore, that they failed, when forced by a new phase of development to cope with events completely beyond their element. The inner organization was not markedly altered. Artillery was still outside the normal organization of the line of battle, though in the period 1660–1740 much was done in all countries to improve the material, and above all to turn the *personnel* into disciplined soldiers. Cavalry was organized in regiments and squadrons, and armed with sabre and pistol. Infantry had by 1703 begun to assume its three-deep line formation and the typical weapons of the arm—musket and bayonet. Regiments and battalions were the units of combat as well as of organization. In the fight the company was entirely merged in the higher unit, but as an administrative body it still remained. As for the higher organization, an army consisted simply of a greater or less number of battalions and squadrons, without, as a rule, intermediate commands and groupings. The army was arrayed as a whole in two lines of battle, with the infantry in the centre and the cavalry on the flanks, and an advanced guard; the so-called reserve consisting merely of troops not assigned to the regular commands. It was divided, for command in action, into right and left wings, both of cavalry and infantry, of each line. This was the famous "linear" organization, which in theory produced the maximum effort in the minimum time, but in practice, handled by officers whose chief care was to avoid the expenditure of effort, achieved only negative results. To see its defects one need only suppose a battalion of the first line hard pressed by the enemy. A battalion of the second line was directly behind it, but there was no authority, less than that of the wing commander, which could order it up to support the first. All the conditions of the time were opposed to tactical subdivision, as the term is now understood. But far beyond any faults of organization and recruiting, the inherent vice of these armies was, as Machiavelli had pointed out two centuries previously, and as Prussia was to learn to her cost in 1806, that once they were thoroughly defeated, the only thing left to be done mas to make peace at once, since there was no other armed force capable of retrieving a failure.

31. Frederick the Great.—The military career of Frederick the Great is very different from those of his predecessors. With an army organized on the customary system, and trained and equipped, better indeed, but still on the same lines as those of his rivals, the king of Prussia achieved results out of all proportion to those imagined by contemporary soldiers. It is to his campaigns, therefore, that the student must refer for the real, if usually latent, possibilities of the army of the 18th century. The prime secret of his success lay in the fact that he was his own master, and responsible to no superior for the uses to which he put his men. This position had never, since the introduction of standing armies, been attained by anyone, even Eugene and Leopold of Dessau being subject to the common restriction; and with this extraordinary advantage over his opponents, Frederick had further the firmness and ruthless energy of a great commander. Prussia, moreover, was more strictly organized than other countries, and there was relatively little of that opposition of local authorities to the movement of troops which was conspicuous in Austria. The military successes of Prussia, therefore, up to 1757, were not primarily due to the system and the formal tactics, but were the logical outcome of greater energy in the leading, and less friction in the administration, of her armies. But the conditions were totally different in 1758–62, when the full force of the alliance against Prussia developed itself in four theatres of war. Frederick was driven back to the old methods of making war, and his men were no longer the soldiers of Leuthen and Hohenfriedberg. If discipline was severe before, it was merciless then; the king obtained men by force and fraud from every part of Germany, and had both to repress and to train them in the face of the enemy. That under such conditions, and with such men, the weaker party finally emerged triumphant was indeed a startling phenomenon. Yet its result for soldiers was not the production of the national army, though the dynastic forces had once more shown themselves incapable of compassing decisive victories: nor yet the removal of the barrier between army and people, for the operations of Frederick's recruiting agents made a lasting impression, and further, large numbers of men who had thought to make a profession of arms were turned adrift at the end of the war. On the contrary, all that the great and prolonged *tour de force* of these years produced was a tendency, quite in the spirit of the age, to make a formal system out of the art of war. Better working and better methods were less sought after than systematization of the special practices of the most successful commanders. Thus Frederick's methods, since 1758, essentially the same as those of others, were taken as the basis of the science now for the first time called "strategy," the fact that his opponents had also practised it without success being strangely ignored. Along with this came a mania for imitation. Prussian drill, uniforms and hair-powder were slavishly copied by every State, and for the next 20 years, and especially when the war-trained officers and men had left active service, the purest pedantry reigned in all the armies of Europe, including that of Prussia. One of the ablest of Frederick's subordinates wrote a book in which he urged that the cadence of the infantry step should be increased by one pace per minute. The only exceptions to the universal prevalence of this spirit were in the Austrian army, which was saved from atrophy by its Turkish wars, and in a few British and French troops who served in the American War of Independence. The British regiments were sent to die of fever in the West Indies; when the storm of the French Revolution broke over Europe, the Austrian army was the only stable element of resistance.

32. The French Revolution.—Very different were the armies of the Revolution. The French volunteers of 1792 were a force by which the routine generals of the enemy, working with instruments and by rules designed for other conditions, were completely puzzled, and France gained'a short respite. The year 1793 witnessed the most remarkable event that is recorded in the history of armies. Raw enthusiasm was replaced, after the disasters and

defections which marked the beginning of the campaign, by a systematic and unsparing conscription, and the masses of men thus enrolled, inspired by ardent patriotism and directed by the ferocious energy of the Committee of Public Safety, met the diciplined formalists with an opposition before which the attack completely collapsed. It was less marvellous in fact than in appearance that this should be so. Not to mention the influence of pedantry and senility on the course of the operations, it may be admitted that Frederick and his army at their best would have been unable to accomplish the downfall of the now thoroughly roused French. Tactically, the fire of the regulars' line caused the Revolutionary levies to melt away by thousands, but men were ready to fill the gaps. No complicated supply system bound the French to magazines and fortresses, for Europe could once more feed an army without convoys, and roads were now good and numerous. No fear of desertion kept them concentrated under canvas, for each man was personally concerned with the issue. If the allies tried to oppose them on an equal front, they were weak at all points, and the old organization had no provision for the working of a scattered army. While ten victorious campaigns had not carried Marlborough nearer to Paris than some marches beyond the Sambre, two campaigns now carried a French army to within a few miles of Vienna. It was obvious that, before such forces and such mobility, the old system was doomed, and with each successive failure the old armies became more discouraged. Napoleon's victories finally closed this chapter of military development, and by 1808 the only army left to represent it was the British. Even to this the Peninsular War opened a line of progress, which, if different in many essentials from Continental practice, was in any case much more than a copy of an obsolete model.

33. The Conscription. — In 1793, at a moment when the danger to France was so great as to produce the rigorous emergency methods of the Reign of Terror, the combined enemies of the Republic had less than 300,000 men in the field between Basle and Dunkirk. On the other hand, the call of the "country in danger" produced more than four times this number of men for the French armies within a few months. Louis XIV., even when all France had been awakened to warlike enthusiasm by a similar threat (1709), had not been able to put in the field more than one-fifth of this force. The methods of the great war minister Carnot were enforced by the ruthless committee. and when men's lives were safer before the bayonets of the allies than before the civil tribunals at home, there was no difficulty in enlisting the whole military spirit of France. There is therefore not much to be said as to the earliest application of the conscription, at least as regards its formal working, since any system possessing elasticity would equally have served the purpose. In the meanwhile, the older plans of organization had proved inadequate for dealing with such imposing masses of men. Even with disciplined soldiers they had long been known as applicable only to small armies, and the deficiencies of the French, with their consequences in tactics and strategy, soon produced the first illustrations of modern methods. Unable to meet the allies in the plain, they fought in broken ground and on the widest possible front. This of course produced decentralization and subdivision; the army was therefore constituted in a number of divisions, each of two or more brigades with cavalry and artillery sufficient for its own needs. It was even more important that each divisional general, with his own staff, should be a real commander, and not merely the supervisor of a section of the line of battle, for he was almost in the position that a commander-in-chief had formerly held. The need of generals was easily supplied when there was so wide a field of selection. For the allies the mere adoption of new forms was without result, since it was contrary both to tradition and to existing organization. The attempts which were made in this direction did not tend to mitigate the evils of inferior numbers and *moral*. The French soon followed up the divisional system with the further organization of groups of divisions under specially selected general officers; this again quickly developed into the modern army corps.

34. Napoleon. — Revolutionary government, however, gave way in a few years to more ordinary institutions, and the spirit of French politics had become that of aggrandizement in the name of liberty. The ruthless application of the new principle of masses had been terribly costly, and the disasters of 1799 reawakened in the mass of the people the old dislike of war and service. Even before this it had been found necessary to frame a new act. the famous law proposed by Gen. Jourdan (1798). With this the conscription for general service began. The legal term of five years was so far exceeded that the service came to be looked upon as a career, or servitude, for life; it was therefore both unavoidable and profitable to admit substitutes. Even in 1806 one quarter of Napoleon's conscripts failed to come up for duty. The *Grande Arme'e* thus from its inception contained elements of doubtful value, and only the tradition of victory and the 50% of veterans still serving aided the genius of Napoleon to win the brilliant victories of 1805 and 1806. But these veterans were gradually eliminated by bloodshed and service exposure, and when, after the peace of Tilsit "French" armies began to be recruited from all sorts of nations, decay had set in. As early as 1806 the emperor had had to "anticipate" the conscription, that is, call up the conscripts before their time, and by 1810 the percentage of absentees in France had grown to about 80, the remainder being largely those who lacked courage to oppose the authorities. Finally, the armies of Napoleon became masses of men of all nations fighting even more unwillingly than the armies of the old *régime*. Little success attended the emperor's attempt to convert a "nation in arms" into a great dynastic army. Considered as such, it had even fewer elements of solidity than the standing armies of the 18th century, for it lacked the discipline which had made the regiments of Frederick invincible. After 1812 it was attacked by huge armies of patriots which possessed advantages of organization and skilful direction that the *levée en masse* of 1793 had lacked. Only the genius and magnificent tenacity of Napoleon staved off for a time the inevitable *débâcle*.

35. The Grande **Armée.**—In 1805–06, when the older spirit of the Revolution was already represented by one-half only of French soldiers, the actual steadiness and manoeuvring power of the *Grande Arme'e* had attained its highest level. The army at this time was organized into brigades, divisions and corps, the last-named unit being as a rule a marshal's command, and always complete as a small army with all the necessary arms and services. Several such corps (usually of unequal strength) formed the army. The greatest weakness of the organization, which was in other respects most pliant and adaptable, mas the want of good staff-officers. The emperor had so far cowed his marshals that few of them could take the slightest individual responsibility, and the combatant staff-officers remained, as they had been in the 18th century, either confidential clerks or merely gallopers. No one but a Napoleon could have managed huge armies upon these terms; in fact the marshals, from Berthier downwards, generally failed when in independent commands. Of the three arms, infantry and cavalry regiments were organized in much the same way as in Frederick's day, though tactical methods were very different and discipline far inferior. The greatest advance had taken place in the artillery service. Field and horse batteries, as organized and disciplined units, had come into general use during the Revolutionary wars, and the division, corps and army commanders had always batteries assigned to their several commands as a permanent and integral part of the fighting troops. Napoleon himself, and his brilliant artillery officers Sénarmont and Drouot, brought the arm to such a pitch of efficiency that it enabled him to win splendid victories almost by its own action. As a typical organization we may take the 3rd corps of Marshal Davout in 1806. This was formed of the following troops:—

Cavalry brigade—Gen. Vialannes—three regiments, 1,538 men. Corps artillery, 12 guns.

1st Division—Gen. Morand—five infantry regiments in. three brigades, 12 guns, 10,820 men.

2nd Division—Gen. Friant—five regiments in three brigades, 8 guns, 8,758 men.

3rd Division—Gen. Gudin—four regiments in three brigades, 12 guns, 9,077 men.

A comparison of this *ordre de bataille* with that of a 1914 army corps will show that the general idea of corps organization

underwent but slight modification between the days of Napoleon and the World War. Yet the spirit of 1806 and that of a century later were essentially different, and the story of the development of this difference through the 19th century is vital to an understanding of the military nature of the World War.

36. The Wars of Liberation. — The Prussian defeat at Jena was followed by a national surrender so abject as to prove conclusively the eternal truth: that a divorce of armies from national interests is fatal to national well-being. But the oppression of the victors soon began to produce a spirit of ardent patriotism which, carefully directed by a small band of able soldiers, led in the end to a national uprising of a steadier and more lasting kind than that of the French Revolution. Prussia was compelled, by the rigorous treaty of peace, to keep only a small force under arms, and circumstances thus drove her into the path of military development which she subsequently followed. The stipulation of the treaty was evaded by the *Kriimper* system, by which men were passed through the ranks as hastily as possible and dismissed to the reserve, their places being taken by recruits. The regimental establishments were therefore mere *cadres*, and the *personnel*, recruited by universal service with few exemptions, ever-changing. This system depended on the willingness of the reserves to come up when called upon, and the arrogance of the French was quite sufficient to ensure this. The *dénouement* of the Napoleonic wars came too swiftly for the full development of the armed strength of Prussia on these lines; and at the outbreak of the Wars of Liberation a newly formed *Landwehr* and numerous volunteer corps took the field with no more training than the French had had in 1793. Still, the principles of universal service *(allgemeine Wehrpflicht)* and of the army reserve were, for the first time in modern history, systematically put into action, and military development during the 19th century concerned itself more with the consolidation of the *Krümper* system than with the creation of another. The *début* of the new Prussian army was most unsuccessful, for Napoleon had now attained the highest point of soldierly skill, and managed to inflict heavy defeats on the allies. But the Prussians were not discouraged; like the French in 1793 they took to broken ground, and managed to win combats against all leaders opposed to them except Napoleon himself. The Russian army formed a solid background for the Prussians, and in the end Austria joined the coalition. Reconstituted on modern lines, the Austrian army in 1813, except in the higher leading, was probably the best organized on the Continent. After three desperate campaigns the Napoleonic *régime* came to an end, and men felt that there would be no such struggle again in their lifetime. Military Europe settled down into grooves along which it ran till 1866. France, exhausted of its manhood, sought a field for military activities in colonial wars waged by long-service troops. The conscription was still in force, but the citizens served most unwillingly, and substitution produced a professional army, which as usual became a dynastic tool. Austria, always menaced with foreign war and internal disorder, maintained the best army in Europe. The British army, though employed far differently, retained substantially the Peninsular system.

37. European and American Armies 1815–70. — The events of 1815–59 showed that such long-service armies were incomparably the best form of military machine for the purpose of giving expression to a hostile "view" (not "feeling"). Austrian armies triumphed in Italy, French armies in Spain, Belgium, Algeria, Italy and Russia, British in innumerable and exacting colonial wars. Only the Prussian forces retained the characteristics of the levies of 1813, and the enthusiasm which had carried these through Leipzig and the other great battles was hardly to be expected of their sons, ranged on the side of despotism in the troubled times of 1848–50. But the principle was not permitted to die out. The Bronnzell-Olmiitz incident of 1850 *(see* SEVEN WEEKS' *WAR)* showed that the organization of 1813 was defective, and this was altered in spite of the fiercest opposition of all classes. Soon afterwards, and before the new Prussian army proved itself on a great battlefield, the American Civil War, a fiercer struggle than any of those which followed it in Europe, illustrated the capabilities and the weaknesses of voluntary-service troops. Here the hostile "view" was replaced by a hostile "feeling," and the battles of the disciplined enthusiasts on either side were of a very different kind from those of contemporary Europe. Thus the great struggle in North America passed without affecting seriously the war ideas and preparations of Europe. The weakness of the staff work with which both sides were credited helped further to confirm the belief of the Prussians in their system, and in this instance they were justified by the immense superiority of their own general staff to that of any army in existence. It mas in this particular that a corps of 1870 differed so essentially from a corps of Napoleon's time. The formal organization had not been altered save as the varying relative importance of the separate arms had dictated. The almost intangible spirit which animates the members of a general staff causes them not merely to "think"—that was always in the quartermaster-general's department — but to "think alike," so that a few simple orders called "directives" sufficed to set armies in motion with a definite purpose before them, whereas formerly elaborate and detailed plans of battle had to be devised and distributed in order to achieve the object in view. A comparison of the number of orders and letters written by a marshal and by his chief of staff in Napoleon's time with similar documents in 1870 indicates clearly the changed position of the staff. In the *Grande Armée* and in the French army of 1870 the officers of the general staff were often absent entirely from the scene of action. In Prussia the new staff system produced a far different result — indeed, the staff, rather than the Prussian military system, was the actual victor of 1870. Still, the system would probably have conquered in the end in any case, and other nations, convinced by events that their departure from the ideal of 1813, however convenient formerly, was no longer justified, promptly copied Prussia as exactly, and, as a matter of fact, as slavishly, as they had done after the Seven Years' War. (C. F. A.; X.)

DEVELOPMENTS FROM 1870 TO 1914

38. General Tendencies. — The Franco-German War of 1870–71 marks a very definite stage in the evolution of armies. The striking successes of the short-service German army over a professional long-service army, reputed the finest in Europe at the time, ushered in a new era of development, which was to last for nearly 43 years, that is right down to the outbreak of the World War. As a result of the 1870 campaign the armies of Europe at once set out to re-model themselves on the pattern which Prussia had created. The period of reform may be put down as from about 1873 to 1890. For the following 25 years — a time of tense struggle during peace for superiority in the next war — the general pattern of the machine was unchanged, though its power and efficiency were progressively improved. Germany set the pace and other nations had perforce to follow. The elements of the system under which the principal armies of the world — Japan too followed the German model — were developed in this period, its merits and its disadvantages, require some examination.

39. Principles of the Modern System. — The first principle was the substitution of universal liability to personal service in place of the methods of conscription formerly practised, which selected by lot a proportion of the manhood of the nation and permitted those on whom the lot had fallen to hire substitutes. The practical result of the old system was to produce an army composed partly of professional soldiers, each of whom was paid by several successive conscripts to discharge their obligations, and partly of conscripts who had no particular taste for soldiering but who were too poor to procure substitutes Thus only a comparatively small part of the nation was trained to war and the well-to-do class usually escaped service altogether. Under the Prussian system now adopted by all the principal armies no substitution whatever was allowed. Only rejection by a medical board could relieve a man from his obligation to service between certain ages. When the numbers of the physically fit in the annual contingent reaching military age exceeded those required to fill the complement of the active army, certain classes were chosen for immediate transfer to the reserves without a period of training in the standing army or navy. Such choice was normally made on the grounds of family circumstances: *i.e.*, relief was given to

those on whom—as the sole supporters of a family, for example—the burden of active military service in peacetime would press most hardly. There was one other remission: attainment of a certain standard of education conferred the privilege of a shortened period of active service followed by transfer to the reserve as an officer or non-commissioned officer. The system was, in theory, at least, an entirely democratic one, based on the equal personal service in the military forces of every citizen, irrespective of his rank or wealth. It mas certainly an advance on the former system, which allowed service by deputy.

The second principle was that the period of active service in the standing army should be as short as was consistent with efficient training, so that the maximum numbers could be instructed and passed to the reserve with the minimum of cost, and also that the able-bodied strength of the nation should be withdrawn from industry for as brief a time as possible. This period of active service varied in the different armies and at different times, and often also according to the arm of the service. The average period in the principal Continental armies at the outbreak of the World War may be taken as three years. Thus in France it was three years for all arms, in Germany and Austria-Hungary three years for cavalry and horse artillery and two years for other arms, in Russia three years for infantry and artillery and four years for other arms. This period, which was one of hard and intensive training, was followed by a period of from five to seven years in the first class of the reserve, the rôle of which was to bring the standing army up to war strength on mobilization. From this category men passed for a iurther five years or so to the second class of the reserve, used in war either to form second-line units or to replace casualties in the field army. The reserves were kept up to date by occasional short periods of training. The remainder of the obligation to military service was usually discharged in an auxiliary force—*Landsturm* in Germany, Terriforiul *Army* in France, *Opolchenie* in Russia—intended mainly for home defence or for duties in the area behind the front-line armies. As a general average it may be taken that a man's liability to service lasted from the age of 20 to the age of 45, of which term three years were spent in the active army, six years in the first reserve, six years in the second reserve, and the remainder in some form of auxiliary or home-defence force. Thus the standing army and its first reserve, which together constituted the first line or field army in war, comprised the able-bodied manhood of the nation between the ages of 20 and 30. Behind this stood a second line of the older men from 30 to 45. The above figures are a generalization and do not correspond exactly with the organization or terms of service of any one nation.

The third principle lay in the elaboration of the arrangements for rapid mobilization in the event of war. As explained above, the essence of the system lay in a comparatively small short-service standing army with large reserves of trained men. The advantage to be gained by the army which could most quickly and smoothly expand from a peace footing to a war footing was obvious, and was sought by every means that the staff could devise. The gain of even a few hours was of the utmost value, the gain of a day might be decisive. To such a pitch of nicety were the calculations eventually brought that a nation could hardly afford to delay even a single hour, once a rival had issued orders to mobilize. This was clearly seen in the crisis of July 1914. The order to mobilize became in fact equivalent to an opening of hostilities. A corollary to this need for rapid mobilization was the "territorialization" of the armed forces. Time would be saved if the reserves required to complete a formation to war strength normally resided in the same area in which the formation was stationed in peace. Hence arose a system by which each army corps had a district allotted to it where it was permanently stationed and recruited and where it mobilized for war. The army corps district was usually subdivided into divisional areas, which again were parcelled out into brigade and regimental areas. This system had obviously many advantages. It was economical of time on mobilization and economical of money in peace, since it involved the minimum of expense in travelling; also it caused the least dislocation to those called up for service, who usually discharged their obligation in their own district, close to home. There were certain exceptions to this territorial principle, due often to the presence in a nation of an alien population not yet wholly absorbed in the nation nor fully trusted. Thus in Germany the principle was not extended to Alsace-Lorraine, and in Russia, where the system of recruiting was only partially territorial, Jews, Poles and other non-Russians were distributed throughout the army.

The efficient working of the system required a corps of officers who made the army their career for life. The need to train successive contingents of recruits to the complicated business of modern war in a short term imposed on the officers a high standard of professional capacity and an unremitting industry—the latter a quality hardly associated hitherto with the profession of arms in peace. They were compensated for small pay and long hours of work by an exaggerated social status, especially in Germany, where the cult of military power most flourished. To assist the officers in the instruction of the rank and file was a body of long-service non-commissioned officers, selected from those of the annual contingent who showed an aptitude for military life and volunteered to remain in the active army after their obligatory period of service had expired. They were attracted by increased pay and privileges and by the promise of subsequent civil employment in a Government post. Lastly, the armies produced under this modern system called for a highly educated (in the military sense) staff. The organization in peace, and the movement and supply in the field, of such masses of men became a complex and highly technical business, and made greater demands on the staff than ever before. In all armies the staff system was overhauled, and great improvements were made in the training of staff officers.

40. Merits and Disadvantages of the System.—The above is a brief outline of the chief features of the method of raising armies which is often referred to as "The Nation in Arms." So far as the rank and file were concerned, it aimed at quantity rather than quality: the "veteran" professional soldier practically vanished from the drill-grounds, the barrack-rooms and the battlefields of Europe. On the other hand, those taken for service included the best of the nation's manhood; and in their three years' intensive training they had forced into them as much military knowledge as the old-type professional soldier absorbed in his many years with the colours. There was naturally bound to he in armies raised under the compulsory system a certain unreliable element, which would fail under the stresses of war. But in a brave and patriotic nation like the Germans, who invented the system, such element was small and could be coerced by a rigid discipline. The moral advantage which the volunteer is supposed to hold over the pressed man has little application to armies like these, which embody the whole manhood of a nation. Financially, the system enabled far larger numbers to be kept under arms and trained to war than would have been possible under any voluntary system. The pay of the soldier was practically a negligible item, and there was not the necessity to study his comfort in the same way as in a voluntary army, which had to attract its recruits.

Thus the system was on the whole efficient, economical and just. The ethical arguments against compulsory service—*e.g.*, that it promotes wars and a warlike spirit or that it hampers industrial progress—are dealt with elsewhere. (See CONSCRIPTION.) From the purely military point of view, however, there were certain defects and difficulties in the Prussian system. The chief of these was the effect on the officers of the hard work and almost unvarying routine which the training of such large masses imposed. The great majority of regimental officers passed their whole military life in the same garrison town, instructing at high pressure successive batches of recruits in the details of military service. Such officers had inevitably a narrow mental outlook and tended to lose initiative and the ability to improvise, two qualities which the conditions of active service—the march, the bivouac and the battlefield—continually demand. *Aus* Kleine *Garnison,* a book which brought its author, an officer of the German army, court-martial and imprisonment a few years before the war, gives a picture drawn from life of the monotony and evils of life in a small garrison town. Kuprin's Poyedinok (The Duel) gives an even darker impression of a similar garrison in Russia.

The reserve officer, of whom large numbers were required on mobilization to complete the field army and to form second-line units, presented a different problem. The chief source from which they were drawn was the "one-year volunteer"; *i.e.*, those who, in consideration of having reached a certain educational standard, served for one year only in the ranks and then became officers of the reserve, in which capacity they were called up for short periods of training. This class naturally comprised some of the best of the nation. But their military training was inadequate to make them really efficient officers, while their superior intelligence and education often led them to dislike military life and to despise the professional officer. In Russia, for instance, the *intelligenzia* class, from which a large proportion of the reserve officers were drawn, was frankly anti-militaristic and served with reluctance. A certain number of commissions in the reserve of officers were given to men who had served long terms as non-commissioned officers in the standing army. This class—the retired sergeant-major—did not usually produce a good type of officer, but was useful for work in depots and in garrison units. The problem of finding sufficient officers to expand these huge national armies in war is obviously one of their principal difficulties, and is inherent in any system which makes numerical strength its main objective. Good non-commissioned officers were also difficult to secure in sufficient numbers, and the low-class tyrannical non-commissioned officer who abused his power constituted one of the most objectionable features of compulsory armies. The difficulty of finding non-commissioned officers was increased when the nation had colonial possessions to be defended Such oversea possessions had to be garrisoned by forces raised on a professional and voluntary basis, short-service armies of the type described being quite unfitted for garrison work abroad. These colonial forces absorbed many men who took up soldiering as a profession and who would otherwise have been available as non-commissioned officers in the home army. In Russia the difficulties of filling the establishment of non-commissioned officers was especially acute owing to the low standard of education of the nation.

To sum up, the difference between the armies thus evolved in Europe at the end of the 19th century and those which they replaced can perhaps best be expressed by the terms "machine-made" and "hand-made." The change was more or less contemporary with the substitution in the industrial world of the machine-made for the hand-made article. Like the machine-made article in commerce, the machine-made soldier had the advantages of cheapness and rapidity of production, but lacked some of the finish and polish of the hand-made article. For a powerful indictment of the objectionable features of the system in Germany, the student may consult a novel published in Germany not long before the war—*Jena* oder *Sedan*. He may also read the story of the "Zabern incident" in 1913.

41. Armies up to the World War.—The chief feature of the quarter of a century from 1890 to 1914, was the contest between the principal European armies for predominance in numbers. Thus Germany, which in 1874 had a peace establishment not much over 400,000, had by 1914 one of 850,000: whereas in 1870 she had put into the field 15 army corps, by 1914 she had ready 25 active corps and nearly as many reserve corps. She had available for war over 4,000,000 trained men. France struggled desperately to hold the pace set by Germany; with her smaller population she was in the position of a runner who has to exert every nerve to keep at the shoulder of his rival whom he sees running easily within himself. She trained every available man, with very few exemptions, while Germany could still afford to exempt from active service nearly half of the annual contingent passed medically fit. France's law of military service of 1913 was practically the last spurt of which she was capable; it increased the period of active service from two years to three and the total liability to service from 25 years to 28. Thus in order to maintain something like equality both in peace and in war strength with Germany, her population was called on to serve one year longer in the active army and two years longer in the reserve—three more years military service in all. Austria-Hungary's effort was approximately similar to Germany's; her peace establishment was close on 500,000 and her war strength 2,000,000. Russia with her almost inexhaustible resources in men trained a smaller proportion of her population than the other great nations, yet had a peace strength of nearly 1,500,000 and about 6,000,000 trained men ultimately available for war. The smaller armies of Europe were all cast in the same mould, and all trained to arms the greater part of the able-bodied manhood of their nations.

Of all the states which maintained standing armies of any size or power, only Great Britain and the United States maintained the principle of voluntary enlistment. It was the temperament of these peoples that insisted on avoiding compulsion for military service, but it was the fact that sea power, not military power, was their first line of defence that made this insistence possible without immediate disaster. For Great Britain, moreover, the principal military problem was, at least up to the beginning of the 20th century, that of maintaining large garrisons of regular troops in her overseas possessions. For this a voluntary long-service army was a better and more comfortable instrument than an army raised on the Continental system. The main trouble about a voluntary army is its expense, since the enlistment of recruits depends on high pay and attractive conditions of service. Thus the strength of the military forces tends to be governed by financial considerations rather than by the demands of strategy. Again, the hours of duty, the rules of discipline and the circumstances of the soldiers' life have all to be determined with an eye to the supply of recruits. Hence a voluntary soldier cannot be worked so hard and takes longer to learn his trade. A long period of colour-service means small reserves, so that a voluntary army has comparatively little capacity of rapid expansion for war. The British army up to 1870 had had practically no reserves, a soldier's whole term of service—usually about 12 years, often extended to 21—was with the colours. Under the Cardwell reforms, which began in 1870, steps were taken to build up a reserve, and the normal term of service was eventually fixed at seven years with the colours and five in the reserve. The British second-line force was not, like the second line of Continental armies, composed of older men who had served in the first line, but of patriotic citizens who voluntarily undertook short periods of training annually, to fit themselves for home defence. This second line was reorganized into the Territorial Force under Mr. Haldane's administration in 1908. (See GREAT BRITAIN.) In the last ten years or so before the outbreak of the World War a considerable body of military opinion—of which Field-Marshal Lord Roberts was the protagonist—urged on the British nation the abandonment of the voluntary principle and the adoption of universal service to meet the increasing menace of German militarism in Europe. But the difficulties of combining within the national budget a voluntary army for service abroad with a compulsory force for home service were great, and none of the schemes produced ever had a chance of acceptance by the nation at large, which has a deep-rooted dislike and mistrust of military service.

The two principal wars of the period under review may be said to have had a local rather than a general influence on the development of armies. The experience of the Boer War (1899–1902) was invaluable to the British army, and led up to the reforms which enabled it to put into the field in 1914 an army equal in equipment and organization, and superior in training, to any in Europe. It also brought Dominion forces into the field in support of the mother country for the first time, and thus inaugurated the preparations which made possible the military effort of the Dominions 1 j years later. The Russo-Japanese War in Manchuria (1904–05) similarly resulted in great efforts in Russia to bring the army up to date. But neither campaign was held by Continental experts to justify any serious modification in organization or theory. The operations in Manchuria were considered a triumph for German methods, on which the Japanese army had formed itself. The warning given by the protracted nature of the battles. and by the sluggishness of the operations generally, passed unheeded.

42. Developments in Armament and Equipment.—Meanwhile weapons and warlike material were being rapidly improved by the discoveries of science. The invention of smokeless powder

changed the whole appearance of the battlefield; the small-bore magazine rifle more than doubled the volume and accuracy of infantry fire; the mitrailleuse of 1870 developed into the modern machine gun, the deadly power of which was recognized only by a few before the World War; and the artillery increased in range, calibre and rapidity of fire. The effects of the petrol (gasolene) engine were only beginning to be suspected when the World War broke out; armies still moved on their feet and were served mainly by horsed transport; the air arm was in its infancy. The principal nations watched each other so jealously that it was difficult for any of them to obtain any decided advantage in armament over its rivals. But armies tended to cultivate proficiency in one particular weapon according to the national traditions and temperament. Thus the French were justly proud of the technical superiority of their quick-firing artillery; the Germans had soonest realized the potentialities of the machine gun; the British rifle fire was in volume and accuracy far above that of Continental nations; while the Russians still wistfully quoted the maxim of Suvorov: "The bullet is a fool; the bayonet only is wise."

Such were the armies which the spirit of Prussia—ruthless, efficient but unimaginative—had imposed on Europe when the World War at last blazed out in a kind of passionate protest against a system that made peace almost as hard a military struggle as war. The standard of strength of these armies was primarily a man-power standard; the aim of each was to place in the field the largest possible host of armed men in the shortest time, and to overwhelm the adversary forthwith by sheer weight of numbers. In such a conception of war minute preparation in peace was held to count for more than generalship in the field, since little manoeuvre was possible once the great masses had been launched to cover every road leading to their objective. The midnight oil of the administrator, who by the scrupulous improvement of mobilization arrangements or by the skilful manipulation of time-tables of railway movement could snatch half-a-day's advantage of time, might do more to win victory than any lightning flash of genius in the battle. It was a theory of brute force against which the French military mind revolted. But the question their strategists put to themselves: "What would Napoleon have done?" had found no very definite answer when 1914 came.

ARMY ORGANIZATION

43. General.—In the foregoing sections the principles on which armies were raised up to the time of the World War have been examined. Before passing on to consider what changes or modifications the grim needs of a prolonged and deadly war occasioned, some outline must be given of the methods on which those armies were organized and commanded, how their order of battle was built up, what laws governed their subdivision into bodies and groups and the composition of those groups.

Military forces may be treated of in three categories: the fighting troops, the auxiliary or administrative troops, and the command and staff. The three principal fighting arms were still in 1914, as they had been for some centuries, cavalry, artillery and infantry. The work of the engineers had increased in importance owing to technical developments—signal communication by cable or wireless had, for instance, become one of their most important responsibilities—but though they worked in the front line, fighting was with them only a secondary rôle; machine guns had not yet been developed into a separate arm, but were incorporated into the cavalry and infantry; mounted infantry were only an improvization, to which the peculiar circumstances of the Boer War gave prominence for a time; and the air force was as yet unarmed. Infantry remained the predominant partner, to further whose efforts to close with the enemy was the main task of the other arms. The administrative troops comprised the supply, medical and veterinary services and so forth. The activities of the fighting troops and the administrative troops were controlled and directed by the commanders and their staffs. Details of the organization, tactics and functions of these various component parts will be found under such headings as ARTILLERY, CAVALRY, INFANTRY, SUPPLY AND TRANSPORT, STAFF. Only enough, however, will be said here to show the general principles involved in assembling these parts into an effective whole.

An essential problem in organizing an army is to determine the proportions which the principal arms should bear to one another. These proportions—generally expressed in the terms of so many sabres and guns per 1,000 rifles—had undergone comparatively little change since 1870. In the French and German armies the proportions ruling for the field armies in 1914 may be taken roughly as about 120 sabres and 6 guns per 1,000 rifles. The Austrian and Russian armies were stronger in cavalry and weaker in guns, about 200 sabres and 4 guns per 1,000 rifles. The proportion of technical troops was increasing with scientific developments and improvements, such as wireless telegraphy, aircraft, mechanical transport and searchlights. The administrative services, too, gained in size and importance as warlike equipment grew more complicated and as the demands of the fighting troops for ammunition and technical stores grew heavier. This scientific expansion of the means of war greatly enhanced the advantage of a State with large manufacturing establishments and an industrial population on which to draw for the technical corps over States such as Russia and Austria, where industrial development was relatively low. But how vital a factor industrial strength was to prove in the forthcoming conflict was not yet fully realized, since it was believed that wars would be short and sharp and that the issue would be decided before the reserves of munitions accumulated in peace were exhausted.

44. Organization of the Fighting Troops.—The first step in military organization is to form each arm independently into units; these units are then combined into what—for want of a better word—are termed formations, (in French, grandes unite's), the lower of which usually consist of one arm only, while the higher include all arms.

To take the infantry first: the unit adopted by all armies was in 1914, as it had been for many years, the battalion of about 1,000 men, subdivided into four companies, the company again being subdivided into three or four sub-units, each of which constituted a subaltern officer's command (varying from about 50 to 75 men). The British army had retained an organization into eight companies up to 1913, when it also adopted the Continental system of four companies. Though the battalion was still spoken of as the unit of infantry, it had long ceased to be so tactically. The definition of a military unit for tactical purposes is the largest body which can be commanded and controlled on the battlefield by the voice of one man, and it was as such that the battalion had originally been constituted at its existing size. Once command has to be exercised indirectly, by means of a staff conveying messages to a number of subordinate commanders, the body ceases to be a unit in the tactical sense and becomes a formation. Thus it had already for some time been recognized that the company had supplanted the battalion as the tactical unit, while many foresaw that the real tactical unit was now the subaltern's command of about 50 men. Similarly the functions of the fire unit (*i.e.*, the largest body whose fire could be controlled in action by one man) had descended from the company to the squad or section of eight to ten men under a junior non-commissioned officer. The battalion was therefore tactically no longer a unit but a formation. It was the normal European practice to group three battalions (in Russia four) into a regiment; two regiments formed an infantry brigade (six battalions—in Russia eight); and two infantry brigades were included in a division. The British grouping was different and will be referred to later.

Of cavalry the unit was the regiment, organized into a number of squadrons. The strength of the squadron (the tactical unit) was in all armies standardized at approximately 150, subdivided into four troops, commanded by subalterns; but the number of squadrons varied in different armies from three to six (Great Britain and United States three, France and Germany four, Italy five, Russia and Austria six). Thus the strength of the regiment varied from a little over 500 up to 1,000. A cavalry brigade comprised two regiments (in the British army, three); and two or three brigades constituted a cavalry division.

The unit of artillery was the battery, normally of six guns

(France four, Russia eight). The subaltern's command was the section of two guns. Three batteries usually constituted a *group* (illogically named a brigade in the British army); and two or three groups a regiment.

As stated above, a subaltern officer's command was usually about 50 men. Originally the duties of junior officers had been mainly to inspire the men around them by their personal example. But as the range and effectiveness of weapons extended the area of the battlefield, the tactical handling of the combat passed into the hands of the junior leaders, by whose quality the effectiveness of an army was largely measured. The next grade of officer was the captain, whose command (in European armies) was a company, a squadron or a battery; then came the major, who commanded a battalion of infantry or a group of artillery. Regiments of all arms were commanded by colonels. In Great Britain batteries were commanded by majors, companies and squadrons by majors or captains; battalions, cavalry regiments and artillery brigades by lieutenant-colonels. The other combatant arms and the administrative services were organized and commanded on similar principles. The army of the United States, it may be noted here, had in peace no higher organization than the regiment.

45. **The** Grouping of Units. — Generally speaking, the number of units grouped in a formation should not be less than three nor more than six. In a formation composed of two units only, the influence of the commander of the formation is small; while it has been found by experience that six units is the maximum that can conveniently be commanded and administered by one headquarters. The student who wishes to make a closer examination of the arguments on this question is referred to the chapter on "Order of Battle" in the second book of Clausewitz's famous work On *War*. The normal number of units in a group is three or four, and the relative merits of the "triangle" or "square" as a tactical formation have been widely discussed. The principle of economy of force is often best served by the "triangle," *i.e.*, two units in front line with a third behind ready to add its weight at the most favourable point; but the "square," in which the two front-line units have two units behind them, certainly facilitates reliefs in the battle and enables the superior commander to retain a reserve in hand for a longer time.

The higher formations are the brigade, the division, the army corps, and, in war, the army. The brigade is composed of one arm only, the others of all arms. In European armies the infantry brigade in 1914 consisted of two regiments (six battalions) with a total of 6,000 to 7,000 combatants at war strength. The cavalry brigade consisted of two regiments, with a war strength of from 1,500 to 2,000. The artillery brigade comprised two regiments (12 batteries), some 2,500 to 3,000 men. The British infantry brigade of four battalions and the artillery brigade of four batteries corresponded with the Continental regiment of those arms; the cavalry brigade was of three regiments, but, since the regiments were smaller, its war strength was approximately the same as that of the Continental cavalry brigade. The commander of a brigade was on the Continent usually a major-general, in the British army a brigadier-general (but the artillery brigade was a lieutenant-colonel's command).

Divisions were of two kinds. A *cavalry* division included a staff, two (exceptionally three) brigades of cavalry, some batteries of horse artillery, a detachment of engineers, and occasionally a battalion of light infantry, with a total strength approaching 5,000. An ordinary *division* (sometimes termed an infantry division) is the smallest body fully organized for the conduct of an operation of war, complete with all arms and with all the necessary administrative services. In all the principal European armies the basis was the same, two brigades of infantry (12 battalions, in Russia 16). The main difference between the divisions of various armies lay in the allotment of artillery. Thus, while the German division had 72 guns, the Russian had 48, the French 36 and the Austrian only 24. These discrepancies did not necessarily mean a much smaller total proportion of artillery; they indicated rather a difference in organization. Thus in the French and Austrian armies a larger portion of the artillery was left at the disposal of the army corps. Practically all divisions had some cavalry allotted to them, usually a regiment; and all had a detachment of engineers. The division was self-contained in administrative services, and its total strength varied from about 17,000 to 20,000 men. The British division had the same number of battalions (12), but they were organized in three brigades of four battalions each; the number of guns was 70.

Some armies — the Japanese, British and Belgian, for instance — had no higher organization than the division. The views of Jomini and Clausewitz were that this was suitable for armies up to 100,000 men. But all the larger armies were organized into army corps both in peace and in war. The normal army corps consisted of two divisions, a varying quantity of artillery and certain technical and administrative units. The Russian army corps included a division of cavalry. In numbers, the army corps amounted to something over 40.000 men all told. It was held to represent the largest body of troops that could march along a single road and come into action in one day. The commander was a lieutenant-general. It will be noticed that the normal European organization — two regiments to a brigade, two brigades to a division, two divisions to an army corps — violated the principle enunciated at the beginning of this section that a group should consist of not less than three units. The brigade was, tactically, an unnecessary link, and the divisional commander could have handled the four regiments direct. The disadvantages of organizing the corps into two divisions was recognized, but it was held that a corps of three divisions would be too cumbersome a body for open warfare and would necessitate two roads being allotted to a corps on the march. The development of mechanical transport mas, however, modifying this view.

Finally, the size of the military forces of the Great Powers made necessary a further organization in war, the grouping of army corps into *armies*. These did not exist in peace and their composition in war was kept secret. Whereas the other higher formations were uniform in their composition, the composition of an army was variable, dependent on the strategical plan. It might include from three to six corps. The Japanese in Manchuria formed armies of a number of divisions, omitting the army corps link. It may here be mentioned that a uniform organization of divisions and army corps, while greatly facilitating command and staff work, assists the enemy's intelligence service to compile a correct order of battle. Napoleon for this reason always strictly avoided regularity in the organization of his forces, and his corps varied very widely in strength.

ARMIES IN THE WORLD WAR

46. Developments in Armament. — Of the developments in the constitution of armies during the World War — to be considered under the three headings: armament, personnel and organization — those in armament were the most considerable. The progress made in aviation during the years 1914–18 introduced into warfare a completely new factor, as radical in its effects as the invention of gun-powder, but far more rapid and disturbing in its development. This subject is dealt with in the articles AIR FORCES; AIR WARFARE. Of the weapons already in existence at the outbreak of hostilities, the machine gun became the "key" weapon of the war. It was the deadliness of the machine gun in defence, protected by entrenchment and barbed wire, that led to the prolonged stagnation on the Western Front. The Germans were the first to realize the potentialities of the machine gun, and throughout the war used it more effectively than any other combatant. The rapid and accurate rifle fire of the original British Expeditionary Force in the opening engagements had almost the stopping effect of machine gun fire, but subsequent reinforcements could not be trained up to this standard and rifle fire declined in value. The light automatic gun, of which the Lewis gun is a type (see INFANTRY and SMALL ARMS), still further increased the volume of fire delivered by infantry and strengthened the defence. The problem for which the attackers sought a solution throughout the war was to subdue the fire of the defenders' machine guns and automatic weapons sufficiently to enable the infantry to advance and occupy the position. The first solution

attempted was to crush resistance by weight of artillery fire. The number of field guns was increased, high-explosive shell was largely substituted for shrapnel, and great quantities of heavy artillery with calibres from 6in. to 18in. were brought into the field. The selected front of attack was subjected to a prolonged bombardment designed to destroy all hostile resistance before the infantry advanced. But it was found that this solution, even when successful in annihilating the enemy, defeated its own ends by so ploughing up the grouqd as to render any rapid advance or exploitation of success impossible. Weight of material failed even as had weight of man power. The solution eventually found to the problem was the introduction of an entirely new weapon, the tank. The invention of this bullet-proof vehicle, armed with light quick-firing guns or machine guns or both, and capable of moving across country on caterpillar tracks, stands to the credit of the British. It first appeared on the battlefield in Sept. 1916, but it was not till nearly t o years later that its influence became decisive. A full account of this weapon, of its development and of its tactical employment, will be found in the article TANKS.

The other new weapon to which the World War gave birth was poisonous gas (see CHEMICAL WARFARE). first used by the Germans in April 1915 in violation of international law, and subsequently by all the combatants. The gases used were of several kinds, asphyxiating, lachrymatory or vesicant, and were discharged by means of cylinders, projectors or shells. Gas added many complications to a war aiready complex. Troops were compelled to add to their growing burden of equipment a respirator. which they had frequently to wear for long periods, during which speech and vision were restricted and eating or drinking impossible. A persistent gas, such as mustard gas (the most effective of the war gases), rendered the area over which it was spread untenable without heavy casualties, since it penetrated the clothing and severely blistered the skin. Another innovation was the use of smoke projected by shells as a protective screen. The aim was so to dispose a cloud of smoke as to blind the enemy without hampering the movements of one's own troops. Smoke was often an effective weapon, but not an easy one to use. Its introduction further complicated the problem of ammunition supply for field guns, which at the opening of the war had relied almost entirely on the man-killing projectile, shrapnel, but at the close might be called on to fire gas shell, smoke shell, high explosive or shrapnel.

There is space only for the merest catalogue of the other military novelties which four years of intensive killing provoked. Some were applications to warlike purposes of recent scientific discoveries, such as the improvements in wireless telegraphy and in mechanical transport, sound-ranging apparatus to locate hostile guns, artillery to fire at aeroplanes, and so forth. Others were expedients dug out of rusty old wars and furbished up for modern use: such were the grenade, the mortar, the flame-thrower, mining, and the use of the carrier-pigeon for inter-communication. From the animal world the soldier borrowed the art of protective mimicry, camouflage. Lastly may be mentioned a weapon not made with hands, aimed at the mind, not at the body, no soldier's weapon but a deadly one, propaganda. Propaganda declaring the high destiny of the nation, the invincibility of her army, the justice of any course her ruler set, had been part of the German peace preparation for a war. In the closing stages of the war subversive propaganda, which aimed at convincing the German people and German army of the hopelessness of their position, did much to hasten the collapse of Germany. (See PROPAGANDA.)

47. The Man Power Problem. — The assumption under which the nations took the field in 1914 was that the conflict would be a short one and would be decided before the reserves of young trained men had all been drafted into the front line and before the stock of munitions held in peace had all been exhausted. The Germans did in fact nearly win the war at the outset by virtue of the superior peace organization which enabled them to place Reserve Corps (formed from surplus reservists) in the field at once. But their first thrust failed, the expectation of a short war was falsified, and before the end came practically every able-bodied citizen of the principal belligerents was engaged on war work. War ceased to be an affair of the armed forces alone; industry and invention were mobilized to make munitions; the Press — after some gropings and perplexities — was enlisted to spread propaganda; chemistry was recruited to seek new poisons or their antidotes, and so forth. Women took a great part in many war activities.

For armies which had a compulsory service system in peace the keeping of the ranks filled was a comparatively simple affair, even though the war wastage was far heavier than had ever been contemplated. Interest for the military student lies rather in the methods adopted by those nations which had to form new armies, Great Britain and her Dominions and, later, the United States. Once again the plain teaching of history, that it is better to expand an existing force, than to create an entirely fresh one, was disregarded. Lord Haldane, the creator of the Territorial Force, had rightly intended that any expansion of the national forces should be carried out through the agency of the same organization that administered the Territorials; *i.e.*, the County Associations But Lord Kitchener, who became War Minister at the outbreak of war, decided to create an entirely new force. So far as essential fighting value was concerned, the decision made little difference. but many difficulties of administration would have been avoided had the medium of the County Associations been used. A majority of the Territorial Force, which in peace enlisted for home service only. at once accepted a liability for service abroad. So that the British had three types of units serving in the war: the Regular, the Territorial, and the New Army. Another axiom in raising large forces, that every available trained officer or non-commissioned officer should be retained to instruct the new levies, was also unfulfilled. The engagement of the first seven divisions of the regular army in the forefront of the fight was of course necessary; and the loss of the flower of the nation's trained men in the first battles was unavoidable. But in the winter of 1914–15 many priceless lives were squandered in the mud of the trenches which might have been preserved to guide and instruct the pew armies.

The United States and the British Dominions had similar problems of raising large forces with a very small nucleus of trained instructors. The circumstances of the conflict were singularly favourable to the birth and upbringing of these new armies. The deadlock in the main theatre gave time for their training to be completed, and the sedentary conditions of trench warfare allowed them to be introduced to their new trade gradually, instead of being thrust at once into the open field, as were the French levies of 1871, for example. When the newly created forces were thus gradually broken in to their work they soon became efficient. It was found that drafts to replace wastage could be incorporated into seasoned units after a very few weeks' training, but then no high standard of manoeuvre was demanded of the troops on the Western Front. As to compulsion in recruiting, Great Britain passed reluctantly to conscription — via national registration and the Derby Scheme — at the beginning of 1916; Canada clung to the voluntary principle till Nay 1917, and Australia throughout the war; the United States passed a compulsory service act on her entry into the struggle.

48. Developments in **Organization.**—The war period, while it necessitated continual modifications, additions and adjustments in detail, produced no organic change in the general framework on which armies were built. The most radical departure was made late in the war by the British, when they decided to separate their air force from the navy and army and to form it into a separate service. This will be discussed later, since its full significance only came to light when the World War was over. In the proportion of arms the chief features were the increase in artillery, which rose to about ten guns per 1,000 rifles, and the decline of cavalry, which found little scope in the European theatres, though the campaigns in Palestine and Mesopotamia showed that the day of the mounted man was by no means over. Infantry remained in name the principal arm, but it was a lame and overburdened infantry, only able to hobble forward on the crutches of artillery and tanks, and propped up by machine guns in defence. The platoon, reduced in size to some 30 men, became the tactical unit in battle. The British made their machine gunners into a separate corps, as they did also their tank personnel. In

other armies the machine guns remained an integral part of the infantry or cavalry arm. In the artillery the French four-gun battery was almost universally adopted, although the British returned to the six-gun battery before the end of the war owing to the shortage of battery commanders. The proportion of the rearward services to the fighting troops grew abnormally with the static nature of the war. An enormous organization sprang up at the bases and behind the lines to supply the multifarious requirements in warlike stores and to minister to the comfort of the troops. New and strange units were formed for such tasks as salvage of derelict material, cleaning and disinfecting the clothing of soldiers from the trenches, camouflage, meteorological forecasts and the like. Out of the United States army of a little over 2,000,000 at the time of the Armistice, over 650,000 were employed on the communications; that is, for every two men in the front line there was one on the communications.

The composition and functions of the division, the army corps and the army underwent no greater changes than followed naturally from the stagnancy of the operations. Corps usually consisted of three, sometimes of four, divisions; and the tendency was to group the bulk of the artillery under corps control, giving the divisional artillery only a limited independence. On the whole it may be said that the organization conceived in peace stood the test of war well. The British, who had had no higher organization in peace than the division, adopted a corps organization immediately on taking the field in 1914. (A. P. W.)

ARMIES SINCE THE WORLD WAR, 1914-18

49. General Tendencies. — In addition to instruments of force, the opposing alliances in the World War, 1914–18, made full use of propaganda to enhance the morale at home, and to impair the morale of the opponent. Each side made a special effort, in domestic propaganda, to place the blame for the war on the other, and succeeded so far as its own people were concerned. The effect on the peoples of the defeated nations, especially the people of Germany, was the creation of a determination to find some method by which they could rearm and make a new bid for victory.

On the peoples of the victorious democracies — Great Britain, France and the United States — the effect was the creation of a belief that, with Germany beaten and disarmed, its military forces limited to a regular army of 100.000 serving a 12-year period, the chief menace to world peace had been rendered permanently impotent, and that there was no longer any necessity for maintaining strong military establishments. Confused idealists joined those who favoured peace at any price to spread a belief that there would never be another war, and that the maintenance of military establishments was a waste of the public funds. Politicians, sensing the trend of public opinion, gathered public support by promising to reduce military expenditures — and reductions were made until the defensive forces of Great Britain and the United States, based on voluntary enlistments, were close to the vanishing point. Those of France, supplied by conscription, were far below what realistic French patriots considered safe.

The United States and Great Britain reduced their regular armies until there were waiting lists of applicants for enlistment. Officer personnel was limited, and, with the exception of normal additions from military academies, the totals remained far below requirements. This public attitude in these two democracies had a softening effect on youth, with the result that the waiting list of prospective recruits vanished, and it became difficult to obtain enough voluntary enlistments to keep the regular armies even at the low strengths desired.

In France, the obligation of every male citizen to bear arms for the republic was universally recognized, but the pacifist trend created a steadily increasing reluctance on the part of the youth to perform their military service. and on the part of the people to approve expenditures for military purposes. French politicians vied with one another in obtaining as many exemptions as possible, in keeping the eligibles called to the colours as small a percentage of the total number as possible, and in demanding reductions in the length of the training period. The French Foreign Legion, a highly-trained volunteer force of professional soldiers, together with the native troops of the French colonies and such force as the relaxed conscription system provided, gave France a military establishment superior in numbers to that permitted her most probable opponent — Germany. Feeling safe in this preponderance of numbers, the French people regarded the gradual weakening of their army with equanimity.

French and British statesmen were not wholly in agreement with the generally accepted view of the perpetual character of the current peace, but feared that any political party which sponsored increased military expenditures would be driven from power. Popular reaction to occasional pleas for better national defence in France, Great Britain and the United States confirmed this fear. Those who made such pleas — some of them distinguished World War commanders — were denounced as war mongers. The peoples of the three great democracies had become so intolerant of the thought of war that they resented pleas for national defence as insulting insinuations that their belief war had been abolished forever was foolhardy. This popular attitude, however, prevailed only in the three great democracies, France, Great Britain and the United States.

Fascist Italy, as well as the independent nations set up by the Treaty of Versailles, established and maintained, by conscription, as powerful armies as they could afford. Their peoples were no more war-minded than those of the great democracies, but the majorities were strongly nationalistic and willing to fight to keep the "place in the sun" the Versailles Treaty had given them. Dictators ruling these small nations manipulated the national consciousness so as to maintain relatively large armies, on the plea that such organized forces enhanced the national prestige, as, in fact, they did. In 1936 the combined peace-time forces of Great Britain, France and the United States exceeded by only about 60,000 the combined peace-time forces of Rumania, Poland, Yugoslavia and Czechoslovakia, all of which existed only by grace of the Treaty of Versailles. The combined reserves of these four small powers was more than three times the combined reserves of the United States and Great Britain, and both Poland and Rumania had larger peace-time armies than either Great Britain or the United States. This military policy in the smaller Treaty nations was encouraged by French and British statesmen, fearful of the political consequences of an attempt to prepare their own countries for military action. They hoped it would provide security against Germany and Russia. They knew Germany was rearming in defiance of the Versailles Treaty but clung to the hope she would be unable to break out of the "iron ring" of small but highly militarized nations with which they sought to surround her. They also hoped that these and several other well-armed small nations would serve as buffers against Russia, which was arming on a grand scale and by 1936 had a peace-time army of 1,185,000, backed up by 14,540,000 trained reserves. In addition, Russia had a large air force, a generous supply of ordnance, and considerable motorized and mechanized transportation for arms and personnel. Its military efficiency, however, was not highly rated, and the potential power of the Germans worried the statesmen more than the Russian army in being.

In the meantime aviation and the machine age became serious factors in the development of the armament of armies. Some military leaders envisioned the far-reaching influence of these new developments on the weapons of warfare. Others denied the importance of these new developments and held to the view that the weapons of the last mar would suffice for future combat. In the democracies this latter view, plus the widespread aspirations for universal peace, were skilfully exploited by politicians to secure reduction of military expenditures.

An additional deterrent to military expenditures in the democracies was the increasing utilization of mechanical inventions for the purposes of war, and the rapidity nith which such devices were superseded by more effective ones. Military leaders hesitated to spend their scanty funds in quantity purchases of implements which were likely to become obsolescent before there was any emergency requiring their use. They mere likewise reluctant to experiment because as soon as discussion attracted attention

to a new weapon, popular imagination pictured it as removing the need for the old and tried military agencies. The appropriations for these were then reduced, without, however, any provision being made for equipping the national forces with the new arm. In the United States a controversy as to whether or not the aeroplane was the master of the battleship brought that nation's naval construction to a standstill for a number of years without giving appreciable impetus to a program for air development.

In the meantime Japan was arming to the limit of her resources in conformity to a military doctrine similar to that of Germany. This was an obvious menace to the Far Eastern interests of the Western democracies. But the prospect of a Japanese attack on the homelands of the democratic peoples appeared remote, so the rise of Japan to a dominant position as a military power in the Far East failed to stir the peace-loving peoples from their dreams of a warless world.

While the victorious democracies of the World War, 1914–18, were turning pacifist, the defeated Germans were devoting their energy and intelligence to evading the terms of the Versailles Treaty, and to discovering some method by which they could rearm without drawing upon themselves the restraining force of their conquerors. This was a phase of national policy on which the numerous political parties of the country agreed. Many schemes were developed for producing the forbidden materials of war and for creating the machinery for making them. The Disarmament Commission had effectively destroyed or removed German arms and armament after 1918. Relieved of the burden of large stocks of old equipment, Germany was free to develop the most modern machinery for war. German industrialists and scientists co-operated closely in fostering a peace-time industry so tooled that it could be switched to mass-production of war munitions without delay.

The problem of acquiring a trained reserve offered some difficulty. The peace treaty had fixed the enlistment period in Germany's limited regular army at 12 years, to prevent the creation of a trained reserve by rapidly turning over the man-power of Germany through the regular army for short training periods. This was one provision of the treaty the victors appeared determined to enforce. So the Germans made no attempt to evade it. The small army became, in fact, a large officer corps, trained for 12-year periods in the duty of command for a new German army.

Various political clubs organized athletic groups of all descriptions, recruited most of the country's able-bodied youth into them, and thorough basic military training was taught under the guise of physical culture. Such weapons as the regular army possessed mere borrowed by the clubs for training purposes, and training in weapons which Germany was forbidden to possess was given with wooden models, or commercial devices similar in method of operation to the military equipment. As these groups were being trained, a supply of weapons was being secretly accumulated, so that by the time the World War victors were sufficiently disturbed to contemplate action against Germany, the Germans had developed considerable military strength. Only determined and costly military action could have restrained Germany to the status provided for by the Treaty of Versailles. Statesmen who recognized the need for such action dared not take it, lest they be voted out of office by the pacifist elements. Germans, understanding perfectly why they were unmolested, increased the tempo of their rearmament.

When Adolf Hitler came to power, he shrewdly concluded that the stronger his military establishment became, the less danger there would be of interference by the French or British. He dropped all pretence of secrecy and frankly set out to restore Germany to the status of a first-class military power. Recognizing the superiority of his adversaries' resources, he realized that to win he would have to win quickly. Lacking formal military education, he was unhampered by any of the tactical doctrines which caused some professional military men to hesitate at adopting new and untried methods of war. He studied the devices made available by modern science with the idea of finding new tactical applications for machine-age materials, and of adopting new inventions to tactical procedures which had been successful before new weapons had made them dangerous or impossible.

Without adopting completely the Douhet theory of the use of the air arm alone on offensive missions, while the naval and ground forces remain on the defensive, Germany developed the use of the air arm in conjunction with offensive attack by all arms. The Douhet theory has not yet been universally accepted. nor have adequate tests been made to determine its true value. Minor approaches to the complete application of this theory were seen in Spain and in other limited areas, prior to Jan. 1, 1940. The German application of the use of the air arm in combination with other arms in offensive actions resulted in the initial aerial bombardment of fortified positions, lines of communication, supply depots and reserve centres of concentration

This use of the air arm preceded the actual advance of other arms and carried aerial bombardment to distant points in rear of the front lines. In addition, the Germans developed the use of the air arm in conjunction with mechanized attacks, and to accomplish the actual movement of the ground forces against an opponent.

For the disconcerting raid in the rear of slow-moving infantry by fast horse units, he substituted raids by parachute troops. To replace the decisive shock of heavy cavalry riding down massed infantry before the latter could reload their clumsy muzzle-loading muskets, he developed a combat team of fast tanks and hedge-hopping aeroplanes which could strike with lightning speed and terrific force and clear the way for his infantry. He developed intelligent and resourceful leaders, trained in the use of the machine on the field of battle, an essential requirement for complete success.

The effectiveness of this method was demonstrated by the speed with which German forces conquered Poland, Norway, Holland, Belgium and France. Its introduction marked a new era in the development of the art of war—the era of the Blitzkrieg—and the end of pacifist domination of the Western World for the time being.

The cultivation of fear and the creation of periods of intense apprehensior in the minds of probable victims of aggression are pre-combat techniques developed with surprising effectiveness as contributing factors of modern warfare. Fear of war and the uncertainty of when or where attacks might develop created a "war of nerves" or "white war," which exerted tremendous effect among the nations facing invasions. The under-cover encouragement of subversive activities within a rival state, the support given to treacherous individuals preaching the futility of defence, the spread of bribery among military and political officials and organizations—these as well as the actual destruction of essential physical structures, on or coincident with the opening of hostilities, have been associated with the modern practice of warfare.

Although history records the activities of many spies, saboteurs and traitors, the extent of operations and the complexity attending them have made modern practices prominent, as companion efforts in the conduct of war. Attacks designed to effect large-scale evacuation of densely populated areas, with the consequent congestion of highways by refugees, appear to be deliberate actions planned as impediments to the manoeuvres of enemy armed forces in the field of combat.

Conclusion.—The development of armies since 1918 indicates four principal characteristics:

(a). The armed forces of a nation represent only one element in the preparation for and conduct of warfare.

(b). The concept of a nation in arms includes intense training and continuous employment of all individuals toward the accomplishment of the national effort of warfare.

(c). The development of aviation, mechanized and motorized equipment with the consequent increase in fire power, has required greater national dependence upon industrial preparedness.

(d). The development of total warfare has introduced wider fronts, greater speed, more powerful action, and requires greater knowledge and positive control by the officers and men in the armed forces. (H. A. DR.)

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THE FUTURE OF ARMIES

The Nation. — It remains true that force continues to be an essential element of the modern state. Organized force for the prosecution of war includes concepts which embody all citizens within the state, as well as organizations subject to state control. The continuation of political aims by warfare has developed in some nations intense application of the principle that the individual exists for the benefit of the state. Where the expanding benefits of civilization have been accepted as the result of the contrary principle — that the state exists for the benefit of the individual — there has been less intensity in the creation of a nation in arms. Dependent upon these contrary principles, governments have accepted or rejected the development of universal national organization for the prosecution of warfare.

In 1940, with warfare in progress in Western Europe and in the Far East, nations both large and small initiated or continued efforts to secure national aims by the employment of organized force. The success or the failure of these efforts remains in doubt as these words are written. The lines of opposition have been clearly established between the conflicting principles. The methods adopted have provided new forces for offensive action, and have raised doubts of the value of defensive action alone. The conflict of national policies, the rise of governments devoted to state-power, the present decline in importance of the individual within the state, the disruption of peaceful pursuits, the actual spread of warfare through the powerful nations of the world, leave the further development of armies in doubt as to the final form, but emphasize sharply certain basic essential requirements for armed forces.

The Army.—Primarily the armies of the world are dependent upon three essentials:

(a). National morale, which prompts the willing acceptance of the burdens of war, and inspires the fighting forces to meet the sacrifices of battle.

(b). A national industrial program for the production in large quantities of the modern weapons for warfare.

(c). The creation of maximum man-power trained, organized and equipped for modern combat.

The successful realization of the maximum effectiveness of an army is dependent upon the development of these three essentials. They are companion pieces in the framework of national security.

Advancement of one at the expense of the other will not promote national aims. The continuous advance of each is the only solution permitting an approach to the realization of national policy.

In the field of the employment of armies, the doctrine of the supremacy of the defensive appears to be a major obstacle in the successful accomplishment of national policy. Every individual in the armed forces of a nation must be imbued with the offensive spirit, in order to employ efficiently and effectively the aids of modern equipment. Modern weapons are of no value if the offensive spirit is lacking in the military personnel. Mechanized forces, aeroplanes, motorized equipment, automatic weapons, require new skills and greater specialization on the pert of military men. The conduct of warfare has broadened to include mechanical accomplishment as well as physical stamina and mental attitudes on

the field of battle. Armies may be equipped with the most modern machinery that science can devise, but the employment of these machines is measured by mental equipment, which can and must direct the conduct of battle.

The technique of modern warfare requires offensive spirit, adequate knowledge of modern equipment, complete co-ordination in the use of machines of war, and incredible speed in the delivery of decisive action at critical moments, to insure complete success.

A few basic requirements for the employment of modern equipment and war illustrate the problems which armies of the future face. In the air, supremacy must be obtained over the opponent at the initial stage of hostilities. This supremacy should be combined with continuous and close co-operation between air bombardment and the operation of ground forces. The use of aerial bombardment permits the approach and attack in force of ground elements, and provides opportunities to disrupt rear echelons back of the front lines. Mechanized forces, both heavy and light, closely followed by motorized troops and artillery, are required if the initial attack is to be successfully exploited. Large mechanized forces are required to deliver powerful blows against flanks, and to accomplish encirclement and effective disruption of enemy organizations. All elements of modern attack require increased speed of delivery, increased power in every attack, and continuous co-ordination of all arms, in order to accomplish the maximum result.

The realization of the modern technique in the conduct of warfare presupposes that every effort of the nation can be directed toward the accomplishment of adequate training with modern equipment in organizations designed for most efficient conduct of warfare on the field of battle.

Since the development of motors facilitating speedy movement of troops, and the adaptation of mechanized equipment, including the air arm, a popular assumption exists that the solution of most military campaigns rests upon rapid and wide troop movements. Encircling movements, raids against supply lines and distant objectives are of first consideration in support of this assumption. Such operations are important, and may at times have decisive influence, but eventually, before a final decision can be secured, a battle must be fought. Irrespective of speed during preliminary movements, an army will engage in a ground battle before securing a final decision. Rapid movement may secure the advantage of position, but cannot ensure decision without the conduct of a ground battle. Consequently training and organization of forces should be directed toward the conduct of battle. Without it, speed of movement will be of little avail. Strategy in warfare includes the disposition of large forces and remains the function of the higher commander. Tactics include the fighting of the battle, and are the function of every individual in the army. The tactics and technique of battle, particularly with modern equipment, are more difficult of accomplishment than speed of movement, and the direction of wide encircling movements. For these reasons the conduct of the battle is far more important than speed alone.

There are specific advantages in speed off the battlefield. It has its place in the art of war and is important. Yet there is nothing in the recent experience on European or Asiatic battlefields to give any indication that mobility off the battlefield can compensate for inefficiency in the conduct of a fight. The actual conduct of a battle, that is, the mechanism of battle, remains the only process through which a final decision may be secured.

The increased fire power and range of modern aviation and field artillery, coupled with the rapid movements of mechanized forces, require battle operations in great depth and width. The combined ground and air battle of the future will embrace an area of conflict equivalent, at least, to the range of light artillery. Decision will seldom be gained until the real area of light artillery is penetrated. Initial combats along the front will develop with a tendency to lack of co-ordination. Supporting artillery will be required to make frequent forward moves, with resultant losses of contact with infantry. Attack air units will be required to join in the fight and supplement artillery. Co-ordination of the attack by aviation, artillery, mechanized units, tanks and motorized infantry will be essential for the conduct of battle.

The use of air bombardment against sensitive points and populous areas to secure decisive results has not been adequately tested at present. The theory behind this use promotes the idea that such air bombardment, by the impairment of industrial production and by the weakening or destruction of the morale of the civilian population, will accomplish decisive results. It appears that such employment of the air arm results in serious effects, but against civilized and courageous people there is no indication that decisive results can be produced. The European War in 1939 and 1940 leaves this question open for future conclusion.

The great difficulty which all armies face is the preservation of the integrity of the fighting units and the maintenance of continuous effort to deliver decisive blows. Speed in combat is essential, both on and off the field of battle. Co-ordination of all arms in the delivery of the maximum fire power directed toward the accomplishment of definite objectives is the real basis for success.

In modern warfare the machine remains the servant of the trained soldier. Well-trained soldiers dominate mechanical equipment, and well-led forces correlate the use of modern arms. Only under these circumstances does the machine remain the means to victory and not the master of man-power. Modern warfare, a reflection of modern life, has made men acutely aware of the increased demands for intelligence, decision and control. The development of these traits requires training not only in the use of modern equipment, but in the art of leadership. The successful army of the future will accomplish the national goal under the leadership of commanders who can win and hold respect from alert, intelligent, adequately-trained, properly-equipped, aggressive soldiers, imbued with the dominant spirit of the offensive and the unshakable will to victory. (H. A. Dr.)

I. Armed Strength of Certain Selected Nations in 1900

Nation	Peace establishment	Militia and reserve forces	Total war strength
Germany	691,900	4,908,300	5,600,200
France	579,900	4,422,600	5,002,500
Italy	211,900	1,834,000	2,045,900
Austria-Hungary	265,600	1,498,000	1,763,600
Russia	883,100	4,590,800	5,473,900
Great Britain	254,500	358,000	612,500
Spain	86,100	1,008,000	1,094,100
Turkey	211,500	1,022,700	1,234,200
United States	68,200	155,200	223,400
Japan	87,900	314,400	402,300

II. Armed Strength on the Eve of the World War (1913)

Nation	Peace establishment	Militia and reserve forces	Total war strength
Germany	870,000	4,430,000	5,300,000
France	720,000*	3,280,000	4,000,000
Italy	250,000	950,000	1,200,000
Austria-Hungary	390,000	1,610,000	2,000,000
Russia	1,290,000	3,300,000	4,590,000
Great Britain	254,500†	476,500	731,000
Spain	115,000	235,000	350,000
Turkey	400,000	300,000	700,000
United States	92,000	121,000	213,000
Japan	250,000	950,000	1,200,000

*Including colonial forces. †Excluding Indian militia.

III. Armed Strength in 1922

Nation	Peace establishment	Militia and reserve forces	Total war strength
Germany	100,000	..	100,000
France	777,000	4,400,000	5,177,000
Italy	250,000	2,350,000	2,600,000
Austria	30,000	..	30,000
Hungary	35,000	..	35,000
U.S.S.R. (Russia)	1,300,000	3,500,000	4,800,000
Great Britain	182,000	205,000	387,000
Spain	217,000	700,000	917,000
Turkey	120,000	800,000	920,000
United States	146,000	227,500	373,500
Japan	300,000	1,700,000	2,000,000

IV. *Chief Characteristics of the Armies of the Selected Countries*

	Nature of the army	System of recruiting voluntary or compulsory service	Duration of military service	
			Service with the colours	Total duration of liability to service in years
Germany	Permanent army	Voluntary	12 years	12
France	,, ,,	Compulsory	18 months	28
Italy	,, ,,	,,	18 months	19
Austria	,, ,,	Voluntary	6 years	12
Hungary	,, ,,	,,	12 years	12
U.S.S.R. (Russia)	Permanent army and militia	Compulsory	2–3–4 years	21
Great Britain	Permanent army	Voluntary	2–9 years	12
Spain	,, ,,	Compulsory	2 years	18
United States	,, ,,	Voluntary	1–3 years	1–3
Japan	,, ,,	Compulsory	2 years	23
Rumania	,, ,,	,,	2 years	29
Poland	,, ,,	,,	2 years	20
Yugoslavia	,, ,,	,,	18 months	29
Czechoslovakia	,, ,,	,,	14 months	30
Greece	,, ,,	,,	18 months	29
Belgium	,, ,,	,,	10–12–13 months	25
Portugal	Permanent army and militia	,,	17 months	25

Source: League of Nations *Armaments Year-Book* (1928).

V. Armed Strength of Certain Selected Nations in 1936

Nation	Peace establishment	Militia, and reserve forces	Total war strength
Germany	600,000	3,050,000	3,650,808
France	564,608	6,347,200	6,911,808
Italy	433,625	5,885,000	6,318,625
Austria	30,000	....	30,000
Hungary	35,000	....	35,000
U.S.S.R. (Russia)	1,185,000	14,540,000	15,725,000
Great Britain	228,362	350,986	579,348
Spain	214,530	2,098,342	2,312,872
United States	165,000	308,000	473,000
Japan	248,000	2,062,000	2,310,000
Rumania	295,827	1,605,000	1,900,827
Poland	324,665	1,721,579	2,046,244
Yugoslavia	142,000	1,200,000	1,342,000
Czechoslovakia	137,100	1,489,000	1,626,100
Greece	79,600	415,000	494,600
Belgium	71,000	500,000	571,000
Portugal	34,900	372,000	406,900
Denmark	8,100	65,700	73,800
Finland	30,336	100,000	
Netherlands	29,500	330,000	
Norway	15,100	315,000	330,100
Sweden	33,500	838,000	871,500
Switzerland	494	629,600	630,094
Turkey	108,000	532,800	640,800

(Note: Since 1939 all data concerning the strength of the world's armies have been subject to censorship. In the absence of reliable information, therefore, no later comparative statistical tables are presented here. Ed.)

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ARMY-WORM (*Ciphis unipuncta* or *Leucania unipuncta* of the family *Noctuidae*) is a small striped green, and nearly naked, caterpillar, found chiefly in the United States and Canada east of the Rocky Mountains, but also in New Mexico, Arizona, California and in some parts of South America. From time to time it becomes enormously destructive to growing cereals and sometimes to forage crops. The fully developed parent of the army-worm is a moth measuring about $1\frac{1}{2}$ in. across the expanded wings, brownish-gray in colour, and having a single small white spot near the centre of the front pair of wings. This moth lays its eggs on the under side of blades of grass, or grass-like grain, preferring marshes and low spots. There the worms hatch and grow rapidly. The greed and capacity of the full grown worm for food is most remarkable. When an army is at work in a field the champing of the jaws may be plainly heard as they devour every tender green blade in sight. When the worms have exhausted the food in the vicinity of their breeding place, they mass together and march (hence the name army-worm) in search of new fields. It is usually in this stage that they are first discovered.

If noticed in their younger stages the army-worm may be destroyed by burning the infested spot or by spraying heavily with a mixture of Paris green in the ratio of 1 lb. to 50 gal. of water. Spraying poison in their line of march is also useful but a more certain method is to plow around the infested area, throwing the earth toward the army so that the worms will have difficulty climbing the opposite and perpendicular side of the furrow and will crawl along the bottom instead. Here they may be destroyed by crushing, or by digging post holes about every 20 ft. in the furrow bottom, into which they will fall. Crude coal oil or petroleum can then be poured into the post hole.

See A. Gibson, "The Army-worm" (Dominion of Canada, Dept. of Agri., Entomological Branch, *Bulletin No. 9*, 1915); W. R. Walton, "The True Army Worm and its Control" (U.S. Dept. of Agri., *Farmers' Bulletin No. 731*, 1916); H. H. Knight, "The Army-worm in New York" (Cornell Agri. Exp. Sta., *Bulletin* No. 376, 1916); H. T. Fernald, "The Army-worm" (Mass. Bd. of Agri., *62nd Ann. Rept.*, 1915).

ARNAL, ÉTIENNE (1794–1872), French comedian, was born at Meulan, Seine-et-Oise, on Feb. 1, 1794. After serving in the army, and working in a button factory, he took to the stage. His first appearance (1817) was in tragedy, and for some time he was unsuccessful; it was not until 1827 that he showed his real ability in comedy parts, especially in plays by Félix August Davert (1795–1876) and Augustin Théodore Lauzanne (1805–77), whose *Cabinets particuliers* (1832), *Le Mari de la dame de choeurs* (1837), *Passe' minuet, L'Homme blase'* (1843), *La Clef dans le dos* (1848), etc., contained parts written for him. He was 20 years in vaudeville, and completed at the various Parisian theatres a stage career of nearly half a century, retiring in 1863. He was also a charming poet, the author of *Epître à bouffe* (1840); *Les Gendarmes* (1826); *Les Acteurs et les Prêtres* (1831); and *Boutades en vers* (1861). He died in Geneva in 1872.

ARNALDUS DE VILLA NOVA, also called *Arnaldus de Villanueva, Arnaldus Villanovanus* or *Arnaud de Villeneuve* (*c.* 1235–1313), alchemist, astrologer and physician, appears to have been of Spanish origin, and to have studied chemistry, medicine, physics, and also Arabian philosophy. After having lived at the court of Aragon, he went to Paris, where he gained a considerable reputation; but he incurred the enmity of the ecclesiastics and was forced to flee, finally finding an asylum in Sicily. About 1313 he was summoned to Avignon by Pope Clement V., who was ill, but he died on the voyage. Many alchemical writings, including *Thesaurus Thesazrrorum* or *Rosarius Philosophorum, Novum Lumen. Flos Florum,* and *Speculum Alchimiae,* are ascribed to him, but they are of very doubtful authenticity.

Collected editions of them were published at Lyons in 1504 and 1532 (with a biography of Symphorianus Campegius), at Basel in 1585, at Frankfort in 1603, and at Lyons in 1686. He is also reputed author of medical works including *Breviarum Practicae.*

See J. *B.* Hauréau in the *Histoire littéraire de la France* (1881), vol. xxviii.; E. Lalande, *Arnaud de Villeneuve, sa vie et ses oeuvres* (1896). A list of writing is given by J. Ferguson in his *Bibliotheca Chemica* (1906). *See* also U. Chevalier, *Répertoire des sources kist., etc., Bio-bibliographie* (1903).

ARNAUD, HENRI (1641–1721), pastor and general of the Vaudois or Waldensians of Piedmont, was born at Embrun. About 1650 his family returned to their native valley of Luserna, where Arnaud was educated at La Tour (the chief village), later visiting the college at Basel (1662 and 1668) and the academy at Geneva (1666). He then returned home, and seems to have been pastor in several of the Vaudois valleys before attaining that position at La Tour (1685). He was thus the natural leader of his co-religionists after Victor Amadeus expelled them (1686) from their valleys. William of Orange gave him help and money.

Arnaud occupied himself with organizing his 3,000 countrymen who had taken refuge in Switzerland, and who twice (1687–88) attempted to regain their homes. The English revolution of 1688, and the election of William to the throne, encouraged the Vaudois to make yet another attempt. Furnished with detailed instructions from the veteran Josué Janavel (prevented by age from taking part in the expedition) Arnaud with about 1,000 followers started (Aug. 17 1689) from near Nyon on the Lake of Geneva for the glorieuse rentre'e. On Aug. 27 the valiant band after many hardships and dangers reached the Valley of St. Martin, having passed by Sallanches and crossed the Col de Very (6,506 ft.), the Enclave de la Fenêtre (7,425 ft.), the Col du Bonhomme (8,147 ft.), the Col du Mont Iseran (9,085 ft.), the Grand Mont Cenis (6,893 ft.), the Petit Mont Cenis (7,166 ft.), the Col de Clapier (8,173 ft.), the Col de Côteplane (7,589 ft.), and the Col du Piz (8,550 ft.). They soon took refuge in the lofty and secure rocky citadel of the Balsille, where they were besieged (Oct. 24 1689 to May 14 1690) by the troops (about 4,000 in number) of the king of France and the duke of Savoy. They maintained this natural fortress against many fierce attacks and during the whole of a winter. In particular, on May 2, one assault was defeated without the loss of a single man of Arnaud's small band But another attack (May 14) was not so successful, so that Arnaud withdrew his force under cover of a thick mist and led them over the hills to the valley of Angrogna, above La Tour.

A month later the Vaudois were received into favour by the duke of Savoy, who had then abandoned his alliance with France for one with Great Britain and Holland. Hence for the next six years the Vaudois helped Savoy against France, though suffering much from the repeated attacks of the French troops. But by a clause in the treaty of peace of 1696, made public in 1698, Victor Amadeus again became hostile to the Vaudois, about 3,000 of whom, with Arnaud, found shelter in Protestant countries, mainly in Württemberg, where Arnaud became the pastor of Durrmenz-Schonenberg, N. W. of Stuttgart (1699).

Once again (1704–06) the Vaudois aided the duke against France. Arnaud, however, took no part in the military operations, though he visited England (1707) to obtain pecuniary aid from Queen Anne. He died at Schonenberg (which was the church hamlet of the parish of Durrmenz) in 1721. During his retirement he compiled from various documents by other hands his *Histoire* de la *glorieuse rentrée* des Vaudois dans leurs *vallées,* which was published (probably at Cassel) in 1710, with a dedication to Queen Anne. It was translated into English (1827) by H. Dyke Acland, and has also appeared in German and Dutch versions. A part of the original ms. is preserved in the Royal Library in Berlin.

See K. H. Klaiber, *Henri Arnaud, ein Lebensbild* (Stuttgart, *1880)*; A. de Rochas d'Aiglun, Les *Vallées vaudoises* (1881); various chapters in the *Bulletin du bicentenaire de la glorieuse rentrée* (Turin, 1889).

(W. A. B. C.)

ARNAULD, the surname of a family of prominent French lawyers, chiefly remembered in connection with the Jansenist troubles of the 17th century. At their head was ANTOINE ARNAULD (1560–1619), a leader of the Paris bar; in this capacity he delivered a famous philippic against the Jesuits in 1594, accusing them of gross disloyalty to the newly converted Henry IV. This speech was afterwards known as the original sin of the Arnaulds.

Of his 20 children several grew up to fight the Jesuits on more important matters. Five gave themselves up wholly to the Church HENRI ARNAULD (1597–1692), the second son, became bishop of Angers in 1649 and represented Jansenism on the episcopal Bench for as long as 43 years. The youngest son, ANTOINE, (1612–1694), was the most famous of Jansenist theologians (see below). The second daughter, ANGÉLIQUE (1591–1661), was abbess and reformer of Port Royal; here she was presently joined by her sister AGNES (1593–1671) and two younger sisters, both of whom died early.

Only two of Antoine's children married—ROBERT ARNAULD D'ANDILLY (1588–1674), the eldest son, and CATHERINE LEMAISTRE (1590–1651), the eldest daughter. But both of these ended their lives under the shadow of the abbey. Andilly's five daughters all took the veil there; the second, ANGÉLIQUE DE ST. JEAN ARNAULD D'ANDILLY (1624–1684) rose to be abbess, was a writer of no mean repute, and one of the most remarkable figures of the second generation of Jansenists. One of Andilly's sons became a hermit at Port Royal; the eldest, ANTOINE (1615–1699), was first a soldier, afterwards a priest. As the Abbé Arnauld, he survives as author of some interesting *Memoirs* of his time. The second son, SIMON ARNAULD DE POMPONNE (1616–1699), early entered public life. After holding various embassies, he rose to be foreign secretary to Louis XIV. and was created Marquis de Pomponne. Lastly Madame Lemaistre and two of her sons became identified with Port Royal. On her husband's death she took the veil there. Her eldest son, ANTOINE LEMAISTRE (1608–1658), became the first of the solitaires, or hermits, of Port Royal. There he was joined by his younger brother, ISAAC LEMAISTRE DE SACI (1613–1684), who took holy orders and became confessor to the hermits.

The Arnaulds' connection with Port Royal (*q.v.*)—a convent of Cistercian nuns in the neighbourhood of Versailles—dated back to 1599, when the original Antoine secured the abbess's chair for his daughter Angélique, then a child of eight. About 1608 she started to reform her convent in the direction of its original Rule; but about 1623 she made the acquaintance of du Vergier (*q.v.*) and thenceforward began to move in a Jansenist direction. Her later history is entirely bound up with the fortunes of that revival. Angélique's strength lay chiefly in her character. Her sister and collaborator, Agnes, was also a graceful writer; and her Letters, edited by Prosper Feugère (1858), throw most valuable light on the inner aims and aspirations of the Jansenist movement. The first relation to join their projects of reform was their nephew, Antoine Lemaistre, who threw up brilliant prospects at the bar to settle down at the Abbey gates (1638). Here he was joined by his brother, de Saci and other hermits, who led an austere semi-monastic existence, though without taking any formal vow. In 1646 they were joined by their uncle, Arnauld d'Andilly, hitherto a personage of some importance at court and in the world; he was a special favourite of the queen regent, Anne of Austria, and had held various offices of dignity in the government. Uncle and nephews passed their time partly in ascetic exercises—though Andilly never pretended to vie in austerity with the younger men—partly in managing the convent estates, and partly in translating religious classics. Andilly put Josephus, St. Augustine's Confessions, and many other works into singularly delicate French. Lemaistre attacked the lives of the saints; in 1654 Saci set to work on a translation of the Bible. His labours were interrupted by the outbreak of persecution. In 1661 he was forced to go into hiding; in 1666 he was arrested, thrown into the Bastille, and kept there more than two years. Meanwhile his friends printed his translation of the New Testament—really in Holland, nominally at Mons in the Spanish Netherlands (1667). Hence it is usually known as the *Nouveau Testament* de Mons. It found enthusiastic friends and violent detractors. Bossuet approved its orthodoxy, but not its over-elaborate style; and it was destructively criticized by Richard Simon, the founder of Biblical criticism in France. On the other hand it undoubtedly did much to popularize the Bible, and was bitterly attacked by the Jesuits on that ground.

By far the most distinguished of the family, however, was Antoine—*le* grand Arnauld, as contemporaries called him—the 20th and youngest child of the original Antoine. Born in 1612,

he was originally intended for the bar; but decided instead to study theology at the Sorbonne. Here he was brilliantly successful and was on the high-road to preferment, when he came under the influence of du Vergier and was drawn in the direction of Jansenism. His book, *De la fréquente Communion* (1643), did more than anything else to make the aims and ideals of this movement intelligible to the general public. Its appearance raised a violent storm, and Arnauld eventually withdrew into hiding; for more than 20 years he dared not make a public appearance in Paris. During all that time his pen was busy with innumerable Jansenist pamphlets. In 1655 two very outspoken *Lettres à un duc et pair* on Jesuit methods in the confessional brought on a motion to expel him from the Sorbonne. This motion was the immediate cause of Pascal's *Provincial Letters*. Pascal, however, failed to save his friend; in Feb. 1656 Arnauld was solemnly degraded. Twelve years later the tide of fortune turned. The so-called peace of Clement IX. put an end to persecution. Arnauld emerged from his retirement, was most graciously received by Louis XIV., and treated almost as a popular hero. He then set to work with Nicole (*q.v.*) on a great work against the Calvinists: *La Perpétuité de la foi catholique touchant l'eucharistie*. Ten years later, however, another storm of persecution burst. Arnauld was compelled to fly from France and take refuge in the Netherlands, finally settling down at Brussels, There the last 16 years of his life were spent in incessant controversy with Jesuits, Calvinists, and opponents of all kinds; there he died on Aug. 8, 1694. His inexhaustible energy is best expressed by his famous reply to Nicole, who complained of feeling tired. "Tired!" echoed Arnauld, "when you have all eternity to rest in?"

Nor was this energy by any means absorbed by purely theological questions. He was one of the first to adopt the philosophy of Descartes, though with certain orthodox reservations; and between 1683 and 1685 he had a long battle with Malebranche on the relation of theology to metaphysics. On the whole, public opinion leant to Arnauld's side. When Malebranche complained that his adversary had misunderstood him, Boileau silenced him with the question: "My dear sir, whom do you expect to understand you, if M. Arnauld does not?" And popular regard for Arnauld's penetration was much increased by his *Art de penser*, commonly known as the *Port-Royal Logic*, which has kept its place as an elementary text-book until quite modern times.

But a purely controversial writer is seldom attractive to posterity. It is to be feared that, but for his connection with Pascal, Arnauld's name would be almost forgotten — or, at most, live only in the famous epitaph Boileau consecrated to his memory—

> Au pied de cet autel de structure grossière
> Git sans pompe, enfermé dans une vile bière
> Le plus savant mortel qui jamais ait écrit.

Full details as to the lives and writings of the Arnaulds will be found in various books mentioned at the close of the article on Port Royal. The most interesting account of Angélique will be found in *Mémoires pour servir à l'histoire de Port Royal* (Utrecht, 1742). Three volumes of her correspondence were also published at the same time and place. There 'are excellent modern lives of her in English by Miss Frances Martin (*Angélique Arnauld*, 1873) and by A. K. H. (*Angélique of Port Royal*, 1905). Antoine Arnauld's complete works were published in 1775–81. No modern biography of him exists; but there is a study of his philosophy in Bouillier, *Histoire de* la *philosophie cartésienne* (1868); and his mathematical achievements are discussed by Dr. Bopp in the 14th volume of *Abhandlungen zur Geschichte der mathematis-hen Wissenschaften* (Leipzig, 1902.) The memoirs of Arnauld d'Andilly and of his son, the abbé Arnauld, are reprinted both in Petitot's and Poujoulat's collections of memoirs illustrative of the 17th century.

ARNAULT, ANTOINE-VINCENT (1766–1834), French dramatist, was born in Paris. His first play, *Marius à Minturnes* (1791), immediately established his reputation. A year later he followed up his first success with a second republican tragedy, *Lucrèce*. He was commissioned by Bonaparte in 1797 to reorganize the Ionian islands, and was nominated to the Institute and made secretary general of the university. He was faithful to his patron through his misfortunes, and after the Hundred Days remained in exile until 1819. His tragedies are perhaps less known now than his *Fables* (1813, 1815 and 1826), which are written in very graceful verse. Arnault collaborated in a *Vie politique et militaire de Napoléon* (1822), and wrote some interesting *Souvenirs d'un sexagénaire* (1833), which contain much out-of-the-way information about the history of the years previous to 1804.

His eldest son, ÉMILIEN LUCIEN (1787–1863), wrote several tragedies, the leading rôles in which were interpreted by Talma. *See* Sainte-Beuve, *Causeries du lundi*, vol. vii. Arnault's *Oeuvres complètes* were published at The Hague and Paris in 1818–19.

ARNDT, ERNST MORITZ (1769–1860), German poet and patriot, was born on Dec. 26, 1769, at Schoritz in the island of Rügen, which at that time belonged to Sweden. He was educated at Stralsund, Greifswald, and Jena, and qualified for the Lutheran ministry. At the age of 28 he renounced the ministry, and for 18 months he led a wandering life, visiting Austria, Hungary, Italy, France, and Belgium. Returning homewards up the Rhine, he was moved by the sight of the ruined castles along its banks to intense bitterness against France. The impressions of this journey he later described in *Reisen durch einen Theil Deutschlands, Ungarns, Italiens, und Frankreichs in den Jahren 1798 und 1799* (1802–04). In 1800 he settled in Greifswald as *Privatdozent* in history, and the same year published *Über die Freiheit der alten Republiken*. In 1803 appeared *Germanien und Europa*, "a fragmentary ebullition," as he himself called it, of his views on the French aggression. This was followed by one of the most remarkable of his books, *Versuch einer Geschichte der Leibeigenschaft in Pommern und Rügen* (1803), a history of serfdom in Pomerania and Riigen, which was so convincing an indictment that King Gustavus Adolphus IV. in 1806 abolished the evil. In 1806 Arndt was appointed to the chair of history at the university. In this year he published the first part of his *Geist der Zeit*, in which he flung down the gauntlet to Napoleon and called on his countrymen to rise and shake off the French yoke. So great was the excitement it produced that Arndt was compelled to take refuge in Sweden to escape the vengeance of Napoleon. In pamphlets, poems, and songs he communicated his enthusiasm to his countrymen. Schill's heroic death at Stralsund impelled him to return to Germany and, under the disguise of "Almann, teacher of languages," he reached Berlin in December 1809. In 1810 he returned to Greifswald, but only for a few months. He again set out on his adventurous travels, lived in close contact with the first men of his time, such as Blucher, Gneisenau, and Stein, and in 1812 mas summoned by the last named to St. Petersburg to assist in the organization of the final struggle against France. Meanwhile,' pamphlet after pamphlet, full of bitter hatred of the French oppressor, came from his pen, and his stirring patriotic songs, such as *Was ist das deutsche Vaterland? Der Gott, der Eisen wachsen liess*, and *Was blasen die Trompeten?* were on all lips. When, after the peace, the university of Bonn was founded in 1818, Arndt was appointed to the chair of modern history. In this year appeared the fourth part of his *Geist der Zeit*, in which he criticized the reactionary policy of the German powers. The boldness of his demands for reform offended the Prussian government, and in the summer of 1819 he was arrested and his papers confiscated. Although speedily liberated, he was in the following year arraigned before a specially constituted tribunal. Although not found guilty, he was forbidden to exercise the functions of his professorship, but was allowed to retain the stipend. The next 20 years he passed in retirement and literary activity. In 1840 he was reinstated in his professorship, and in 1841 was chosen rector of the university. The revolutionary outbreak of 1848 rekindled in the venerable patriot his old hopes and energies, and he took his seat as one of the deputies to the National Assembly at Frankfort. He formed one of the deputation that offered the imperial crown to Frederick William IV., and indignant at the king's refusal to accept it, he retired with the majority of von Gagern's adherents from public life. He died at Bonn on Jan. 29, 1860.

Arndt's untiring labour for his country rightly won for him the title of "the most German of all Germans." His lyric poems are not, however, all confined to politics. Many among the Gedichte (1803–18; complete edition, 1860) are religious pieces of great beauty. Among

his other works are *Reise durch Schweden* (1797); *Nebenstunden, eine Beschretbung und Geschichte der schottländischen Inseln und der Orkaden* (1820); *Die Frage über die Niederlande* (1831); *Erinnerungen aus dem ausseren Leben,* an autobiography, and the most valuable source of information for Arndt's life (1840); *Rhein- und Ahrwanderungen* (1846); *Wanderungen und Wandlungen mit dem Reichsfreiherrn von Stein* (1858) and *Pro populo Germanico* (1854), which was originally intended to form the fifth part of the *Geist der Zeit.* Arndt's *Werke* have been edited by H. Rosch and H. Meisner in 8 vols. (not complete) (1892–98). Biographies have been written by E. Langenberg (1869) and Wilhelm Baur, 5th ed. (1882). *See* also H. Meisner and R. Geerds, *E. M. Arndt, ein Lebensbild in Briefen* (1898), and *R.* Thiele, *E. M. Arndt* (1894). There are monuments to his memory at Schoritz, his birthplace, and at Bonn, where he is buried.

ARNDT, JOHANN (1555–1621), German Lutheran theologian, was born at Ballenstadt, in Anhalt, and studied in several universities. He was at Helmstadt in 1576; at Wittenberg in 1577. At Wittenberg the crypto-Calvinist controversy was then at its height, and he took the side of Melanchthon and the crypto-Calvinists. He became pastor of Badeborn in 1583, but in 1590 he was deposed for refusing to remove the pictures from his church and discontinue the use of exorcism in baptism. He found an asylum in Quedlinburg (1590), and afterwards was transferred to St. Martin's church at Brunswick (1599).

Arndt's fame rests on his writings. These were mainly of a mystical and devotional kind, and were inspired by St. Bernard, J. Tauler, and Thomas à Kempis. His principal work, *Wahres Christentum* (1606–09), which has been translated into most European languages, has served as the foundation of many books of devotion, both Roman Catholic and Protestant. After *Wahres Christentum,* his best known work is *Paradiesgärtlein aller christlichen Tugenden,* which was published in 1612. Arndt has always been held in very high repute by the German Pietists.

A collected edition of his works was published in Leipzig and Gorlitz in 1734. A valuable account of Arndt is to be found in C. Aschmann's *Essai sur* la *vie, etc., de J. Arndt. See* further, Herzog-Hauck, *Realencyklopiidie.*

ARNE, THOMAS AUGUSTINE (1710–1778), English composer, was born in London, being the son of an upholsterer. Intended for the legal profession, he was educated at Eton, and afterwards apprenticed to an attorney for three years. His natural inclination for music, however, proved irresistible, and his father, after strongly opposing his wishes for a time, eventually provided the means for his training. On March 7, 1733, he produced his first work at Lincoln's Inn Fields Theatre, a setting of Addison's *Rosamond,* the heroine's part being performed by his sister, Susannah Maria, who afterwards became celebrated as Mrs. Cibber. This, proving a success, was immediately followed by a burletta, entitled *The Opera of Operas,* based on Fielding's *Tragedy of Tragedies.* The part of Tom Thumb was played by Arne's younger brother, and the opera was produced at the Haymarket Theatre. On Dec. 19, 1733, Arne produced at the same theatre the masque *Dido and Aeneas,* a subject which Purcell had treatedmore than half a century earlier in such amemorable fashion.

Arne's individuality of style first distinctly asserted itself in the music to Dr. Dalton's adaptation of Milton's *Comus,* which was performed at Drury Lane in 1738, and speedily established his reputation. In 1740 he wrote the music for Thomson and Mallet's *Masque of Alfred,* which, if otherwise unnoteworthy, will always be remembered as containing *Rule, Britannia!* In 1740 he also wrote his beautiful settings of the songs *Under the greenwood tree, Blow, blow, thou winter wind* and *When daisies pied,* for a performance of Shakespeare's *As you like it.*

Four years before this, in 1736, he had married Cecilia, the eldest daughter of Charles Young, organist of All Hallows, Barking. She was considered the finest English singer of the day and was frequently engaged by Handel for his performances. In 1742 Arne went with his wife to Dublin, where he remained two years and produced his oratorio *Abel,* containing the beautiful melody known as the *Hymn of Eve,* and the operas *Britannia, Eliza* and *Comus,* and where *he* also gave a number of successful concerts. On his return to London he was engaged as leader of the band at Drury Lane Theatre (1744), and as composer at Vauxhall (1745).

In 1745 he composed his successful pastoral dialogue, *Colin and Phoebe,* and in 1746, in connection with a revival of Shakespeare's *Tempest* at Drury Lane, one of the most delightful of his songs, *Where the bee sucks.* In 1760 he transferred his services to Covent Garden Theatre, where, Nov. 28, he produced his *Thomas and Sally.* Here, too, Feb. 2, 1762, he produced his *Artaxerxes,* an opera in the Italian style with recitative instead of spoken dialogue, the popularity of which is attested by the fact that it continued to be performed at intervals for upwards of 80 years. The libretto, by Arne himself, was a very poor translation of Metastasio's *Artaserse* In 1762 also was produced the ballad-opera *Love in a Village* His oratorio *Judith,* of which the first performance was Feb. 27, 1761, at Drury Lane, was revived at the Chapel of the Lock Hospital, Pimlico, Feb. 29, 1764, in which year was also performed his setting of Metastasio's *Olimpiade* in the original language at the King's Theatre in the Haymarket. At a later performance of *Judith* at Covent Garden Theatre Feb. 26, 1773, Arne for the first time introduced female voices into oratorio choruses. In 1769 he wrote the musical parts for Garrick's ode for the Shakespeare jubilee at Stratford-on-Avon, and in 1770 he gave a mutilated version of Purcell's *King Arthur.* One of his last dramatic works was the music to Mason's *Caractacus,* published in 1775. Dr. Arne died March 5, 1778, and was buried at St. Paul's, Covent Garden.

Though not to be reckoned the equal of his great predecessor Purcell, Arne has none the less high claims. There is true inspiration in such airs as *Blow, blow, thou winter wind,* and *Where the bee sucks,* while *Rule, Britannia!* will last, it is hardly too much to say, as long as the English language. If as a writer of glees Arne does not take such high rank, he deserves notice as a leader in the revival of that peculiarly English form of composition. It may be added that he was author as well as composer of *The Guardian Outwitted, The Rose, The Contest of Beauty and Virtue,* and *Phoebe at Court.*

See the article *in* Grove's *Dictionary* and two interesting papers in the *Musical Times,* Nov. and Dec. 1901.

ARNETH, ALFRED, RITTER VON (1819–1897), Austrian historian, born in Vienna on July 10, 1819, was the son of Joseph Calasanza von Arneth (1791–1863), an historian and archaeologist, who wrote a history of the Austrian empire (Vienna, 1827) and several works on numismatics. Alfred Arneth studied law and became an official of the Austrian State archives, of which in 1868 he was appointed keeper In 1879 he was appointed president of the *Kaiserliche Akademie der Wissenschaften* (Academy of Sciences) in Vienna, and in 1896 succeeded von Sybel as Chairman of the historical commission at Munich. He died July 30, 1897. Arneth was an indefatigable worker, and his scientific temper and the special facilities which he enjoyed for drawing from original sources gave to his numerous historical works a special value.

Among his publications may be mentioned: *Leben des Feldmarschalls Grafen Guido Starhemberg* (1863); *Prinz Eugen von Savoyen (ibid,,* 1864); *Gesch. der Maria Theresa (ibid.,* 1863–79); *Mario Theresa u. Marie Antoinette, ikr Briefwechsel (ibid.,* 1866); *Marie Antoinette, Joseph II. und Leopold II., ihr Briefwechsel* (1866); *Maria Theresa und Joseph II., ihre Korrespondenz samt Briefen Josephs an seinen Bruder Leopold* (1867); *Beaumarchais und Sonnenfels* (1868); *Joseph II. und Katharina von Russland, ihr Briefwechsel* (1869); *Johann Christian Barthenstein und seine Zeit* (1871); *Joseph II. und Leopold von Toskana, ihr Briefwechsel* (1872); *Briefe der Kaiserin Maria Theresa an ihre Kinder und Freunde* (1881); *Marie Antoinette: Correspondance secrbte entre Marie-Thérèse et le comte de Mercy-Argenteau* (1874), in collaboration with Auguste Geffroy; *Graf Philipp Cobenzl und seine Memoiren* (1885); *Correspondance secrète du comte de Mercy-Argenteau avec l'empereur Joseph II. et Kaunite* (1889–91), in collaboration with Jules Flammermont; *Anton Ritter von Schmerling. Episoden aus seinem Leben 1835, 1848–49* (1895); *Johann Freiherr von Wessenberg, ein osterreichischer Staatsmann des 19. Jahrh.* (1898). Arneth also published in 1893 two volumes of early reminiscences under the title of *Aus meinem Leben.*

ARNHEM, capital, province of Gelderland, the Netherlands, on the right bank of the Rhine (here crossed by a pontoon bridge), and a junction 35 mi. by rail east-southeast of Utrecht. Pop. (1939) 88,997. Tramways connect with Zutphen and Utrecht, and there is a regular service of steamers to Cologne, Amsterdam, Nijmwegen. Tiel, 's Hertogenbosch and Rotterdam.

Arnhem is beautifully situated. It was known in the Middle Ages as *Arnoldi Villa* and may be the *Arenacum* of the Romans. It is first mentioned in 893. In 1233 Otto II, count of Gelder, resided there and conferred municipal rights on the town, and fortified it. Later it entered the Hanseatic league. Charles the Bold of Burgundy captured it in 1473 and Philip, son of Maximilian I, gave it coining rights in 1505. In 1514 Charles of Egmont, duke of Gelder, took it from 'the Spaniards; but in 1543 it fell to the emperor Charles V, who made it the seat of the council of Gelderland. It joined the union of Utrecht in 1579, and came finally under the states general in 1585. In 1586 Sir Philip Sidney died in the town. The French took it in 1672, but left it dismantled in 1674 It was refortified by Coehoorn, in the 18th century. In 1795 it was again stormed by the French and in 1813 was taken from them by the Pmssians. Gardens and promenades have taken the place of the old ramparts. The Groote kerk of St. Eusebius has a chime of forty-five bells. The Roman Catholic church of St. Walburgis is of earlier date, and a new Roman Catholic church dates from 1894. The town hall was built as a palace in the 15th century, and converted to its present use in 1830. The provincial government house occupies the site of the former palace of the dukes of Gelder. Arnhem is an important market centre. It is the seat of a court. Two miles away are the fine residential suburbs of Velp and Oosterbeek. Three miles from the city is the famous castle of Middachten (13th century property of Count van Aldenburg Bentinck). The surrounding woods and parks are considered the finest in Holland. There are several national parks.

ARNICA, a genus of plants belonging to the family Compositae, and containing 50 species, mostly north-west American, of which the most important is *Arnica montana*, a perennial herb of the mountains and uplands in northern and central Europe. The root-stock of *A. montana* is tough, slender, of a dark brown colour and an inch or two in length. It gives off numerous simple roots from its under side, and shows on its upper side the remains of rosettes of leaves. It yields an essential oil in small quantity, and a resinous matter called arnicin ($C_{12}H_{22}O_2$), a yellow crystalline substance with an acrid taste. The tincture prepared from it has a popular reputation in the treatment of bruises and sprains.

Typical of the various far northern species is *A. angustifolia*, with very narrow leaves, occurring in Arctic Asia and America. The heads of flowers are 2 to $2\frac{1}{2}$ in. across, orange-yellow in colour, and borne on the summit of the stem or branches; the outer ray-flowers are an inch in length. The fruit is brown and hairy, and crowned by a tuft of stiffish hairs. The plant was introduced into England in the 18th century.

In North America arnicas are most numerous in the Rocky Mountain region from Colorado northward but there are also many in the Sierra Nevada and Cascade ranges. Conspicuous species may be observed in Rocky Mountain, Glacier, Yosemite, Mount Rainier and other national parks of the western United States and Canada. Four arnicas occur in the northeastern United States and adjacent Canada, mostly on the higher mountains.

ARNIM, ELISABETH (BETTINA) VON (1785–1859), German authoress, sister of Klemens Brentano, and daughter of the Maximiliane Brentano, who had been one of the intimates of Goethe's youth, was born at Frankfort-on-Main on April 4, 1785. From Goethe's mother Bettina had heard stories of the poet's childhood, and she was an ardent admirer of his works and had corresponded with him before she met him in Weimar in 1807. In that year she paid two visits to Weimar, and poured out her enthusiasm and devotion at Goethe's feet. He was delighted with her gaiety and elfin charm, though her demonstrations of affection often wearied him, and she bitterly complained of his coldness. In 1811 she married Ludwig Achim von Arnim, and in that year again visited Goethe. But a violent scene with Christiane, Goethe's wife, put an end to the long standing affection between the poet and Bettina, and Goethe forbade her the house. In 1831 von Arnim died, and in 1835 Bettina published *Goethes Briefwechsel mit einem Kinde*. For years it was regarded as purely fictitious, but the publication of G. von Loeper's *Briefe Goethes an Sophie Laroche und Bettina Brentano, nebst dichterischen Beilagen* (1879) proved that the *Briefwechsel* was based on authentic material. But the whole is treated in a romantic and fantastic spirit. Possibly Bettina herself had so woven the real story into her dreams that she could no longer disentangle truth from fantasy. Equally fantastic is her correspondence *Die Günderode* (1840), with her unhappy friend, the poet, Karoline von Gunderode (1780–1806), who committed suicide, and that with her brother Klemens Brentano, under the title *Klemens Brentanos Frühlingskranz* (1844). She died at Berlin on Jan. 20, 1859.

Part of a design by her for a colossal statue of Goethe, executed in marble by the sculptor Karl Steinhauser (1813–78), is in the museum at Weimar.

Her collected works (*Sämtliche Schriften)* were published in Berlin in 1853. *Goethes Briefwechsel mit einem Kinde* was edited by H. Grimm (4th ed., 1890).

See also *C.* Alberti, B. *von Arninz* (Leipzig, 1885); Moritz Carriere, *Bettina von Arnim* (Breslau, 1887); *Briefe von und an Joseph Joachzm* (1911; Eng. trans. 1914); and the literature cited under Ludwig von Arnim.

ARNIM, HARRY KARL KURT EDUARD VON, COUNT (1824–81), German diplomatist, was born in Pomerania, Oct. 3, 1824, and brought up by his uncle Heinrich von Arnim, who was Prussian ambassador at Paris and foreign minister from March to June 1848. After holding other posts in the diplomatic service Arnim was in 1864 appointed Prussian envoy (and in 1867 envoy of the North German Confederation) at the papal court. In 1869 he proposed that the Governments should appoint representatives to be present at the Vatican council, a suggestion which was rejected by Bismarck, and foretold that the promulgation of papal infallibility would bring serious political difficulties.

After the recall of the French troops from Rome he attempted unsuccessfully to mediate between the pope and the Italian Government. He was appointed in 1871 German commissioner to arrange the final treaty with France, and was afterwards appointed German envoy at Paris, and in 1872 received his definite appointment as ambassador, a post of the greatest difficulty and responsibility:.

Differences soon arose between him and Bismarck; he wished to support the monarchical party which was trying to overthrow Thiers, while Bismarck ordered him to stand aloof from all French parties; he did not give that explicit obedience to his instructions which Bismarck required. In the beginning of 1874 he was recalled and appointed to the embassy at Constantinople, but this appointment was immediately revoked. A Vienna newspaper published some correspondence on the Vatican council, including confidential despatches of Arnim's, with the object of showing that he had exhibited greater foresight than Bismarck. It was then found that a considerable number of papers were missing from the Paris embassy, and on Oct. 4 Arnim was arrested on the charge of embezzling State papers. Arnim avoided imprisonment by leaving the country, and in 1875 published anonymously at Zurich a pamphlet entitled *Pro nihilo,* in which he attempted to show that the attack on him was caused by Bismarck's personal jealousy. For this he was accused of treason, insult to the emperor, and libelling Bismarck, and in his absence condemned to five years' penal servitude. From his exile in Austria he published two more pamphlets on the ecclesiastical policy of Prussia, *Der Nunzius kommt!* (Vienna, 1878), and *Quid faciamus nos?* (ib. 1879). He made repeated attempts, which were supported by his family, to be allowed to return to Germany in order to take his trial afresh on the charge of treason; his request had just been granted when he died, May 19, 1881.

In 1876 Bismarck carried an amendment to the criminal code making it an offence punishable with imprisonment or a fine up to £250 for an official of the foreign office to communicate to others official documents, or for an envoy to act contrary to his instructions. These clauses are commonly spoken of in Germany as the "Arnim paragraphs."

ARNIM, LUDWIG ACHIM (JOACHIM) VON (1781–1831), German poet and novelist. was born in Berlin on June 26, 1781, and died at Dahme, Prussia, on Jan. 21. 1831.

From the earlier writings of Goethe and Herder he learned to appreciate German legends and folk-songs. He published a collection of these (1806–08), in collaboration with Klemens Brentano (*q.v.*) under the title Des *Knaben* Wunderhorn. Arnim's best work is to be found in the short stories *Fürst* Ganzgott und *Sänger* Halbgoft and Der tolle *Invalide* auf dem Fort Ratonneau and the unfinished romance Die *Kronenwächter* (1817), which promised to develop into one of the finest historical romances of the 19th century.

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ARNIM-BOYTZENBURG, HANS GEORG VON (1581–1641), German general and diplomatist, was born in 1581 at Boytzenburg in Brandenburg. He served in the Swedish army under Gustavus Adolphus, took part in the Russian war, and afterwards fought against the Turks in the service of the king of Poland. In 1626, though a Protestant, he was induced by Wallenstein to join the new imperial army. He quickly rose to the rank of field marshal, and became Wallenstein's close friend and faithful ally. This attachment to Wallenstein, and a spirit of religious toleration, were the leading motives of a strange career of military and political inconstancy. After the dismissal of Wallenstein, Arnim left the imperial service for that of the elector of Saxony, and commanded the Saxon army which fought by the side of the Swedes at Breitenfeld (1631), and indeed the alliance of these two Protestant powers in the cause of their common religion was largely his work. During the Lützen campaign, Arnim was operating with success at the head of an allied army in Silesia. In the following year he was under the hard necessity of opposing Wallenstein in the field, but little was done by either. In 1634 Wallenstein was assassinated, and Arnim began at once more active operations. He won an important victory at Liegnitz in May 1634, but from this time he became more and more estranged from the Swedes. The peace of Prague followed. Soon after this event he refused an offer of high command in the French army and retired from active life. From 1637 to 1638 he was imprisoned in Stockholm, having been seized at Boytzenburg by the Swedes on suspicion of being concerned in various intrigues. He made his escape ultimately, and died suddenly at Dresden in 1641, whilst engaged in raising an army to free German soil from foreign armies of all kinds (see THIRTY YEARS' WAR).

See K. G. Helbig, "Wallenstein und Arnim" (1850) and "Der Prager Friede," in Raumer's Historisclzes Taschenbuch (1858); also E. D. M. Kirchner, Das *Schloss* Boytzenburg, etc. (1860); and Archiv fur die *sächsische* Geschichte, vol. viii. (1870).

ARNO, ARN or **AQUILA** (750?–821), archbishop of Salzburg and scholar, entered the church at an early age, became abbot of Elnon, or St. Amand, where he made the acquaintance of Alcuin. In 785 he was made bishop of Salzburg, and in 787 was employed by Tassilo III., duke of the Bavarians, as an envoy to Charlemagne at Rome. Through Charlemagne's influence Salzburg was made in 798 the seat of an archbishopric; and Arno became metropolitan of Bavaria and received the pallium from Pope Leo III.

The area of his authority was extended to the east by the conquests of Charlemagne over the Avars. He acted as one of the *missi* dominici, and spent some time at the court of Charlemagne, where he was known as Aquila, and his name appears as one of the signatories to the emperor's will. Soon after the death of Charlemagne in 814, Arno appears to have withdrawn from active life, although he retained his archbishopric until his death Jan. 24, 821.

Aided by a deacon named Benedict, Arno drew up about 788 a catalogue of lands and proprietary rights belonging to the church in Bavaria, under the title of *Indiculus* or Congesturn *Arnonis* (ed. F. Keinz, Munich, 1869). Other works produced under the protection of Arno include a Salzburg consuetudinary (ed. L. Rockinger in *Quellen* und Erorterungen zur bayrischen und deutschen Geschichte, Band vii. (Munich, 1856). W. von Giesebrecht suggests that Arno was the author of an early section of *Annales Laurissenses maiores,* a history of the Frankish kings from 741 to 829 (Monumenta Germaniae *historica Scriptores,* Band i., p. 128–131. G. H. Pertz, Hanover, 1826). If this supposition be correct, Arno was the first writer whose works are extant to apply the name Deutsch (theodisca) to the German language.

ARNO (anc. *Arnus*), river, Italy, rising in Mte. Falterona, about 25m. E.N.E. of Florence, 4,265ft. above sea. It first runs south-south-east through the beautiful Casentino; near Arezzo it turns west, and at Montevarchi north-north-west; 10m. below it forces a way through limestone rock at Incisa and 10m. farther on it is joined by the Sieve. Thence it runs west to Florence and through the gorge of Golfolina to Empoli and Pisa, and falls into the sea 7½m. west of Pisa, after a course of 155m. The Serchio (anc. *Auser*), joining the Arno at Pisa in ancient times, now flows into the sea independently. Barges can go up the Arno to Florence; but it is liable to sudden floods, and so needs careful regulation. Great floods occurred in 1537 and 1740; in 1537 the water rose to 8ft. in the streets of Florence. The valley between Montevarchi and Rignano contains fossil bones of deer, elephant, rhinoceros, mastodon, hippopotamus, bear, tiger, etc., of the middle and upper Pliocene; while S. Giovanni Valdarno, 4m. below the former, is the centre of lignite mines.

ARNOBIUS (called AFER, and sometimes THE ELDER), early Christian writer, was a teacher of rhetoric at Sicca Venerea in proconsular Africa during the reign of Diocletian. His great treatise, in seven books, *Adversus* Gentes (or *Nationes*), on account of which he takes rank as a Christian apologist, appears to have been occasioned by a desire to answer the complaint then brought against the Christians that the prevalent calamities and disasters mere due to their impiety and had come upon men since the establishment of their religion.

The work of Arnobius appears to have been written when he was a recent convert, for he does not possess a very extensive knouledge of the Scriptures. He knows nothing of the Old Testament, and only the life of Christ in the New, while he does not quote directly from the Gospels.

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ARNOBIUS (called THE YOUNGER), Christian priest or bishop in Gaul, flourished about 460. He is the author of a mystical and allegorical commentary on the Psalms, first published by Erasmus in 1522, and by him attributed to the elder Arnobius. It has been frequently reprinted, and in the edition of De la Barre, 1580, is accompanied by some notes on the Gospels by the same author. The opinions of Arnobius, as appears from the commentary, are semi-Pelagian.

ARNOLD, known as "Arnold of Brescia" (d. 1155), one of the most ardent adversaries of the temporal power of the popes. He was born probably at Brescia, in Italy, towards the end of the 11th century. He studied theology in Paris, but there is no proof that he was a pupil of Abélard. Returning to Italy he became a canon regular. His life was rigidly austere, St. Bernard calling him homo nequc *manducans neque bibens.* He fought against the corruption of the clergy, and especially against the temporal ambitions of the high dignitaries of the church. During the schism of Anacletus (1131–37) the town of Brescia was torn by the struggles between the partisans of Pope Innocent II. and the adherents of the anti-pope, and Arnold incited the people to rise against their bishop, and, exiled by Innocent II., went to France. St. Bernard accused him of sharing the doctrines of Abélard (see Ep. 189, 195), and procured his condemnation by the council of Sens (1140) at the same time as that of the great scholastic. It seems certain that Arnold professed moral theology in Paris and several times reprimanded St. Bernard, whom he accused of pride and jealousy. St. Bernard persuaded King Louis VII. to take severe measures against Arnold, who took refuge at Zürich. There he found support with the lay nobility; but, denounced anew by St. Bernard, he turned his steps towards

Rome (1145). Two years previously, in 1143, the Roman commune had rejected the temporal power of the pope. The urban nobles had set up a republic, which, under forms ostensibly modelled on antiquity, concealed but clumsily a purely oligarchical government. Pope Eugenius III. and the cardinals had been driven into exile at Viterbo. Arnold denounced the Roman clergy, and, in particular the Curia, which he stigmatized as a "house of merchandise and den of thieves." According to Otto of Freising (Lib. *de gestis Friderici,* bk. ii. chap. xx.) the whole of his teaching, outside the preaching of penitence, was summed up in these maxims:—"Clerks who have estates, bishops who hold fiefs, monks who possess property, cannot be saved." Arnold's was the only vigorous personality which stood out from the mass of rebels, and he was the principal victim of the repression that ensued. On July 15, 1148, Eugenius III. anathematized Arnold and his adherents; but when soon afterwards the pope entered Rome Arnold remained in the town unmolested, under the protection of the senate. But Frederick I. (Barbarossa) concluded with the pope a treaty of alliance (Oct. 16, 1152); and when the second successor of Eugenius III., the energetic and austere Adrian IV. (the Englishman, Nicholas Breakspear), placed Rome under an interdict the senate, already rudely shaken, submitted and Arnold was forced to fly into Campania (1155). He was seized by order of the emperor Frederick, then in Italy, and delivered to the prefect of Rome, by whom he was condemned to death. In June 1155 Arnold was hanged, his body burnt, and the ashes thrown into the Tiber. It is probable that Arnold's adherents became merged in the communities of the Lombard Waldenses, who shared their ideas on the corruption of the clergy. Legend, poetry, drama, and politics have from time to time been much occupied with the personality of Arnold of Brescia. He was before everything an ascetic, who denied to the church the right of holding property, and who occupied himself only as an accessory with the political and social consequences of his religious principles.

The bibliography of Arnold of Brescia is very vast and of varying value. The following works will be found useful: W. von Giesebrecht, *Arnold von Brescia* (Munich, 1873); G. Gaggia, *Arnaldo da Brescia* (Brescia, 1882); and notices by Vacandard in the *Revue des questions historiques* (1884), pp. 52–114; by R. Breyer in the *Histor. Taschenbuch* (Leipzig, 1889), vol. viii. pp. 123–178, and by A. Hausrath in *Neue Heidelberg. Jahrb.* (1891), Band i. pp. 72–144.

ARNOLD, **BENEDICT** (1741–1801), American soldier, was born in Norwich, Conn., on Jan. 14, 1741. He was the great-grandson of Benedict Arnold (1615–78), thrice colonial governor of Rhode Island between 1663 and 1678; and was the fourth in direct descent to bear the name. He received a fair education but was not studious, and his youth was marked by the same waywardness which characterized his whole career. At 15 he ran away from home and took part in an expedition against the French, but he soon deserted and returned home. In 1762 he settled in New Haven, where he engaged successfully in trade with the West Indies. Immediately after the battle of Lexington, Arnold led the local militia company, of which he was captain, to Cambridge, and on April 29, 1775, proposed to the Massachusetts committee of safety an expedition against Crown Point and Ticonderoga. The offer was accepted, and as a colonel of Massachusetts militia he was directed to enlist the men necessary for the undertaking. He was forestalled, however, by Ethan Allen (*q.v.*), acting on behalf of some members of the Connecticut assembly. Under him, reluctantly waiving his own claim to command, Arnold served as a volunteer; and soon afterwards, Massachusetts having angered Arnold by sending a committee to make an inquiry into his conduct, he resigned and returned to Cambridge. He was then ordered to co-operate with Gen. Richard hfontgomery in the invasion of Canada. Starting with 1,100 men from Cambridge on Sept. 17, 1775, he reached Gardiner, Me., on the 20th, advanced through the Maine woods, and, after suffering terrible hardships, his little force reached Quebec on Nov. 13. The garrison had been forewarned, and Arnold was compelled to await the coming of hfontgomery from Montreal. The combined attack on Dec. 31, 1775, failed; Montgomery was killed, and Arnold was severely wounded. Arnold, who had been commissioned a brigadier general, remained in Canada until the following June, being after April in command at Montreal.

Some time after the retreat from Canada, charges of misconduct and dishonesty were brought against him. These charges were tardily investigated by the Board of War, which in a report made on May 23, 1777, declared that his "character and conduct" had been "cruelly and groundlessly aspersed." Having constructed a flotilla on Lake Champlain, Arnold engaged a greatly superior British fleet near Valcour Island (Oct. 11, 1776), and after inflicting severe loss on the enemy, made his escape under cover of night. This engagement was the first between British and American fleets. Arnold's brilliant exploits had drawn attention to him as one of the most promising of the Continental officers, and had won for him the friendship of Washington. Nevertheless, when in Feb. 1777, Congress created five new major generals, Arnold, although the ranking brigadier, was passed over, in favour of his juniors. At this time it was only Washington's urgent persuasion that prevented Arnold from leaving the service. Two months later while he was at New Haven, Governor Tryon's descent on Danbury took place; and Arnold attacked the British with such vigour at Ridgefield (April 27, 1777), that they escaped to their ships with difficulty.

In recognition of this service Arnold was now commissioned major general. After serving in New Jersey with Washington, he joined General Philip Schuyler in the Northern Department, and in Aug. 1777, proceeded up the Mohawk valley against Colonel St. Leger, and raised the siege of Fort Stanwix (or Schuyler). Subsequently, after Gates had superseded Schuyler (Aug. 19), Arnold commanded the American left wing in the first battle of Saratoga (Sept. 19, 1777). His ill-treatment at the hands of General Gates led to a quarrel which terminated in Arnold being relieved of command. He remained with the army, however, and although nominally without command served brilliantly in the second battle of Saratoga (Oct. 7, 1777), during which he was seriously wounded. For his services he was thanked by Congress, and received a new commission giving him at last his proper relative rank.

In June 1778, Washington placed him in command of Philadelphia. Here he soon came into conflict with the state authorities. In the social life of Philadelphia, largely dominated by families of Loyalist sympathies, Arnold was the most conspicuous figure; he lived extravagantly, entertained lavishly, and in April 1779, took for his second wife, Margaret Shippen (1760–1804), the daughter of Edward Shippen (1729–1806), a moderate Loyalist. Early in Feb. 1779, the executive council of Pennsylvania, presided over by Joseph Reed, one of his most persistent enemies, presented to Congress eight charges of misconduct against Arnold. In April 1779, Congress, though throwing out four charges, referred the other four to a court-martial. Despite Arnold's demand for a speedy trial, it was December before the court was convened. It was probably during this period of vexatious delay that Arnold, always sensitive and now incited by a keen sense of injustice, entered into a secret correspondence with Sir Henry Clinton with a view to joining the British service. On Jan. 26, 1780, the court, before which Arnold had ably argued his own case, rendered its verdict, practically acquitting him of all intentional wrong, but directing Washington to reprimand him for two trivial offences. Arnold, who had expected absolute acquittal, was inflamed with a burning anger that even Washington's kindly reprimand, couched almost in words of praise, could not subdue.

It was now apparently that he first conceived the plan of betraying some important post to the British. With this in view he sought and obtained from Washington (Aug. 1780) command of West Point, the key to the Hudson valley. Arnold's offers now became more explicit, and, in order to perfect the details of the plot, Clinton's adjutant-general, Major John André, met him near Stony Point on the night of Sept. 21. On the 23rd, while returning by land, André with incriminating papers was captured, and the officer to whom he was entrusted unsuspectingly sent information of his capture to Arnold, who was thus enabled to escape to the British lines. Arnold, commissioned a brigadier general in the British army, received £6,315 in compensation for

his property losses, and was employed in leading an expedition into Virginia which burned Richmond, and in an attack upon New London in September, 1781. In Dec. 1781, lie removed to London and was consulted on American affairs by the king and ministry, but could obtain no further employment in the active service. Disappointed at the failure of his plans and embittered by the neglect and scorn which he met in England, he spent the years 1787–91 at St. John, N.B., once more engaging in the West India trade, but in **1791** he returned to London, and after war had broken out between Great Britain and France, was active in fitting out privateers. He gradually sank into melancholia, and died in London June **14,** 1801.

BIBLIOGRAPHY.—Jared Sparks' "Life and Treason of Benedict Arnold" (Boston, 1835), in his *Library of American Biography,* is biased and unfair. The best general account is Isaac Newton Arnold's *Life of Benedict Arnold* (Chicago, 1880), which, while offering no apologies or defense of his treason, lays perhaps too great emphasis on his provocations. Charles Burr Todd's *The Real Benedict Arnold* (1903) is a curious attempt to make Arnold's wife wholly responsible for his defection. Two good accounts of the Canadian Expedition are Justin H. Smith's *Arnold's March from Cambridge to Quebec* (1903), which contains a reprint of Arnold's journal of the expedition; and John Codman's *Arnold's Expedition to Quebec* (1901). Arnold's *Letters on the Expedition to Canada* were printed in the Maine Historical Society's *Collections* for 1831 (repr. 1865). *See* also William Abhatt, *The Crisis of the Revolution* (1899); *The Northern Invasion of 1780* (Bradford Club Series, No. 6, 1866); "The Treason of Benedict Arnold" (letters of Sir Henry Clinton to Lord George Germaine) in *Pennsylvania Magazine of History and Biography,* vol. xxii. (Philadelphia, 1898); *Proceedings of a General Court Martial for the Trial of Major General Arnold* (Philadelphia, 1780; reprinted with introduction and notes, 1865); and Kenneth L. Roberts, *March to Quebec* (New York, 1938) the journals of the members of Arnold's expedition.

ARNOLD, BION JOSEPH (1861–1942), U.S. electrical engineer, was born at Casnovia, near Grand Rapids, Mich., on Aug. 14, **1861.** He studied at the University of Nebraska in 1879–80, graduated from Hillsdale college, Hillsdale, Mich., in **1884,** and did graduate work at Cornell university in 1888–89. Establishing himself in Chicago as an independent consulting engineer in **1893,** and later in the Arnold Engineering Company, of which he was president, he became widely known as an expert on electric traction. Important undertakings in which he was engaged as chief engineer or authoritative adviser include the electrification of the New York Central railroad's terminal in New York city, the construction of subways in New York city, and the rebuilding of the Chicago street railway system. He also acted at various times as advisory engineer on traction problems for Pittsburgh, San Francisco, Los Angeles, Cincinnati, Toronto and many other cities. During World War I he was a member of army and navy consulting boards and in 1917–19 served in the regular army in various engineering activities, especially in connection with aircraft production. He invented a magnetic clutch, various storage battery improvements and numerous devices and systems for electric railway operation, and was one of the first to make use of alternating current and single-phase electric traction systems. He died Jan. 29, 1942 at Chicago.

ARNOLD, SIR EDWIN (1832–1904), British poet, scholar and journalist, was born on June 10 1832, and was educated at the King's school, Rochester; King's college, London; and University college, Oxford, where in 1852 he gained the Newdigate prize for a poem on Belshazzar's feast. Arnold went out to India as the principal of the government Sanskrit college at Poona Returning to England in **1861** he joined the staff of the *Daily Telegraph,* with which he continued to be associated for more than 40 years. He was a brilliant journalist, full of ideas and of enthusiasm for his work. Nevertheless he was best known to his contemporaries as a poet, author of the *Light of Asia, or the Great Renunciation* (*Mahābhinshkramana*) (1879), an Indian epic. In it the life and teaching of Buddha are exponnded with much wealth of local colour and not a little felicity of versification. Oriental scholars complained that it gave a false impression of Buddhist doctrine; on the other hand the suggested analogy between Sakyamuni and Christ offended the taste of some devout Christians. The latter criticism probably suggested to Arnold the idea of a second narrative poem of which the central figure should be the founder of Christianity, as the founder of Buddhism had been that of the first. But *The Light of the World* (1891), in which this idea took shape, failed to repeat the success attained by *The Light of Asia.* In his later years Arnold resided for some time in Japan, and his third wife was a Japanese lady. In *Seas and Lands* (1891) and *Japonica* **(1892)** he gives an interesting study of Japanese life. Sir Edwin Arnold, who had received the K.C.I.E. in **1888,** died March **24,** 1904.

Arnold's other works include: *The Book of Good Counsels,* from the Sanskrit of the Hitopadesa (1861); *The Indian Song of Songs,* from the Sanskrit of the Gita Govinda of Jayadeva (1875); *Indian Idylls* (1883) and *The Song Celestial* (1885), both from the Mahabarata; and other translations. He also wrote a *History of the Administration of British India under the late Marquis of Dalhousie* (186244). His poetical works were collected in 8 vols. in 1888.

ARNOLD, GOTTFRIED (1666–1714), German Protestant divine, was born at Annaberg, in Saxony, where his father was a schoolmaster. His first work, *Die erste Liebe zu Chrisfo,* to which in modern times attention was again directed by Leo Tolstoy, appeared in **1696.** It went through five editions before **1728,** and gained the author much reputation. In **1699** he began to publish his largest work, *Unparteiische Kirchen- und Ketzerhistorie,* in which he has been thought by some to show more impartiality towards heresy than towards the Church (*cf.* Otto Pfleiderer, *Development of Theology,* p. **277).**

See Calwer-Zeller, *Theologisckes Handwörterbuch,* and the account of him in Albert Knapp's edition of *Die erste Liebe zu Christo* (1845).

ARNOLD, MATTHEW (1822–1888), English poet, literary critic, and inspector of schools, was born at Laleham, near Staines, on Dec. 24, **1822.** He was the son of the famous Dr. Arnold, of Rugby, and was educated at Winchester, Rugby and Balliol college, Oxford. After a year at Winchester, Matthew Arnold entered Rugby school in **1837.** He early began to write and print verses, His first publication was a Rugby prize poem, *Alaric* at *Rome,* in **1840.** This was followed, in **1843,** after he had gone up to Oxford in **1840** as a scholar of Balliol, by his poem *Cromwell,* which won the Newdigate prize. In **1844** he graduated with second-class honours, and in **1845** was elected a fellow of Oriel college, where among his colleagues was A. H. Clough, his friendship with whom is commemorated in that exquisite elegy *Thyrsis.* From **1847** to **1851** he acted as private secretary to Lord Lansdowne; and in the latter year, after acting for a short time as assistant-master at Rugby, he was appointed to an inspectorship of schools, a post which he retained until two years before his death. This was probably not the career he would have chosen,

FROM RUSSELL, "MATTHEW ARNOLD"

PAINS HILL COTTAGE AT COBHAM, SURREY, THE HOME OF THE ENGLISH POET AND CRITIC. MATTHEW ARNOLD, FROM 1873 TO HIS DEATH IN 1888

but his impending marriage (June 1851), with Frances Lucy Wightman, made a settled income desirable. Meanwhile, in **1849,** appeared *The Strayed Reveller, and other Poems, by A,* a volume which gained a considerable esoteric reputation. In 1852 he published another volume under the same initial, *Empedocles on Efna, and other Poems. Empedocles* is as undramatic a poem, perhaps, as was ever written in dramatic form, but studded with lyrical beauties of a very high order. In **1853** Arnold published a volume of *Poems* under his own name. This consisted partially of poems selected from the two previous volumes. A second series of poems, which contained, however, only two new ones, was published in 1855. So great was the impression made by these

in academic circles, that in 1857 Arnold was elected professor of poetry at Oxford, and he held the chair for ten years. In 1858 he published his classical tragedy, *Merope.* Nine years afterwards his *New Poems* (1867) were published. While he held the Oxford professorship he published several series of lectures, which gave him a high place as a scholar and critic. The essays (edited in 1905 with an introduction by W. H. D. Rouse) *On Translating Homer: Three Lectures given at Oxford,* published in 1861, supplemented in 1862 by *On Translating Homer: Last Words,* a fourth lecture given in reply to F. W. Newman's *Homeric Translation in Theory and Practice* (1861) and *On the Study of Celtic Literature,* published in 1867, were full of subtle and brilliant criticism. So were the two series of *Essays in Criticism,* the first of which, consisting of articles reprinted from various reviews, appearing in 1865. The essay on "A Persian Passion Play" was added in the editions of 1875; and a second series, edited by Lord Coleridge, appeared in 1888.

Arnold's poetic activity almost ceased after he left the chair of poetry at Oxford. He was several times sent by the Government to make enquiries into the state of education in France, Germany, Holland and other countries; and his reports, with their thorough-going and searching criticism of continental methods, as contrasted with English methods, showed how conscientiously he had devoted some of his best energies to the work. His fame as a poet and a literary critic has somewhat overshadowed the fact that he was, during 35 years of his life (1851–86) employed in the education department as one of H.M. inspectors of schools. The influence he exerted on schools, on the department, and on the primary education of the whole country was very great. His annual reports of which more than 20 were collected (1889) into a volume (new edition, with additional matter and introduction by F. S. Marvin, [1908]) by his friend and official chief, Sir Francis (afterwards Lord) Sandford attracted, by reason of their freshness of style and thought, more public attention than is usually accorded to Blue Book literature.

In 1859, as foreign assistant commissioner, he prepared for the duke of Newcastle's commission to enquire into the subject of elementary education a report (printed 1860) which was afterwards reprinted (1861) in a volume entitled *The Popular Education of France, with Notices of that of Holland and Switzerland.* In 1865 he was again employed as assistant-commissioner by the Schools enquiry commission under Lord Taunton; and his report on this subject, *On Secondary Education in Foreign Countries* (1866), was subsequently reprinted under the title *Schools and Universities on the Continent* (1868). Twenty years later he was sent by the education department to make special enquiries on certain specified points, *e.g.,* free education, the status and training of teachers, and compulsory attendance at schools. The result of this investigation appeared as a parliamentary paper, *Special Report on certain points connecfed with Elernentary Education in Germany, Switzerland and France,* in 1886. He also contributed the chapter on "Schools" (1837–87) to the second volume of Mrs. Humphrey Ward's *Reign* of *Queen Victoria.* All these reports form substantial contributions to the history and literature of education in the Victorian age. They have been quoted often, and have exercised marked influence on subsequent changes and controversies. One great purpose underlies them all. It is to bring home to the English people a conviction that education ought to be a national concern. To this theme he constantly recurred in his essays, articles, and official reports. *"Porro unum est necessarium.* One thing is needful; organize your secondary education."

Arnold's critical work includes: *Culture and Anarchy* (1869); *St. Paul and Protestantism . . .*; *Friendship's Garland: being the Conversations, Letters and Opinions of the late Arminius Baron von Thunder-ten-Tronckh* (1871); *Literature and Dogma: an Essay towards a Better Apprehension of the Bible* (1873); *God and the Bible: a Review of Objections to Literature and Dogma* (1875); *Last Essays on Church and Religion* (1877); *Mixed Essays* (1879); *Irish Essays and Others* (1882); *Discourses in America* (1885). These books startled the public. But, objectionable as Arnold's rationalizing criticism was to contemporary orthodoxy, and questionable as was his equipment in point of theological learning, his spirituality of outlook and ethical purpose were not to be denied. Yet it is not Arnold's views that have become current coin so much as his literary phrases—his craving for "culture" and "sweetness and light," his contempt for "the dissidence of Dissent and the Protestantism of the Protestant religion," his classification of "Philistines and barbarians." His death at Liverpool, of heart failure on April 15, 1888, was sudden and quite unexpected.

Arnold was a prominent figure in that great galaxy of Victorian poets who were working simultaneously (Tennyson, Browning, Rossetti, William Morris and Swinburne), poets between whom there was at least this connecting link, that the quest of all of them was the old-fashioned poetical quest of the beautiful. Beauty was their watchword, as it had been the watchword of their immediate predecessors—Wordsworth, Coleridge, Keats, Shelley and Byron. That this group of early 19th century poets might be divided into two (those whose primary quest was physical beauty, and those whose primary quest was moral beauty) is no doubt true. Still, in so far as beauty was their quest they were all akin. And so with the Victorian group to which Arnold belonged. Notwithstanding the exquisite work that Arnold has left behind him, some critics have come to the conclusion that his primary impulse in expression was that of the poetically-minded *prosateur* rather than that of the born poet. And this has been said by some who, nevertheless, deeply admire poems like "The Scholar Gypsy," "Thyrsis," "The Forsaken Merman," "Dover Beach," "Heine's Grave," "Rugby Chapel," "The Grande Chartreuse," "Sohrab and Rustum," "The Sick King in Bokhara," "Tristram and Iseult." Perhaps the place Arnold held and still holds as a critic is due more to his exquisite felicity in expressing his views than to the penetration of his criticism. Nothing can exceed the easy grace of his prose at its best. It is conversational and yet absolutely exact in the structure of the sentences; and in spite of every vagary, his distinguishing note is urbanity. Keen-edged as his satire could be, his writing for the most part is as urbane as Addison's own. His influence on contemporary criticism, and contemporary, ideals was considerable and generally wholesome. His insistence on the necessity of looking at "the thing in itself," and the need for acquainting oneself with "the best that has been thought and said in the world," gave a new stimulus alike to originality and industry in criticism; and in his own selection of subjects (such as *Joubert,* or the *De Guérins*) he opened a new world to a larger class of the better sort of readers, exercising in this respect an awakening influence in his own time akin to that of Walter Pater a few years afterwards. The comparison with Pater might indeed be pressed farther, and yet too far. Both were essentially products of Oxford. But Arnold, whose description of that "home of lost causes, and forsaken beliefs, and unpopular names, and impossible loyalties," is in itself almost a poem, had a classical austerity in his style that savoured more intimately of Oxford tradition, and an ethical earnestness, even in his most flippant moments, which kept him notably aloof from the more sensuous school of aesthetics.

The first collected edition of Arnold's poems was published in **1869** in two volumes, the first consisting of *Narrative and Elegiac Poems,* and the second of *Dramatic and Lyric Poems.* Other editions appeared in 1877, **1881**; a library edition (1885); a one-volume reprint of the poems printed in the library edition, with one or two additions (1890); another edition **(1926)** is edited with an introduction by A. T. Quiller-Couch and notes by G. St. Quintin. Publications by Matthew Arnold not mentioned in the foregoing article include: *England and the Italian Question* **(1859)** *a* pamphlet; *A French Eton; or, Middle Class Education and the State* **(1864)**; *Higher Schools and Universities in Germany* (1874), a partial reprint from *Schools and Universities on the Continent* **(1868)**; *A Bible Reading for Schools; The Great Prophecy of Israel's Restoration,* an arrangement of *Isaiah,* chs. xl.–lxvi. (1872), republished with additions and varying titles in **1875** and **1883**; an edition of the *Six Chief Lives from Johnson's Lives of the Poets* (1878); editions of the *Poems of Wordsworth* (1879), and the *Poetry of Byron* (1881) for the Golden Treasury series, with prefatory essays reprinted in the second series of *Essays in Criticism;* an edition of *Letters, Speeches and Tracts on Irish Affairs by Edmund Burke* (1881); and many contributions to periodical literature. *The Letters of Matthew Arnold* (1848–88) were collected and arranged by G. W. E. Russell in **1895** (reprinted 1901). *Matthew Arnold's Note Books, with a Preface by the Hon. Mrs. Wodehouse,* appeared in **1902.**

A complete and uniform edition of *The Works of Matthew Arnold* (1904–05) includes the letters as edited by Russell. Vol. iii. contains a complete bibliography of his works, many of the early editions of which are very valuable, by T. B. Smart, who published a separate bibliography in 1892. A valuable note on the rather complicated subject of Arnold's bibliography is given by H. Buxton Forman in Arnold's *Poems, Narrative, Elegiac and Lyric* (Temple classics, 1900). There are innumerable reprints of Arnold's different works.

It was Arnold's expressed desire that his biography should not be written, and before his letters were published they underwent considerable editing at the hands of his family. There are, however, monographs on Matthew Arnold (1899) in *Modern English Writers* by Prof. Saintsbury, and by H. W. Paul (1902), in the English Men of Letters series. These two works were supplemented by G. W. E. Russell, in a sense, as the editor of Arnold's letters, the official biographer, in *Matthew Arnold* (1904, Literary Lives series). There are also studies of Arnold in J. M. Robertson's *Modern Humanists* (1891), and in W. H. Hudson's *Studies in Interpretation* (1896), Sir J. G. Fitch's *Thomas and Matthew Arnold* (1897); one by G. K. Chesterton in the "Everyman" edition of the *Essays,* and by *W.* L. Jones in *Cambridge History of Modern Literature,* vol. xiii. (1916), and a review of some of the works above mentioned in the *Quarterly Review* (Jan. 1905) by T. H. Warren.

ARNOLD, SAMUEL (1740-1802), English composer, was born in London and educated at the Chapel Royal, though his subsequent activities were mainly associated with the stage. He was indeed little more than 20 when he was appointed official composer to Covent Garden Theatre, and between 1765 and 1802 he wrote as many as 43 operas, after-pieces and pantomimes. He also composed numerous oratorios and in 1793 became organist of Westminster Abbey, where he was buried. His collection of *Cathedral Music,* once much esteemed, is now less highly thought of on account of its serious omissions.

ARNOLD, THOMAS (1795–1842), English clergyman and headmaster of Rugby School, was born at West Cowes, in the Isle of Wight, on June 13 1795. He was the son of William and Martha Arnold. His father was collector of customs at Cowes. He was educated at Winchester and Corpus Christi College, Oxford; in 1815 he was elected fellow of Oriel College; and there he continued to reside until 1819. This interval was diligently devoted to the pursuit of classical and historical studies, to theology, ecclesiastical polity and social philosophy. For the writings of Thucydides and Aristotle he formed an attachment which remained until the close of his life. He left Oxford in 1819 and settled at Laleham, near Staines, where he took pupils for the university. His spare time was devoted to the prosecution of studies in philology and history, more particularly to the study of Thucydides, and of the new light which had been cast upon Roman history and upon historical method by the researches of Niebuhr. Shortly after he settled at Laleham, he married Mary, youngest daughter of the Rev. John Penrose, rector of Fledborough, Nottinghamshire. After nine years at Laleham, he was elected headmaster of Rugby School in Dec. 1827, and in Aug. 1828 entered on his new office.

Under Arnold's superintendence the school became not merely a place where a certain amount of classical or general learning was to be obtained, but a sphere of intellectual, moral and religious discipline, where healthy characters were formed, and men were trained for the duties, struggles and responsibilities of life. His energies were chiefly devoted to the business of the school; but he found time also for much literary work, as well as for an extensive correspondence. Five volumes of sermons, an edition of Thucydides, with English notes and dissertations, a history of Rome in three volumes, besides numerous articles in reviews, journals, newspapers and encyclopaedias, show the untiring activity of his mind. His interest in public matters also was incessant, especially ecclesiastical questions, and matters that bore upon the social welfare and moral improvement of the masses.

In 1841, after 14 years at Rugby, Dr. Arnold was appointed by Lord Melbourne to the chair of modern history at Oxford. On Dec. 2 1841, he delivered his inaugural lecture. Seven other lectures were delivered during the first three weeks of the Lent term of 1842. He died on Sunday, June 12 1842. His remains were interred on the following Friday in the chancel of Rugby Chapel, immediately under the communion table.

Dr. Arnold was not a notable scholar, and he had not much of what is usually called tact in his dealings either with the juvenile or the adult mind. What gave him his power, and secured for him so deeply the respect and veneration of his pupils and acquaintances, was the intensely religious character of his whole life and his severe and lofty estimate of duty.

BIBLIOGRAPHY.—His *Life* was written by Dean Stanley (1845). *See* also Lytton Strachey, *Eminent Victorians;* and, for a satirical portrait, Samuel Butler, *The Way of all Flesh.*

ARNOTT, NEIL (1788–1874), Scottish physician, was born at Arbroath May 15 1788, and died in London on March 2 1874. He invented the "Arnott water-bed," the "Arnott ventilator," the "Arnott stove," etc. He was a strong advocate of scientific, as opposed to purely classical, education; and gave £2,000 to each of the four universities of Scotlandand to the University of London, to promote practical scientific study.

ARNOULD, MADELINE SOPHIE (1740–1802), famous French actress and operatic singer, was born in Paris, where, from her début in 1757 to her retirement in 1778, she enjoyed almost unrivalled popularity. In Gluck's *Iphigénie en Aulide* and *Orphée* she created the parts of Iphigénie and Eurydice. She was renowned, incidentally, hardly less for her wit and conversation than for her histrionic powers.

BIBLIOGRAPHY.—Edmond and Jules de Goncourt, *Sophie Arnould d'après sa correspondance et ses mémoires inédits* (1877); L'Augé de Lassus, *Sophie Arnould à Luzarches;* and R. Douglass, *Sophie Arnould.*

ARNOULD-PLESSY, JEANNE SYLVANIE (1819–1897), French actress, was born in Metz, the daughter of a local actor named Plessy. She made her début at the Comédie Française in 1834 in Alexandre Duval's *La Fille d'honneur,* and for the next 11 years filled leading rôles there. Suddenly she broke her contract and left for London to marry J. F. Arnould, the dramatist. She then played in St. Petersburg for 11 years. In 1855 she returned to the Comédie, where she was especially successful in Émile Augier's *Le Fils de Giboyer* and *Maître Guérin.*

ARNSBERG, a town in Westphalia, Germany, built on high ground almost surrounded by the river Ruhr, 44 mi. S.S.E. of Miinster. Pop. (1939) 14,788. Near by are the ruins of the castle of the counts of Arnsberg which was blown up in 1762. Arnsberg received its first charter in 1237 and later joined the Hanseatic league. It is the seat of the provincial authorities, and has a chamber of commerce. Paper is made.

ARNSTADT, a town in Thuringia, Germany, 11 mi. S. of Erfurt. Pop. (1939) 22,911. It dates from the 8th century and was bought in 1306 by the counts of Schwarzburg, who lived here till 1716. The Liebfrauenkirche is Romanesque (12th and 13th centuries). The town hall dates from 1561. There are copper mines and tepid springs in the neighbourhood. The industries are partly based on the mines, but also include machine making. chemical and dye works. There is trade in wheat, leather, seeds and cattle.

ARNSWALDE, a town of Germany, in the Prussian province of Pomerania, in a marshy district, 20 mi. S.E. of Stargard on the railway to Posen. Pop. (1939), 14.116. Its industries include spinning and weaving and the manufacture of brushes, bricks, sugar, machinery. Trade is in corn.

ARNULF (850?–899), Roman emperor, illegitimate son of Carloman, king of Bavaria and Italy, was made margrave of Carinthia about 876, and on his father's death in 880 his dignity and possessions were confirmed by the new king of the east Franks, Louis III. He did homage to the emperor Charles the Fat in 882, and spent the next few years in constant warfare with the Slavs and the Northmen. In 887, however, Arnulf identified himself with the disgust felt by the Bavarians and others at the incapacity of Charles the Fat. Gathering a large army, he marched to Tribur; Charles abdicated and in 888 the Germans recognized Arnulf as their king, a proceeding which L. von Ranke describes as "the first independent action of the German secular world." Arnulf's real authority did not extend far beyond the confines of Bavaria, and he contented himself with a nominal recognition of his supremacy by the kings who sprang up in various parts of the empire. He continued the struggle with the Northmen in 891, and gave effective aid to

Zvatorpluk, king of Moravia, in his struggle with the nobles. Invited by Pope Formosus to deliver him from the power of Guido III., duke of Spoleto, who had been crowned emperor, Arnulf went to Italy in 894, but after storming Bergamo and receiving the homage of some of the nobles at Pavia, he was compelled by desertions from his army to return. In the next three years he succeeded in establishing his illegitimate son, Zwentibold, as king of the district afterwards called Lorraine. The restoration of peace with the Moravians and the death of Guido prepared the way for a more successful expedition in 895 and Arnulf was crowned emperor by Formosus in Feb. 896. He then set out to establish his authority in Spoleto, but on the way was seized with paralysis. He returned to Bavaria, where he died in Dec. 899, and was buried at Regensburg. He left, by his wife Ota, a son Louis surnamed the Child.

See "Annales Fuldenses" in the *Monumenta Germaniae historica. Scriptores,* Band i. (Hanover and Berlin, 1826); M. J. L. de Gagern, *Arnulfi imperatoris vita* (Bonn, 1837); E. Dümmler, *De Arnulfo Francorum rege* (1852); *W.* B. Wenck, *Die Erhebung Arnulfs und der Zerfall des karolingischen Reiches* (Leipzig, *1852)*; E. Mühlbacher, *Die Regenten des Kaiserreichs unter den Karolingern* (Innsbruck, 1881); E. Dummler, *Geschichte des ostfrankischen Reichs* (Leipzig, 1887–88); O. Dietrich, *Beiträge zur Geschichte Arnolfs von Karnthen und Ludwigs des Kindes* (1890).

AROLSEN, a town of Germany, in the Prussian province of Hesse-Nassau, formerly capital of the principality of Waldeck, 25 mi. N.W. of Cassel, with which it is connected by rail via Warburg. Pop. 2,564. Arolsen is the birthplace of the sculptor C. Rauch, and of the painters Wilhelm and Friedrich von Kaulbach.

ARONA, a town in Piedmont, Italy, province of Novara, on Lake Maggiore, 3 mi. from its southern extremity, 23 mi. N. of Novara, and 42 mi. N.W. of Milan by rail on the Simplon line. Pop. (1936) 5,667 (town), 8,632 (commune). On a hill to the north a colossal bronze statue of S. Carlo Borromeo (born here 1538) was erected in 1697.

ARORA: *see* CASTE.

AROSA, a climatic station of Switzerland, situated at a height of 6,000 ft. in the high valley of the Plessur, south-east of Chur Here, among extensive pine forests (remnants of which still shelter the valley), a village has existed from the 14th century. The extension of the tourist industry and the development of winter sports have made it one of the best-known Alpine resorts.

ARPEGGIO, in music, the playing of the notes of a chord, not simultaneously but in succession, as on a harp.

ARPEGGIONE, a musical instrument whose nature is indicated by its alternative name of guitar violoncello; that is to say, it was shaped like a guitar but played with a bow, being about the size of a viol da gamba or small violoncello. It was invented by G. Staufer, of Vienna, in 1823, but was never taken up and is now remembered only by reason of the fact that Schubert wrote a sonata for it.

ARPI (Gr. Ἀργύριππα), ancient city, Apulia, 20m. W. of the coast and 5m. N. of the modern Foggia. Legend attributes its foundation to Diomedes, and the figure of a horse on its coins shows the local importance of horse-breeding in early times. Its territory extended to the sea, and Strabo says that from the extent of the city walls one could gather that it had been one of the greatest cities of Italy. As a protection against the Samnites Arpi became an ally of Rome and remained faithful until after the battle of Cannae, but Fabius captured it in 213 B.C., and it never recovered its former importance.

ARPINO (anc. ARPINUM), a town of Lazio, Italy, in the province of Frosinone, 1,475ft. above sea-level; 12m. by rail N.W. of Roccasecca, a station on the older railway from Naples to Rome. Pop. (1936) 2,613 (town), 10.564 (commune). Arpino occupies the lower part of the ancient Volscian town finally taken from the Samnites by the Romans in 305 B.C. It received full civic privileges in 188 B.C. with Formiae and Fundi. The finely preserved polygonal walls are among the best in Italy, 11ft. high in places and 7ft. wide at the top. A single line of wall, with mediaeval round towers at intervals, runs on the north side from the present town of Civita Vecchia (2,055ft.), site of the old citadel. Below Arpino, in the valley of the Liris, lies the church of S. Domenico, on the site of the villa in which Cicero was born and often lived. The painter Giuseppe Cesari (1560–1640), more often known as the Cavaliere d'Arpino, was also born here.

See O. E. Schmidt, *Arpinum, eine topographisch-historische Skizze* (Meissen, 1900).

ARQUA PETRARCA, village of Venetia, Italy, 3m. S.W. of Battaglia. Pop. (1936) 684 (town), 2,487 (commune). Petrarch lived his last few years and died here in 1374. Near Arqua. on the banks of the small Lago della Costa, is the site of a prehistoric lake village.

ARQUATA SCRNIA, village, province of Alessandria, Italy, from which it is 20 miles S S.E. by rail. Pop. (1936) 2,485 (commune 4,149). It is the junction of the lines to Genoa from Turin and Milan, and was the supply base for British forces in Italy (1917–1919). Two miles north are the ruins of Libarna, a Roman town on the Via Postumia from Genua (Genoa) to Placentia (Piacenza), an amphitheatre, a theatre, streets and houses have been found. The town was rectangular, and buildings found belong to the 1st or 2nd centuries A.D. For full details *see* Moretti in *Not. Scavi,* 1914, 113 *sqq.;* Barocelli, *ib.* 1922, 362 ***seq.***

ARQUEBUS, also called HARQUEBUS, HACKBUT, etc., a firearm of the 16th century, the immediate predecessor of the musket. The word itself is certainly to be derived from the German *Hakenbühse* (mod. *Hakenbüchse, cf.* Eng. *hackbut* and *hackbush*), "hook gun." The French *arquebuse* and Italian *arcobugio, archibugio,* often and wrongly supposed to indicate the hackbut's affinity with the crossbow ("hollow bow" or "mouthed bow"), are popular corruptions, the Italian being apparently the earlier of the two and supplanting the first and purest French form *haquebut.* Previous to the French wars in Italy, hand-gun men and even arbalisters seem to have been called arquebusiers, but in the course of these wars the arquebus or hackbut came into prominence as a distinct type of weapon. The Spanish arquebusiers, who used it with the greatest effect in the Italian wars, notably at Bicocca (1522) and Pavia (1525), are the originators of modern infantry fire action. Filippo Strozzi made many improvements in the arquebus about 1530, and his weapons were effective up to four and five hundred paces. He also standardized the calibres of the arquebuses of the French army, and from this characteristic feature of the improved weapon arose the English term "caliver." In the latter part of the 16th century (c. 1570) the arquebus began to be displaced by the musket.

ARQUES-LA-BATAILLE, village of northern France, in the department of Seine-Inférieure, 4 mi. S.E. of Dieppe by the Western railway. Pop. (1936), 2,269. Arques is situated near the confluence of the rivers Varenne and Bethune; the forest of Arques stretches to the north-east. The castle, built in the 11th century, was regarded as a menace by William the Conqueror, who besieged and occupied it. It later came into the possession of the English, who were expelled in 1449 after an occupation of thirty years. In 1589 its cannon decided the battle of Arques in favour of Henry IV. In 1869 the castle was made state property.

ARQUIJO, JUAN DE (c. 1564–1623), Spanish poet, belonged to the Italianate school of poetry at Seville. A delicate simplicity characterizes his *Sonetos* (ed. J. Colon y Colon, Seville, 1841) and *Poesias* (ed. A. de Castro, 1854).

ARRACK, RACK or **RAK,** a generic name applied to a variety of spirituous liquors distilled in the Far East. According to some authorities the word is derived from the Arabic *arak* (perspiration), but according to others *(see* Morewood's *History* of *Inebriating Liquors,* 1834, p. 140) it is derived from the *arecanut,* a material from which a variety of arrack was long manufactured, and is of Indian origin. The liquor to which this or a similar name is applied is (or was, since the introduction of European spirits and methods of manufacture is gradually causing the native spirit industries on the old lines to decay) manufactured in India, Ceylon, Siam, Java, Batavia, China, Korea, etc., and its manufacture still constitutes a considerable industry. The term arrack as designating a distilled liquor does not, however, appear to have been confined to the Far East, as,

in Timkowski's Travels, it is stated that a spirit distilled from koumiss (*q.v.*) by the Tartars, Mongols and presumably the Caucasian races generally, is called arrack, araka or *ariki*. In Ceylon arrack is distilled chiefly from palm toddy, which is the fermented juice drawn from the unexpanded flower-spathes of various palms, such as the Palmyra palm (Borassus flabelliformis) and the cocoa palm (*Cocos nucifera*). At the beginning of the 19th century the arrack industry of Ceylon was of considerable dimensions, whole woods being set apart for no other purpose than that of procuring toddy, and the distillation of the spirit took place at every village round the coast.

On the Indian continent arrack is made from palm toddy, rice and the refuse of the sugar refineries, but mainly from the flowers of the muohwa or mahua tree (*Bassia* latifolia). The mahua flowers are very rich in sugar, and may, according to H. H. Mann, contain as much as 58% of fermentable sugar, calculated on the total solids. Even in modern times the process of manufacture is very primitive, the fermentation as a rule being carried on in so concentrated a liquid that complete fermentation rarely takes place. According to Mann, the total sugar in the liquor ready for fermentation may reach 20%. The ferment employed (it is so impure that it can scarcely be called yeast) is obtained from a previous fermentation, and, as the latter is never vigorous, it is not surprising that the resulting spirit contains, compared with the more scientifically prepared European spirits, a very high proportion of by-products (acid, fusel oil, etc.). The injurious nature of these native spirits has long been known and has been frequently set down to the admixture of drugs, such as hemp (*ganga*), but investigation appears to show that this is not generally the case. The chemical constitution of these liquors alone affords sufficient proof of their inferior and deleterious character.

ARRAH, a town of British India, headquarters of Shahabad district, in the Patna division of Bihar and Orissa. Pop. (1931) 48,922. Arrah is famous for an incident in the Mutiny, when 15 Englishmen and Eurasians, with 50 Sikhs, defended a small building against 2,000 Sepoys and a body of armed insurgents, perhaps four times that number, under Kuav Singh. A British relief force from Dinapur was disastrously repulsed; but they were ultimately rescued, after eight days' fighting, by a small force under Maj. (afterwards Sir) Vincent Eyre.

ARRAIGNMENT, a law term, properly denoting the calling of a person to answer in form of law upon an indictment. After a true bill has been found against a prisoner by the grand jury, he is called by name to the bar, the indictment is read over to him, and he is asked whether he be guilty or not of the offence charged. This is the arraignment.

His plea in answer to the charge is then entered, or a plea of not guilty is entered for him if he stands mute of malice and refuses to plead. If a person is mute by the visitation of God, *i.e.*, deaf and dumb, it will be no bar to an arraignment, provided he is sane and intelligence can be conveyed to him by signs or symbols.

The arraignment is complete when the accused has pleaded.

ARRAN, EARLS OF. The extinct Scottish title of the earls of Arran (not to be confused with the modern Irish earls of Arran —from the Arran or Aran Islands, Galway—a title created in 1762) was borne by some famous characters in Scottish history With the exception of the first earl, Thomas Boyd and James Stewart, all the holders of this title were members of the Hamilton family.

JAMES HAMILTON, 1st earl (1475?–1529), son of James, 1st Lord Hamilton, and of Mary, daughter of James II. of Scotland succeeded to his father's titles and estates in 1479. In 1503 he negotiated the marriage of James IV. with Mary Tudor, and mas created earl of Arran. Arran was intercepted in England on his way home from a mission to France in 1507 and was imprisoned for a short time. In 1513 he was entrusted with the command of a naval expedition against England, but failed lamentably. On his return he found his rival Angus married to the queen dowager and supreme at court, and joined the party of Albany, and was president of the council of regency from 1517 to 1520. In the feuds of these years Arran supported now one party, now another. The most spectacular encounter was in 1520 when the fierce fight between the Hamiltons and the Douglases known as "Cleanse the Causeway" took place in the streets of Edinburgh in 1520. On the proscription of Angus and the Douglases (1528) Arran joined the king at Stirling. He died in 1529.

JAMES HAMILTON, 2nd earl of Arran and duke of Chbtelherault (1515?–75), became heir presumptive to the throne on the death of James V. and the accession of Mary, and was appointed protector of the realm. After arranging for a marriage between Mary and Prince Edward (afterwards Edward VI. of England), he suddenly joined the French party, repudiated the proposed English marriage and repudiated Protestantism. After a first resistance he agreed to share the regency with Mary of Lorraine. The repudiation of the English alliance brought war with England, and the Scots were defeated at Pinkie. He then agreed to the marriage of Mary with the dauphin of France, and in 1554 resigned office. In 1559, however, he joined the Lords of the Congregation and became one of the provisional governors of the kingdom. He was in disgrace and exiled from 1564 to 1569, but on her abdication Mary named him one of the regents for her son James VI. and he returned to Scotland to support the queen's cause. It was not until 1573 that he admitted James's authority and laid down his arms. He died Jan. 22, 1575.

JAMES HAMILTON, 3rd earl (1537–1609), was intended by his father to marry Mary, Queen of Scots. Later on Henry VIII. promised the hand of his daughter Elizabeth as the price of the adherence of Hamilton's father to the English interest. He was immersed in the political factions of the time in Scotland. In 1550 he went to France and received the command of the Scots Guards, but in 1559 was obliged to leave France. On his return to Scotland he became one of the Lords of the Congregation, and was supported by the Protestants as a suitor for Mary's hand. In 1561 he showed signs of insanity and the rest of his life was spent in confinement. He died in 1609.

During the insanity of the 3rd earl, his honours were claimed, and for a short time enjoyed by JAMES STEWART, his cousin, known as earl of Arran from 1581 to 1586. He was the rival of Lennox for the chief power in the country, but both were deprived of office by the raid of Ruthven Aug. 22, 1582, and Arran was imprisoned till September under the charge of the earl of Gowrie. In 1583, however, he assembled a force of 12,000 men against the new government; the Protestant lords escaped over the border, and Arran, returning to power, was made governor of Stirling Castle and in 1584 lord chancellor. The same year Gowrie was captured through Arran's treachery and executed after the failure of the plot of the Protestant lords against the latter's government. He now obtained the governorship of Edinburgh Castle and was made provost of the city and lieutenant-general of the King's forces. Arran's tyranny and insolence, however, stirred up a multitude of enemies and caused his rapid fall from power. On account of the murder of Lord Russell on the border in July 1585, of which he was accused by Elizabeth, he was imprisoned at the castle of St. Andrews, and subsequently the banished lords with Elizabeth's support entered Scotland, seized the government and proclaimed Arran a traitor. He fled in November, and from this time his movements are furtive and uncertain. In 1586 he was ordered to leave the country, but it is doubtful whether he ever quitted Scotland. He contrived secretly to maintain friendly communication with James, and in 1592 returned to Edinburgh, and contrived to get reinstated in the court and kirk. His unscrupulous and adventurous career was terminated towards the close of 1595 by his assassination near Symontown in Lanarkshire by Sir James Douglas (nephew of his victim the earl of Morton), who carried his head in triumph on the point of a spear through the country.

ARRAN, the largest island of the county of Bute, Scotland, at the mouth of the Firth of Clyde. Its greatest length, from the Cock of Arran to Bennan Head, is about 20m., and the greatest breadth—from Drumadoon Point to King's Cross Point—is 11m. Area 165sq m. Pop. (1921) 8,294.

The scenery of Arran is very fine, and the geological structure complex. The greatest elevations are found in the north,

where Goatfell reaches 2,866ft. The name of this hill is said to be a corruption of the Gaelic Goadh *Bhein,* "Mountain of the Winds." It belongs to the series of intrusive igneous rocks of Tertiary age—granites—which occupy most of the northern half of the island and form its grandest natural features. These rocks are partly surrounded by an incomplete ring of the oldest rocks in the island—slate, mica-schists, and grits—while in the south the rocks are mainly Triassic, the Sedimentary rocks, however, being metamorphosed or broken at many points by volcanic intrusions. Many beautiful glens, notably Glen Rosa and Glen Sannox, score the flanks of the mountains, and Loch Ranza, an inlet in the north, is one of the finest sea-lochs in Scotland. The streams or "waters," as they are called, are generally hill burns, and they and their small mountain-lochs carry trout. Blackcock and grouse are numerous, and there are a few red deer. Cattle and sheep are raised in considerable numbers. The sea fisheries, centring on Loch Ranza, are of some importance. Brodick is the chief village in Arran; most of the dwelling-houses have been built at Invercloy close to the pier. Three miles south is Lamlash, on a fine bay so completely sheltered by Holy Island as to form an excellent harbour. Four miles north lies the village of Corrie, taking its name from a rugged hollow in the hill of Am Binnein (2,172ft.) which overshadows it. Daniel Macmillan (1813–1857), the founder of the publishing firm of Macmillan and Co., was a native of Corrie. Steamers from Glasgow and Ardrossan communicate with Brodick, Lamlash, Whiting Bay, Corrie and Loch Ranza, especially in summer when the island receives many visitors.

About 1½m. east of Lamlash village lies Holy Island, 1¾m. long, nearly ¾m. wide, and its finely marked basaltic cone rises to a height of 1,030ft. St. Molios, a disciple of St. Columba, founded a church near the north-west point. In the saint's cave on the shore may be seen the rocky shelf on which he made his bed. Off the south-east coast, 1m. from Port Dearg, lies the pear-shaped isle of Pladda on which are a lighthouse and telegraph station from which the arrival of vessels in the Clyde is notified to Glasgow and Greenock.

Standing stones, cairns and other antiquities occur near Tormore, on Machrie Bay, Lamlash, and other places. The Norse raiders found a home in Arran for a long period until the defeat of Haakon V. at Largs (1263) compelled them to retire. Robert Bruce found shelter in the King's Caves on the western coast. From the point still known as King's Cross he crossed over to Carrick, in answer to the signal for the supreme effort. Ruins in Glen Cloy bear the name of Bruce's Castle, in which his men lay concealed. On the southern arm of Loch Ranza stands a picturesque ruined castle said to have been his hunting-seat.

ARRANGEMENT, DEED OF, an arrangement under written instrument by a debtor for the benefit of the general body of his creditors for the discharge of his liability. It is not binding on creditors who do not assent. Under the Deeds of Arrangement Act, 1914, such deeds must be registered at the supreme court within seven days of their execution. The majority of creditors must assent within 21 days after registration before a deed can be declared valid. The trustee must give and maintain security and furnish full periodical accounts. If the deed is not really for the benefit of the creditors, it may be avoided at any time. Provisions are included regarding the trustee and his office. As to composition or scheme of arrangement in bankruptcy, *see* BANKRUPTCY.

ARRANGEMENTS, in music: *see* TRANSCRIPTIONS.

ARRANT, a word at first used in its original meaning of wandering, as in "knight-errant" (Lat. *errare,* to wander); thus an arrant or itinerant preacher, an arrant thief, one outlawed and wandering at large; the meaning easily passed to that of self-declared, notorious, and by the middle of the 16th century was confined to words of opprobrium and abuse, an arrant coward meaning thus a self-declared, downright coward.

ARRAS, northern France, chief town of the department of Pas-de-Calais, 38 mi. N N E. of Amiens on the railway between that city and Lille. Pop. (1936) 31,410. Arras is situated on the right bank of the Scarpe, at its junction with the Crinchon, which skirts the town on the south and east.

Most of the town was destroyed by four years of bombardment during World War I. The Hôtel de Ville, the cathedral and the Abbaye de St. Vaast were among the ruins. For details of its military and strategic importance see ARRAS, BATTLE OF. During World War II also, heavy fighting and bombing took place in this area.

Its industrial establishments include oilworks, dyeworks and breweries, and manufactories of hosiery, railings and other ironwork, and of oilcake. For the tapestry manufacture formerly flourishing at Arras see TAPESTRY. The trade of the town is facilitated by the canalization of the Scarpe, the basin of which forms the port. It is the seat of a bishop and a prefect and has tribunals of first instance and of commerce as well as a chamber of commerce.

HISTORY

Before the Christian era Arras was the chief town of the Atrebates, from whose name the word Arras is derived. It became important under Roman rule, and shared the fortunes of north-east Gaul during the troubles of the 5th century. Its bishopric, promoted by St. Vedast (Vaast) was soon transferred to Cambrai, but brought back to its original seat about 1100. As the chief town of Artois, Arras passed to Baldwin I., count of Flanders, in 863. The woollen manufacture was established there at an early date, and a commune was founded early in the 12th century, but the earliest known charter only dates from about 1180; owing to the importance of Arras, this soon became a model for many neighbouring communes. When Philip Augustus, king of France, married Isabella, niece of Philip, count of Flanders, Arras came under the rule of the French king, who confirmed its privileges in 1194. As part of Artois it came in 1237 to Robert, son of Louis VIII., king of France, and in 1384 to Philip the Bold, duke of Burgundy, who promised to respect its privileges. Anxious to recover the city for France, Louis XI. placed a garrison therein after the death of Charles the Bold, duke of Burgundy, in 1477. This was driven out by the inhabitants, and Louis then stormed Arras, razed the walls, deported the citizens, whose places were taken by Frenchmen, and changed the name to Franchise. The successor of Louis, Charles VIII. restored the city to its former name and position, and as part of the inheritance of Mary, daughter and heiress of Charles the Bold, it was contended for by the French king and his rival, the German king, Maximilian I. The peace of Senlis in 1493 gave Arras to Maximilian, and in spite of attacks by the French, it remained under the rule of the Habsburgs until 1640. Taken in this year by the French, this capture was ratified by the peace of the Pyrenees in 1659, and henceforward it remained part of France. It suffered severely during the French Revolution, as well as during World Wars I and II.

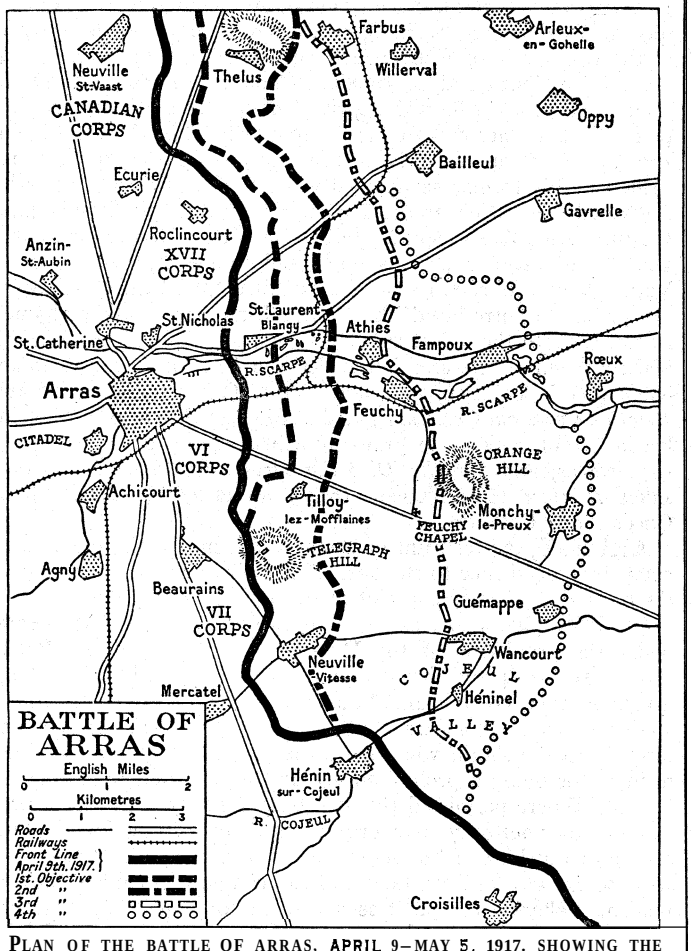
See E. Lecesne, *Histoire d'Arras jusqu'en 1789* (Arras, 1880); Arras *sous* la Rdvolution (Arras, 1882–83).

ARRAS, BATTLE OF. The great battles which opened the campaign of the Allies in 1917 on the Western Front were the direct outcome of two main causes; the first was the strategical position resulting from the battle of the Aisne in 1914, and the second the tactical position resulting from the battle of the Somme in 1916.

The former placed the bulk of the German forces in the West in the huge salient Nieuport–Noyon–Verdun, and the second *a* considerable portion of these forces in the smaller salient Arras–Gommecourt–Morval. The first offered considerable possibilities for the Allies to get in a right and left hand blow on Valenciennes and Mézières, the main centres of the German lateral communications, and the second of similar blows in the direction of Quéant against the northern and southern flanks of the German VI. and I. Armies. If it had been possible to bring off this last operation successfully, such a debacle of the German forces would have resulted that not only would the advance of the British armies have threatened Valenciennes, but the rush of German reserves to stop the gap would have withdrawn pressure from before the French about Reims, and would probably have enabled them to advance on Mézières.

Alternative Plans.—In June 1916 a plan, known as the Blaireville project, was prepared, the object of which was to strike at the Germans between Monchy-au-Bois and Beaurains

during the later stages of the battle of the Somme, but on account of the casualties sustained during the early stages of this battle this project was abandoned. In October the project was revived and its scope extended. A simultaneous offensive on all fronts was suggested, in which, whilst the main attack was to be made by the British, a subsidiary attack was to be carried out by the French in the neighbourhood of Reims. In October the British



PLAN OF THE BATTLE OF ARRAS, APRIL 9–MAY 5, 1917. SHOWING THE OBJECTIVES GAINED

This battle opened the Allied spring offensive in 1917. Although an appreciable advance was made on a front of 15 miles, and many important German positions taken, the cost of breaking through the strong German entrenchments was heavy. Trench defences had been perfected, and in addition to areas of barbed wira, the Germans had made strong points by erecting circular concrete huts, known as "pill-boxes," each armed with machine guns

plan included the following operations: At the earliest date possible (about March 15, 1917) the IV. and V. Armies were to reassume the offensive and the III. to strike between Beaurains and Arras, occupy Monchy-le-Preux, and by pushing south-east, deny to the Germans the Cojeul Valley as a line of retreat, and, if possible, that of the Sensée also. Meanwhile the I. Army was to attack north of the Scarpe and form a defensive flank.

In December General Nivelle, who had recently been appointed to the chief command of the French Armies, objected to the subsidiary part to be played by the French, and put forward a plan in which the decisive blow was to be delivered from the Aisne. The task of the British, according to this plan, was to deliver an offensive in Artois which would draw in large forces of the enemy, and so reduce opposition on the French front.

From October onwards vast preparations, which were impossible to disguise, were put in hand. Railways and roads were extended, dumps formed, gun emplacements built, aerodromes levelled and the greater portion of the underground quarries of Arras, St. Sauveur, and Ronville opened up and made ready in every detail to accommodate two divisions which were to reinforce the attack by passing underground. This sudden and unexpected reinforcing of the front was to be the surprise of the battle.

Preliminaries. — Meanwhile a hostile operation was begun which bid fair to filch from the British the tactical advantage won during the preceding summer. Towards the end of February it became apparent that the Germans intended to evacuate the Goinmecourt salient, and the recent construction of the Hindenburg line suggested a rounding off of the right angle between Arras and Craonne. If this could be successfully accomplished, not only could the tactical blow against the Gommecourt salient be avoided, but the strategical blows against Valenciennes and Mézières be impeded or delayed. The problem which now faced the Allies was a threefold one, namely, whether to hit at once, or recast their plan, or finish their preparations and carry it out as originally intended. As weather impeded the first and want of time the second, the third was adopted with the following modifications. The III. Army was now to play the leading part, and by attacking north and south of the river Scarpe with three corps, whilst holding one corps and the Cavalry Corps in reserve, was to penetrate the German defences and by advancing on Cambrai turn the Hindenburg line from Heninel and Marcoing. The I. and V. Armies were to operate on the left and right flanks of the III. Army.

The battle front, some 15m. in width, extended from just north of Croisilles to a little south of Givenchy-en-Gohelle, at the northern foot of the Vimy ridge. This ridge which rises to a height of 475ft. above sea level dominated the whole battlefield from the north. From its summit overlooking Lens the ground falls away to the river Scarpe, between which and the Cojeul river it is in nature undulating. In the forward zone of defence the Germans had dug three lines of trenches, each of which was heavily wired. Then four to five miles east of this system was dug the Drocourt–Quéant line, which at the date of the battle was still unfinished and but lightly wired.

At the beginning of April the German reserves numbered some 600,000 men, and consequently the success of the battle depended on the time it would take to penetrate the Drocourt-Quéant line. If this line could be broken within 48 hours of the initial attack, the intervention of these reserves might be avoided and so large a gap created that eventually great numbers would be drawn towards it and away from the French offensive in the south, where the main blow was to fall. This time could only have been gained by the employment of a considerable number of tanks, or by a preliminary bombardment of not more than 24 hours' duration. After denuding the training grounds of both France and England, only 60 tanks could be assembled. Therefore the only alternative was a hurricane bombardment, and though the III. Army for long suggested such an operation, G.H.Q. insisted on three weeks' systematic wire cutting, culminating in a general bombardment of several days' duration. During this period 2,700,000 shells were fired, and though the wire was destroyed all chance of surprise vanished.

Plan of Attack. — The final plan of attack was as follows: —

(a) III. Army (Gen. Allenby). The VI. and VII. Corps were to attack south of the Scarpe between Arras and Mercatel. Their objective contained two formidable lines of defence, namely, the Cojeul–Neuville Vitasse–Telegraph Hill–Tilloy-lez-Mofflaines lines, and the Feuchy Chapel-Feuchy line. South of these were some 3,000yd. of the Hindenburg line and east the strong position of Monchy-le-Preux, which dominated the whole of the surrounding country. The XVII. Corps was to continue the front of attack north of the Scarpe.

(b) I. Army (Gen. Horne). The Canadian Corps and the 13th Bde. of the 5th British Div. were to attack the Vimy heights, a position considered one of the strongest in France.

(c) V. Army (Gen. Gough). The Australian Corps and the V. Corps were to operate on the south of the III. Army. The position of this Army was a most difficult one, as the destruction of the roads and the bad weather had rendered it impossible to move forward much artillery, a *sine* qua *non* of the battles of this period.

(d) The whole of the above operations was to be considered as

a preliminary step to the advance of the Cavalry Corps and the XVIII. Corps south of the Scarpe. These corps were to break through at Monchy-le-Preux and advance eastwards through the Drocourt–Quéant line.

Opening of the Attack.—On April 9, at 5.30 A.M., the general attack was launched under cover of a magnificently timed creeping barrage, and within 40 minutes the whole of the German first line system, except a small portion of the Vimy ridge, was captured. About Tilloy-lez-Mofflaines and Telegraph Hill tanks accounted for a good many of the enemy and then proceeded eastwards to assist in the reduction of the Blue line and such parts of the Brown line as they were able to reach during daylight. By noon the greater part of the second objective had fallen and a number of hostile batteries were captured. By the close of the day practically the whole of the objectives north of the Scarpe had been taken, but south of this river the third objective had only been penetrated in places, and the fourth objective remained untouched.

During the night of the 9th–10th, the 37th Div., which had been held in reserve, advanced to the northern slopes of Orange Hill; and during the morning of the 10th this advance was followed by a general attack on the Brown line which enabled the 37th Div. to reach the outskirts of Monchy-le-Preux, which on the morning of the 11th was captured by this division assisted by tanks. Whilst these operations were in progress the Germans strongly reinforced their front, and so stubborn had become the opposition that to relieve the pressure on the VII. and VI. Corps fronts the V. Army was ordered to attack on the morning of the 11th from the direction of Bullecourt northwards. At 4.30 A.M. 11 tanks, followed by the 62nd Div. on the left and the 4th Australian Div. on the right, stormed the Hindenburg line, but on account of the width of the trenches and inadequate artillery support, only two tanks, co-operating with the Australians, were able to cross this line. These led the attack as far as Riencourt-lez-Cagnicourt when a strong German counter-attack drove the Australians back; meanwhile the attack of the 62nd Div. had been completely held up on the southern outskirts of the village of Bullecourt.

On the 12th, Heninel and Wancourt were captured by the 21st and 56th Div., and minor operations were carried out on the 13th and 14th when the main offensive of the III. and V. Armies terminated, 13,000 prisoners and 200 guns having been captured. Pressure, however, was not altogether relaxed, as on the 16th the French launched their grand offensive on the Aisne, and to assist in this operation it was considered necessary to hold the enemy. Though this attack proved a complete fiasco, pressure was maintained on the Arras Front, and the line pushed forward to include the villages of Guémappe, Gavrelle, and Arleux-en-Gohelle. On May 5 the battle of Arras was brought to a close. From April 14, 6,000 additional prisoners and some 50 guns were taken, but British casualties had been severe, totalling, between April 9 and May 5, no less than 132,000 officers and men killed, wounded, and missing.

Results of the Battle.—The failure of the Allied spring offensive may be traced to various causes, the most important being: The exhaustion of the French due to the battles of Verdun and the Somme in 1916, the total lack of surprise on both the British and French fronts; the distance apart of the two battlefields, and the comparative narrowness of the fronts attacked when compared with the strength of the German reserves.

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(J. F. C. F.)

ARRAY, orderly arrangement, particularly the drawing up of an army in position of battle. From the 13th century onwards in England "commissions of array" issued from the King for the levy of military forces (*see* MILITIA). In English law the term is used for the setting in order, name by name, of the panel of a jury, which may be challenged as a whole, "to the array," or individually, "to the polls."

ARREARS, the whole or any part of a debt or other obligation which remains unpaid after the expiration of the time set for its payment. In financial matters it relates particularly to past dividends due on cumulative preferred stock, in which case it is the same as cumulated or accumulated dividends (*q.v.*) (*see* CUMULATIVE PREFERENCE SHARE).

ARREBOE, ANDERS-KRISTENSEN (1587–1637), Danish poet, was born in the island of Aeroc on Jan. 2, 1587, and died at Vordingborg, Zealand, on March 7, 1637. After studying at the University of Copenhagen he was appointed to preach at the Danish Court, and, in 1618, was nominated bishop of Drontheim; but in 1622 he was deprived of his bishopric by the Imperial Diet, on account of his dissipated habits. During his enforced retirement into private life Arreboe appears to have repented of his former scandalous way of life; he began to write a rhymed translation of the Psalms, which was published under the title, *David's Psalter Sangviis udsat* (Copenhagen, 1623 and 1662), and in 1626 he was appointed to be a priest again, in Vordingbord. Arreboe is sometimes called "the father of Danish poetry." He introduced the Alexandrine and double rhymed hexameter into the literature of his country, his best known work being a poem on the creation, called the *Hexaemeron rhythmico-danicum* (Copenhagen, 1641 and 1661). Other works of his are, *Relation i vers om Christian IV. des sejr over de Svenske* (Copenhagen, 1611), a poem in praise of Christian IV.'s victories over the Swedes, and *Sorgelig Digt om Dronning Annae Catharinae salige Hcnfart* (Copenhagen, 1612), an elegy on the death of Queen Anne Catherine.

ARREST, the restraint of a man's person, for the purpose of compelling obedience to the law. It is defined as the execution of the command of some court of record or officer of justice.

In Civil Cases.—Arrest in civil cases is now abalished save under the provisions of the Debtors Act 1869 and the Bankruptcy Act 1914 and for contempt of court. It is effected by attachment or committal. Attachment is appropriate for neglecting to do what a person was ordered to do, and the writ is directed to the sheriff who lodges the prisoner in gaol. Commitment is for doing a prohibited act and is executed by the court tipstaff. Where permitted the arrest must be by virtue of a precept or order out of some court, and must be effected by corporal seizing or touching of the defendant's body, or as directed by the writ, *capias et attachias*, take and catch hold of. And if the defendant make his escape it is a *rescous*, or rescue, and attachment may be had against him, and the bailiff may then justify the breaking open of the house in which he is, to carry him away.

Arrests on mesne process in any action before judgment obtained, were abolished by the Debtors Act 1869, s. 6; an exception, however, is made in cases in which the plaintiff proves, at any time before final judgment, by evidence on oath to the satisfaction of a judge of one of the superior courts, that he has a good cause of action to the amount of £50, that there is probable cause to believe that the defendant is about to quit the country, and that his absence will materially prejudice the plaintiff in prosecuting his action. In such cases an order for arrest may be obtained till security to the amount of the claim be found. Power is given by the Bankruptcy Act 1914 to arrest a debtor under certain circumstances where there is probable reason for believing he is about to abscond or remove his goods.

The following persons are privileged from arrest: (1) Members of the royal family and the ordinary servants of the king or queen regnant, chaplains, lords of the bedchamber, etc. This privilege does not extend to servants of a consort queen or dowager; (2) Peers of the realm, peeresses by birth, creation or marriage, Scottish and Irish peers and peeresses; (3) Members of the House of Commons during the session of parliament, and for a convenient time (40 days) before and after it. Members of Convocation appear to have the same privilege. (4) Foreign ambassadors and their "domestics and domestic servants." Temporary privilege from arrest in civil process is enjoyed by barristers travelling on circuit, by parties, witnesses or attorneys connected with a cause, and by clergymen whilst performing divine service. The arrest of any privileged person is irregular ab *initio*,

and the party may be discharged on motion. There is no privilege from arrest in the case of contempt of a criminal nature such as interference with the course of justice.

Civil arrest cannot be made on a Sunday, and if made it is void (Sunday Observance Act 1676); but it may be made in the night as well as in the day.

In Criminal Cases.—All persons whatsoever are, without distinction, equally liable to this arrest, save the Sovereign and a foreign sovereign. In spite of the assertions of writers on international law there is no diplomatic immunity from the criminal law. The statute of Anne of 1708 refers to civil matters. The privilege of sanctuary was abolished by a statute of James I., and although that statute was repealed in 1863, the privilege has not been revived.

Arrest may be made (1) without a warrant (a) by a peace officer, (b) by a private person, and (2) by warrant. As to (1) a private person and *a fortiori* a peace officer, if a felony is committed or attempted to be committed in his presence is bound to arrest the felon, and may also arrest without a warrant a person committing a breach of the peace. A peace officer would include justices of the peace, sheriffs, coroners and constables, besides other persons appointed under statutory powers. The personal po er of justices is confined to offences committed in their presence. The difference between other peace officers and a private person in their power of arrest without warrant in the case of a felony not committed in their presence lies in the fact that, whereas a peace officer may justify the arrest if he has a reasonable cause for believing that a felony has been committed and that the accused was guilty of that felony, in the case of a private person it must be shown that there has been a felony actually committed and that the private person had reasonable grounds to believe that the person arrested or given into custody committed that felony. These are their powers at common law, but under very many statutes power is given to private persons, but more generally to constables, to arrest without warrant. Instances are to be found in the Night Poaching Act 1828, the Malicious Damage Act 1861, under Coinage and Customs Acts, and more recently under the Criminal Law Amendment Act 1912 and the Dangerous Drugs Act 1920, but the tendency of modern legislation has been to confine this power of arrest to constables. In the case of misdemeanours there is no common law power of arrest without a warrant, although both peace officers and private persons have a right to arrest in the case of actual breach of the peace, and probably where such breach or its renewal is immediately apprehended. As to (2) a warrant for arrest granted by a justice of the peace may only be executed by a peace officer, and its execution is justified by its issue, whether the offence has been committed or not. The officer executing the warrant is entitled to break open doors and effect the arrest, which may be done at any time of the day or night, and certainly in the case of indictable offences and breaches of the peace can be executed on a Sunday, and, in arresting, he may use all reasonable and necessary force. Formerly there were local limits to a warrant except in the case of warrants issued by a metropolitan police magistrate, being executed by a metropolitan police officer, and "backing" by local justices was required; further, it was necessary for the constable to be armed with the warrant at the time of making the arrest. But now under the Criminal Justice Act 1925 s. 31 (3) any warrant lawfully issued by a justice for apprehension of a person charged with an offence punishable on summary conviction or on indictment may be executed in any county or place in England or Wales outside the jurisdiction of the justice by whom it was issued as if it had been originally issued by a justice having jurisdiction in that county or place, and the execution may be effected either by any person to whom the warrant was originally directed or by any constable of that county or place. Further, by s. 44 of the same Act, any warrant lawfully issued by a justice for apprehending any person charged with any offence may be executed by any constable at any time, notwithstanding that the warrant is not in his possession at the time; but the warrant, on the demand of the person apprehended, is to be shown as soon as practicable after his arrest. *(See* also BAIL.)

The old common law arrest by hue and cry has long since been abolished by statute, save in the case of the sheriff and *posse comitatus* under the Sheriffs Act 1887. By the Fugitive Offenders Acts 1881 and 1915 provision was made for the arrest in the United Kingdom of persons committing treason, and certain felonies, misdemeanours and crimes in any of the British colonies and protectorates and vice versa; as to the arrest of fugitives in foreign countries *see* EXTRADITION. The remedy for a wrongful arrest is by an action for false imprisonment.

For arrest of a ship *see* ADMIRALTY JURISDICTION. *(See* also ATTACHMENT.) (W. DE B. H.)

United States.—The law of arrest in the United States is the outgrowth of the English system and follows it very closely at most points.

In criminal cases arrests may be made with a warrant, by a peace officer without a warrant, or by a citizen without a warrant for felony actually committed. The right to arrest includes the right to search the person but not the premises where the arrest is made. The person arrested must be arraigned as prescribed in the warrant or, if arrested without a warrant, immediately before the nearest appropriate sitting magistrate. Diplomatic representatives of foreign powers, legislators, State and Federal, witnesses actually under subpoena, jurors, etc., are exempt from arrest in most instances. The power of the arresting officer is limited to the State or local boundary of his official district unless enlarged by legislation.

Civil Cases. While imprisonment for debt has been much limited in all jurisdictions the right in some form to enforce civil liability by imprisonment exists in nearly every State. Such remedy consists, usually, of (1) preliminary arrest, and (2) final arrest or execution against the person.

(1) The right to preliminary arrest ordinarily exists in such tort actions as involve injury to the person and fraud and contract actions where the breach of contract is accompanied by fraud or violation of a fiduciary relationship. Preliminary arrest may also be granted where, because of facts extrinsic to the cause of action, such as the intent of the debtor to leave the jurisdiction, the ultimate power of the court to enforce its mandates may be imperilled.

(2) Final arrest or execution against the person may generally issue in a case where the right to preliminary arrest existed.

In order to obtain preliminary arrest in a civil case an application must be made to the court upon affidavit or petition, governed by the provisions of the statute of the particular jurisdiction, and upon a bond or undertaking to indemnify the defendant if the arrest proves unauthorized or the cause of action not sustained. The order of arrest or warrant issued upon it must be directed to an appropriate officer such as the sheriff or marshal. Final arrest is not bailable except to the jail limits but in civil cases may be discharged by payment of the judgment. Commitment for contempt of court, or disobedience to court order is not strictly an arrest, although in some instances, as the enforcement of alimony orders, it is used substantially as an execution against the person. The defendant may move to vacate the order as improperly granted or give bail in accordance with the order. (B. RE.)

ARRESTMENT, in Scots law, the process by which a creditor detains the goods or effects of his debtor in the hands of third parties till the debt due to him shall be paid. It is divided into two kinds: (1) Arrestment in security, used when proceedings are commencing, or in other circumstances where a claim may become, but is not yet, enforceable; and (2) Arrestment in execution, following on the decree of a court, or on a registered document, under a clause or statutory power of registration, according to the custom of Scotland. By the process of arrestment the property covered is merely retained in place; to realize it for the satisfaction of the creditor's claim a further proceeding called "furthcorning" is necessary. By old practice, alimentary funds, *i.e.,* those necessary for subsistence, were not liable to arrestment. By the Wages Arrestment Limitation (Scotland) Act, 1870, as amended by the Small Debt (Scotland) Act, 1924, the wages of all labourers, farm-servants, manufacturers, artificers, and work-people are not arrestable except (1) in so far as they exceed 35 shillings per week; but the expense of the arrest,

ment is not to be charged against the debtor unless the sum recovered exceed the amount of the said expense; or (2) under decrees for alimentary allowances and payments, or for rates and taxes imposed by law.

ARRETIUM (mod. AREZZO), ancient city, Etruria, upper valley of Arno, on the Via Cassia, 50m. S.E. of Florentia. The hill top, enclosed by a wall, was the site of the ancient city and the mediaeval citadel, as so often in Italy. Etruscan tombs have been found in the lower part of the modern town, which appears to be on the Roman site. Vitruvius and Pliny speak of the strength of its walls of bricks, and remains have been found belonging, at the earliest, to the 4th century B.C., and probably destroyed by Sulla in 81 B.C. The bricks measured 1½ by 1 Roman foot and ½ foot thick. Many Roman buildings have been found, and the amphitheatre is still visible in the south angle. Arretium aided the Tarquins after their expulsion. It opposed Rome at the end of the 4th and beginning of the 3rd century B.C., but soon sought for help against the Gauls, against whom it was almost a frontier fortress. It was an important Roman base during the Hannibalic Wars, and in 205 B.C. furnished Scipio with quantities of arms and provisions. In 187 B.C. the high road was extended as far as Bononia. Arretium took the part of Marius against Sulla, and the latter settled some of his veterans there as colonists. A considerable contingent from Arretium joined Catiline, and in 49 B.C. Caesar occupied it. C. Maecenas was perhaps a native of Arretium. Its fertility was famous in ancient times, and still more famous was its red pottery (*see* POTTERY AND PORCELAIN: *Roman Pottery*). The museum contains a fine collection of vases and of their moulds and of mediaeval majolica. (See *Studi Etruschi*, I. [1927], 99–127.)

ARRHENIUS, SVANTE AUGUST (1859–1927), one of the founders of the modern science of physical chemistry, was born on Feb. 19, 1859, at the castle of Wijk, near Uppsala in Sweden. The family name derives from the property of Arena. As a young child he showed an extraordinary facility in calculating, and at school distinguished himself by his mathematical ability. At the age of 17 he entered the University of Uppsala, devoting himself to physics in particular, but, finding that the practical instruction in physics there left something to be desired in those days, in 1881 he went to study under Edlund at Stockholm. In 1884 he took his doctor's degree at Uppsala with a thesis entitled *Recherches sur la conductibilité galvanique*. This thesis, which later earned for Arrhenius the Nobel prize, was awarded the lowest "note" which could be granted without a definite refusal. It is divided into two parts, the first dealing with the experimental determination of the electrical conductivity of extremely dilute solutions, and the second with the theory of electrolytic conductivity. This second part expounds his theory of electrolytic dissociation and activity co-efficients (*see* ELECTRICITY, CONDUCTION OF: *Liquids;* and ELECTROLYSIS). It contains some ideas which later investigations have shown to require modification, but forms the foundation upon which all subsequent theories of conductivity of solutions have been built. The revolutionary nature of the theory, which required, for instance, that free sodium ions should exist in a solution of sodium chloride, prevented its being speedily accepted, and it may be said that it was neglected rather than actively opposed.

Arrhenius himself has put on record an anecdote which throws light on the attitude towards his views when they were new: "I came to my professor, Cleve, whom I admired very much, and I said, 'I have a new theory of electrical conductivity as a cause of chemical reactions.' He said, 'This is very interesting,' and then he said. 'Good-bye.' He explained to me later that he knew very well that there are so many different theories formed, and that they are almost all certain to be wrong, for after a short time they disappeared; and therefore, by using the statistical manner of forming his ideas, he concluded that my theory also would not exist long."

In 1887 he published a much revised, extended and consolidated version of his theory of electrolytic dissociation, entitled "Über die Dissociation der in Wasser gelosten Stoffe" in the *Zeitschrift fur physikalische Chemie,* which had just been founded. Arrhenius' first thesis had won him the support of Ostwald (*q.v.*), in whose institution he worked in 1886, and in 1887 he entered into an intimate friendship with van't Hoff (*q.v.*). The theories of van't Hoff on osmotic pressure and of Ostwald on the affinity of acids accorded admirably with the views of Arrhenius, and these three friends fought together in unselfish alliance for the new doctrines, which ultimately won general acceptance. Arrhenius had a genius for friendship, and in the 40 years between 1887 and his death met practically all the great men of science, and won their affection no less than their regard.

In 1891 Arrhenius declined a professorship at Giessen and was appointed lecturer at the Stockholm university: in 1895 he was elected to a professorship there. From 1887 to 1902 he also fulfilled the office of rector of the university. During this time he was occupied in extending the application of the doctrine of electrolytic conductivity to a variety of problems of chemical action, and also, on the supposition that in certain conditions air conducts electrolytically, to the phenomena of atmospheric electricity. In 1900 he published his *Lärobok i teoretisk electrokemi* (Treatise on theoretical electrochemistry) which was translated into German and English and his *Lehrbuch der kosmischen Physik* (Treatise on Cosmic Physics) appeared in 1903. In the same year he was awarded the Nobel prize for chemistry.

Arrhenius was a man of very wide interests, and about this time he began to turn his attention to problems of the chemistry of living matter. In 1904 he delivered at the University of California a course of lectures designed to illustrate the applications of the methods of physical chemistry to explaining the reactions of toxins and antitoxins. These lectures were published in 1907 under the title *Immunochemistry,* and in 1915 he published further contributions to exact biochemistry under the title *Quantitative Laws* in *Biological Chemistry,* in which he again devoted much attention to toxins. He was also much occupied with problems of cosmogony. In his *Worlds in the Making* (1908), an English translation of *Das Werden der Welten* (1907), he combated the generally accepted doctrine that the universe is tending to what Clausius termed *Warmetod* (death of heat) through exhaustion of all sources of heat and motion, and suggested that by virtue of a mechanism which maintains its available energy it is self-renovating, energy being degraded in bodies which are in the solar state, but elevated or raised to a higher level in bodies which are in the nebular state. He further put forward the conception that life is universally diffused, constantly emitted from all habitable worlds in the form of spores which traverse space for years or ages, the majority being ultimately destroyed by the heat of some blazing star, but some few finding a resting-place on bodies which have reached the habitable stage. He was one of the first to stress the important part which the pressure of light must play in cosmic physics, and pointed out that the repulsion of the tails of comets from the sun could be explained by this pressure. Astronomical problems, especially the question of the habitability of Mars, are discussed in his *Destinies of the Stars* (1918).

With the Nobel prize in 1903 Arrhenius may be said to have received universal recognition as one of the great men of his time. In 1905 he refused a full professorship and private laboratory in Berlin, and was appointed director of the Nobel Institute for Physical Chemistry at Experimentalfaltet, just outside Stockholm, a post which he held until his death on Oct. 1, 1927. In 1910 he was made a foreign member of the Royal Society, and in the course of his later career he received numerous honorary doctorates in both the old and new world, as well as the Davy medal of the Royal Society and the Faraday medal of the Chemical Society. He delighted both to visit his colleagues abroad and to receive his contemporaries and students at his home. A genial humour characterized both his discourses and his private conversation, and few men more than Arrhenius were welcome at scientific discussions in any land.

Besides the books mentioned above Arrhenius wrote *Theories of Solution* (1912). He also published, in 1926, *Erde und Weltall,* a combined and revised reissue of *Das Werden der Welten* and *Der Lebenslauf der Planeten.* A German translation of his original thesis on Galvanic Conduction in Electrolytes was published as

No. 160 of *Ostwald's Klassiker* in 1907. A study of the life and work of Arrhenius, written by Ostwald, appeared in the *Zeitschrift fur physikalische Chemie* in 1909, and there is much about him in Professor Ernst Cohen's study, *Jacobus Henricus van't Hoff*, published in Leipzig in 1912. (E. N. DA C. A.)

ARRHYTHMIA: *see* HEART, DISEASES OF THE.

ARRIA, in Roman history, the wife of Caecina Paetus. When her husband was implicated in the conspiracy of Scribonianus against the Emperor Claudius (A.D. 42) and condemned to death, she resolved not to survive him. She accordingly stabbed herself with a dagger, which she then handed to him with the words, "Paetus, it does not hurt" *(see* Pliny, *Epp.* iii. 16; Martial i. 14; Dio Cassius lx. 16). Her daughter, also called Arria, was the wife of Thrasea Paetus. When he was condemned to death by Nero, she would have imitated her mother's example, but was dissuaded by her husband. She was sent into banishment (Tacitus, *Annals* xvi. 34; Pliny, *Epp.* iii. 11; ix. 13).

ARRIAGA, MANOEL JOSÉ D' (1839–1917), Portuguese politician, was born in Horta, in the Azores, July 8 1839. Educated at the University of Coimbra, he was graduated in law in 1866. Arriaga early showed signs of his Republican sympathies, with the result that his father, an ardent royalist, disinherited him; and as a student he was obliged to support himself by coaching his juniors. He had a distinguished scholastic career, among his appointments being the rectorship of the University of Coimbra, and a professorship at the Lyceum in Lisbon. His political career opened in 1882, when he was elected Republican deputy for Funchal. From 1890 to 1892 he represented Lisbon. During the revolution of 1910 *(see* PORTUGAL) he was a prominent figure on the Republican side; and on Aug. 24 1911, he was elected first constitutional president of the Portuguese Republic. The royalist risings of 1911 and 1912 taxed his strength; and in 1915, feeling no longer able to cope with the difficulties of the situation particularly in face of the coup d'état of May 14, he resigned May 27. He died March 5 1917. His full name was Manoel José d'Arriaga Brun da Silveira e Peyrelongue.

ARRIAM (FEAVIUS ARRIANUS), of Nicomedia in Bithynia, Greek historian and philosopher, was born about A.D. 96, and lived during the reigns of Hadrian, Antoninus Pius and Marcus Aurelius. He was greatly esteemed by Hadrian, who appointed him governor (*legatus*) of Cappadocia (131–137), where he distinguished himself in a campaign against the Alani. This is the only instance before the 3rd century in which a first-rate Roman military command was given to a Greek. Arrian spent a considerable portion of his time at Athens, where he was archon 147–148. In his declining years, he retired to his native place, where he devoted himself to literary work. He died about 180. His biography, by Dio Cassius, is lost.

When young, Arrian was the pupil and friend of Epictetus. He took verbatim notes of his teacher's lectures, which he subsequently published under the title of *The Dissertations* (Διατριβαί), in eight books, of which the first four are extant and constitute the chief authority for Stoic ethics, and *The Encheiridion* (*i.e.*, Manual) *of Epictetus*, a handbook of moral philosophy; this was adapted for Christian use by St. Nilus of Constantinople (5th century), and Simplicius (about 550) wrote a commentary on it which we still possess. The most important of Arrian's original works is his *Anabasis of Alexander*, containing the history of Alexander the Great from his accession to his death. Arrian's chief authorities were, as he tells us, Aristobulus of Cassandreia and Ptolemy, son of Lagus (afterwards king of Egypt), who both accompanied Alexander on his campaigns. Arrian's is the most complete and trustworthy account of Alexander that we possess. Other extant works of Arrian are: *Zndica*, a description of India in the Ionic dialect, including the voyage of Nearchus, intended as a supplement to the *Anabasis; Acies Contra Alanos*, a fragment of importance for the knowledge of Roman military affairs; *Periplus of the Euxine*, an official account written (131) for the Emperor Hadrian; *Tactica*, attributed by some to Aelianus, who wrote in the reign of Trajan; *Cynegeticus*, a treatise on the chase. supplementing that of Xenophon; the *Periplus of the Erythraean Sea*, attributed to him, is by a later compiler. Amongst his lost works may be mentioned: Τὰ μετ' Ἀλέξανδρον, a history of the period succeeding Alexander, of which an epitome is preserved in Photius; histories of Bithynia, the Alani and the Parthian wars under Trajan; the lives of Timoleon of Corinth, Dion of Syracuse and a famous brigand named Tilliborus.

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ARROL, SIR WILLIAM (1839–1913), British engineer, was born at Houston, Renfrewshire, Feb. 13 1839. In his boyhood he was apprenticed to a smith at Paisley, and worked through several engineering shops until, in 1868, he was able to set up as a boiler-maker. In 1872 he took up construction in steel, and started the Dalmarnock ironworks, becoming an expert in bridge-building.

The Caledonian Railway bridge at Glasgow, the reconstructed Tay bridge (1882–87), Forth bridge (1882–89), the Tower bridge, London, and the Nile bridge at Cairo were among his principal achievements. He was knighted in 1890. He sat in the House of Commons for Ayrshire (S.) as a Unionist member from 1895 to 1906. He died at Ayr Feb. 20 1913.

See Sir Robert Purvis, *Sir William Arrol* (1913).

ARRONDISSEMENT (from Fr. *arrondir*, to make round), in France, an administrative subdivision of a department. It comprises within itself the canton and the commune. It is merely an administrative division and not a complete legal personality with power to acquire and possess. It is the electoral district for the chamber of deputies, and is a judicial district having a court of first instance. It is under the control of a sub-prefect. There are 362 arrondissements in the 87 departments. Each arrondissement has a council, with as many members as there are cantons, whose function is to subdivide among the communes their *quota* of the direct taxes charged to the arrondissement by the general council of the department. *(See* FRANCE.) The cities of Paris and Lyons are divided into local administrative units also termed arrondissements.

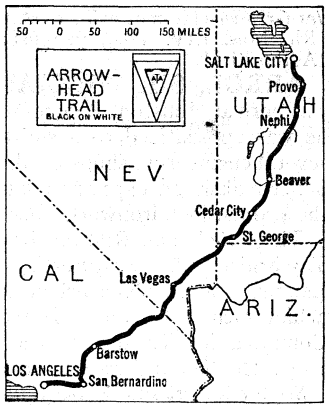
France is also subdivided, for purposes of defence, into five *maritime* divisions, termed arrondissements. They are under the direction of maritime prefects, who, by a decree of 1875, must be vice-admirals in the navy.

BY COURTESY OF WILD FLOWER PRESERVATION SOCIETY

THE COMMON ARROW-HEAD (SAGITTARIA LATIFOLIA), WHICH GROWS IN SHALLOW WATERS OF NORTH AMERICA

ARROW-HEAD *(Sagittaria)*, a group of perennial aquatic or marsh herbs of the water-plantain family *(Alismataceae)*, so named because the leaves of the best known species are characteristically arrow-shaped. The scapes, which rise from tuber-bearing or fleshy knotted root-stocks, are mostly erect though sometimes decumbent and more rarely floating. Though borne on partly submerged stalks, the strongly nerved leaves usually rise conspicuously above the water. The flowers, arranged in whorls of three at the top of the scapes, have three broad white petals alternating with three small green sepals; the fruit is a dense head of small achenes. There are about 30 species, native to temperate and tropical regions, but chiefly American. The common Old-World arrow-head *(S. sagittifolia)*, found in ditches in England and Ireland, is very widely distributed in Europe and Asia. It grows 3ft. to 4ft. high and bears showy white flowers and orbicular achenes. Many profusely

blooming and double-flowered varieties are cultivated in lily ponds and bog gardens. The similar broad-leaved arrow-head (*S. latifolia*), with sharply beaked achenes, grows in shallow water throughout North America except in the Arctic region. Its large starchy tubers, called *wappato*, are used for food by the American Indians. In the lower San Joaquin and Sacramento valleys in California this arrow-head is known as "tule potato," and is often cultivated for food by the Chinese of the district in a manner similar to the cultivation for its starchy tubers of *S. chinensis* (which by most botanists is reduced to the widespread *Sagittaria sagittifolia*) in China. The giant arrow-head (S. montevidensis) sometimes grows 6 ft. tall, with leaf blades 2 ft. long, and bears showy white flowers from 2 in to 3 in. across, blotched with brownish-purple at the base. This handsome species is native in South America from Peru and Chile to Brazil and Argentina, and was first introduced into cultivation in 1883 from seeds sent to England from Buenos Aires. It is now planted in water gardens in the warmer parts of the U.S. and has run wild in slow streams in California and the south Atlantic states.



ARROWHEAD TRAIL, a scenic highway extending from Salt Lake City, Utah, to Los Angeles, California, is 725 mi. long. It not only connects two of the nation's favourite playgrounds, but traverses sections of unusual natural beauty and great historical interest. The Grand Canyon of the Colorado is accessible over one of its branches.

ARROWROOT. A large proportion of the edible starches obtained from the rhizomes or root-stocks of various plants are known in commerce under the name of arrowroot. Properly the name should be restricted to the starch yielded by two or three species of Maranta (fam. Marantaceae), the chief of which is M. *arundinacea;* and when genuine or West Indian arrowroot is spoken of it is understood that this is the variety meant. *M. arundinacea* is probably a native of Guiana and western Brazil but it has long been cultivated in the West Indies and has now spread to most tropical countries. The plant is a herbaceous perennial with a creeping root-stock which gives off fleshy cylindrical tubers, covered with pale brown or white scales and afterwards ringed with their scars. When these tubers are gorged with starch, immediately before the season of rest, it is ripe for use. In addition to about 25% of starch, the tubers contain woody tissue, protein, and salts. The arrowroot may be separated on a small scale by peeling the root and grating it in water, when the starch falls to the bottom. The liquor is then drained off and the starch purified by repeated washings. On a large scale the manufacture of arrowroot is conducted with special machinery.

Arrowroot is distinguished by the granules agglomerating into small balls, and by yielding with boiling water a fine, transparent, inodorous, and pleasant-tasting jelly. In microscopic structure the granules present an ovoid form, marked with concentric lines, similar to potato starch, but having the hilum at the thick extremity of the granule instead of at the thin end. In addition to the West Indian supplies, arrowroot is cultivated in Brazil, the East Indies, Australia, and South Africa. The slender much-branched stem is 5 or 6ft. high and bears numerous leaves with long narrow sheaths and large spreading ovate blades, and a few short-stalked white flowers.

Tous-les-mois or Tulema arrowroot, also from the West Indies, is obtained from species of Canna, a genus allied to Maranta and cultivated in the same manner. The granules of tous-les-mois are very large. East India arrowroot is obtained from the root-stocks of species of *Curcuma* (fam. Zingiberaceae), chiefly C. *angustifolia,* a native of central India. Brazilian arrowroot is the starch of the cassava plant (Manihot *utilissima*), which when agglutinated on hot plates forms tapioca. Tacca or Otaheite arrowroot is the product of Tacca *pinnatifida,* the pia plant of the South Sea islands. Portland arrowroot was formerly prepared on the Isle of Portland from the tubers of the common cuckoo-pint, *Arum maculatum.* Various other species of the arum yield valuable food-starches in hot countries. Under the name of British arrowroot the farina of potatoes is sometimes sold., The chief use, however, of potato-farina is for adulterating more costly preparations. This falsification can be detected by microscopic examination. Arrowroot contains about 82% of starch, and about 1% of proteid and mineral matter.

THE ARROWROOT PLANT (MARANTA ARUNDINACEA), CULTIVATED IN TROPICAL COUNTRIES BECAUSE OF THE EDIBLE STARCH IT YIELDS

Middle figure shows upper part of flowering stem. Right figure shows base of flowering stem and young branch of rhizome. Below is part of the mature rhizome containing starch from which arrowroot is prepared

ARROWSMITM, the name of an English family of geographers. The first of them, Aaron Arrowsmith (1750–1823), made himself famous by his large chart of the world on Mercator's projection (1700). Four years later he published another large map of the world on the globular projection, with a companion volume of explanation. He left two sons, Aaron and Samuel, the elder of whom was the compiler of the Eton Comparative *Atlas,* of a Biblical atlas, and of various manuals of geography. They carried on the business in company with John Arrowsmith (1790–1873), nephew of the elder Aaron. In 1834 John published his London Atlas, the best set of maps then in existence. He followed up the atlas with a long series of elaborate and carefully executed maps, those of Australia, America, Africa and India being especially valuable.

ARROYO, the channel of a stream where the water flows only at certain seasons of the year, a term used in U.S.A. for a gully with bed of loose earth.

ARSACES, a Persian name, which occurs on a Persian seal, where it is written in cuneiform characters. The most famous Arsaces was the chief of the Parni, one of the nomadic Scythian or Dahan tribes in the desert east of the Caspian sea. A later tradition, preserved by Arrian, derives Arsaces I. and Tiridates from the Achaemenian king Artaxerxes II., but this had evidently no historical value. Arsaces, seeking refuge before the Bactrian king, Diodotes, invaded Parthia, then a province of the Seleucid empire, about 250 B.C. (Strabo **xi.** p. 515, cf. Arrian p. 1, Müller, in Photius, Cod. 58, and Syncellus p. 284). After two years (according to Arrian) he was killed, and his brother Tiridates, who succeeded him and maintained himself for a short time in Parthia, during the dissolution of the Seleucid empire by the attacks of Ptolemy III. (247 et seq.), was defeated and expelled by Seleucus II. (c. 238). But when this king was forced, by the rebellion of his brother, Antiochus Hierax, to return to the west, Tiridates came back and defeated the Macedonians (Strabo xi. p. 513, 515; Justin xli. 4; Appian, Syr. 65; Isidorus of Charax 11). He was the real founder of the Parthian empire, which was of very limited extent until the final decay of the Seleucid empire, occasioned by the Roman intrigues after the death of Antiochus IV. Epiphanes (165 B.C.), enabled Mithridates I, and his successors to conquer Media and Babylonia. Tiridates adopted the name of his brother Arsaces, and after him all the other Parthian kings (who by the historians are generally called by their proper names), amounting to the number of about 30, officially bear only the name Arsaces. With very few exceptions, only the name ΑΡΣΑΚΗΣ (with various epithets) occurs on the coins of the

Parthian kings, and the obverse generally shows the seated figure of the founder of the dynasty, holding in his hand a strung bow. The Arsacid empire was overthrown in A.D. 226 by Ardashir (Artaxerxes), the founder of the Sassanid empire, whose conquests began about A.D. 212. The name Arsaces of Persia is also borne by some kings of Armenia, who were of Parthian origin (see PERSIA and PARTHIA).

ARSENAL, an establishment for the construction, repair, receipt, storage and issue of warlike stores. The word "arsenal" appears in various forms in Romanic languages (from which it has been adopted into Teutonic), *i.e.*, Italian *arzanale*, Spanish arsenal, etc.; Italian also has *arzana* and darsena, and Spanish a longer form atarazanal.

ARSENIC, a hard, steel-grey, metallic element occurring widely in various ores. The oxide known as white arsenic is mentioned by the Greek alchemist, Olympiodorus, who obtained it by roasting arsenic sulphide. These substances were all known to the later alchemists who used minerals containing arsenic to give a white colour to copper. Albertus Magnus was the first to state that arsenic contained a metal-like substance, although later writers considered it to be a bastard or semi-metal, and frequently called it *arsenicum rex*. In 1733 G. Brandt showed that white arsenic was the calx (oxide) of this element which has the symbol **As,** atomic number 33, and atomic weight 74.96.

Arsenic occurs in the uncombined condition in various localities, but more generally in combination with other metals and sulphur, in the form of more or less complex sulphides. Native arsenic is usually of a dull grey colour, owing to surface tarnish; only on fresh fractures is the colour tin-white with metallic lustre. The hardness is 3.5 and the specific gravity 5·63–5·73. Crystals of arsenic belong to the rhombohedral system; natural crystals are, however, of rare occurrence, and are usually acicular in habit. Native arsenic occurs usually in metalliferous veins in association with ores of antimony, silver, etc., the silver mines of Freiberg in Saxony, St. Andreasberg in the Harz, Norway, Borneo, United States, Chile and the province Echizen in Japan being well-known localities.

Arsenic is a constituent of the minerals realgar, As_2S_2; orpiment, As_2S_3; arsenical pyrites or mispickel, FeAsS; cobaltite, CoAsS; smaltite, $CoAs_2$; cobalt bloom, $Co_3(AsO_4)_2,8H_2O$; pharmacolite $(CaHAsO_4)_2,5H_2O$; and mimetisite $(Pb[Pb_3(AsO_4)_2]_3)F_2$, whilst it is also met with in small quantities in nearly all specimens of iron pyrites. The ordinary commercial arsenic is either the naturally occurring form, which is, however, more or less contaminated with other metals, or is the product obtained by heating arsenical pyrites, out of contact with air, in earthenware retorts fitted with a roll of sheet iron at the mouth, and an earthenware receiver. By this method of distillation the arsenic sublimes into the receiver, leaving a residue of iron sulphide in the retort. For further purification, it may be sublimed, after having been previously mixed with a little powdered charcoal, or it may be mixed with a small quantity of iodine and heated. It can also be obtained by the reduction of white arsenic (arsenious oxide) with carbon.

Arsenic exists in more than one form and in this display of allotropy (*q.v.*) it resembles phosphorus, with which it is allied. (See PERIODIC LAW.)

In its stable form arsenic possesses a steel-grey colour, and a decided metallic lustre; it crystallizes in rhombohedra, isomorphous with those of antimony and tellurium. It is very brittle. It is volatile at temperatures above 100°C, and rapidly vaporizes at a dull red heat. When heated to 450°C, under atmospheric pressure solid arsenic volatilizes without passing through the liquid phase, but it liquefies when heated under increased pressure, and its melting point lies between 830° and 860°C. By sublimation an amorphous variety is obtained in addition to rhombohedral arsenic. The vapour of arsenic is of a golden yellow colour, and has a garlic odour. The vapour density is 10·6 (air=1) at 564°C, corresponding to a tetratomic molecule As_4; at a white heat the vapour density shows a considerable lowering in value, due to the dissociation of the complex molecule.

When arsenic vapour is cooled suddenly below 0°C, yellow arsenic is produced which is soluble in carbon disulphide and crystallizes therefrom in cubic crystals. Even at 60°C it begins to change into the metallic form. Arsenic heated in a current of oxygen burns with a pale lavender-coloured flame, forming arsenious oxide. It is easily oxidized to arsenic acid by heating with concentrated nitric acid. It burns in an atmosphere of chlorine to form the trichloride; it also combines directly with bromine and sulphur on being heated, while on fusion with alkalis it forms arsenites.

Arsenic alloys with most metals and is frequently present as an impurity in commercial alloys. A small proportion (0·3 to 0·6%) added to molten lead facilitates the formation of truly spherical pellets when the liquid metal is poured down a shot-tower. Electro-deposition of arsenic is employed to give a dark oxidized finish to brass; the depositing bath contains potassium cyanide, sodium phosphate and arsenious oxide, to which a nickel salt is sometimes added to produce a darker effect.

Detection. — Arsenic and most of its soluble compounds are very poisonous, and consequently the methods used for the detection of arsenic are important. The usual methods are: (a) *Reinsch's* test. A piece of clean copper is dipped in a solution of an arsenious compound, which has been previously acidified with pure hydrochloric acid. A grey film is produced on the surface of the copper, probably due to the formation of a copper arsenide. The reaction proceeds better if the solution is heated. On removing, washing and gently drying the metal and heating it in a glass tube, a white crystalline sublimate is formed on the cool part of the tube; under the same conditions antimony does not produce a crystalline sublimate.

(b) *Fleitmann's* test depends on the fact that arsenic and its compounds, when present in a solution in which hydrogen is being generated, are converted into arseniuretted hydrogen, or arsine AsH_3, which can be readily detected either by its action on silver nitrate solution or by its decomposition on heating. The solution containing the arsenious compound is mixed with pure potassium hydroxide solution and a piece of pure zinc or aluminium foil dropped in and the whole then heated. A piece of absorbent paper, moistened with silver nitrate, is held over the mouth of the tube, and if arsenic be present a grey or black deposit is seen on the paper, due to the silver nitrate being reduced by the arseniuretted hydrogen. Antimony gives no reaction under these conditions, so that the method can be used to detect arsenic in the presence of antimony, but the test is not so delicate as either Reinsch's or Marsh's method.

(c) Marsh's Test. — The solution containing the arsenious compounds is mixed with pure hydrochloric acid and placed in an apparatus in which hydrogen is generated from pure zinc and pure sulphuric acid. The arseniuretted hydrogen produced is passed through a tube containing lead acetate paper and soda-lime, and finally through a narrow glass tube, constricted at various points, and heated by a very small flame. As the arseniuretted hydrogen passes over the heated portion, it is decomposed and a black deposit formed. Instead of heating the tube, the gas may be ignited at the mouth of the tube, and a cold surface of porcelain or platinum placed in the flame, when a black deposit is formed on the surface. This may be distinguished from the similar antimony deposit by its ready solubility in a solution of sodium hypochlorite. A blank experiment should always be carried out in testing for small quantities of arsenic, to ensure that the materials used are quite free from traces of arsenic. The presence of nitric acid interferes with Marsh's test, and if the arsenic is present as an arsenic compound it must be reduced to the arsenious condition by the action of sulphurous acid.

(d) *Gutzeit's Test.*—The acidified solution to be tested is treated with zinc, in the presence of stannous and ferrous salts, and the gas, passed through lead acetate solution to remove hydrogen sulphide, and then passed over paper soaked in mercuric chloride; a dark stain is due to arsenic. The stain becomes much more distinct when viewed in ultra-violet light.

Arsenious oxide and arsenites, acidified with hydrochloric acid, give a yellow precipitate of arsenic trisulphide on the addition of sulphuretted hydrogen; this precipitate is soluble in solutions of

the alkaline hydroxides, ammonium carbonate and yellow ammonium sulphide. Under like conditions arsenates only give a precipitate on long-continued boiling.

Estimation. — Arsenic is usually estimated either in the form of magnesium pyroarsenate, $Mg_2As_2O_7$, or as arsenious sulphide As_2S_3. For the pyroarsenate method it is necessary that the arsenic should be in the quinquevalent condition; if necessary this can be effected by heating with nitric acid; the acid solution is then mixed with 'magnesia mixture" and made strongly alkaline by the addition of ammonia. After twenty-four hours the precipitate is filtered, washed with dilute ammonia, dried, ignited to constant weight and weighed, the filter paper being incinerated separately after moistening with nitric acid.

In the sulphide method, the arsenic should be in the tervalent form. Sulphuretted hydrogen is passed through the liquid until it is thoroughly saturated, the excess of sulphuretted hydrogen is expelled from the solution by a brisk stream of carbon dioxide, and the precipitate is filtered on a Gooch crucible and washed with water containing a little sulphuretted hydrogen and dried at 100°C; it is then well washed with small quantities of pure carbon disulphide to remove any free sulphur, again dried and weighed. Arsenic can also be estimated by volumetric methods; for this purpose it must be in the tervalent condition, and the method of estimation consists in converting it into the quinquevalent condition by means of a standard solution of iodine, in the presence of a cold saturated solution of sodium bicarbonate.

INORGANIC COMPOUNDS

Arsenic **Hydrides.**—The dihydride As_2H_2 is a brown velvety unstable powder formed when sodium or potassium arsenide is decomposed by water. Arsenic trihydride (arsine or arseniuretted hydrogen) AsH_3 is formed by decomposing zinc arsenide with dilute sulphuric acid, by the action of nascent hydrogen on arsenious compounds, and by the electrolysis of solutions of arsenious and arsenic acids; it is also a product of the action of organic matter on many arsenic compounds. It is conveniently prepared by dropping water on to aluminium arsenide, obtained by a modified thermite process. It is a colourless gas of unpleasant smell, excessively poisonous, very slightly soluble in water. It easily burns, forming arsenious oxide if the combustion proceeds in an excess of air, or arsenic if the supply of air is limited; it is also decomposed into its constituent elements when heated. It liquefies at −40°C and becomes solid at −118·9°C (K. Olszewski). Metals such as tin, potassium and sodium when heated in the gas form arsenides with liberation of hydrogen; and solutions of gold and silver salts are reduced by the gas with precipitation of metallic gold and silver. Chlorine, bromine and iodine decompose arsine readily.

Halide Derivatives of Arsenic. — Arsenic forms compounds of the type AsX_3 with fluorine, chlorine, bromine and iodine; there is also a lower iodide, As_2I_4, and a higher gaseous fluoride, AsF_5 (b.p.−53°C, m.p.−80°C). Arsenious chloride, a colourless oily liquid of specific gravity 2·205, boils at 130°C and is prepared by distilling arsenious oxide with strong hydrochloric acid. It is also obtained by direct combination of arsenic and chlorine or by heating arsenious oxide with sulphur chloride $As_4O_6+6S_2Cl_2=4AsCl_3+3SO_2+9S$. Arsenious bromide (m.p. 35°C), soluble yellowish white crystals, and arsenious iodide (m.p. 146°C), red hexagonal crystals, are both used in medicine.

Oxides and **Oxyacids of** Arsenic. — Arsenious oxide (white arsenic), As_4O_6, occurs in an amorphous or vitreous condition and also in two crystalline modifications which are found as minerals, arsenolite in octahedra (cubic system), and claudetite of the monoclinic system, the latter being converted into the former when boiled in water. At 193°C arsenious oxide sublimes without fusion, although it can be melted under pressure. It is sparingly soluble in water, the solution being acid to test papers.

Arsenious oxide is used in glass-making as an oxidizing agent to remove the colour produced by the lower oxides of iron. It is employed in the manufacture of arsenic acid, pigments, enamels, sheep dips and arsenical soaps. It enters into the composition of germicides, insecticides and rat poisons. It also finds employment in calico printing, in the fixation of aniline colours, and as Fowler's solution (potassium arsenite) in medicine. Arsenious oxide arises as a volatile by-product in many smelting operations for the extraction of metals, and in this form has been known from the earliest times, being called Huttenrauch (furnace smoke) by Basil Valentino. It occurs as an impurity or adulterant in many commercial products, having been found in caustic soda, glucose, cosmetics and in certain wines. In 1900 an outbreak of "peripheral neuritis" with various skin affections occurred in Lancashire and was traced to beer made from glucose and invert sugar, in the preparation of which arsenical sulphuric acid had been used.

On concentration, an aqueous solution of arsenious oxide deposits the anhydrous oxide and not arsenious acid, H_3AsO_3. But although this acid has not been isolated its salts are well known. Sodium arsenite and the other alkali arsenites are soluble in water. Silver arsenite, Ag_3AsO_3, is a yellow precipitate soluble in acid or ammonia. Cupric arsenite, $CuHAsO_3$, Scheele's green, is a green powder formerly used extensively for wallpapers and for calico printing. Schweinfurt green, also known as imperial green or emerald green, is a mixed copper metarsenite and acetate, $3Cu(AsO_2)_2,Cu(C_2H_3O_2)_2$, employed as a pigment for wallpapers. By the combined action of damp and moulds, paper tinted with this pigment evolves a peculiar odour said to be due to diethylcacodyl oxide $(As[C_2H_5]_2)_2O$ (Biginelli, 1900).

Arsenic pentoxide, As_2O_5, is manufactured by oxidizing white arsenic (arsenious oxide) with nitric acid (sp. gravity 1·35). The solution on concentration yields crystalline ortho-arsenic acid $H_3AsO_4,\frac{1}{2}H_2O$. At 160°C this substance loses water and passes into the pentoxide, As_2O_5, a deliquescent crystalline solid which at red heat evolves oxygen and reverts to the lower oxide. Arsenic acid was formerly employed in the manufacture of magenta (*see* DYES, SYNTHETIC).

Sodium arsenate, used in calico printing, is prepared by adding sodium carbonate to aqueous arsenic acid or by heating sodium arsenite with sodium nitrate. This salt, which crystallizes as $Na_2HAsO_4,12H_2O$, is isomorphous with the corresponding phosphate (*see* CRYSTALLOGRAPHY.)

Soluble arsenates and phosphates have many properties in common; they both yield colourless crystalline precipitates with ammoniacal solutions of ammonium and magnesium chlorides, and with ammonium molybdate they furnish similar yellow precipitates (arsenomolybdate and phosphomolybdate), but with silver nitrate arsenates give a reddish-brown precipitate, whilst from phosphates a yellow precipitate results.

Sulphides of Arsenic.—Three sulphides are known, two occurring native, yellow orpiment (*auripigmentum*), As_2S_3, in yellow prisms and realgar, As_2S_2, in reddish orange prisms, whereas the pentasulphide is produced artificially either by heating together the trisulphide and sulphur or by acidifying a cold solution of thioarsenate. The tri- and penta-sulphides are insoluble in water but dissolve in alkali sulphides to give alkali thioarsenites and thioarsenates respectively.

Realgar and orpiment are used as pigments and in pyrotechny; they have been produced artificially for these purposes by heating white arsenic with appropriate amounts of sulphur.

Pharmacology and Therapeutics.—Of arsenic and its compounds, arsenious oxide and Fowler's solution (potassium arsenite) are in very common use. The iodide of arsenic is one of the ingredients of Donovan's solution (see MERCURY); and iron arsenate, or a mixture of ferrous and ferric arsenates with some iron oxide, is of great use in certain cases. An iron and arsenic injection is widely employed in anaemic conditions and constitutes one of the few treatments which are effective in such circumstances. Sodium arsenate is somewhat less commonly prescribed.

Externally, arsenious oxide is a powerful caustic when applied to raw surfaces, though it has no action on the unbroken skin. Internally, unless the dose be extremely small, all preparations are severe gastro-intestinal irritants. This effect is the same however the drug be administered, as, even after subcutaneous injection, the arsenic is excreted into the stomach after absorption, and thus sets up gastritis in its passage through the mucous membrane. In

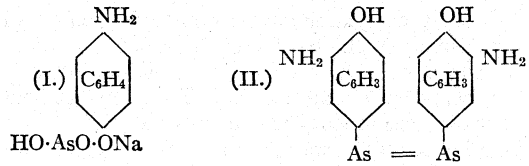
minute doses it is a gastric stimulant, promoting the flow of gastric juice. It is quickly absorbed into the blood, where its presence can be demonstrated especially in the white blood corpuscles. In certain forms of anaemia it increases the number of the red corpuscles and also their haemoglobin content. None of these known effects of arsenic is sufficient to account for the profound change that a course of the drug will often produce in the condition of a patient. It has some power of affecting the general metabolism, but no wholly satisfactory explanation is forthcoming. According to Binz and Schultz its power is due to the fact that it is an oxygen-carrier, arsenious acid withdrawing oxygen from the protoplasm to form arsenic acid, which subsequently yields up its oxygen again. It is thus vaguely called an alterative, since the patient recovers under its use. It is eliminated chiefly by the urine, and to a less extent by the alimentary canal, sweat, saliva, bile, milk, tears, hair, etc., but it is also stored up in the body, mainly in the liver and kidneys. Arsenic is administered on account of its tonic effects on the general and nervous systems. It is also considered by many authorities to have an antiperiodic action as in malaria and it is known to be effective in various chronic skin affections.

Externally arsenious oxide has been much used by quack doctors to destroy morbid growths, etc., a paste or solution being supplied, strong enough to kill the mass of tissue, thus making it slough out quickly. But accidents have resulted from the arsenic being absorbed, the patient being thereby poisoned. Internally it is useful in certain forms of dyspepsia, but as some patients are quite unable to tolerate the drug, it must always be administered in very small doses at first, the quantity being slowly increased as tolerance is shown. Children as a rule bear it better than adults. It should never be given on an empty stomach, but always after a full meal. It is the routine treatment for pernicious anaemia and Hodgkin's disease, though here again the drug may be of no avail. For the neuralgia and anaemia following malaria, for rheumatoid arthritis, for chorea and also asthma and hay fever, it is constantly prescribed with excellent results. Certain skin diseases, as psoriasis, pemphigus and occasionally chronic eczema are much benefited by its use, though sometimes a too prolonged course will produce the very lesion for which in other circumstances it is a cure. Occasionally, as among the Styrians, individuals acquire the habit of arsenic-eating, which is said to increase their weight, strength and appetite, and to clear their complexion. The probable explanation is that an antitoxin is developed within them, but definite proof is not at present forthcoming. Arsenic-eating is also found in Salzburg and the Tirol.

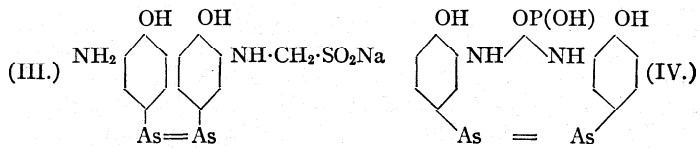
ORGANIC DERIVATIVES OF ARSENIC

Aliphatic Compounds. — The first organometallic material, a fuming liquid, was discovered by L. C. Cadet de Gassicourt in 1760 on heating together white arsenic and potassium acetate. The product was subsequently shown by R. W. Bunsen (1837–43) to consist principally of the substance $(As[CH_3]_2)_2O$ for which the name cacodyl oxide was proposed by J. Berzelius. The inflammability of the liquid was due to the presence of a small amount of cacodyl itself $(CH_3)_2As{\cdot}As(CH_3)_2$. Many cacodyl derivatives were described by Bunsen, who also oxidized the oxide to cacodylic acid $(CH_3)_2AsO{\cdot}OH$, a colourless crystalline solid readily soluble in water or alcohol. Although cacodyl compounds are very toxic, cacodylic acid is comparatively innocuous and its salts are employed medicinally. Sodium cacodylate has been given both by the mouth and intravenously in tuberculosis, diabetes, leprosy, psoriasis and syphilis. Another arsenical salt, sodium methyl arsinate, $CH_3{\cdot}AsO(ONa)_2,H_2O$ (Arrhenal, new cacodyl), prepared by warming an alkaline solution of sodium arsenite with methyl iodide and alcohol, has been employed in the treatment of the foregoing diseases.

Aromatic Compounds. — Greater success has attended the introduction of aromatic derivatives of arsenic. By heating aniline arsenate at 180° Béchamp in 1863 first obtained a substance of acidic character, the sodium salt of which was long afterwards shown by P. Ehrlich and A. Bertheim (1907) to be sodium p-arsanilate or *p*-aminophenyl-arsinate (I.).

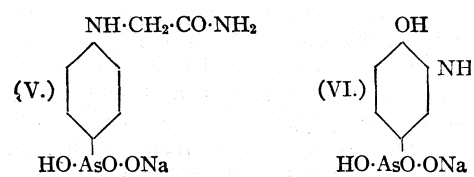


When introduced into medicine, sodium p-arsanilate was found to be forty times less toxic than sodium arsenite (Fowler's solution) and hence received the name "atoxyl." It became extensively employed in the treatment of diseases of protozoal origin such as syphilis and trypanosomiasis. Continued use of the drug was, however, sometimes attended by unpleasant secondary effects, *e.g.*, disturbance of vision followed by atrophy of the optic nerve, and accordingly Ehrlich instituted a search for an organic arsenical in which the ratio between curative dose and lethal dose would be as small as possible. This search culminated in the discovery of salvarsan (3:3′-diamino-4:4′-dihydroxyarsenobenzene dihydrochloride) which is sometimes referred to as "606" in allusion to the circumstance that Ehrlich and his collaborators examined 605 other substances before they obtained the optimum result with salvarsan. The hydrochloride has several other synonyms, arsenobenzol, kharsivan, arsenobillon. Before being administered intravenously, the aqueous solution of the hydrochloride is very carefully neutralized with sodium hydroxide so that the actual drug is the base indicated in formula (II.). Since the preparation of the perfectly neutral solution of salvarsan base suitable for intravenous injection is a process requiring considerable care, another drug was introduced under the name of neosalvarsan (synonyms: neokharsivan, novarsenobenzol, novarsenobillon) which dissolved to a neutral solution without chemical treatment. This substance (III.) is produced by condensing salvarsan dihydrochloride with sodium-formaldehyde-sulphoxylate, $HO{\cdot}CH_2{\cdot}SO_2Na$, whereby a methyl sulphinate group becomes attached to one of the basic groups of salvarsan.



This neutral sodium salt is more popular than salvarsan because of its ease of administration. The German Pharmacopoeia (1926) describes five modifications of salvarsan. In England salvarsan and neosalvarsan come within the scope of the Therapeutic Substances Act (1925). Standard preparations are kept in the National Institute of Medical Research at Hampstead, and biological tests and stability tests are applied to commercial samples. Salvarsan and neosalvarsan are remarkable antisyphilitic remedies and are very widely used for this purpose. Variants have been suggested, such as combinations of salvarsan with silver. French practice has favoured the use of galyl (IV.), a phosphoric acid derivative of salvarsan, and of luargol, a complex co-ordination compound of salvarsan containing silver bromide and an antimony1 group $(C_{12}H_{12}O_2N_2As_2)_2,AgBr,SbO(H_2SO_4)_2$.

It will be noticed that salvarsan and its allies are organic substances containing tervalent arsenic, and until recently substances with arsenic in the lower state of oxidation have been most favoured in therapeutics, but medical opinion is veering round in favour of compounds containing quinquevalent arsenic of which atoxyl was the forerunner. Tryparsamide (V.) or sodium *N*-phenylglycinamide-*p*-arsinate, has had considerable vogue in the treatment of sleeping sickness, having only $\frac{1}{20}$ the toxicity of salvarsan.



Stovarsol (Sodium acetylaminohydroxyphenylarsinate, VI.) has been used extensively in the treatment of amoebic dysentery both alone and in conjunction with auramine, emetine and iodine, the complex drug being termed auremetine. These medicaments have been used in yaws, and in early treatment of syphilis.

A diethylamine salt of stovarsol known as acetylarsan has been used for injections, and a precipitation compound with bismuth has been employed in syphilis and yaws.

Toxicology and Forensic Medicine.—The commonest source of arsenical poisoning is arsenious oxide or white arsenic, which in one form is white and opaque like flour, for which it has been mistaken with fatal results. Moreover, as it has little taste and no colour it is easily mixed with food for homicidal purposes. When combined with potash or soda it is used to saturate flypapers, and strong solutions can be obtained by soaking these in water; this fact has also been used with criminal intent. Copper arsenite (or Scheele's green) used to be much employed as a pigment for wall-papers and fabrics, and toxic effects have resulted from their use. Metallic arsenic is probably not poisonous, but as it usually becomes oxidized in the alimentary canal the symptoms of arsenical poisoning follow its ingestion.

In acute poisoning the interval between the reception of the poison and the onset of symptoms ranges from ten minutes or even less, if a strong solution be taken on an empty stomach, to twelve or more hours if the drug be taken in solid form and the stomach be full of food. The usual period, however, is from half an hour to an hour. In a typical case a sensation of heat developing into a burning pain is felt in the throat and stomach. This is soon followed by uncontrollable vomiting and later by severe purging, the stools being first of all faecal but later assuming a rice-water appearance, and often containing blood. The patient suffers from intense thirst, which cannot be relieved, as drinking is immediately followed by rejection of the swallowed fluid. There is profound collapse, the features are sunken, the skin moist and cyanosed. The pulse is feeble and irregular, and respiration is difficult. The pain in the stomach is persistent, and cramps in the calves of the legs add to the torture. Death may be preceded by coma, but consciousness is often maintained to the end. The similarity of the symptoms to those of cholera is very marked, but if suspicion arises it can be cleared up by examining any of the secretions for arsenic. More rarely the poison attacks the nerve centres, and gastro-intestinal symptoms may be almost or quite absent. In such cases the acute collapse occurs in company with both superficial and deep anaesthesia of the limbs, and is soon followed by coma terminating in death. In criminal poisoning repeated doses are usually given, so that such cases may not be typical, but will present some of the aspects of acute and some of chronic arsenical poisoning. As regards treatment, the stomach should be washed out with warm water by means of a soft rubber tube, an emetic being also administered. Then, if available, freshly precipitated ferric hydrate should be given, which can be prepared by adding a solution of ammonia to one of iron perchloride. The precipitate is strained off, so that the patient may swallow it suspended in water. While this is being obtained, magnesia, castor oil or olive oil can be given; or failing all these, copious draughts of water. The collapse should be treated with hot blankets and bottles, but medical aid should be summoned for the administration of subcutaneous injections of brandy, ether or strychnine, and for injections of morphia to lessen the pain.

Arsenic may be gradually absorbed into the system in very small quantities over a prolonged period, the symptoms of chronic poisoning resulting. The commonest sources used to be wall-papers, fabrics, artificial flowers and toys: also certain trades, as in the manufacture of arsenical sheep-dipping. But cases arising from these causes now occur very rarely. The earliest symptoms are slight gastric disorders, loss of appetite and general malaise, followed later by colicky pains, irritation of eyelids and skin eruptions. But sooner or later peripheral neuritis develops, usually beginning with sensory disturbances, tingling, numbness, formication, and usually cutaneous anaesthesia. Later the affected muscles become exquisitely tender, and then atrophy, while the knee-jerk or other reflex is lost. Pigmentation of the skin may occur in the later stages. Recovery is very slow, and in fatal cases death usually results from heart failure.

After acute poisoning, the stomach at a *post-mortem* presents signs of intense inflammation, submucous haemorrhages are usually present, but perforation is rare. The rest of the alimentary canal exhibits inflammatory changes in a somewhat lesser degree. After chronic poisoning a widely spread fatty degeneration is present. Arsenic is found in almost every part of the body, but is retained in largest amount by the liver, secondly by the kidneys. After death from chronic poisoning it is found present even in the brain and spongy bone. The detection of arsenic in criminal cases is effected either by Reinsch's test or by Marsh's test, the urine being the secretion analysed when available.

Production and Exploitation of Arsenic.—In 1926 the production of arsenic in the United States, Canada and Mexico was about 16,000 tons, whereas the output from the Old World, including Belgium, England, France, Germany, Greece and Japan, was about 11,000 to 12,000 tons. These data are somewhat less than the estimates of the previous year (1925). The United States maintains its lead in both the production and consumption of arsenical compounds. Among the latter are the well-known insecticides, calcium arsenate and lead arsenate, which are employed extensively. Arsenical compounds are also employed as wood preservatives or as clearing agents in glass manufacture.

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ARSENHUS (c. 354–450), an anchorite, said to have been born of a noble Roman family. He was appointed by Theodosius the Great, tutor of the young princes Arcadius and Honorius; but at the age of 40 he retired to Egypt, where for 40 years he lived in monastic seclusion at Scetis in the Thebais, under the spiritual guidance of St. John the Dwarf. He died at the age of 95 at Troe near Memphis. His biography by Simeon Metaphrastes is largely fiction.

Of his writings, two collections of admonitory maxims are extant: see Fr. Combefis in *Auctarium biblioth. patr. novissim.* (1672), pp. 301 et seq.; and Cotelerius, *Eccl. graec, monum.*, 1677, i. pp. 353–372.

ARSENIUS AUTORIANUS (13th century), patriarch of Constantinople, lived about the middle of the 13th century. He received his education in Nicaea at a monastery of which he later became the abbot, though not in orders. Subsequently he led a life of solitary asceticism in a Bithynian monastery. From this seclusion he was called by Theodore II. Lascaris in A.D. 1255 to the position of patriarch at Nicaea, and four years later, on the death of Theodore II. became joint guardian of his son John. His fellow-guardian Georgios Mouzalon was immediately murdered by Michael Palaeologus, who assumed the position of tutor. Arsenius then took refuge in the monastery of Paschasius. In 1261 Michael, having recovered Constantinople, induced Arsenius to undertake again the office of patriarch, but Arsenius excommunicated the emperor for having ordered the young prince John to be blinded.

He was banished to Proconnesus, where some years afterwards (according to Fabricius in 1264; others say in 1273) he died. He declined to remove the sentence of excommunication which he had passed upon Michael, and after his death, when the new patriarch Josephus gave absolution to the emperor, the quarrel was carried on between the "Arsenites" and the "Josephists." The "Arsenian schism" lasted till 1315, when reconciliation was effected by the patriarch Niphon *(see* Gibbon, *Decline and Fall* of *the Roman Empire*, ed. J. B. Bury, 1898, vol. vi. 467 et seq.).

Arsenius is said to have prepared a summary of ecclesiastical laws under the title *Synopsis Canonum.* This was published (Greek original and Latin version) by G. Voel and H. Justel in *Bibliotheca Jur. Canon. Vet.* (1661), 749 et seq. Some hold that the *Synopsis* was the work of another Arsenius, a monk of Athos *(see* L. Petit in Cacant's *Dict. théol. cathol.*, i. col. 1,994); the ascription depends on whether the patriarch Arsenius did or did not sojourn at Mt. Athos.

BIBLIOGRAPHY.—See Georgius Pachymeres ii. 15, iii. *passim*, iv. 1–16; Nicephorus Gregoras iii. I. iv. I.; for the will of Arsenius *see* Cotelerius, *Monumenta* ii. 168.

ARSES, king of Persia, the youngest son of Artaxerxes III., was raised to the throne in 338 B.C. by Bagoas (q v.), who had murdered his father and all his brothers.

But when the young king tried to make himself independent. Bagoas killed him too, with all his children, in the third year of his reign (336 B.C.).

ARSINE, ARSENIURETTED HYDROGEN, also known as arsenic trihydride, is a colourless, neutral gas mith a disagreeable smell, having the formula AsH_3. (See also ARSENIC.)

ARSINOE, the (Greek) name of four Egyptian princesses of the Ptolemaic dynasty. The name was introduced into the Ptolemaic dynasty by the mother of Ptolemy I. This Arsinoe was originally a mistress of Philip II. of Macedon, who presented her to a Macedonian soldier a short time before Ptolemy was born. It was, therefore, assumed by the Macedonians that the Ptolemaic house was really descended from Philip (see PTOLEMIES). .

1. Daughter of Lysimachus, king of Thrace, first wife of Ptolemy II., Philadelphus (285–247 B.C.). Accused of conspiring against her husband, who perhaps already contemplated marriage with his sister, also named Arsinoe, she was banished to Coptos, in Upper Egypt. Her son Ptolemy was afterwards king under the title of Euergetes [see BERENICE (A. 3)].

2. Daughter of Ptolemy I. Soter and Berenice. Born about 316 B.C., she married Lysimachus, king of Thrace. To secure the succession for her own children she brought about the murder of her stepson Agathocles. Lysandra, the wife of Agathocles, took refuge with Seleucus, king of Syria, who made war upon Lysimachus and seized his kingdom (281). After her husband's death Arsinoe fled to Ephesus and afterwards to Cassandreia in Macedonia. Seleucus was murdered in 281 by Ptolemy Ceraunus (half-brother of Arsinoe), who thus became master of Thrace and Macedonia. To obtain possession of Cassandreia, he oifered his hand in marriage to Arsinoe, and being admitted into the town, killed her two younger sons and banished her to Samothrace. Escaping to Egypt, she became the wife of her full brother Ptolemy II., the first instance of the practice of the Greek kings of Egypt of marrying their sisters. She was a woman of a masterful character and won great influence. Her husband, though she bore him no children, was devoted to her and paid her all possible honour after her death in 271.

3. Daughter of Ptolemy III. Euergetes, sister and wife of Ptolemy IV. Philopator. She seems to be erroneously called Eurydice by Justin (xxx. 2), and Cleopatra by Livy (xxvii. 4). Her presence encouraged the troops at the battle of Raphia (217), in which Antiochus the Great was defeated. Her husband put her to death to please his mistress (between 210 and 205). She was worshipped as Thea philopatōris; she and her husband as Theoi philopatores (Polybius v. 83, 84; xv. 25–33).

4. Youngest daughter of Ptolemy XIII., Auletes, and sister of the famous Cleopatra. During the siege of Alexandria by Julius Caesar (48) she was recognized as queen by the inhabitants; her brother, the young Ptolemy, being then held captive by Caesar. Caesar took her with him to Rome as a precaution, but after his triumph she was allowed to return to Alexandria. After the battle of Philippi she was put to death by order of Mark Antony, at the request of Cleopatra (Dio Cassius xlii. 39; Caesar, *Bell. civ.,* iii. 112; Appian., Bell. *civ.,* v. 9).

BIBLIOGRAPHY.—For general authorities see article PTOLEMIES. The article "Arsinoe" in Pauly-Wissowa's Realencyklopadie contains a full list of those who bore the name, and also of the numerous towns which were called after the various princesses.

ARSINOITHERIUM (from the Egyptian queen Arsinoe), a gigantic horned mammal from the Middle Eocene beds of the Fayum, Egypt, representing a sub-order of Perissodactyla called Barypoda. The skull carries a huge pair of horn-cores above the muzzle, which seem to be the enlarged nasal bones, and a rudimentary pair farther back; the front horn-cores, like the rest of the skull, consist of a mere shell of bone, and were probably clothed in life mith horny sheaths. The teeth form a continuous even series, the small canines being crowded between the incisors and premolars; the crowns of the cheek-series are tall (hypsodont), with a distinctive pattern. Although the brain is relatively larger, the bones of the limbs, especially the short, five-toed feet, approximate to those of the Amblypoda and Proboscidea (*qq.v.*); but in the articulation of the astragalus with both the navicular and cuboid *Arsinoitherium* is nearer the former than the latter.

It is probable, however, that these resemblances are mainly due to parallelism in development, and are in all three cases adaptations necessary to support the enormous weight of the body. On the other hand, the marked resemblance of the structure of the tarsus is probably indicative of descent from nearly allied condylarthrous ancestors (see PXENACODUS).

See C. W. Andrews, Descriptive Catalogue of the Tertiary *Vertebrata* of the Fayum, British *Museum* (1906).

ARSON, a crime which has been described as the malicious and voluntary burning of the house of another (3 Co. *Inst.* 66). At common law and by statute it is an offence of the degree of felony. The common-law offence of arson (which has been greatly enlarged by statute) required some part of the house to be actually burnt; neither a bare intention nor even an actual attempt by putting fire in or towards it will constitute the offence, if no part was actually burnt, but the burning of any part, however trifling, is sufficient, and the offence is complete even if the fire is put out or goes out of itself. The burning must be malicious and wilful, otherwise it is only a trespass. If a man by wilfully setting fire to his own house burn the house of his neighbour also, it will be a felony, even though the primary intention of the party was to burn his own house only. The word house, in the definition of the offence at common law, extends not only to dwelling-houses, "but to all outhouses which are parcel thereof, though not adjoining thereto." Barns with corn and hay in them, though distant from a house. are within the definition.

The varieties of the offence are specified in the British Malicious Damage Act 1861. The following crimes are thereby made felonies: (1) setting fire to any church, chapel, meeting-house or other place of divine worship; (2) setting fire to a dwelling-house, any person being therein; (3) setting fire to a house, out-house, manufactory, farm-building, etc., with intent to injure or defraud any person; (4) setting fire to buildings appertaining to any railway, port, dock or harbour; or (5) setting fire to any public building. In these cases the act provides that the person convicted shall be liable, at the discretion of the court, to be kept in penal servitude for life, or for any term not less than three years, or to be imprisoned for any time not exceeding two years, with or without hard labour, and, if a male under 16 years of age, with or without whipping. Setting fire to other buildings, and setting fire to goods in buildings under such circumstances that, if the building were thereby set fire to, the offence would amount to felony, are subject to the punishments last enumerated, with this exception that the period of penal servitude is limited to 14 years. The attempt to set fire to any building, or any matter or thing not enumerated above, is punishable as a felony. In R. v. *Manning,* 1872 (L.R. 1 C.C.R. 338), it was held that an unfinished house was a building within the meaning of the act. The setting fire to crops of hay, grass, corn, etc., is punishable by penal servitude for any period not exceeding 14 years, but setting fire to stacks of the same, or any cultivated vegetable produce, or to peat, coals, etc., is regarded as a more serious offence, and the penal servitude may be for life. For the attempt to commit the last two offences penal servitude is limited to seven years. Setting fire to mines of coal, anthracite or other mineral fuel is visited with the full measure of penalty, and in the case of an attempt the penal servitude is limited to 14 years. By the Dockyards, etc., Protection Act 1772 it is a felony punishable by death wilfully and maliciously to set fire to any of His Majesty's ships or vessels of war, or any of His Majesty's arsenals, magazines, dockyards, rope-yards, victualling offices or buildings therein, or any timber, material, stores or ammunition of war therein or in any part of His Majesty's dominions. If the person guilty is subject to naval discipline, he is triable by court-martial, and if found guilty, a sentence of capital punishment may be passed. The Malicious Damage Act 1861, s. 43,

also includes as a felony the setting fire to any ship or vessel, with intent to prejudice any owner or part owner of the vessel, or of any goods on the same, or any person who has underwritten any policy of insurance on the vessel, or any goods on board the same.

In Scotland the offence equivalent to arson in England is known by the more expressive name of fire-raising. (X.)

United States.—In the United States arson is now a statutory crime in most jurisdictions. Some statutes have enlarged it to include the burning of all sorts of property, in some jurisdictions to include the burning of any building of any nature whatsoever. The usual definition when enlarged by statute includes the burning of a dwelling, house, barn, stable, store, outhouse, shop, office, warehouse, steamboat, vessel, canal boat, church, meeting-house. school-house, public building, water-craft or railroad car. These are the more serious offences, the lesser usually being the burning of any fences, woods, stacks of hay, grain or straw or growing crops. The penalty of the greater offences is regulated by the statutes, anywhere from one to 20 years' imprisonment, the lesser offences usually less than one year or fine or both. The statutes sometimes make "an attempt to commit the crime" equal to the crime of arson, which is another deviation from the common law. Some statutes make it arson for the owner to burn his own building or property for the purpose of defrauding another, *e.g.*, to collect insurance. (J. P. EA.)

ARSOT, a forest near Belfort, eastern France. Area, about 1,500 acres. It is almost encircled by a small stream, the Eloie, and is about 1,400ft. above the sea. It is continued east by the forest of Denney. The lakes and woodlands, associated with cold tertiary clays, are typical of the Trou de Belfort.

ARS-SUR-MOSELLE, a town of Moselle, France, a terminus 5 mi. S. of Metz on the railway to Novéant. It has a handsome Roman Catholic church and extensive foundries; in the vicinity are the remains of a Roman aqueduct. Pop. (1936) 3,109.

ARSUF, a town on the coast of Palestine, 12m. N.N.E. of Jaffa, famous as the scene of a victory of the crusaders under Richard I. of England over the army of Saladin (third Crusade). After the capture of Acre on July 12, 1191, and the departure for home of Philip of France, the army of the crusaders, under Richard Coeur-de-Lion and the duke of Burgundy, opened their campaign for the recovery of Jerusalem by marching southward towards Jaffa, from which place it was intended to move direct upon the holy city. The march was along the seashore, and, the forces of Saladin being in the vicinity, the army moved in such a formation as to be able to give battle at any moment. Richard thus moved slowly, but in such compact order as to arouse the admiration even of the enemy. The right column of baggage and supplies, guarded by infantry, was nearest the sea, the various corps of heavy cavalry, one behind the other, formed the central column, and on the exposed left flank was the infantry, "level and firm as a wall," according to the testimony of Saracen authors. The crusaders maintained for many days an absolutely passive defence, and could not be tempted to fight; Richard and his knights made occasional charges, but quickly withdrew, and on Sept. 7 this irregular skirmishing, in which the crusaders had scarcely suffered at all, culminated in the battle of Arsuf. Saladin had by now decided that the only hope of success lay in compelling the rear of the Christians' column to halt—and thus opening a gap, should the van be still on the move. Richard, on the other hand, had prepared for action by closing up still more, and as the crusaders were now formed a simple left turn brought them into two lines of battle, infantry in first line, cavalry in second line. Near Arsuf the road entered a defile between the sea and a wooded range of hills; and from the latter the whole Muslim army suddenly burst forth. The weight of the attack fell upon the rear of Richard's column, as Saladin desired. The column slowly continued its march, sufferingheavily in horses, but otherwise unharmed. The first assault thus made no impression, but a fierce hand-to-hand combat followed, in which the Hospitallers, who formed the rear of the Christian army, were hard pressed. As Richard gave the signal for the whole line to charge, the sorely pressed Hospitallers rode out upon the enemy on their own initiative. At once the whole of the cavalry followed suit. The head (or right wing) and centre were not closely engaged. and their fleeter opponents had time to ride off, but the rear of the column carried all before it in its impetuous onset, and cut down the Saracens in great numbers. Their loss was more than tenfold that of the Christians, who lost but 700 men. The army arrived at Jaffa on Sept. 10, unopposed, for Arsuf had broken the spirit of the Saracen army. The harvest—Jerusalem—was not reaped, owing to the internal dissensions of the crusaders.

See C. W. C. Oman, *Hist. of the Art of War in the Middle Ages,* **vol.** i. 305–318 (1924).

ART is defined in the article following and under AESTHETICS. There are articles on PAINTING; LANDSCAPE PAINTING; PORTRAIT PAINTING, etc. Technical methods are described under ART: Far *Eastern Methods*; DRAWING; ENGRAVING; ETCHING; LITHOGRAPHY; MEZZOTINT, etc.; CARICATURE; ILLUSTRATION, etc.

The article PERIODS OF ART is supplemented by CHINESE PAINTING; INDIAN AND SINHALESE ART AND ARCHAEOLOGY; JAPANESE PAINTING AND PRINTS, etc.

Artists have full biographies: APELLES; BOTTICELLI; CONSTABLE, etc.

Aspects of Art are treated under BRONZE AND BRASS ORNAMENTAL WORK; IRON IN ART; SILVERSMITHS' AND GOLDSMITHS' WORK, etc.; COSTUME DESIGN; DRESS. etc.; ENAMEL; JEWELLERY; SEALS, etc.; GLASS; INTERIOR DECORATION; LANDSCAPE ARCHITECTURE; MOTION PICTURES; POTTERY AND PORCELAIN; SCULPTURE; TEXTILES AKD EMBROIDERY; THEATRE, and many more.

There are special articles on ARTS AND CRAFTS; ART TEACHING; FINE ARTS; SCHOOLS OF ART; SOCIETIES OF ART, etc.

Many have full cross references and bibliographies.

ART. In any attempt to arrive at a clear and comprehensive definition of the meaning of art it is necessary to disregard all philological or etymological derivations which, in the past, have led to much confusion of thought and to an expansion of the human activities embraced by this term, which oversteps the limitations imposed upon it by the modern conception of its meaning. We are not concerned with the meaning attached to the word Art, or its Greek, Latin and German equivalents, in the past, which was so vague that almost all attempts to define it led to contradictory and often diametrically opposed conclusions, but with the more restricted and purely aesthetic interpretation put upon it by modern thinkers.

The old meaning, in its widest sense, of the Greek τέχνη, the Latin ars, the German *Kunst* (derived from *Können*), implied skill and ability, acquired through patient practice and directed towards a definite end, whether this end be aesthetical, ethical or useful. According to their aim the arts would thus be divided into Fine Arts, Arts of Conduct, and Liberal Arts, the Fine Arts being concerned with the attainment of the beautiful, the Arts of Conduct with the good, and the Liberal Arts with the useful.

In the modern and more restricted sense the term art applies only to those human activities which tend towards an aestheticism —in other words, the Fine Arts—and although, in a figurative way, we speak of the art of cooking, the art of the chase, the art of living, the art of war, and so forth, neither cooking, nor hunting, nor living, nor warfare would ever be seriously included in a list of the arts which embraces the static arts—architecture, sculpture and painting, with their subdivisions—and the dynamic arts—music, poetry and the drama (rhetoric).

Many attempts have been made to explain the essential nature of art, the quality which distinguishes art from all other manifestations of human activity, but most of them lack clearness, do not cover the whole field, or are capable of being extended to non-artistic activities. A number of writers on aesthetics, from Plato and Schiller to K. Lange, recognizing the non-utilitarian, immaterialistic character of art, explain it as a form of play—a theory which cannot be reconciled with the now generally accepted notion that superstitious fear of the unknown forces of nature is one of the main springs of artistic creation in primitive man who, by the productions of his art, tries to placate the mysterious hostile powers or to create symbols of stability and rest in the bewildering turmoil of the universe.

Equally unsatisfactory, in the light of modern speculation,

is the *Einfühlung* (empathy, *q.v*) theory, first advanced by Herder and elaborated, among others, by Vernon Lee, which, whilst throwing valuable light on the true nature of aesthetic enjoyment, does not supply a complete solution of the problem presented by the investigation of the basic constitution of art. Neither is this solution to be found in Croce's equation of art and intuition, nor in Santayana's "objectified pleasure"; less still in the entirely fallacious popular definition of art being nature seen through a temperament. Tolstoy came nearer the truth in insisting upon emotional impulse as indispensable to all artistic expression, but went sadly astray in the elaboration of his theory.

It is scarcely necessary to insist upon the fallacy of such popular notions as the identifications of art with the representation of nature, or, worse still, of the beautiful in nature. Art is not representation, but interpretation; and it is not too much to say that art begins where the artist departs from strict imitation of nature, imposing upon her a rhythm of his own creation, according to his own sense of fitness. Nature is the artist's inexhaustible source of inspiration, but the laws which govern the work of art are wholly independent from the laws of nature. If the Pastoral Symphony is a sublime work of art, it is because Beethoven, far from imitating the sounds of nature in the manner of "programme music" (which more often than not is but remotely connected with art), expressed the emotions awakened in him by intimate communion with nature in terms of abstract rhythm dictated to him by his inspiration and controlled by that perfect craftmanship which is essential to the creation of a work of art.

ART ANDNATURE

It is true that the arts of painting and sculpture, less abstract than the art of music, necessitate a higher degree of verisimilitude to nature; but it is equally certain that the aesthetic appeal of the painter's or sculptor's work, though enhanced by the pleasure of recognition and association with familiar visual experience, is based on abstract qualities akin to the qualities of music, the difference being merely the medium—sound in the one case, form and colour in the other. But whereas our ears are trained to be susceptible to the rhythmic combination of sounds and to accept the musical work of art without probing into the representational meaning of these sounds, the aesthetic education of our eyes has been comparatively neglected. Instinctively we turn to the painting or piece of sculpture with a feeling of curiosity as to its meaning. Instinctively we compare it with our own experience of natural appearance and are apt to make its verisimilitude the criterion of its artistic merit, disregarding, at first sight at least, the abstract rhythm of form and colour which distinguishes the work of art from the mechanical imitation of nature. The associations of the subject are apt to blind us to the essential art qualities. If the Japanese painter looks at a landscape through his straddling legs with his head lowered to the level of his knees, it is because, through seeing his subject upside down, he is not led astray by the associations of the various "incidents" that constitute the landscape, and his attention is riveted upon the pure pattern of colours and forms. For the same reason many Western painters, in the course of their work, at times turn their canvas upside down in order to be able to concentrate on the abstract qualities of the design, which are obscured by "life-like" representation.

If representational truth were the criterion of the work of art, a good photograph would have a better claim to this title than an Egyptian statue, a torso by Michelangelo, the Primavera of Botticelli, or a landscape by Claude or by Cézanne. Yet photography has no place among the arts, even though the photographer may, by his tact in selection, give evidence of a good deal of artistic taste. It does not rank among the arts, because it has to accept nature uncontrolled and unmodified. And it is just that power of control and purposeful modification—vide the broad simplification and relations of planes in the Egyptian statue; the amplified muscles and heightened vitality of the Michelangelo torso; the graceful arabesque line of Botticelli's decorative painting; the orderly classic arrangement of the features in Claude's landscape; the deliberate architectural building up and accentuation of volumes in the Cézanne—that constitute the artistic significance of these works.

The function of art is the creation of beauty. Indeed, it may be said that there is no beauty outside art, or, to be more exact, no beauty that has not been revealed by art. Nothing in nature is either beautiful or ugly, for beauty and ugliness are not positive attributes of matter, but matter is invested with these attributes by the artist's emotional reactions to some outside stimulus Beauty thus resolves itself into objectified aesthetic emotion. The artist has the power to make this emotion visible or audible to others, and to make them partake of his pleasurable excitement We become aware of beauty and acquire the habit of transferring it from the work of art to the aspect of nature which was the source of its inspiration. We learn to see beauty in a tree, in a mountain, and even in things which, before the artist had opened our eyes, left us cold or even repelled us. A toothless old hag becomes beautiful under Rembrandt's magic touch, because he saw his subject emotionally and taught us to see it in the same way. It is doubtful if anybody found anything but dinginess and "ugliness" in the mist and fog of the Thames-side in London before Whistler, by the work of his brush and the poetic imagery of his "Ten o'clock Lecture," invested the murky London atmosphere with permanent beauty.

To go farther back, it is extremely doubtful whether the otherwise highly cultured anthropocentric Greek mind that evolved the ideal type of human proportions, which to this day remains the standard of perfection, was capable of discerning any beauty in the inanimate world. The Greek artist aimed at a perfection of symmetry and rhythm which was beyond the reach of nature. When, therefore, he borrowed any farms from nature, he evolved from them a stylistic formula representing the ideal type of these forms—an ideal which has no counterpart in actual existence. Greek ornament, architectural and otherwise, owes its origin to this attitude.

Until the dawn of the Renaissance in Italy the beauty of mountain scenery was a closed book to the mediaeval mind. A mountain was a thing to be shunned, an impediment to traffic, a source of danger and fatigue. Even a poet of the stamp of Petrarch found it necessary, in a long letter, to plead, as an excuse for his eccentricity in undertaking an unnecessary mountain expedition—an almost unheard-of adventure in his days—the example of Philip of Macedonia, who had ascended Mount Haemus in a similar spirit of enterprise. But this letter, which fills ten printed pages, whilst containing much information about the hardships, dangers and fatigue of the expedition, and theoretical reflections which might as well have been penned at the desk in his study, includes no hint of emotional response to nature in her most majestic moods, no description, no word of aesthetic appreciation. Petrarch in this proved himself the child of his time. Mountains only became beautiful in the eyes of mankind after Giotto and his followers had introduced them into their pictures to replace the traditional gold backgrounds of early mediaeval art. Art had then once more fulfilled its educational mission.

That beauty is not an attribute of nature, but of art, or of the artist's mind, need scarcely be demonstrated. If it were not so, it would be an immutable value, not subject to fluctuations. Yet, not only does the ideal of baauty change with successive generations, but it varies with races and individuals. It is only the beauty values set up by art that remain permanent, and their appreciation is largely a matter of artistic education. To define art as the attainment of the beautiful would, therefore, only be substituting one term for another, and would necessitate the even more elusive definition of the beautiful. Clive Bell's "significant form" as the determining factor of all art does not take us any further, for this "significant form" is only beauty in a new disguise. It would be as difficult to establish where exactly form becomes significant or where beauty begins.

Beauty, although the aim of art, has thus to be eliminated from any plausible and receptable definition of art. To find such a definition it is necessary to trace the common denomination of

the infinitely varied manifestations of human activity which legitimately come under the heading of art, the peculiar characteristic which distinguishes the work of art both from the product of natural forces and of purely industrial activity. What is there in common between, say, a Gothic cathedral, a Beethoven symphony, a Greek vase, a Rembrandt etching, a Giotto fresco, a Shakespeare sonnet, the Ludovisi "Throne of Venus," the stained glass windows of Chartres cathedral, a Benin bronze, an Ispahan carpet, and a Euripedes tragedy, to explain their being accounted as works of art, whilst no such claim could be advanced for a coloured photograph, a cast of the human figure from life, the tawdry mantel ornament of factory production, a piece of doggerel verse, or a rubbishy ballad?

THE PLACE OF CRAFTSMANSHIP

The degree of expressional power acquired by the mastery of craftsmanship, the greater or lesser intensity of the emotional urge, and the varying skill in adjusting the rhythmic relations of lines, colours, forms, sounds or words, distinguish the masterpiece from the inferior artistic production. It is for this reason that Leonardo da Vinci and Michelangelo and Rembrandt stand for all time as supreme masters, whilst their imitators, notwithstanding all their executive skill, are relegated to a comparatively insignificant position in the hierarchy of art. The mysterious smile of the Mona Lisa becomes a meaningless smirk when perpetuated in innumerable versions by apt pupils of the stamp of Gianpietrino. The muscular accentuation and amplification of Michelangelo's heroic sculpture assume an almost ludicrous aspect in Bandinelli and other Italian sculptors of the mid-16th century, because the generation that stood under the spell of the master's genius annexed—and often distorted to the verge of caricature—his forms without having experienced the emotional impulse to which these forms owed their existence. Their relation to Michelangelo finds a counterpart in the attitude of the early 19th century pseudo-classic sculptors to Pheidias and Praxiteles.

Craftsmanship is the handmaiden of art, but is, in the popular mind, often confused with art. Innumerable pictures are produced, year by year, by painters who are endowed with a certain amount of technical skill, but who lack the power of expression because they have nothing to express—copies of nature, painstaking or careless, as the case may be, but devoid of the three elements of art: emotion, expression and rhythm. Such pictures are no more entitled to be reckoned as works of art than the rows of featureless, ill-proportioned brick houses in the working quarters of a modern manufacturing town can claim to be regarded as examples of architectural art.

The function of art is almost as difficult to define as the meaning of art. The main purpose of art is to give pleasure; and for this reason art is held by many to be a useless luxury for the idle. From a materialistic point of view art certainly is useless, in so far as it produces nothing of a strictly utilitarian character.

Yet art is, and has always been, an indispensable need of humanity. It is implanted in the soul of the child, as in that of primitive man. It is as necessary as articulate speech. It is indispensable to civilization. It is the art of each race that gives its civilization its distinct character and rhythm. It reflects, if it does not actually condition, the whole manner of life of a nation or period. Life and art are closely, inseparably interwoven, but life passes—the life of individuals and the life of nations—and art remains. It is the only thing that is permanent; and our knowledge of the past, of civilizations that have flourished and disappeared, is derived almost entirely from the fragmentary relics of their art. It is not from printed books that we visualize and form our estimate of the life, culture and character of ancient Egypt, Assyria, Greece or Rome, but from the ruined buildings, carved stones, half-decayed bronzes, fragments of pottery, frescoed walls, personal adornments and household objects dug out of the ground by the excavator's spade, which are of far greater and more lasting significance than the transitory effects of great wars and revolutionary political changes. History becomes a living reality to us through art. Without it, it would be a dead letter. Above all, art brings pure pleasure into the humblest life. It is a source of exaltation that raises us above the sordid realities of everyday existence. Without art, life would be intolerable, inconceivable. The human imagination requires fcod as imperiously as the human body, and art is the inexhaustible spring from which our imagination draws sustenance.

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PRINCIPLES OF ART

Man, since the earliest period of which there is knowledge, has striven to give his impressions form and meaning. At times, as in the great fifth century in Greece or in the European Renaissance, he has produced work after work astonishingly excellent; and even when culture seemed nearly dormant, as in the early Middle Ages, the urge to represent the impressions and creations of his mind continued in the individual.

A feeling of pleasure is evident on the countenance of a child who has made marks, signifying nothing, in sand. Soon his marks represent familiar objects: a crude circle indicates the sun, an oval supported by straggling lines a dog, and the human form appears with a circle for the head, an inverted Y for the body and legs, and a cross-line for the arms. (See DRAWING.) These figures are crude, for not only does the child lack skill but his models are imperfect memories of his impressions. In a similar way, prehistoric man would seem to have begun to carve and draw on stone, wood, bone and whatever other materials were available, slowly developing his art until it culminated in the figurines and cave-paintings found in Europe.

The desire to incorporate movement in such figures follows their first representation closely. Life itself is movement; even plant life moves, as the Chinese artist who studies the aspiring quality of grass knows; bodies without this movement are dead and uninspiring. In the minds of savages, movement is associated with life so vitally that to them animals may not seem themselves unless moving in a characteristic way. A snake, for instance, is represented by a wavy or zigzag line; often there is no attempt to indicate the more static details; the movement alone suffices.

Rhythm is almost a necessary element of movement. In the line representing a snake curve follows curve. In cave-paintings animals in groups are often inclined upward and downward to indicate movement. Rhythm was soon used simply to create pleasing movement in the relation of various figures, one to another. No one knows what may have been the development of the rhythmical motives which through countless generations have been built up in the minds of the American Indians, the natives of the Pacific islands and other primitive peoples. Such symbolism as adheres to them is often conflicting and vague. The rhythm counts for itself alone. It is satisfying and beautiful.

Once man began to decorate the handles of his weapons, a wall space, skins or his utensils, composition began and proportion was born. If in Europe a prehistoric man wished to carve a reindeer on a dart-thrower, he confined the scope of his work within definite limits and had to evolve a ratio between the length and height of

the reindeer and the length and breadth of the dart-thrower. In time, simple direct proportions became tiresome, more involved relationships formed more intricate compositions, and from the application of an already pleasing quality of art to a given area or form, another pleasing quality, valuable in itself, resulted. Later this was highly developed until, in such works as the sculpture-filled tympana in the pediments of the Parthenon or Leonardo's "Last Supper," the artist utilized his minor figures, each in itself exquisite, to enhance the one on which he wanted attention focused, seeking variety for the individual figures but unity for the whole composition. Often in the history of the arts — though rarely in the East, for the Eastern artist holds tenaciously to fundamental principles in art and is not easily led astray by a new phase — men, becoming interested in other means of making their work beautiful and pleasing, have lost sight of the possibilities in composition. Composition, in a sense, is related to movement and to rhythm, for identical arrangements of lines located differently in given frames produce very different movements, and rhythm can be set up between the structural lines of a composition, or between a structural line and a boundary.

No other important principle in art appeared until the European Renaissance. Meanwhile, the grace of prehistoric carving had been forgotten and sculpture had taken on the stiffer forms of Egypt and Western Asia, whence it came to Greece and flourished in the human form idealized; architecture, in Greece and mediaeval Europe, on the basic structural principles of the post and lintel and the masonry arch, had developed compositions with rhythm, movement and proportions still unequalled; poetry, beginning with the folk-song, had assumed the epic, then shorter, more conventional forms; in Greece the drama had risen to great heights of character portrayal and expression but only its form continued to grow during the period of Imperial Rome, and even that withered during the Middle Ages; and music, in the early days always allied closely with religion, had found in Christianity an energy that ever drove men to seek new ways of using its enchantments to glorify their destiny. In these arts, it will be seen, representation, movement, rhythm, composition and proportion, govern, as in painting.

In the fifteenth century men in Italy attained an efficient knowledge of perspective. Painting achieved a new dimension, depth, and the impetus given to the art was like that given to literature by the invention of printing, to music by Bach's system of equal temperament enabling it to move freely in all keys, or to architecture by steel-skeleton construction. People could now look *into* a picture. Painters tried to grasp not only the outline of the object portrayed but its three-dimensional mass. They strove not so much for the appearance of the object as to portray it as they knew it to exist. On the other hand, they found reason to portray much that they saw but knew to be untrue. It might be argued that the road as it penetrated the distance maintained a constant width; the painter could reply that it looked as though it were growing narrower. Enthusiasm for the possibilities of representing three-dimensional form continues even among modern painters, artists like Cézanne seeking to realize on canvas the basic relationships between solids. Perspective is not essential to enjoyment of a work of art. A picture can be beautiful if painted in the manner of the East, perhaps without perspective. Movement, rhythm, composition and proportion, the elements that from childhood up the race has learned instinctively to watch for and to want, yield most enjoyment in the arts.

With the breaking down of the restraint imposed by mediaeval Christianity, men's minds were freed to realize, unhampered by tradition, their pagan heritage. Equally important, finding again the joy of mental conquest, they sought all forms of knowledge with almost unbelievable persistence. Often, artists were inventors, too. Science entered inextricably the tangled skein of forces influencing srt. Its ever-widening field has since continuously fed the artist with more accurate knowledge of the nature of the objects that he represents, better materials and tools with which to execute his work and, through its agencies, a larger audience. Research has revealed the elements of sound. From the machine, architects and sculptors have learned new harmonies in form and line. The resources of modern invention enhance the drama.

Poetry that expresses the beauties of modern science in exquisite language and form may well capture such beauty and artistic truth as has been rarely known. But the application of scientific principies in art can best be seen in painting. Leonardo da Vinci, himself a scientist, understood that as the subject in question recedes from the eye delicate changes in illumination and hue call for reproduction. Study of chiaroscuro continued, but, although Newton first explained the dispersion of light in 1666, the significance of his discovery for painting was not fully realized until the time of Monet, in the nineteenth century. Monet, understanding that white light is made up of many colours, and that two colours may blend to form a third, achieved his effects by amassing small patches of different colours in close juxtaposition, to be blended by the eye of the observer to produce the colours that he wished to represent; his work carries broken colour to extremity.

Behind all art lie certain fundamental causes. **A** work of art, whether it is a symphony, a poem or a painting, requires of its creator broad and deep understanding of the elements represented, fused with extraordinarily skillful technique by an impelling and emotional urge to create. Whether artistic understanding is inherited or acquired is hardly ascertainable. Technique can be achieved through study, but the physical attributes of the individual artist, such as the hearing of a musician or the eyesight of a painter, affect his facility according to their degree of excellence.

That emotional urge which spurs civilized men to create art has at different times and in different individuals been caused by different influences, but it is safe to say that, analyzed, it may be resolved into a will either to represent nature, as in the early Chinese artists, or to idealize its forms, as in Greece; into a will to escape from this life by exalting symbols of the world to come, by fashioning guardians against its evils, or by propitiating spirits, as in Egypt and in mediaeval Europe; or into a will to exalt an individual or group, as in Imperial Rome and in Renaissance Europe. To-day each of these is present. **(A.** DEW.)

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FAR EASTERN METHODS

The art of the Far East aims to depict the spirit, rather than the semblance, of a thing. So the mission of an oriental artist is not necessarily to represent, but to interpret, the inner meaning of his subject. Vain, indeed, is an attempt to reproduce with paint a phenomenon of Nature. **A** picture of a wild flower, for example, may be true to form and colour, but where are the inherent purity and the fragrance of the blossom? Realizing the utter impossibility of imitation, the eastern painter seeks, instead, to express the impression which he has gained through admiration of nature or to give form to an ideal, by means of his brush, even as the poet expresses himself in words. The mood of the artist, then, is one of self-forgetfulness, since he is merely an interpreter of the beautiful and the mysterious in nature.

It has been said that "art is a tryst," for in the joy of it maker and beholder meet. In the West, this epigram is explained as the reproduction, on the part of the beholder, of the artist's mood at the time of his conception of a work of art. But this dual process, when applied to the art of the Far East, assumes a deeper significance; for in the East art becomes a whole only when the beholder's imagination co-operates with the suggestion conveyed by the artist in his work. The aesthetic nature of the oriental first

seeks intrinsic beauty and then evolves extrinsic completeness. The function of a picture, therefore, is not to display but to suggest; the beautiful is present but it is concealed. After all, a painted twig is important in that it invites one to reconstruct, by exercise of the imagination, a towering tree through which the joy of life flows, and a painted figure is interesting if it depicts the inner nature with its striving for the highest. Hence, the suggestive quality of the art of China and Japan is a vital factor; the more emphatic the suggestion on the part of the artist, the more profound the appeal to the beholder.

It is true that in the pictorial art of the Far East there are various schools or styles, as in the art of the West: idealistic, impressionistic, romantic, realistic, etc.; then, too, the subjects treated by eastern artists include all things religious and secular, animate and inanimate. Yet, taken as a whole, one may note that oriental paintings are distinct, not only in aesthetic expression, but also in technical achievement. In creating a picture, the Far Eastern artist, before all else, grasps the spirit of his subject, then conveys this mood to the brush. He paints, not what he sees, but what he feels. This does not mean an occult treatment of the theme, for in presenting it an intelligible delineation of the subject is demanded. Broadly speaking, the external form is but a mask under which reality hides and this reality the artist attempts to reveal. The importance of the embodiment of soul in a picture was mentioned in China as early as the 4th century; emphasis on this point, however, may be said to date from the 5th century when Hsieh Ho laid down his celebrated "Six Canons of Painting," which have been the basis of art criticism in the Far East throughout the subsequent centuries. The canons, translated freely, are (1) life-motion engendered by spiritual harmony; (2) use of the brush in rendering bone-structure; (3) delineation of forms in conformity with the objects; (4) application of colours appropriate to the kinds; (5) spacing based on proper planning; (6) copying of classic pictures, thereby preserving tradition. A masterpiece should exemplify all six points. It is to be noted that spiritual expression, or life-quality, in art is the prime requisite of the canons. Turning to the remaining five canons, all of which refer to technique, it will be seen that the use of the brush is placed before imitative accuracy in form and colour, composition or tradition; for "brush-strokes" are considered in the light of the bodily structure of that which encases the spirit, while "form" and "colour" are but the flesh and the skin. The term "spacing" means embellishment of the design, and "copying" refers to the transfusion of principles established by past masters. But brush-strokes are more than bone-structure; they are the nerve system as well, for they suggest force, in that they invoke living motion. Motion being durative in nature is best conveyed in uninterrupted lines made by a feeling hand. The strokes, therefore, are more than mere outlines or spots indicating shapes or areas; by their very vigour, they express the life-quality of the subject pictured. Brush-strokes at the same time are an index to the character of the individual who made them, the more inspired the artist, the more spontaneous their response. If the painter is noble-minded, the spiritual expression in his handwork is abundant, and if the spiritual expression is abundant, the picture causes life-motion; otherwise, mere dexterity in brush-manipulation is but the skill of an artisan.

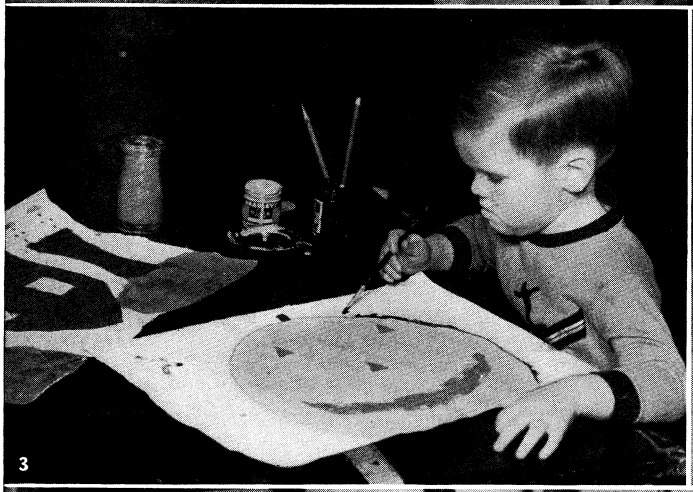
Use of Brush and Ink-tones. — The Far Eastern artist, accordingly, is trained to perceive and to feel that which is beautiful and interesting in nature and to put his conception into execution. His early training is devoted to copying repeatedly model works by his master, consisting of simple drawings effected in broad and vigorous strokes. He begins by grinding "China ink" on an ink-slab, and with a large brush he drams on paper with a view to reproducing the exact order and strength of each stroke of the model. The brush is held perpendicular to the paper, almost at right angles to the hand and is firmly grasped, at a considerable distance from the point, by the thumb, index and middle fingers. During the process of drawing, the fingers remain almost immobile, for the work is done by the arm unsupported, with barely the point of the hair touching the paper. Constant practice in manipulation of the brush in this manner makes the arm alert and flexible, so that lines of even and continuous strength, some swift and some gentle, may be produced through proper control of the nerves of the arm. Only when drawing extremely delicate lines does the hand make use of the wrist as a support.

Ordinarily an oriental artist does not use an easel when painting or drawing, since he works seated with paper or silk spread before him. As he paints, his head is bent down, the shoulders supported by the left arm, of which the hand rests on the table or floor. By long and unceasing practice in handling the brush, he becomes efficient in producing strokes thin or heavy, light in touch or abrupt in force. The brush-strokes in a painting are often compared to those employed in the calligraphy of China and Japan. In fact, in the matter of the use of the brush there exists but little distinction between the two arts. That much attention has been paid to brush-strokes in the Far East is evidenced by careful studies of various types of brush-marks which have been made by great and old masters. There are collections of strokes used in delineating figures, rocks, water, trees, etc., which are referred to as either "wrinkles" or "touches." For drawing and painting the manifold contours of mountains and rocks, there are 16 (or 18) kinds of strokes, each of which is known by a fancy name such as rain-drops, scattered brushwood, alum crystals, demon skin, large axe, horse's teeth, folded belt, hemp fibres, lotus leaf veins, unravelled rope, bullock hair, eddying water, etc. Again, in drawing figures, especially their draperies, there are "touches" known as "harp string," "moving cloud and flowing water," "rat-tail," "willow leaf," etc. These have always been useful guides to painters, and have served to deter beginners from attempting crude and meaningless styles. It must be understood, however, that over-emphasis on classification of this sort and strict adherence to it is detrimental to initiative.

Having acquired a certain amount of facility in manipulation of the brush, the student is next taught the value of ink-tones. The ink used in Far Eastern painting is a mixture of lampblack or pine soot with glue, moulded into cake form. Upon a slate-like slab with a depression at one end to hold a small amount of liquid, the cake of ink is rubbed, with an admixture of water, until the latter becomes a solid black. This process takes place just before painting. When light shades of black are desired, the liquid ink is mixed with water by means of the brush, in a white porcelain saucer, according to the requirement. The much-valued lustre of the ink when dry on paper or silk depends largely upon the quality of the ink itself, as well as upon the stone employed for grinding. It is said that an artist who thoroughly understands the proper use of ink is able to ascertain the shade immediately upon dipping his brush without testing it on the white saucer or on paper.

Like the quality of the brush-strokes themselves, the quality of the ink-tones differs according to the painter, and determines his artistic ability. It is important that a good painting in ink should show proper relation of light and dark tones varying from lustrous black to delicate grey. Satisfactory results demand that various shades be applied in harmonious order, so that there may be no violent break in gradual tone-scales. Indeed, a correct use of ink produces a sense of natural colours, and atmospheric perspective, colours being after all but intermediaries between black and white, and differences in distance but degree of visibility. It must be pointed out that dark ink does not necessarily suggest strength, nor light ink weakness, nor does a heavy stroke always indicate vitality or a thin stroke lack of it. A proper combination of brush-power and ink-tone creates life-motion in a picture. The duration of an inspired mood is but temporary; hence the transference of this mood into ink with the brush must be relatively spontaneous.

There are, roughly, two types of brush-strokes--one broad and often massive, which in itself forms a component part of a picture; the other thin and crisp which is used in the nature of an outline. On both alike, the technical demand of expressiveness is imposed. The brushes used naturally differ in size, but because all except the flat varieties, are so made, of the hair of a deer, goat, fox, badger or rabbit, as to possess needle-like points when wet, and because generally the tips only touch the surface for



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U.S. FEDERAL (WPA) ART CLASSES FOR CHILDREN

1. Group of children painting in a summer playground. The Federal (WPA) art program emphasizes practice rather than instruction in technique
2. Art class in Sacramento, California. Many children attend these classes after school hours, or during the summer
3. A four-year-old boy painting a jack-o'-lantern in water colour at a community centre in Washington, D.C.
4. Pupil in a clay-modelling class
5. Children's art class in New York city. Stimulation of the child's imagination and instinctive feeling for colour is a major objective of the painting classes

ART

A JAPANESE WATER-COLOUR ARTIST AT WORK

PHOTOGRAPH, SPORT AND GENERAL PRESS AGENCY, LTD.

painting, a small drawing may be made with a comparatively large brush. It may be remarked in passing that painters of certain schools use almost the entire length of the hair when it is desired to reproduce an effect of light and shadow in a single stroke. First the brush is allowed to absorb a light shade of ink; then, after touching the tip of the hair to the thick black, a leaf, for example, is immediately painted, the brush being used sidewise and a little pressure being exerted as the drawing is made. The running of the dark ink into the light automatically results in gradation producing in a single stroke the effect of chiaroscuro. A variety of paper which absorbs ink very quickly is used in practising manipulation of the brush, which includes making strokes and producing ink-tones. Because of the bibulous nature of this paper and of the ink used, blurring is likely to occur, unless the amount of ink held on the brush is carefully gauged and the brush-marks made swiftly. The paper admits of no erasing or retouching, thus compelling the pupil to be certain of his every movement prior to actual execution of a picture. Having been instructed in proper use of the brush and in quality of ink-tones, the pupil is allowed to study and sketch from nature.

Sketching and **Colouring.**—Generally speaking, in the art of the Far East sketching from actual objects does not mean working from a model so much as training an artist in the observation of that which is real. According to the Chinese idea, the spirit of all phenomena originated in Heaven and was formed into shape on earth; every phenomenon is endowed with spirit and is a worthy subject for a picture; each is an inspiration for a painter who, by searching inquiry into its peculiar nature, may succeed in grasping its very spirit. Thus an artist is urged to examine every significant feature of his subject and to imagine himself to be it before delineating it. By this means and this alone may he be able to express its spirit. So a sketch-book of an artist may be a jumble of unrelated and incomplete parts of all kinds of plants, landscapes, figures, etc. Useful though these actual sketches are, their importance is insignificant in comparison to the deep mental notes which he has made. For example, a bamboo under different atmospheric conditions, in wind or in rain, in sunlight or in moonlight—how preserve the impression except by mental notes? A great master, in painting a bamboo leaf, though it hang downward, would still indicate its longing to point to the sky; and a story is told of a Chinese painter who, finding that his sketch of caged insects did not adequately picture them, freed the insects in their natural haunts, and himself lying on the ground for purposes of close observation, succeeded in catching the spirit of his subject. Indeed, orientals doubt the desirability of employing, for the sake of anatomical correctness, an ordinary man as a model for a picture of a king. For painting a horse trotting, a study of an animal in a stall is of little value; accordingly, the artist of the Far East tries to delineate his impression of the appearance the horse presented when in motion. It is said that a good picture must needs be truthful, but in reality an attempt at faithful reproduction in paint and with brush is futile; so a painter's aim should be to create a picture which will make on the beholder a deeper impression than the original itself.

The same observations apply to the use of colour. It is true that all visible phenomena have shape and colour, but in making pictures of them, a painter is not concerned with the idea of reproduction. If he were, a sculpture in the round with appropriate colouring would be the ideal medium for his purpose. For this reason, the art of the Far East considers colour but an accessory which adds a certain decorative value to a picture. In introducing colours the artist merely intends to approximate the colour-aspect of the object depicted. Some Eastern connoisseurs argue that since "China ink" correctly used creates a sense of chromatic beauty and the presence of pigments in a painting suggests artificiality, the latter are therefore detractive to the minds of those who love purity. In any case, the palette of the eastern artists is limited, the colouring materials being drawn chiefly from mineral, earth and vegetable substances compounded with fine glue. The medium is water, which fact contributes toward the free movement of the brush, a rigid requirement in order to illustrate motion at the sacrifice of realism.

Conception and Composition,—In their pictures, the artists of the Far East attempt to present a certain space and time within a comparatively small area. Oriental painters seek first to grasp the essential attributes of their subjects and then to depict them with the utmost economy of brush-strokes. Landscapes provide the subjects most often treated. The artist feels that a landscape shows Nature with her manifold mysteries and that therefore it is worthy to be his pictorial theme. He considers it his mission, as well as his privilege, to interpret and present this large subject in a small space, so that both he and the beholder may enjoy and admire nature in her varied forms. Majestic mountain peaks, rambling brooks, gnarled trees shrouded in mists, a solitary hermit —all may be brought to one's home by the artist. In order to represent such a vast scene, it is not possible to depict every detail, so there are suggestions for the right proportions of component parts: "In painting a landscape, make the mountain ten feet high, the tree one foot, the house one-tenth of a foot and the human figure the size of a pea." Then there are conventions which show the oriental attitude toward perspective (*q.v.*). "A mountain at a distance shows no ledge-marks; water at a distance, no waves; a man at a distance, no eyes. Not that these things are absent, but they appear as if they were absent." In executing a painting, the idea of perspective is indicated by three successive planes, one above the other, nearest objects being represented in the lowest plane. The general tones of ink or colour also indicate variations in distance—dark tones for the foreground, light for the far distance and medium tones for the intermediate spaces. The effect, therefore, is not linear but aerial perspective. Instructions in landscape painting deal, not with methods whereby to copy real scenery, but with suggestions how to compose such a picture. As the oriental conception of a landscape is "mountains accompanied by water," the artist who attempts such a theme cannot escape from introducing water in some phase, be it a river, a lake or a waterfall. He selects interesting parts from several scenes for his landscape, and then groups them to form complete unity, thereby creating an entirely new world. However, there should always be a clear distinction between the principal and the subordinate parts. Essays on the subject of landscape speak further of the general characteristics to be associated with scenery in the different seasons: "Mountains in spring should appear as if smiling; in summer as if freshly bathed; in autumn, bedecked; in winter, as if sleeping."

In the Far East, trees, plants, fruits, animals, insects and even fish are often included in the category of "Flower-and-Bird" paintings. The mode to follow in treating these motives is, first, to observe the innocence or the elegance of the flowers, or the instincts of the birds and animals, and then to paint the character or spirit of the subjects. Attempts have been made to establish rules governing the order for making the component parts. Both in China and Japan there are guide-books for painting orchids, chrysanthemums, plum blossoms and bamboos which, because of their virtuous characteristics, are together called the Four Sages. Rules explain the general arrangement of compositions, in particular showing the relation between the *principal* (or guest) and the *subordinate* (or host). The former is the chief portion of the design and the latter its adjunct. Broadly speaking, by *principal* is meant that portion of the design which occupies the centre of attraction, larger in size and more abundant in details. The *subordinate*, which is small in proportion, supports the *principal* by maintaining proper balance in a composition. Balance, in this case, does not denote a symmetrical arrangement of parts, but agreeable spacing in relation to the shape of the paper or silk on which the painting is done. There are also instructions which prescribe the order of brush-strokes to be followed when developing the theme. In painting a picture of bamboo, for example, the main stalk is drawn first in light ink, from the bottom upward, in a few sections which are graduated in length, the lowest being the shortest. The next step is to make the joints with darker ink. Then follow strokes for the branches, in light ink, each drawn by starting from one of the joints. The leaves are painted next, and the artist must bear in mind that each one grows from a branch; they are executed in a variety of ink-tones, due attention being

paid to differences in distance, those nearer being drawn in dark ink. Among painters there are those who would define various arrangements or combinations of leaves by their resemblance to Chinese ideographs, a fact which proves the fastidious manner in which some rules have been formulated. In the main, it is important that a painter of bamboo or of other plants should always remember the natural order of growth, from the root gradually heavenward, and that he should follow in painting the same orderly process. Furthermore, the artist must strive to convey the characteristics of his subjects — the stern quality of the ever-bending but never-yielding bamboo, the courage of the plum which blossoms in winter, the purity of the orchid which unfolds its beauty in solitude and the nobility of the chrysanthemum which possesses the mind of a hermit. Likewise in painting birds, animals, etc., the artist must try to understand their special attributes — the beak and claws of an eagle, the plumage of a peacock, the horns of a deer, etc.; and he must emphasize their significance almost to the point of exaggeration.

Portrait and figure-painting have never attained, in China and Japan, a height corresponding to landscape or flower-and-bird subjects. Painting a figure merely for the sake of showing physical beauty, or a portrait from a model, has not been customary. On the other hand, portraying ideal or imaginary likenesses of historical or legendary persons has been common, which explains the existence of treatises on figure-painting. The latter, however, refer to types of features and facial expressions: an emperor should always look dignified; a general, brave; a recluse, noble; a lady, refined; a farmer, rustic; etc. In addition to this generalization, the essays discuss appropriate accessories to be included in these pictures — palaces, chairs, mountain-scenery, ponds, farms, etc. They also give scales of proportion for a figure: the height of a body in standing pose should be seven times the size of the head; the body when seated should be three times the size of the head; the size of the head itself should be twice the open palm of the subject's hand, etc. Further, the discussion covers varieties of brush-strokes to be used in depicting the draperies of figures, mention of which has already been made. Of course stress is laid upon the importance of revealing the soul of the subjects, but there is no reference to anatomical correctness. The absence of modelling in portraits, as in all subjects, is one of the peculiarities of oriental paintings. The contours of the face, the features and the muscles are indicated by lines. This linear treatment in two dimensions, though it fails to suggest a sense of relief, nevertheless produces a state of animation. In a composition, a figure or a tree often lacks indication of the ground on which it stands; the reason being that the artist, as well as the beholder, prefers that such an obvious element be disregarded entirely. A "filled-up picture" is wearisome, while an empty space allows the beholder's imagination to roam about. When asked what part of a painting is most difficult of execution, a Japanese painter replied: "The space which is to be left unpainted."

Far Eastern paintings are executed in ink and water-colours, usually on either paper or silk that has been sized with a thin solution of a mixture of transparent glue and alum. On the receptive surface of either paper or silk, the work of the artist is executed by one of three methods: (1) by painting immediately without any preliminary sketch; (2) by indicating in charcoal a skeleton of the design; or (3) by preparing a careful outline drawing of the design on a sheet of paper and tracing it upon the surface proper.

Copying and Tradition. — In the art of the Far East certain pictorial subjects frequently recur, each bearing a well-appointed title, usually somewhat fanciful and often poetic. Moreover, their treatment is similar, if not identical. The reason is not far to seek, for the artists of the Orient come of races which not only view the old with reverence, but always revert to the past for inspiration. It has been remarked that a pupil's training consists in copying and recopying his master's works and that there are model-books which show the proper methods of painting various subjects. So much stress upon tradition, at once a safeguard against radicalism and an obstacle to free development, naturally gave birth to pronounced school mannerisms and to restrictions which extend even to choice of subject and result in inevitable repetition. It may be added that artists of the East often select themes which cannot be studied from nature or observed at first hand; consequently, dependence upon old pictures for general guidance is necessary. It is probable, however, that the special reference in the "Six Canons" to copying old masters was not intended to mean mere copying; rather it should be interpreted as emphasizing the importance of preserving that part of tradition which ever lives as an eternal principle and of transmitting it to the next generation. A work of art may betray its maker's individuality, and however hard he may try, he cannot free himself from the influence of the past; so that orientals praise, rather than condemn, one who turns to classic pieces as models. A Chinese in the 4th century pointed out that the art of painting may be developed from copying old masters. There are four recognized methods of copying (1) tracing; (2) reproduction which consists in faithfully copying the original without resorting to the process of tracing; (3) interpretation, being a near copy of the design and characteristics of the original but embodying much of the copyist's personality; (4) reduction, which is usually sketchy in nature. The third method must have been the type of copying recommended by the formulator of the canons. Thereby the copyist preserves what is good of the past and develops it to meet his ideals as well as the conditions of his time. The art of the Far East has been evolving in this manner from the time of its inception.

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ARTA (NARDA or ZARTA), a town in Greece, province of Epirus, on the site of the ancient Ambracia. The present name is derived from its river (anc. Arackthus) which enters the Gulf of Arta south of the town and was formerly the frontier between Greece and Turkey. There are a few old walls, a picturesque bridge, formerly neutral ground, a Byzantine castle on the ancient citadel; the palace of the Greek metropolitan; many mosques and churches. The population (8,446) manufactures woollens, cottons, Russia leather and embroidery, and there is trade in cattle, wine, tobacco, hemp, hides and grain. The neighbouring plain is fertile, and the town has gardens and orchards of orange, lemon and citron. As a Greek frontier post, Arta has often been in dispute. In 1083 it was taken by Bohemund of Tarentum; in 1449 by the Turks; in 1688 by the Venetians. In 1797 it was held by the French, but in 1798 Ali Pasha of Iannina captured it. During the Greek War of Independence it suffered severely; in 1854 it revolted; and in 1881 it was ceded to Greece. In 1897 the Greeks gained some successes at Arta, and after the war of 1912 the Greek annexation of southern Epirus changed Arta's circumstances altogether. Germany occupied Arta in 1941.

ARTA, GULF OF (anc. *Sinus Ambracius*), an inlet of the Ionian sea, 25m. long and 10m. broad, on the west coast of Greece. Its only important affluent, besides the Arta, is the Luro (anc. Charadra). The gulf abounds with mullets, soles, and eels. Around its shores are numerous ruins of ancient cities: Actium at the entrance, where the famous battle was fought in 31 B.C.; Nicopolis, Argos, Limnaea and Olpae.

The river ARTA (anc. Arachthus or *Aratthus*, in Livy xxxviii. 3, *Aretho*) is the chief river of Epirus, and is said to have been navigable in ancient times as far as Ambracia. Below this town it flows through a marshy plain, consisting mainly of its own alluvium; its total length is about 50 miles.

ARTABANUS (ahr″tà-bā′nus), the name of a number of Persian princes, soldiers and administrators. The most important are the following: —

1. Brother of Darius I., and, according to Herodotus, the trusted adviser of his nephew Xerxes. Herodotus makes him a principal figure in his dialogues; he warns Darius not to attack the Scythians (iv. 83; see also iv. 143), and predicts to Xerxes his defeat by the Greeks (vii. 10 et seq., 46 et seq.); Xerxes sent him home to govern the empire during the campaign (vii. 52, 53).

2. Vizier of Xerxes (Ctesias, Pers., 20), whom he murdered in 465 B.C. According to Aristotle (Pol., v. 1311b), he had previously killed Xerxes' son Darius, and was afraid that the father would avenge him; according to Ctesias (Pers., 29, Justin iii. 1, Diod. xi. 69), he killed Xerxes first, and then pretended that Darius had murdered him, and instigated his brother Artaxerxes to avenge the parricide. At all events, during the first months of the reign of Artaxerxes I. he was the ruling power in the State (therefore the chronographers wrongly reckon him as king, with a reign of seven months), until Artaxerxes, having learned the truth about the murder of his father and his brother, overwhelmed and killed Artabanus and his sons in open fight.

3. A satrap of Bactria, who revolted against Artaxerxes I., but was defeated in two battles (Ctesias, *Pers.*, 31).

The name was borne also by four Parthian kings. The Parthian king Arsaces, who was attacked by Antiochus III. in 209, has been called Artabanus by some modern authors without adequate reason.

4. ARTABANUS I., successor of his nephew Phraates II. about 127 B.C., perished in a battle against the Tochari, a Mongolian tribe, which had invaded the E. of Iran (Justin xli. 2). He is perhaps the Artabanus mentioned in Trogus, Prol. xlii.

5. ARTABANUS II. (*c.* A.D. 10–40), son of an Arsacid princess (Tac., *Ann.*, ii. 3), lived in the E. among the Dahan nomads. He was raised to the throne by those Parthian grandees who would not acknowledge Vonones I., whom Augustus had sent from Rome. The war between the two pretenders was long and doubtful; but at last Artabanus defeated his rival completely and occupied Ctesiphon; Vonones fled to Armenia, where he was acknowledged as king, under the protection of the Romans. But when Artabanus invaded Armenia, Vonones fled to Syria, and the Emperor Tiberius thought it prudent to support him no longer. Germanicus, whom he sent to the E., concluded a treaty with Artabanus. Armenia was given (A.D. 18) to Zeno, the son of the king of Pontus (Tac., Ann., ii. 3 et seq., 58; Joseph., Ant., 18. 24).

Artabanus II., like all Parthian princes, was much troubled by the opposition of the grandees. To strengthen his power he killed all the Arsacid princes whom he could reach (Tac., Ann., vi. 31). Rebellions of the subject nations may have occurred also. We learn that he intervened in the Greek city Seleucia in favour of the oligarchs (Tac., Ann., vi. 42, 44), and that two Jewish brigands maintained themselves for years in Neerda in the swamps of Babylonia, and were acknowledged as dynasts by Artabanus (Jos., Ant., 18. 9). In A.D. 35 he tried anew to conquer Armenia, and to establish his son Arsaces as king there. A war with Rome seemed inevitable. But that party among the Parthian magnates which was hostile to Artabanus applied to Tiberius for a king of the race of Phraates. Tiberius sent Phraates' grandson, Tiridates III., and ordered L. Vitellius (the father of the emperor) to restore the Roman authority in the East. Vitellius succeeded completely, and Artabanus, deserted by his followers, fled to the East. Tiridates, who was proclaimed king, could no longer maintain himself, because he appeared to be a vassal of the Romans; Artabanus returned from Hyrcania with a strong army of Scythian (Dahan) auxiliaries, and was again acknowledged by the Parthians. Tiridates left Seleucia and fled to Syria. But Artabanus was not strong enough for a war with Rome; he therefore concluded a treaty with Vitellius, in which he gave up all further pretensions (A.D. 37). A short time afterwards Artabanus was deposed again, and took refuge with his vassal, the king Izates of Adiabene, who induced the Parthians to restore him once more to the throne (Jos., *Ant.*, 20. 3). Shortly afterwards Artabanus died, and was succeeded by his son, Vardanes, whose reign was still more turbulent than that of his father,

6. ARTABANUS III. reigned a short time in A.D. 80 (on a coin of this year he calls himself Arsaces Artabanus) and the following years, and supported a pretender who rose in Asia Minor under the name of Nero (Zonaras xi. 18), but could not maintain himself against Pacorus II.

7. ARTABANUS IV., the last Parthian king, younger son of Vologaeses IV., who died A.D. 209. He rebelled against his brother Vologaeses V. (Dio Cass. vii. 12), and soon obtained the upper hand, although Vologaeses V. maintained himself in a part of Babylonia till about A.D. 222. The Emperor Caracalla, wishing to make use of this civil war for a conquest of the East, attacked the Parthians in 216. He crossed the Tigris, destroyed the towns and spoiled the tombs of Arbela; but when Artabanus advanced at the head of an army, he retired to Carrhae. There he was murdered by Macrinus in April 217. Macrinus was defeated at Nisibis and concluded a peace with Artabanus, in which he gave up all the Roman conquests, restored the booty, and paid a heavy contribution to the Parthians (Dio Cass. lxxviii. 26 et seq.). But at the same time, the Persian dynast Ardashir (q.v.) had already begun his conquests in Persia and Carmania. When Artabanus tried to subdue him his troops were defeated. The war lasted several years; at last Artabanus himself was vanquished and killed (A.D. 226), and the rule of the Arsacids came to an end.

See further PERSIA: *History,* Ancient, and works there quoted.

(ED. M.)

ART AND PART, a term used in Scots criminal law; in contradistinction to "actor," and denoting guilt of the crime by accession before or concomitant with the fact. For practical purposes the distinction between the guilt of an actor, and guilt art and part, in the perpetration of a crime, was abolished by the Criminal Procedure (Scotland) Act 1887. Accession after the fact does not infer guilt of the crime.

ARTAPHERNES or, probably more correctly **ARTAPHRENES,** brother of Darius Hystaspes, and satrap of Sardis. It was he who received the embassy from Athens sent probably by Cleisthenes (*q.v.*) in 507 B.C., and subsequently warned the Athenians to receive back the tyrant Hippias. Subsequently he took an important part in suppressing the Ionian revolt (see IONIA; ARISTAGORAS; HISTIAEUS), and after the war compelled the cities to make agreements by which all differences were to be settled by reference. He also measured out their territories in parasangs and assessed their tributes accordingly (Herod. vi. 42). In 492 B.C. he was superseded in his satrapy by Mardonius (Herodotus v. 25, 30–32, 35, etc.; Diod. Sic. x. 25). His son, of the same name, was appointed (490 B.C.), together with Datis, to take command of the expedition sent by Darius to punish Athens and Eretria for their share in the Ionian revolt. After the defeat of Marathon he returned to Asia. In the expedition of Xerxes, ten years later, he was in command of the Lydians and Mysians (Herod. vi. 94, 119; vii. 74; Aesch., Persae, 21).

Aeschylus in his list of Persian kings (Persae, 775 et seq.), which is quite unhistorical, mentions two kings with the name Artaphrenes. who may have been developed out of these two Persian commanders.

ARTAXERXES, a namd representing Persian Artakhshatra, "he whose empire is well-fitted" or "perfected," Heb. *Artakh*shasta, Bab. Artakshatsu, Susian *Irtakshashsha* (and variants), Gr. *'Αρταξέρξης, 'Αρτοξέρξης,* and in an inscription of Tralles (Dittenberger, *Sylloge,* 573) *'Αρταξέσσης*; Herodotus (vi. 98) gives the translation *μέγας ἀρήιος,* and considers the name as a compound of Xerxes, showing thereby that he knew nothing of the Persian language; the later Persian form is Ardashir, which occurs in the form Artaxias (Artaxes) as the name of some kings of Armenia. It was borne by three kings of the Achaemenian dynasty of ancient Persia.

1.—ARTAXERXES I., surnamed *Macrocheir,* Longimanus, "Longhand," because his right hand was longer than his left (Plut. drtax. i.). He was the younger son of Xerxes, and was raised to the throne in 465 B.C. by the vizier Artabanus, the murderer of his father. After a few months he became aware of the crimes of the vizier, and slew him and his sons in a hand-to-hand fight in the palace. His reign was, on the whole, peaceful; the empire had

reached a period of stagnation. Plutarch (*Artax.* i.) says that he was famous for his mild and magnanimous character, Nepos (de Reg. i.) that he was exceedingly beautiful and valiant. From the authentic report of his cup-bearer Nehemiah we see that he was a kind, good-natured, but rather weak monarch, and he was undoubtedly much under the baneful influence of his mother Amestris (for whose mischievous character cf. Herod, ix. 109 et seq.) and his sister and wife Amytis. His reign was disturbed by several insurrections. At the very beginning the satrap Artabanus raised a rebellion in Bactria, but was defeated in two battles. More dangerous was the rebellion of Egypt under Inarus (Inarōs), which was put down by Megabyzus only after a long struggle against the Egyptians and the Athenians (460–454 B.C.). Out of it sprang the rebellion of Megabyzus, who was exasperated because, though he had persuaded Inarus to surrender by promising that his life would be spared, Artaxerxes, yielding to his wife Amytis, who wanted to avenge the death of her brother Achaemenes the satrap of Egypt, had surrendered Inarus to her for execution.

In 448 the war with Athens was terminated by the treaty concluded by Callias (see CALLIAS and CIMON), by which the Athenians left Cyprus and Egypt to the Persians, while Persia gave up nothing of her rights, but promised not to make use of them against the Greek cities on the Asiatic coast. In the Samian and the Peloponnesian wars, Artaxerxes remained neutral. During the reign of Artaxerxes I. the Jewish religion was definitely sanctioned by law in Jerusalem, on the basis of a firman granted by the king to the Babylonian priest Ezra in 458 B.C., and the appointment of Nehemiah as governor of Judaea in 445 B.C. Artaxerxes I. died in Dec. 425, or Jan. 424 (Thuc. iv. 50). To his reign must belong the famous quadrilingual alabaster vases from Egypt (on which his name is written in Persian, Susian and Babylonian cuneiform characters and in hieroglyphics), for Artaxerxes II. and III. did not possess Egypt. A great many tablets, dated from his reign, have been found in Nippur (published by H. von Hilprecht and Clay The Babylonian Expedition of the University of *Pennsylvania,* series A, Vol. ix.), and a few others at other places in Babylonia. Inscriptions of the king himself are not extant; his grandson mentions his buildings in Susa. For the suggested identification of Artaxerxes I. with the Biblical Ahasuerus see AHASUERUS.

2.—ARTAXERXES II., surnamed Mnemon, the eldest son of Darius II., whom he succeeded in the spring of 404. According to Ctesias (Pers. 57; Plut. *Artax.* i.) he was formerly called Arsaces or Arsikas, whereas Dinon (Plut. *Artax.* i.) calls him Oarses. This is corroborated by a Babylonian tablet with observations of the moon (Brit. Mus. Sp. ii. 749; *Zeitsch.* f. Assyriologie, vii. 223), which is dated from the 26th year of "Arshu, who is Artakshatsu," *i.e.,* 379 B.C. (cp. Ed. Meyer, *Forschungen zur alten Geschichte,* ii. 466 ff.). When Artaxerxes II. mounted the throne, the power of Athens had been broken by Lysander, and the Greek towns in Asia were again subjects of the Persian empire. But the original force of the Persians had been exhausted, and the king, though personally brave and good-natured, was quite dependent upon his favourites and his harem, and especially upon his mother Parysatis. In the beginning of his reign falls the rebellion of his brother Cyrus, who was secretly favoured by Parysatis and by Sparta. Although Cyrus was defeated at Cunaxa, this rebellion was disastrous because it opened to the Greeks the way into the interior of the empire, and demonstrated that no oriental force was able to withstand well-trained Greek soldiers. Greek mercenaries became indispensable not only to the king but also to the satraps, who thereby gained the means for attempting successful rebellions, into which they were provoked by the weakness of the king, and by the continuous intrigues between the Persian magnates. The reign is, therefore, a continuous succession of rebellions. Egypt soon revolted anew and could not be subdued again. When in 399 war broke out between Sparta and Persia, the Persian troops in Asia Minor were quite unable to resist the Spartan armies. The active and energetic Persian general Pharnabazus succeeded in creating a fleet by the help of Evagoras, king of Salamis in Cyprus, and the Athenian commander Conon, and destroyed the Spartan fleet at Cnidus (Aug. 394). This victory enabled the Greek allies of Persia (Thebes, Athens, Argos, Corinth) to carry on the Corinthian war against Sparta, and the Spartans had to give up the war in Asia Minor. But it soon became evident that the only gainers by the war were the Athenians, who in 389, under Thrasybulus, tried to found their old empire anew (see DELIAN LEAGUE). At the same time Evagoras attempted to conquer the whole of Cyprus, and was soon in open rebellion. The consequence was that, when in 388 the Spartan admiral Antalcidas (*q.v.*) came to Susa, the king was induced to conclude a peace with Sparta by which Asia fell to him and European Greece to Sparta. After the peace, Evagoras was attacked. He lost his conquests, but had to be recognized as independent king of Salamis (380 B.C.). Two expeditions against Egypt (385–383 and 374–372) ended in complete failure. At the same period there were continuous rebellions in Asia Minor; Pisidia, Paphlagonia, Bithynia and Lycia threw off the Persian yoke and Hecatomnus, the satrap of Caria, obtained an almost independent position. Similar wars were going on against the mountain tribes of Armenia and Iran, especially against the Cadusians on the Caspian sea. In this war Artaxerxes is said to have distinguished himself personally (380 B.C.), but got into such difficulties in the wild country that he was glad when Tiribazus succeeded in concluding a peace with the Cadusian chieftains.

The peace of Antalcidas (387 B.C.) was an indication of Persian predominance in Greek affairs; and in the following wars all parties, Spartans, Athenians, Thebans, Argives continually applied to Persia for a decision in their favour. After the Theban victory at Leuctra, when the power of Thebes was founded by Epaminondas (*q.v.*), Pelopidas went to Susa (367) and restored the old alliance between Persia and Thebes. The Persian supremacy, however, was not based upon the power of the empire, but only on the discord of the Greeks. Shortly after the edict by which the king had proclaimed his alliance with Thebes, and the conditions of the general peace which he was going to impose upon Greece, his weakness became evident, for since 366 all the satraps of Asia Minor (Datames, Ariobarzanes, Mausolus, Orontes, Artabazus) were in rebellion again, in close alliance with Athens, Sparta and Egypt. The king could do little against them; even Autophradates, satrap of Lydia, who had remained faithful, was forced for some time to unite himself with the rebels. But every one of the allies mistrusted all the others; and the sole object of every satrap was to improve his condition and his personal power, and to make a favourable peace with the king, for which his neighbours and former allies had to pay the costs. The rebellion was at last put down by a series of treacheries and perfidious negotiations. Some of the rebels retained their provinces; others were punished, as opportunity offered. Mithridates betrayed his own father Ariobarzanes (who was crucified), and murdered Datames, to whom he had introduced himself as a faithful ally. When the long reign of Artaxerxes II. came to its close in the autumn of 359 the authority of the empire had been restored almost everywhere.

Artaxerxes himself had done very little to obtain this result. In fact, in the last years of his reign he had sunk into a perfect dotage. All his time was spent in the pleasures of his harem, the intrigues of which were further complicated by his falling in love with and marrying his own daughter Atossa (according to the Persian religion a marriage between the nearest relations is no incest). At the same time, his sons were quarrelling about the succession; one of them, Ochus, induced the father by a series of intrigues to condemn to death three of his older brothers, who stood in his way. Shortly afterwards, Artaxerxes II. died.

In this reign an important innovation took place in the Persian religion. Berossus (in Clemens Alex. *Protrept.* i. 5. 65) tells us that the Persians knew of no images of the gods until Artaxerxes II. erected images of Anaitis in Babylon, Susa, Ecbatana, Persepolis, Bactra, Damascus, Sardis. This statement is proved correct by the inscriptions; all the former kings name only Auramazda (Ahuramazda), but Artaxerxes II. in his building inscriptions from Susa and Ecbatana invokes Ahuramazda,

Anahita and Mithra. These two deities belonged to the old popular religion of the Iranians, but had until then been neglected by the true Zoroastrians; now they were introduced into the official worship much in the way in which the cult of the saints came into the Christian religion. About the history of Artaxerxes II. we are comparatively well informed from Greek sources; for the earlier part of his reign from Ctesias and Xenophon (*Anabasis*), for the later times from Dinon of Ephesus, the historian of the Persians (from whom the account of Justin is derived), from Ephorus (whose account is quoted by Diodorus) and others. Upon these sources is based the biography of the king by Plutarch.

3.—ARTAXERXES III. is the title adopted by Ochus, the son of Artaxerxes II., when he succeeded his father in 359. The chronographers generally retain the name Ochus, and in the Babylonian inscriptions he is called "Umasu, who is called Artakshatsu." The same form of the name (probably pronounced Uvasu) occurs in the Syrian version of the canon of Ptolemy by Elias of Nisibis (Amos).

He was a cruel but an energetic ruler. To secure his throne he put to death almost all his relatives. In 356 he ordered all the satraps to dismiss their mercenaries. Most of them obeyed; Artabazus of Phrygia, who tried to resist and was supported by his brothers-in-law, Mentor and Memnon of Rhodes, was defeated and fled to Philip of Macedon. Athens, whose general Chares had supported Artabazus, was by the threatening messages of the king forced to conclude peace, and to acknowledge the independence of its rebellious allies (355 B.C.). Then the king attempted to subjugate Egypt, but two expeditions were unsuccessful and, in consequence, Sidon and the other Phoenician towns, and the princes of Cyprus, rebelled against Persia and defeated the Persian generals. After great preparations the king came in person, but again the attack on Egypt was repelled by the Greek generals of Nectanebus (346). One or two years later Artaxerxes at the head of a great army, began the siege of Sidon. The Sidonian king Tennes considered resistance hopeless, and betrayed the town to the Persian king, assisted by Mentor, who had been sent with Greek troops from Egypt to defend the town. Artaxerxes repressed the rebellion with great cruelty and destroyed the town. The traitor Tennes was put to death, but Mentor rose high in the favour of the king, and entered into a close alliance with the eunuch Bagoas, the king's favourite and vizier. They succeeded in subjecting the other rebels, and, after a hard fight at Pelusium, and many intrigues, conquered Egypt (343); Nectanebus fled to Ethiopia. Artaxerxes used his victory with great cruelty; he plundered the Egyptian temples and is said to have killed the Apis. After his return to Susa, Bagoas ruled the court and the upper satrapies, while Mentor restored the authority of the empire everywhere in the west. He deposed or killed many Greek dynasts, among them the famous Hermias of Atarneus, the protector of Aristotle, who had friendly relations with Philip (342 B.C.). When Philip attacked Perinthus and Byzantium (340), Artaxerxes sent them support, by which they were enabled to withstand the Macedonians; Philip's antagonists in Greece, Demosthenes and his party, hoped to get subsidies from the king, but were disappointed.

In 338 Artaxerxes III., with his older sons, was killed by Bagoas, who raised his youngest son Arses to the throne. Artaxerxes III. is said never to have entered the country of Persia proper, because, being a great miser, he would not pay the present of a gold piece for every Persian woman, which it was usual to give on such occasions (Plut. *Alex.* 69). But we have a building inscription from Persepolis, which contains his name and genealogy, and invocations of Ahuramazda and Mithra.

For the relations of Artaxerxes I.–III. with the Jews (see JEWS, §§ 19–21). For bibliographical references (see PERSIA: *Ancient* History).

The name Artaxerxes was adopted by Bessus when he proclaimed himself king after the assassination of Darius III. It was borne by several dynasts of Persis, when it formed an independent kingdom in the time of the Parthian empire (on their coins they call themselves Artakhshathr; one of them is mentioned by Lucian *Macrobii,* 15), and by three kings of the Sassanid dynasty, who are better known under the modern form Ardashir (*q.v.*). (ED. M.)

ARTAYGA, the patrician families of the Hadāreb Arabs in the vicinity of Suakin.

See H. A. MacMichael, History of the Arabs in the Sudan. (1922).

ARTEMIDORUS. (1) A geographer of "Ephesus" who flourished about 100 B.C. His large work on general geography (Τὰ γεωγραφούμενα) in 11 books, much used by Strabo and others, is lost, but we possess many small fragments and larger fragments of an abridgment made by Marcianus of Heracleia (5th century), which contains the periplus of the Euxine and accounts of Bithynia and Paphlagonia.

(2) (A. Daldianus.) A soothsayer and interpreter of dreams who flourished during the reigns of Hadrian and the Antonines. His Ονειροκριτικά, or interpretation of dreams, in four books, with an appendix, is extant and affords a valuable insight into ancient superstitions. It is mainly a compilation from the works of earlier authors. According to Suidas, Artemidorus also wrote on augurs and cheiromancy, but all trace of these works is lost. (Editions: Reiff, 1805; Hercher, 1864; translation and notes, Krauss, 1881; English translation by Wood, 1644, and later editions.)

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ARTEMIS (ahr'tĕ-mĭs), one of the principal goddesses in Greek mythology, the counterpart of the Roman Diana (*q.v.*). In Homer, she is the daughter of Zeus and Leto, twin-sister and counterpart of Apollo. She is said to have been born a day before him (on the 6th of the month) and tradition assigns them different birthplaces—Delos to Apollo, Ortygia to Artemis. But the name Ortygia ("home of quails") applies still to Delos, and may well have been a synonym for that island.

Artemis is the goddess of chastity, the protectress of young men and maidens, who defies and contemns the power of Aphrodite. Like her brother, armed with bow and arrows, she deals death to mortals, sometimes gently and suddenly, especially to women, but also as a punishment for offences against herself or morality. With him she takes part in the combat with Python and with Tityus, in the slaughter of the children of Niobe, while alone she executes vengeance on Orion (*q.v.*). She is not only a goddess who deals death, but is also, like Apollo, a healing and a purifying divinity, Oulia ("the healer," cf. Apollo Oulios), *Luaia* ("purifier") and *Sōteira,* "she who saves from all evils." Her connexion with the prophetic art is doubtful, although mention is made of an Artemis Sibylla. To her association with Apollo are certainly to be referred the names Delphinia and Pythia, and titles referring to state and family life. It probably accounts for her appearance as a goddess of seafarers, the bestower of fair weather and prosperous voyages.

It is in the Arcadian and Athenian rites and legends, however, which are certainly earlier than Homer, that the original conception of the goddess is to be found. These tend to show that Artemis was first and foremost a nature goddess, whose cult shows numerous traces of totemism. As a goddess of fertilizing moisture, lakes, rivers, springs and marshy lowlands are brought into close connexion with her. Thus, she is *Limnaia* ("lady of the lake"), *Heleia* ("of marshes"), *Potamia* ("of rivers" especially of the Alpheus, whence her name *Alpheiaia*). Her influence is very active in promoting the increase of the fruits of the field, hence she is specially a goddess of agriculture. She drives away the mice (cf. Apollo Smintheus) and slays the Aloidae (*q.v.*), the corn spirits; she is the friend of the reapers, and requires her share of the first-fruits. Her character as a harvest goddess is shown in the legend of the Calydonian boar, sent by her to ravage the fields in resentment at not having received a harvest offering from Oeneus (see MELEAGER). As *Epimulios* and *Epiklibanios* ("presiding over the mill and the oven") she extends her protection over the further development of the grain for the use of man.

Artemis was naturally also a goddess of trees and vegetation. Near Orchomenus her wooden image stood in a large cedar-tree — an indication that her worship was originally that of the tree itself (Kedreatis, "the cedar goddess"); at Caryae there was an image of Artemis, *Karuatis* ("the nut-tree goddess"). Two curious epithets deserve notice, *Lugodesma* ("bound with withies"), derived from the legend that the image of Artemis Orthia ("upright") was found in a thicket of withies, which twined round it and kept it upright (*lugos* is the *agnus castus,* and points to Artemis in her relation to women); and *Apangchomenē* ("the suspended") probably a reference to the custom of hanging the mask or image of a vegetation-divinity on a tree to obtain fertility (cf. the *Aiōra,* "swing" festival of the Greeks and the oscilla of the Romans).

ARTEMIS FINISHING HER TOILET, AFTER A STATUE FOUND IN THE RUINS OF THE ROMAN CITY OF GABII

The functions of the goddess extended from the vegetable to the animal world, to the inhabitants of the woods and mountains. This is clearly expressed in the cult of Artemis *Laphria* (possibly connected with *laphura* "spoils"), at whose festivals all kinds of animals, both wild and tame, as well as fruits, were thrown together on a huge wood fire. Her general name in this connexion was Agrotera ("roaming the wilds"), to whom 500 goats were offered every year by the Athenians as a thanksgiving in commemoration of the victory at Marathon. It has been observed that she is rather the patroness of the wild beasts of the field than of the more agricultural or domestic animals, although the epithet, Hdmerasia ("the tamer"), seems to refer to her connexion with the latter. The bear was especially associated with her in Arcadia, and in her worship as Artemis Brauronia at Brauron in Attica. According to the legend, Callisto (*q.v.*), an Arcadian nymph, became by Zeus the mother of Arcas, the eponymous hero of the Arcadians. Zeus, to conceal the amour, changed Callisto into a she-bear; Hera, however, discovered it, and persuaded Artemis to slay Callisto, who was placed amongst the stars as Arktos ("the bear"). There is no doubt that Callisto is identical with Artemis; her name is an obvious variation of *Kallistē* ("most beautiful"), a frequent epithet of the goddess.

Closely connected with this legend is the worship of Artemis Brauronia. The accounts of its institution agree that it was intended to appease the wrath of the goddess aroused by the killing of a bear. A number of young girls, between five and ten years of age, wearing bear-skins (afterwards saffron-coloured robes) danced a bear dance, the girls themselves being called bears. In one account a maiden was ordered to be sacrificed to the bear Artemis, but a certain man who had a goat called it his daughter and offered it up in secret, just as at Munychium a fawn dressed up as a girl was sacrificed to the goddess. In place of the goat or fawn a bear might have been expected, but the choice may have been influenced by the animal totem of the tribe into whose hands the ritual fell. The whole is a reminiscence of earlier times, when the goddess herself was a bear, to whom human sacrifice was offered. Callisto was originally a bear-goddess, worshipped in Arcadia, identified with Artemis, when nothing remained of the original animal-worship but name and ritual. Various explanations have been given of the epithet Orthia: (1) that it refers to the primitive type of the "erect" wooden idol; (2) that it means "she who safely rears children after birth," or "heals the sick"; (3) that it has a phallic significance.

The protecting influence of Artemis was extended to man. She was especially concerned in the bringing up of the young. Boys were brought by their nurses to the temple of Artemis *Kourotrophos* ("rearer of boys") and there consecrated to her. At the Apaturia (*q.v.*), on the day called *Koureōtis,* boys cut off and dedicated their hair to her. Girls as well as boys were under her protection. Her function as a goddess of marriage is less certain, but her connexion with child-birth is clearly shown; in many places she is even called *Eilithuia* (goddess of child-birth), who in the earlier poets was regarded as distinct from her. Women in child-birth invoked her aid, and after delivery offered up their clothes or a lock of hair. As already noticed, in Homer Artemis appears as a goddess of death; closely akin to this is the conception of her as a goddess of war.

The idea of Artemis as a virgin goddess, the "queen and huntress, chaste and fair," which attained great prominence in early times, and seems inconsistent with her association with child-birth, is generally explained as due to her connection with Apollo, but it is suggested by Farnell that *Parthenos* originally meant "unmarried," and that "*Artemis* Parthenos originally may have been the goddess of a people who had not yet the advanced Hellenic institutions of settled marriage . . . and when society developed the later family system the goddess remained celibate, though not opposed to childbirth."

There is no trace of Artemis as a moon-goddess in the epic period, and the Homeric hymn knows nothing of her identification with Selene. The attribute of the torch will apply equally well to the goddess of the chase, and epithets such as "light-giving" although applicable, are by no means convincing. The idea dates from the 5th century, and was due to her connection with Hecate and Apollo (*q.v.*). When the latter came to be identified by philosophical speculation with the sun-god Helios, it was natural that his sister and counterpart should be identified with the moon-goddess Selene. But she is nowhere recognized in cult as such.

Various non-Hellenic divinities were identified with Artemis, and their cult gradually amalgamated with hers. The most important of these was Artemis of Ephesus who, like the Greek Artemis, was essentially a nature goddess. the great foster-mother of the vegetable and animal kingdom. Her chief festival, Ephesia or Artemisia, was held in the spring, at which games and various contests took place after the Greek fashion, although the ritual continued to be of a modified oriental, orgiastic type. This goddess is closely connected with the Amazons (*q.v.*), who are said to have built her temple and set up her image in the trunk of a tree. The Greeks of Ephesus identified her with their own Artemis and claimed that her birthplace Ortygia was near Ephesus, not in Delos. She has much in common with the oriental prototype of Aphrodite, and the Cappadocian goddess Ma, another form of Cybele. The usual figure of the Ephesian Artemis, which was said in the first instance to have fallen from heaven, is in the form of a female with many breasts, the symbol of productivity or a token of her function as the all-nourishing mother. From the waist to the feet her image resembles a pillar, narrowing downwards and sculptured all round with rows of animals (lions, rams and bulls).

Among the chief attributes of Artemis are: the hind, specially regarded as her sacred animal; the bear, the boar and the goat; the lion, one of her oldest animal symbols; bow and arrows, as goddess of the chase and death; a mural crown, as the protectress of cities; the torch, originally an attribute of the goddess of the chase or marriage, but, like the crescent (originally an attribute of the Asiatic nature goddesses), transferred to Artemis when she came to be regarded as a moon-goddess. The Greek Artemis was usually represented as a huntress with bow and quiver or torch in her hand, in face very like Apollo, her drapery flowing to her feet, or more frequently, girt high for speed. She is accompanied often by a deer or a dog. Perhaps the finest existing statue of her is the Diana of Versailles from Hadrian's Villa (now in the Louvre), in which she wears a short tunic drawn in at the waist and sandals on her feet; her hair is bound up into a knot at the back of her head, with a band over the forehead. With her left hand she holds a stag, while with the right she is drawing an arrow from the quiver on her shoulder. Another famous statue is one from Gabii, in which she is finishing her toilet and fastening the *chlamys* over her tunic.

In older times her figure is fuller and stronger, and the clothing more complete; certain statues discovered at Delos, imitated from wooden models (xoana), are supposed to represent Artemis; they are described as stiff and rigid, the limbs as it were glued to the body without life or movement, garments closely fitting, the

folds of which fall in symmetrical parallel lines. As a goddess of the moon she wears a long robe, carries a torch, and her head is surmounted by a crescent.

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ARTEMISIA, daughter of Lygdamis, was queen of Halicarnassus and Cos about 480 B.C. She took part in the expedition of Xerxes against the Greeks, and fitted out five ships, with which she distinguished herself in the sea-fight near Salamis (480) (Hdt. vii. 99, viii. *87,* 88). According to Herodotus it was her advice which decided Xerxes not to risk another battle, but to retire at once from Greece. (For the legend of her love for Dardanus of Abydos, and her death by leaping from the Leucadian promontory, *see* Photius, *Cod.* 153a.)

ARTEMISIA, the sister and wife of Mausolus (or Maussollus), king of Caria, was sole ruler from about 353 to 350 B.C. She built for her husband, in Halicarnassus, the magnificent Mausoleum, which was one of the seven wonders of the world. There are statues of Mausolus and Artemisia in the British Museum.

See Vitruvius ii. *8*; Diodorus Siculus xvi. 36; Cicero, *Tusc.,* iii. **31**; Val. Max. **iv.** 6.

ARTEMISIA, a large genus of plants of the family Compositae (*q.v.*), comprising some 280 species, most abundant in arid regions, notably in the western United States, the Asiatic steppes, South Africa and South America. They are bitter-aromatic herbs or low shrubs, often with much divided leaves and with inconspicuous flowers borne in very numerous small heads. Several are grown for ornamental and medicinal purposes. Four species are found in Great Britain; 75 or more occur in the United States and Canada, chiefly from the Great Plains westward, and several Old World species have become widely naturalized. Here belong the wormwood, beach-wormwood, mugwort (*qq.v.*), southernwood and tarragon of the gardens and also the well-known sagebrush (*q.v.*) of western North America.

ARTEMON (fl. *c.* A.D. *230*), a prominent Christian teacher at Rome, who held Adoptianist *(see* ADOPTIANISM), or humanitarian, views of the same type as his elder contemporaries the Theodotians, though perhaps asserting more definitely than they the superiority of Christ to the prophets in respect of His supernatural birth and sinlessness. *(See* MONARCHIANISM.)

ARTEMOVSK (formerly Bakhmut), a town and railway junction in the Artemovsk province of the Ukrainian S.S.R. Lat. 48° 34' N.. long. 38° E. Population (1939) 55,165. Its salt springs and salt mines have been worked since the 17th century. Coal, alabaster and quicksilver are also mined, and steel rails manufactured.

ARTENA, village, province of Rome, Italy, at north-northwest extremity of Volscian Mountains; 36 mi. S.E. by rail, and 24 mi. direct from Rome. Pop. of the commune (1936), 6,343; town, 3,725. On the mountain above (2,073 ft.) are fine remains of a fortified city built in rough blocks of local limestone; within the walls are traces of buildings, and a massive terrace which supported some edifice of importance. The name of this city is quite uncertain; Ecetra is a possible suggestion.

See T. Ashby and *G.* J. Pfeiffer in *Supplementary* Papers *of the American School in Rome,* i. 87 *seq.,* for an account of the ruins.

ARTERIES, in anatomy, the elastic tubes which carry the blood away from the heart to the tissues. As, after death, they are always found empty, the older anatomists believed that they contained air, and to this belief they owe the name, which was originally given to the windpipe (*trachea*). Two great trunks, the aorta and pulmonary artery, leave the heart and divide again and again until they become minute vessels to which the name of arterioles is given. The larger trunks are fairly constant in position and receive definite names, but as the smaller branches are reached there is an increasing inconstancy in their position. Many arteries are tortuous, especially when they supply movable parts such as the face or scalp, but when one or two sharp bends are found they are generally due to the artery going out of its way to give off a constant and important branch. Small arteries unite or anastomose with others near them very freely, so that when even a large artery is obliterated a collateral circulation is carried on by the rapid increase in size of the communications between the branches coming off above and below the point of obstruction. Some branches, however, such as those going to the basal ganglia of the brain and to the spleen, are known as "end arteries" and these do not anastomose with their neighbours at all; thus, if one is blocked, arterial blood is cut off from its area of supply. As a rule, there is little arterial anastomosis across the middle line of the body near the surface, though the scalp, lips and thyroid body are exceptions.

The distribution of the pulmonary artery is considered with the anatomy of the lungs *(see* RESPIRATORY SYSTEM).

Aorta.—The *Aorta* lies in the cavities of the thorax and abdomen, and arises from the base of the left ventricle of the heart. It ascends forward, upward, and to the right as far as the level of the second right costal cartilage, then runs backward, and to the left to reach the left side of the body of the 4th thoracic vertebra, and then descends almost vertically. It thus forms the *aortic arch,* which has attached to its concave surface a fibrous cord, the *ductus arteriosus,* which connects it with the left branch of the pulmonary artery. The aorta continues downward close to the bodies of the thoracic vertebrae, then passes through an opening in the diaphragm (*q.v.*), enters the abdomen, and descends in front of the bodies of the lumbar vertebrae as low as the 4th, where it usually divides into two terminal branches, the common iliac arteries. Above and behind the angle of bifurcation, however, a long slender artery, called the *middle sacral,* is prolonged downward in front of the sacrum to the end of the coccyx.

Carotid System.—The branches for the head, neck and upper limbs arise, as three large arteries from the transverse part of the aorta; they are named *innominate, left common carotid* and *left subclavian.* The innominate artery is the largest and passes upward and to the right, to the root of the neck, where it divides into the right common carotid and the right subclavian. The carotid arteries supply the two sides of the head and neck; the subclavian arteries the two upper extremities. The *common carotid* artery runs up the neck by the side of the windpipe, and on a level with the upper border of the thyroid cartilage divides into the internal and external carotid arteries.

The *internal carotid* artery ascends through the carotid canal in the temporal bone into the cranial cavity. It gives off an *ophthalmic* branch to the eyeball and other contents of the orbit, and then divides into the *anterior* and *middle cerebral* arteries. The middle cerebral artery extends outward into the Sylvian fissure of the brain, and supplies the island of Reil, the orbital part, and the outer face of the frontal lobe, the parietal lobe, and the temporo-sphenoidal lobe; it also gives a choroid branch to the choroid plexus of the velum interpositum. The anterior cerebral artery supplies the inner face of the hemisphere from the anterior end of the frontal lobe as far back as the internal parieto-occipital fissure. At the base of the brain not only do the two internal carotids anastomose with each other through the *anterior communicating* artery, which passes between their anterior cerebral branches, but the internal carotid on each side anastomoses with the posterior cerebral branch of the basilar, by a *posterior communicating* artery. In this manner a vascular circle, the *circle of Willis,* is formed, which permits of freedom of circulation between the arteries on opposite sides of the mesial plane. The vertebral and internal carotid arteries, which are the arteries of supply for the brain, are distinguished by lying at some depth from the surface in their course to the organ, by having curves or twists in their course, and by the absence of large collateral branches.

The *external carotid* artery ascends through the upper part **of**

the side of the neck. and behind the lower jaw into the parotid gland, where it divides into the internal maxillary and superficial temporal branches. This artery gives off the following branches: *(a) Superior thyroid* to the larynx and thyroid body; *(b) Lingual* to the tongue and sublingual gland; *(c) Facial* to the face, palate, tonsil and submaxillary gland; *(d) Occipital* to the sterno-mastoid muscle and back of the scalp; *(e) Posterior auricular* to the back of the ear and the adjacent part of the scalp; *(f) Superficial temporal* to the scalp in front of the ear, and by its *transverse facial* branch to the back part of the face; *(g) Internal maxillary,* giving *muscular* branches to the muscles of mastication, *meningeal* to the dura mater, *dental* to the teeth, and other branches to the nose, palate and tympanum; *(h) Ascending pharyngeal,* which supplies the pharynx, palate, tonsils and dura mater.

Subclavian System.—The *subclavian* artery is the commencement of the great arterial trunk for the upper limb. It passes across the root of the neck and behind the clavicle, where it enters the armpit, and becomes the *axillary* artery; by that name it extends as far as the posterior fold of the axilla, where it enters the upper arm, takes the name of *brachial,* and courses as far as the bend of the elbow; here it bifurcates into the *radial* and *ulnar* arteries. From the subclavian part of the trunk the following branches arise:—(a) *Vertebral,* which enters the foramen at the root of the transverse process of the 6th cervical vertebra, ascends through the corresponding foramina in the vertebrae above, lies in a groove on the arch of the atlas, and enters the skull through the foramen magnum, where it joins its fellow to form the *basilar* artery; it gives off numerous branches in its course. The *basilar* artery extends from the lower to the upper border of the pons Varolii; it gives off *transverse* branches to the pons, *auditory* and *inferior cerebellar* branches and breaks up into four terminal branches; viz., two *superior cerebellar* and two *posterior cerebral; (b) Thyroid axis,* which immediately divides into the *inferior thyroid,* the *suprascapular,* and the *transverse cervical* branches; *(c) Internal mammary,* which supplies the anterior surface of the walls of the chest and abdomen, and the upper surface of the diaphragm; *(d) Superior intercostal,* which supplies the first intercostal space,,and by its deep *cervical* branch the deep muscles of the back of the neck.

The *axillary* artery supplies *thoracic* branches to the wall of the chest, the pectoral muscles, and the fat and glands of the axilla; an *acromio-thoracic* to the parts about the acromion; *anterior* and *posterior circumflex* branches to the shoulder joint and deltoid muscle; a *subscapular* branch to the muscles of the posterior fold of the axilla.

The *brachial* artery supplies *muscular* branches to the muscles of the upper arm; a *nutrient* branch to the humerus; *superior* and *inferior profunda* branches and an *anastomotic* to the muscles of the upper arm and the region of the elbow joint.

The *ulnar* artery extends down the ulnar side of the front of the fore-arm to the palm of the hand, where it curves outward toward the thumb, and anastomoses with the superficial volar or other branch of the radial artery to form the *superficial palmar arch.* In the fore-arm the ulnar gives off the *interosseous* arteries, which supply the muscles of the fore-arm and give *nutrient* branches to the bones; two *recurrent* branches to the region of the elbow; *carpal* branches to the wrist joint: in the hand it gives a *deep* branch to the deep muscles of the hand, and from the superficial arch arise *digital* branches to the sides of the little, ring, and middle fingers, and the ulnar border of the index finger.

The *radial* artery extends down the radial side of the front of the fore-arm, turns round the outer side of the wrist to the back of the hand, passes between the 1st and and metacarpal bones to the palm, where it joins the deep branch of the ulnar, and forms the *deep palmar* arch. In the fore-arm it gives off a *recurrent* branch to the elbow joint; *carpal* branches to the wrist joint; and *muscular* branches, one of which, named superficial volar, supplies the muscle of the thumb and joins the ulnar artery: in the hand it gives off a branch to the thumb, and one to the radial side of the index, *interosseous* branches to the interosseous muscles, *perforating* branches to the back of the hand, and *recurrent* branches to the wrist.

Visceral Branches.—The branches of the aorta which supply the viscera of the thorax are the coronary, the oesophageal, the bronchial and the pericardiac. The *coronary* arteries, two in number, are the first branches of the aorta, and arise opposite the anterior and left posterior segments of the semilunar valve, from the wall of the aorta, where it dilates into the sinuses of Valsalva. They supply the tissue of the heart.

The *oesophageal, bronchial* and *pericardiac* branches are sufficiently described by their names.

The branches of the aorta which supply the viscera of the abdomen arise either singly or in pairs. The single arteries are the coeliac axis, the superior mesenteric, and the inferior mesenteric, which arise from the front of the aorta; the pairs are the capsular, the two renal, and the two spermatic or ovarian, which arise from its sides. The single arteries supply viscera which are either completely or almost completely invested by the peritoneum, and the veins corresponding to them are the roots of the vena portae. The pairs of arteries supply viscera developed behind the peritoneum, and the veins corresponding to them are rootlets of the inferior vena cava.

The *coeliac axis* is a thick, short artery, which almost immediately divides into the gastric, hepatic and splenic branches.

The *superior mesenteric* artery gives off an *inferior pancreatico-duodenal* branch to the pancreas and duodenum; about twelve *intestinal* branches to the small intestines, which form in the substance of the mesentery a series of arches before they end in the wall of the intestines; an *ileocolic* branch to the end of the ileum, the caecum and beginning of the colon; a *right colic* branch to the ascending colon; and a *middle colic* branch to the transverse colon.

The *inferior mesenteric* artery gives off a *left colic* branch to the descending colon, a *sigmoid* branch to the iliac and pelvic colon, and ends in the *sztperior haemorrhoidal* artery, which supplies the rectum.

The *capsular* arteries, small in size, run outward from the aorta to end in the suprarenal capsules.

The *renal* arteries pass one to each kidney. Additional renal arteries are fairly common.

The *spermatic* arteries are two long slender arteries, which descend, one in each spermatic cord, into the scrotum to supply the testicle. The corresponding ovarian arteries in the female do not leave the abdomen.

Parietal Branches.—The branches of the aorta which supply the walls of the thorax, abdomen and pelvis, are the intercostal, the lumbar, the phrenic and the middle sacral.

The *intercostal* arteries arise from the back of the thoracic aorta, and are usually nine pairs. They run round the sides of the vertebral bodies as far as the commencement of the intercostal spaces, where each divides into a *dorsal* and a *proper inter-*

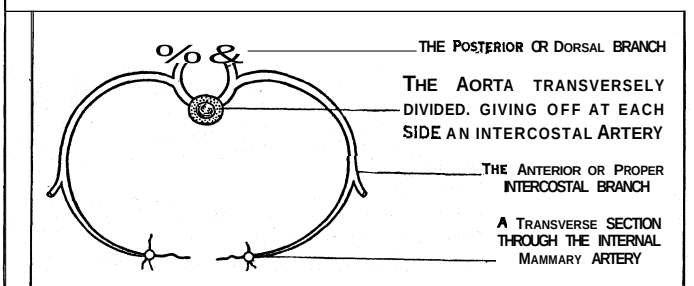


FIG. 1.—A PAIR OF INTERCOSTAL ARTERIES AND THEIR BRANCHES

costal branch; the dorsal branch passes to the back of the thorax to supply the deep muscles of the spine; the proper intercostal branch runs outward in the intercostal space to supply its muscles, and the lower pairs of intercostals also give branches to the diaphragm and wall of the abdomen. Below the last rib a subcostal artery runs.

The *lumbar* arteries arise from the back of the abdominal aorta, and are usually four pairs. They run round the sides of the lumbar vertebrae, and divide into a *dorsal* branch which supplies the deep muscles of the back of the loins, and an *abdominal*

branch which runs outward to supply the wall of the abdomen. The distribution of the lumbar and intercostal arteries exhibits a transversely segmented arrangement of the vascular system, like the transversely segmented arrangement of the bones, muscles and nerves met with in these localities, but more especially in the thoracic region.

The two *phrenic* arteries supply the under surface of the diaphragm.

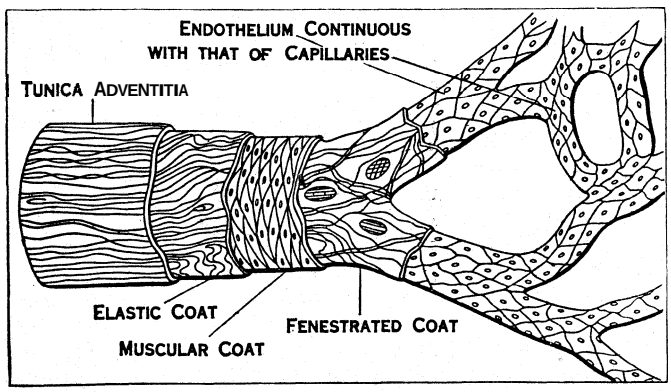


FIG. 2.—A DIAGRAM SHOWING THE STRUCTURE OF AN ARTERY

The *middle sacral* artery, as it runs down the front of the sacrum, gives branches to the back of the pelvic wall.

The arteries to the pelvis and hind limbs begin at the bifurcation of the aorta into the two common iliacs.

Iliac System.—The *common iliac* artery, after a short course, divides into the internal and external iliac arteries. The *infernal iliac* enters the pelvis and divides into branches for the supply of the pelvic walls and viscera, including the organs of generation, and for the great muscles of the buttock. The *external iliac* descends behind Poupart's ligament into the thigh, where it takes the name of *femoral* artery. The femoral descends along the front and inner surface of the thigh, gives off a profunda or deep branch, which, by its *circumflex* and *perforating* branches, supplies the numerous muscles of the thigh; most of these extend to the back of the limb to carry blood to the muscles situated there. The femoral artery then runs to the back of the limb in the ham, where it is called *popliteal* artery. The popliteal divides into two branches, of which one, called *anterior tibial*,

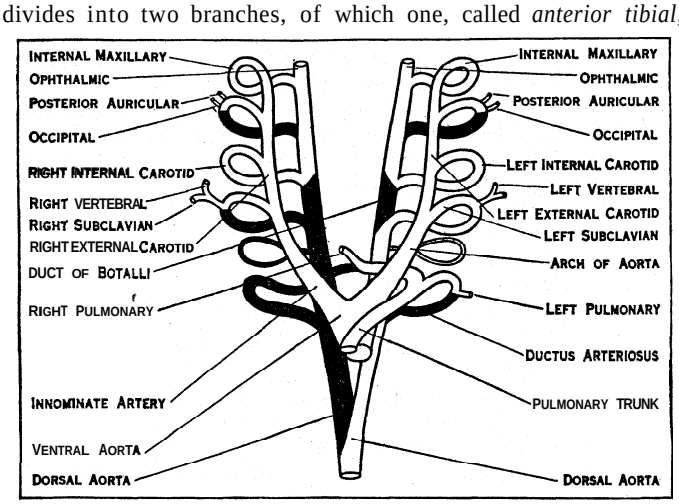


FIG. 3.— ARRANGEMENT OF THE ARTERIAL ARCHES

passes between the bones to the front of the leg, and then downward to the upper surface of the foot; the other, *posterior tibial*, continues down the back of the leg to the sole of the foot, and divides into the *internal* and *external plantar* arteries; branches proceed from the external plantar artery to the sides of the toes, and constitute the *digital* arteries. From the large arterial trunks in the leg many branches proceed, to carry blood to the different structures in the limb.

Structure of Arteries.—The wall of an artery consists of several coats (*see* fig. 2.). The outermost is the *tunica adventitia*, composed of connective tissue; immediately internal to this is the *yellow elastic* coat; within this again the *muscular* coat, formed of involuntary muscular tissue arranged transversely to the long axis of the artery; in the larger arteries the elastic coat is much thicker than the muscular, but in the smaller the muscular coat is relatively strong; the vaso-motor nerves terminate in the muscular coat. In the greater part of the aorta and arteries of the retina there is nc muscular coat. Internal to the muscular coat is the *elastic fenestrated coat*, formed of a smooth elastic membrane perforated by small apertures. Most internal of all is a layer of *endothelial cells*, which form the free surface over which the blood flows. The arteries are not nourished by the blood which flows through them, but by minute vessels, *vasa vasorum*, distributed in their external, elastic and muscular coats.

EMBRYOLOGY

The earliest appearance of the blood vessels is dealt with under VASCULAR SYSTEM. Here will be briefly described the fate of the main vessel which carries the blood away from the truncus arteriosus of the developing heart (*q.v.*). This ventral aorta, if traced forward, soon divides into two lateral parts, the explanation being that there were originally two vessels, side by side, which fused to form the heart, but continued separate anteriorly. The two parts run for a little distance toward the head of the

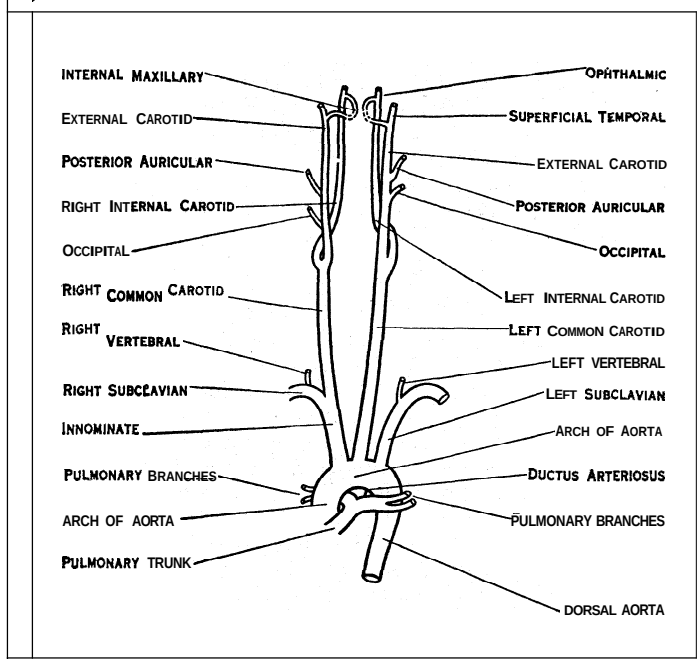


FIG. 4.— THE HUMAN AORTA. THE GREAT ARTERY WHICH CARRIES THE BLOOD FROM THE HEART TO ALL PARTS OF THE BODY EXCEPT THE LUNGS, AND ITS MAIN BRANCHES

embryo, ventral to the alimentary canal, and then turn toward the dorsum, passing one on either side of that tube to form the first aortic arch. Having reached the dorsum they turn backward toward the tail end and form the dorsal aortae. The anterior loop between the ventral and dorsal aortae already described as the first aortic arch is included in the *maxillary* or *first visceral* arch of the soft parts (*see* fig. 3, *1*). Later, four other well-marked aortic arches grow behind this in the more caudal visceral arches, so that there are altogether five arterial arches on each side of the pharynx, through which the blood can pass from the ventral to the dorsal aorta. Of these arches the first soon disappears, but is probably partly represented in the adult by the *internal maxillary* artery, one branch of which, the *infra-orbital*, is enclosed in the upper jaw, while another, the *inferior dental*, is surrounded by the lower jaw. Possibly the ophthalmic artery also belongs to this arch. The second arch also disappears, but the *posterior auricular* and *occipital* arteries probably spring from it, and at an early period it passed through the stapes as the transitory stapedial artery. The third arch forms the beginning

of the internal carotid. The fourth arch becomes the arch of the adult aorta, between the origins of the left carotid and left subclavian on the left side, and the first part of the right subclavian artery on the right. The apparent fifth arch on the left side (fig. 3) remains all through foetal life as the *ductus arteriosus,* and, as the lungs develop, the pulmonary arteries are derived from it. J. E. V. Boas and W. Zimmermann have shown that this arch is in reality the sixth and that there is a very transitory true fifth arch in front of it (fig. 3). The part of the ventral aorta from which this last arch rises is a single median vessel due to the same fusion of the two primitive ventral aortae which precedes the formation of the heart, but a spiral septum has appeared in it which divides it in such a way that while the anterior or cephalic arches communicate with the left ventricle of the heart, the last one communicates with the right (see HEART). The fate of the ventral and dorsal longitudinal vessels must now be followed. The fused part of the two ventral aortae, just in front of the heart, forms the ascending part of the adult aortic arch, and where this trunk divides between the fifth and fourth arches (strictly speaking, the sixth and fifth), the right one forms the innominate (fig. 3) and the left one a very short part of the transverse arch of the aorta until the fourth arch comes off (see fig. 4). From this point to the origin of the third arch is common carotid, and after that, to the head, external carotid on each side. The dorsal longitudinal arteries on the head side of the junction with the third arch form the internal carotids. Between the third and fourth arches they are obliterated, while on the caudal side of this, until the point of fusion is reached on the dorsal side of the heart, the left artery forms the upper part of the dorsal aorta, while the right entirely disappears. Below this point the thoracic and abdominal aortae are formed by the two primitive dorsal aortae which have fused to form a single median vessel. As the limbs are developed, vessels bud out in them. The subclavian for the arm comes from the fourth aortic arch on each side, while in the leg the main artery is a branch of the caudal arch which is curving ventralward to form the umbilical artery. From the convexity of this arch the internal iliac and sciatic at first carry the blood to the limb, as they do permanently in reptiles, but later the external iliac and femoral become developed, and, as they are on the concave side of the bend of the hip, while the sciatic is on the convex, they have a mechanical advantage and become the permanent main channel.

For further details see O. Hertwig, Handbuch der *vergleichenden und* experintentellen *Entwickelungslehre* der *Wirbeltiere* (Jena, 1905).

For the heart and vascular systems in other animals see HEART, COMPARATIVE PHYSIOLOGY OF; FISH; AMPHIBIA; REPTILES; BIRDS; MAMMALIA; CRUSTACEA; INSECTS; MOLLUSCA; ANNELIDA; etc. (F. G. P.)

ARTERIES, DISEASES OF. Apart from their implication in neighbouring foci of disease, *e.g.,* abscess or new growth, arteries suffer from certain well-defined morbid processes whereby the character of their walls is affected and changes may be induced in the tissues they normally supply with blood and in the heart which pumps that blood along them. The chief of these processes are atheroma, arteriosclerosis, syphilitic endarteritis (endarteritis obliterans), embolism and thrombosis. In addition the normal diameter of the arteries may be altered by nervous causes as in shock, various paralytic states, Raynaud's disease (*q.v.*) and by surgical or accidental means as in ligature.

In *atheroma* a local proliferation of endothelial cells takes place in the arterial wall at the junction of the middle and inner coats and later undergoes fatty or caseous degeneration. The degenerated material may ultimately be discharged into the lumen of the vessel, an atheromatous ulcer being formed, or it may become infiltrated with calcium salts when its site is represented by a calcareous plaque in the wall of the artery. Atheroma is commonest in the aorta including the aortic valves and the incidence increases with age; it chiefly affects males and small innocuous patches are present in most men above the age of 50. The atheromatous ulcer may become the starting point of an aneurysm (*q.v.*) or of embolism from dislodgment of a fragment of fibrin deposited on the Aoor of the ulcer by the circulating blood. If the atheroma be so extensive that small as well as large arteries are involved, the calcareous process is likely to convert a vessel such as the radial or tibial into a rigid tube in which thrombosis (*q.v.*) occurs and leads to local gangrene. Where atheroma affects the aortic valves and leads to stenosis or regurgitation the heart reacts to the valvular condition by dilatation and hypertrophy (*q.v.*) as in similar non-atheromatous cases. Even extensive atheroma of the aorta does not introduce any factor modifying the work of the left ventricle unless at the same time the orifices of the coronary arteries be narrowed. Under the last mentioned condition nutrition of the cardiac muscle and endocardiac ganglia is impaired, fatty degenerative changes occur and anginal attacks are probable (see ANGINA PECTORIS). When calcareous atheroma affects extensively the smaller arteries, the rigidity and diminution of calibre introduce an obstacle in the peripheral resistance which the heart cannot overcome by increased work. Hence the left ventricle does not hypertrophy. Indeed the age of the patient and the general conditions are such that the heart in these cases is small, feeble and somewhat dilated.

In arterio-sclerosis the smaller arteries throughout the body become thickened and their lumen narrowed by the formation of an increased amount of fibrous tissue, and possibly of the muscular elements, in the middle coat. In the first instance, at all events, the inner and outer coats are unaffected. The condition leads to hypertrophy of the left ventricle owing to the increased peripheral resistance introduced by the narrowed, but still distensible arteries, and the general blood pressure rises. The arterioles of the kidney share in the general change and the organ shows the fibrotic and parenchymatous changes constituting chronic granular kidney (see KIDNEY, DISEASES OF). The clinical symptoms of arterio-sclerosis are therefore those of heightened arterial tension together with those of renal fibrosis, complicated later by the cardiac changes the hypertrophied heart undergoes when compensation fails (see HEART, DISEASES OF). Apart from these changes the altered blood vessels are, themselves, liable to undergo degenerative processes identical with or resembling those occurring in atheroma, and where relatively unsupported as in the lenticulostriate region of the brain, small aneurysms are often formed, one of which may rupture under the force of the ventricular systole and lead to cerebral haemorrhage (see APOPLEXY). Such so-called miliary or millet seed aneurysms are of pin-head size. Haemorrhage may also occur into the retina, the semi-circular canals and the intestinal mucosa. In the eye they lead to varying degrees of impaired vision according to their extent and situation and in the ear to Menibre's disease (*q.v.*). One feature of all these haemorrhages is that they are liable to be repeated owing to the permanent character of the underlying arterial and cardiac changes. In an autopsy upon a case of fatal cerebral haemorrhage evidence of earlier small haemorrhages into other parts of the brain is often found.

In syphilitic *endarteritis* or *endarteritis* obliterans the inner coat of the artery is the seat of a localized but often widespread inflammatory proliferation of endothelial cells with an admixture of lymphocytes. Such foci involve a portion of the circumference of the vessel and thus narrow the lumen and make it irregular in shape. They are avascular, and caseous degeneration early occurs with the result that the superficial endothelium dies and local thrombosis occludes the lumen completely. Affecting the large arteries the condition is highly diagnostic but rarely gives rise to symptoms. In arteries of small calibre, on the contrary, especially those of the brain, it is of grave importance; in young adults symptoms of "apoplexy" almost invariably are due either to syphilitic endarteritis with thrombosis or to embolism. What relation this form of endarteritis bears to atheroma is uncertain. In well-marked instances of syphilitic endarteritis soft flattened excrescences from the smooth inner lining of the arteries occur in numbers and distribution recalling those of widespread calcareous atheroma, and it may be that the latter condition is a late stage of the former. Indeed many cases of syphilitic endarteritis were described as "soft atheroma" before the Treponema pallidum was discovered.

Apart from rupture with its associated haemorrhage, aneurysm with its special pressure effects and liability to rupture, and arteriosclerosis with its associated renal and cardiac changes, disease of an artery is important mainly because of the thrombosis it provokes and the nutritive changes that its occlusion may induce in the tissues it supplies. As is shown elsewhere (see THROMBOSIS) the effects of occlusion depend upon whether the occluded vessel anastomoses freely or not and whether the condition is septic or aseptic.

The treatment of arterial diseases is mainly that of the condition upon which they depend or of the states to which they give rise. For the arterial condition itself no treatment is available except in some cases of aneurysm where thrombosis may be induced by ligature of the vessel. In arterio-sclerosis the ill effects of high arterial tension, renal inadequacy and the excessive work thrown on the heart are combated by eliminating as far as possible the external conditions that favour the occurrence of these ill effects. Thus, muscular exertion is reduced, diet is restricted, sleep is encouraged and, in order to relieve the kidneys, adequate action of the skin and intestines is promoted. In atheroma where gangrene occurs the treatment is that of the gangrene combined with such general treatment as is required by the age and cardiac weakness of the patient.

See T. McCrae, *Osler's Modern Medicine;* Tice, *Practice of Medicine;* Allbutt and Rolleston, *System of Medicine.* (W. S. L.-8.)

ARTERIOSCLEROSIS: *see* ARTERIES, DISEASES OF.

ARTERN, a town of Germany, in Prussian Saxony, on the Unstrut, at the influx of the Helme, at the junction of railways to Erfurt, Naumburg and Sangerhausen, 8 m. S. of the last named. Pop. 5,890. Its brine springs, known as early as the 15th century, are still frequented.

ARTESIAN WELLS, named after Artois, the ancient Artesium, a French province, where the method of boring was first adopted in Europe. A bore-hole is carried down into water-bearing strata, and the water, in certain formations, rises by hydrostatic pressure, or is pumped up. There is a well within the old Carthusian convent at Lillers which has been flowing since the 12th century. Traces of more ancient bored wells appear in Lombardy, in Asia Minor, Persia, China, Egypt, Algeria, and in the Sahara desert. Very big yields are often obtained; for instance, a set of eight wells at Camberwell, London, give a million and a half gallons per day. A large variety of tools is employed in the work of boring, some rotary, some percussive, and their operation is effected with hand plant, or by power. A derrick is erected on the spot to suspend the rods from, and carries the winding drum, and, in rotary plants, an engine for turning the rods. The diagram shows a percussive plant, with the chisel seen well into the water-bearing strata. Changes in tools have to be made according to the strata encountered; in some instances a rotary crown of diamonds, costing thousands of pounds, has to be used to bore through rock. Lining-tubes, which range from 3 in. to 24 in. or more in diameter are driven down as the bore progresses, while permanent lining-tubes are put in for the passage of the fluid. This is therefore only able to rise from the water-bearing strata, no surface percolations gaining access. The use of a continuous casing, or pipe, insures this. Depths reach to as much as 2,500ft. in some cases.

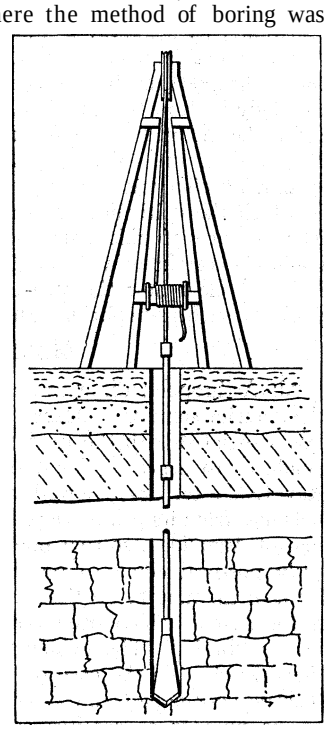


DIAGRAM SHOWING THE PROCESS OF BORING AN ARTESIAN WELL

Several kinds of pumps are applied to the duty of raising water, some being reciprocating, worked from a crankshaft at the top; and operating a bucket with flap or lift valves, in conjunction with a foot-valve. As the bucket rises the water is sucked up through the foot-valve, and as it descends the font-valve shuts, and those in the bucket open to pass the water upwards. The driving is done by belt, steam-engine, internal-combustion engine, or electric motor. Latterly multi-stage turbine pumps have been installed to an increasing extent, while the compressed-air method, forcing up the water without any moving mechanism below, is much utilized. The turbine pumps are driven in some instances direct by a vertical electric motor on the top end of the shaft, and this goes down through a tube jointed up in sections, with lignum-vitae bearings, which are lubricated by the water itself, as it flows through the tube to the delivery outlet at the top. (*See* PUMP; AIR LIFT.)

ARTEVELDE, JACOB VAN (*c.* 1290–1345), Flemish statesman, born at Ghent about 1290, sprang from one of the wealthy commercial families of the city. His brother John, a rich cloth merchant, took a leading part in public affairs during the first decades of the 14th century. Jacob, who according to tradition was a brewer by trade, made his first appearance as a political leader in the year 1337, when the outbreak of hostilities between France and England threatened the industrial welfare of his native town.

As the Flemish cities depended upon England for the supply of the wool for their staple industry of weaving, he proposed, at a great meeting at the monastery of Biloke, a scheme for an alliance of the Flemish towns with those of Brabant, Holland and Hainaut, to maintain an armed neutrality in the dynastic struggle between Edward III. and Philip VI. of France. His efforts were successful. Bruges, Ypres and other towns formed a league with Ghent, where Artevelde, with the title of captain-general, henceforth until his death exercised almost dictatorial authority. His first step was to bring about the conclusion of a commercial treaty with England.

The efforts of the Count of Flanders to overthrow the power of Artevelde by force of arms completely failed, and he was compelled at Bruges to sign a treaty (June 21 1338) sanctioning the federation of the three towns, Ghent, Bruges and Ypres, henceforth known as the "Three members of Flanders." This was the first of a series of treaties, made during the year 1339–40, which gradually brought into the federation many towns and provinces of the Netherlands. The policy of neutrality, however, proved impracticable, and the Flemish towns, under the leadership of Artevelde, openly took the side of the English king, with whom a close alliance was concluded.

Artevelde now reached the height of his power, concluding alliances with kings, and publicly associating with them on equal terms. Under his able administration trade flourished, and Ghent rose rapidly in wealth and importance. But the proposal of Artevelde to disown the sovereignty of Louis, count of Flanders, and to recognize in its place that of Edward, Prince of Wales (the Black Prince), gave rise to violent dissatisfaction. A popular insurrection broke out in Ghent, and Artevelde was murdered on July 24 1345.

See J. Hutton, *James and Philip van Artevelde* (London, 1882); *W. J.* Ashley, *James and Philip van Artevelde* (London, 1883); P. Namèche, *Les van Artevelde et leur époque* (Louvain, 1887); L. Vanderkindere, *Le Siècle des Arteveldes* (Brussels, 1879).

ARTEVELDE, PHILIP VAN (*c.* 1340–1382), youngest son of Jacob van Artevelde (*q.v.*), and godson of Queen Philippa, lived in retirement until 1381. The Ghenters had in that year risen in revolt against the oppression of the count of Flanders, and Philip, now 40 years of age, and without any military or political experience, was offered the supreme command. He defeated Louis de Mile, count of Flanders, before Bruges, entered that city in triumph, and was soon master of all Flanders. But France took up the cause of the Flemish count, and a splendid French army was led across the frontier by the young king Charles VI. in person. Artevelde's burgher army of some 50,000 Flemings was defeated with terrible loss at Roosebeke near Courtrai (Nov. 27, 1382), Philip himself being among the slain. His career is the subject of Sir H. Taylor's drama, *Philip van Artevelde.*

See James Hutton, *Jacob and Philip van Artevelde (1882)*; *W. J.* Ashley, *James and Philip van Artevelde (1883).*

ART GALLERIES: *see* MUSEUMS AND ART GALLERIES.

ARTH, a picturesque little town of Switzerland, situated at the southern end of Lake Zug. Its origin probably goes back to Roman times. Pop. about 5,000.

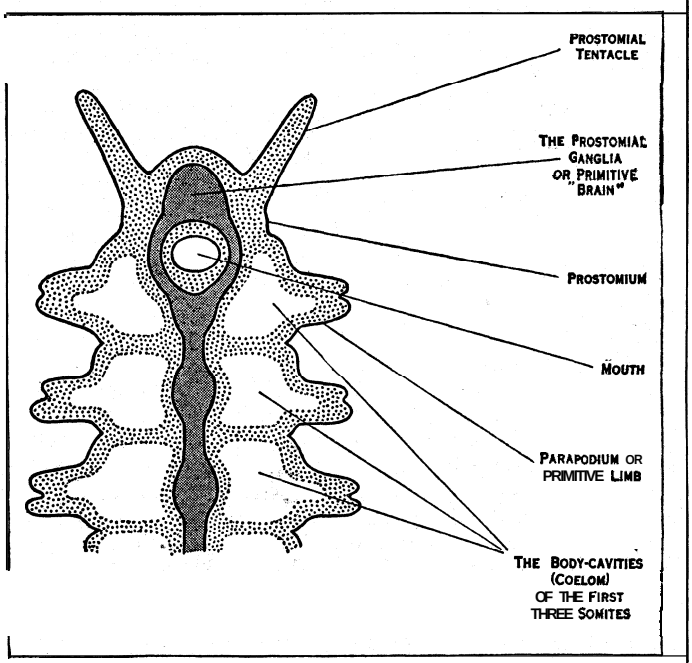
ARTHRITIS, inflammation of the joints, occurring in acute and in chronic forms as the result of injury or in the course of other diseases, *e.g.*, gout, rheumatism, gonorrhoea.

Arthritis may end in fixation of the joint and it sometimes is suppurative.

ARTHROPODA, a phylum of the animal kingdom, comprising animals with a segmented body enclosed in a firm integument or exoskeleton, provided with jointed limbs some of which are modified to serve as jaws. The group includes the classes Crustacea, Myriopoda, Insecta and Arachnida, together with several less extensive groups.

It corresponds to the class Insecta of Linnaeus. but that name has, by more than a century of usage, been restricted to one of its subdivisions.

The Arthropoda have many features in common with the Annelid worms *(see* ANNELIDA), from some primitive form of which, it can hardly be doubted, they have been derived. They agree with the Annelida in the segmented body, the segments or "somites" of which arise during development in regular order from front to rear, new somites being added in front of an unsegmented terminal region or "telson"; in the structure of the nervous system, consisting of a ventral double chain of segmentally arranged ganglia connected by a pair of cords which encircle the gullet with a pair of ganglia (the "brain") in front of the mouth; and in having segmental hollow appendages (parapodia, limbs) moved by muscles. They differ from the Annelida in having the external cuticle—which in the Annelida is a delicate membrane composed chiefly of a substance known as chitin—thickened and stiffened so as to form an exoskeleton, remaining thin and flexible only at the joints between the segments of the body and limbs; in having one or more pairs of appendages in the neighbourhood of the mouth converted into paired, laterally moving, jaws; and in having the apparent body-cavity (haemocoel) forming part of the blood-system communicating with the contractile dorsal vessel or heart by segmentally arranged valved openings or ostia, the true body-cavity (coelom) being almost obliterated.



AFTER GOODRICH

FIG. 1.—DIAGRAM OF HEAD AND ANTERIOR REGION OF AN ANNELID WORM. THE NERVOUS SYSTEM IS IN BLACK

The possession of a rigid exoskeleton, of which the segments form jointed levers moved by muscles, is associated with a much more complicated muscular system than is found in the Annelida and has rendered possible the development of elaborate mechanisms for carrying on the varied activities of life. The appendages are modified in an endless variety of ways for creeping, swimming or flying, for catching and killing prey, for biting or grinding food, for the support of sense-organs, for aiding the functions of reproduction or for protecting the eggs and young. Along with these developments, the nervous system and the organs of special sense, in particular the eyes, become correspondingly complex and efficient. The protection which the continuous cuticle affords to the underlying tissues has facilitated the transition, many times repeated in the evolution of the group, from aquatic to terrestrial life, in which the insects above all have been conspicuously successful.

With the body and limbs enclosed in a continuous and inextensible envelope, growth is only possible if the envelope is periodically shed and renewed, and this process of "moulting" or "ecdysis" is very characteristic of Arthropoda. In some, growth appears to continue at a diminishing rate throughout life, and ecdysis occurs at successively longer intervals. This is probably the case with most of the higher Crustacea. In the winged insects, however, growth ceases at the end of the larval stage and the adult insect does not undergo ecdysis. Although the geceral association of ecdysis with growth is obvious there are exceptions which forbid the assumption that the t o phenomena are causally connected. Thus in certain Decapod Crustacea (prawns) repeated ecdysis may occur without any perceptible increase in size, and in individuals subjected to starvation there may even be a shrinkage in bulk of the animal. On the other hand, certain parasitic Crustacea increase enormously in size without ecdysis, the cuticle, which remains thin and membranous, extending apparently by some process of interstitial growth.

A remarkable peculiarity, which is all but universal throughout the Arthropoda, is the absence of vibratile cilia from all parts of the body both in the larval and in the adult stages. In this character the Arthropoda differ from all other animals except the Nematode worms. The only Arthropoda known to possess actively moving cilia are certain species of *Peripatus* (Onychophora) in which the epithelium of the receptaculum seminis is ciliated. The absence of cilia from the external surface of the body is doubtless correlated with the development of a strong cuticle; but it is not clear how this can explain their absence from internal passages such as nephridial and genital ducts.

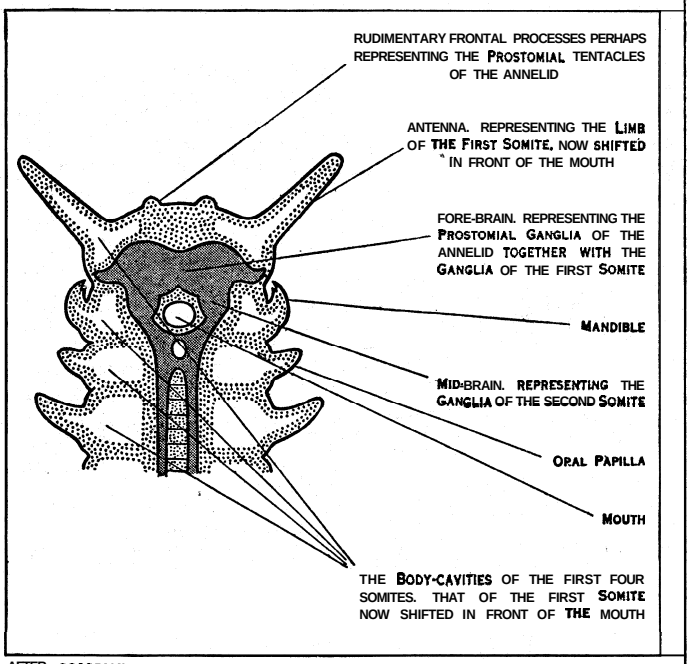
MORPHOLOGY

All Arthropoda differ from the Annelida in having some of the anterior somites coalesced to form the "head." This is doubtless associated with the modification of some of the anterior appendages to serve as jaws. Further, there has taken place, as Ray Lankester first showed, a backward shifting of the mouth-opening, from its primitive position on the first somite (peristomium of Annelida), so that one or more somites which were originally postoral come to be situated, with their appendages, in front of the mouth. At the same time the nerve-ganglia belonging to these somites have been moved forward to become incorporated in the "brain." The evidence for the forward shifting is particularly clear in the case of the antennae of the Crustacea and their nerve-ganglia (see CRUSTACEA).

The number of somites constituting the head differs in the classes of the Arthropoda but considerable difficulties are encountered in attempting to determine the actual numbers, and to compare the various classes with one another in respect of this character. Embryological study has shown that clearly marked somites may be present in the early stages which disappear in the course of development and that the number of appendages present in the adult does not always correspond to the number of somites originally present. Even where no such embryonic vestiges can be discovered it cannot safely be assumed that the cephalic appendages are serially homologous in widely different types of Arthropoda. The following comparison of the consti-

tution of the head in the different classes must be understood as subject to this reservation.

The structure of the head is simplest in the Onychophora *(Peripatus)* which in this, as in many other respects, occupy a very primitive and isolated position among existing Arthropoda. In the early embryo the first pair of mesoblastic somite-rudiments lie, at their first appearance, well behind the mouth, but



AFTER GOODRICH

FIG. 2. — DIAGRAM OF HEAD AND ANTERIOR REGION OF ONYCHOPHORA (PERIPATUS), A PRIMITIVE SPECIES OF ARTHROPODA

move forwards in the course of development until they are in front of the mouth. From these arise a pair of limb-buds which become the antennae of the adult. From the similar limb-buds on the second pair of somites arise the single pair of jaws and from those on the third somites the "oral papillae" of the adult. In all other Arthropoda there is evidence of more than one preoral segment. Even in the Arachnida, in which only one pair of appendages, the chelicerae, are in front of the mouth, a pair of pre-cheliceral somite-rudiments have been found in the embryo in spiders. In Crustacea there are three preoral somites, a pair of preantennular somite-rudiments being present in the embryo in front of those that carry the antennulae and antennae of the adult. In the Chilopoda (Myriopoda) there are also three preoral somites, transitory embryonic rudiments being found in front of and behind the antennae, which are the only preoral appendages of the adult. In insects also a preantennal somite has been demonstrated and there is stated to be some evidence of the existence of another somite in front of it; a transitory somite between antennae and mandibles completes the resemblance to Chilopods and Crustacea.

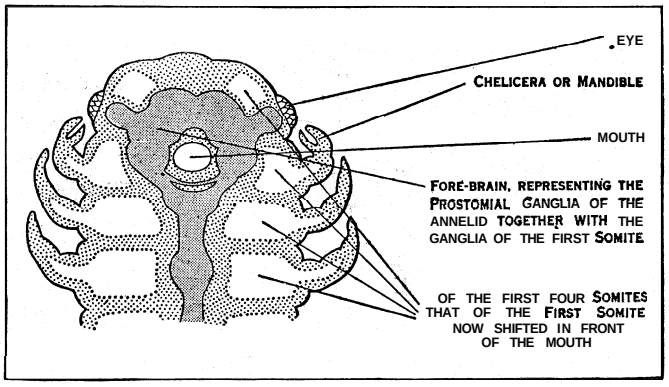
Subject to the reserves indicated above, the probable homologies of the anterior somites and their appendages in the chief classes of Arthropoda may be tabulated as follows (embryonic somites are indicated by italics):—

Peripatus.	Arachnida.	Crustacea.	Chilopoda.	Insecta.
Antenna.	*Pre-cheliceral somite.*	*Pre-antennular somite.*	*Pre-antenna1 somite.*	*Pre-antennal somite.*
Jaw . .	Chelicera	Antennule	Antenna	Antenna
Oral papilla .	Pedipalp	Antenna	*Pre-mandibular somite*	*Pre-mandibular somite*
1st leg .	1st leg	Mandible	Mandible	Mandible
and leg .	and leg	Maxillula	1st maxilla	Maxillula
3rd leg .	3rd leg	Maxilla	2nd maxilla	1st maxilla
4th leg .	4th leg	Maxilliped or 1st leg	Maxilliped	2nd maxilla (Labium)

The constitution of the head in the Diplopod Myriopoda (sometimes regarded as a class distinct from the Chilopoda) is not clearly ascertained, but for further details reference must be made to the articles dealing with the different groups.

The sensory organs of the Arthropoda present numerous and diverse complexities of structure many of which are clearly associated with the presence of a hard and often opaque cuticle. With the body and limbs so encased it may be supposed that the sense of touch would be very dull unless it were localized in special organs. These organs are provided by the hairs or "setae" which are scattered over the surface in all Arthropoda. They are hollow projections of the cuticle containing prolongations of the underlying cells of the hypodermis into which nerve-fibrils can be traced. At the base, the seta arises from a cup-shaped depression where the cuticle is thinned away to form a more or less movable joint, and movements caused by touching solid bodies will cause afferent impulses to be transmitted to the central nervous system. The finer setae are often furnished with secondary hairs set along their length like the barbs of a feather, and such setae, which are especially common in aquatic Arthropoda, can be seen to respond to movements in the water and even to the delicate vibrations caused by sound waves. Another modification of setae gives rise to organs of taste and smell or, more generally, of chemical sense. In these the cuticle of the setae is exceedingly thin, permitting diffusion of substances from the surrounding medium which thus reach the nerve-endings within.

The eyes of Arthropoda are very characteristic of the group, and here again the structure seems to be conditioned by the presence of a thick cuticle. Only in *Peripatus* (Onychophora) are the eyes of a type found in Annelida, consisting of a closed sack or vesicle, folded off from the skin and enclosing a lens that seems to be cuticular in origin. In all other Arthropoda the eyes are developed as pits in the ectoderm, the cavity of the pit being filled by a transparent thickening of the cuticle which acts as a lens, concentrating light on the receptive cells beneath. These receptive or retinal cells contain rod-like bodies (rhabdomes) perhaps also cuticular. The simpler types of eye consist each of a single pit with single lens overlying a group of retinular cells, or a number may be grouped together, leading to the remarkably complex "facetted" or "compound" eyes which are especially characteristic of crustaceans and insects. In these the transparent cuticle forming the cornea which covers the eye is divided into a number (often a very large number) of lenticular



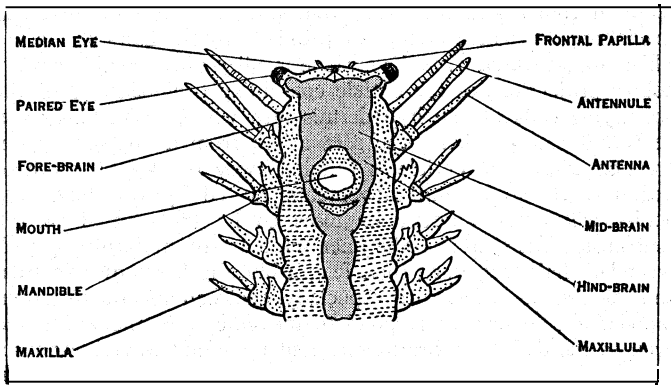
AFTER GOODRICH

FIG. 3. — DIAGRAM OF THE HEAD AND ANTERIOR REGION OF AN ARACHNID

facets each of which corresponds to a little group of retinular cells and usually an additional refractive body, the "crystalline cone." While there is considerable diversity in minute details of structure it should be emphasized that the agreement in general plan between the compound eyes of Crustacea and those of insects is remarkably close.

Respiration in aquatic Arthropoda is carried on by gills or, in the more minute forms, by the general surface of the body. The gills are plate-like or branching outgrowths from some of the limbs or from the surface of the body. The organs of respiration in air-breathing Arthropoda are more varied. The

characteristic "lung books" of many Arachnida are plainly derivable from the very similar "gill books" of the aquatic Xiphosura and their allies (see ARACHNIDA). The most common method of aerial respiration, however, is by tracheae. These are delicate tufted or branching tubules, opening to the exterior and filled with air. They are lined by a delicate continuation of the external cuticle, often strengthened by a spiral thickening. In the simpler forms the tracheae penetrate only a little way into

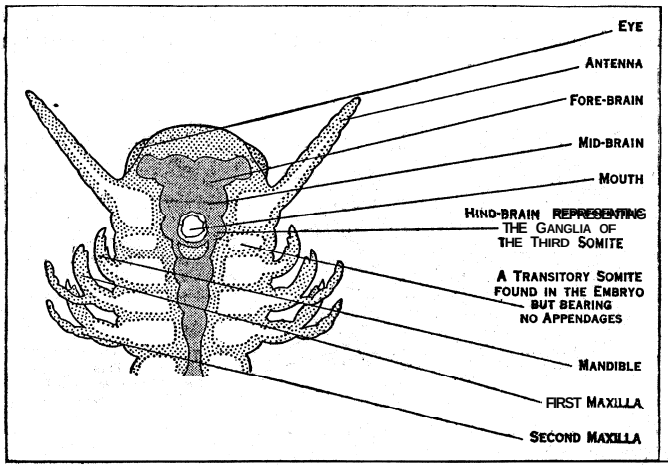


FROM LANKESTER, TREATISE ON ZOOLOGY, BY PERMISSION OF A. & C. BLACK

FIG. 4 — DIAGRAM OF HEAD AND ANTERIOR REGION OF A CRUSTACEAN

the body and the blood no doubt acts as intermediary in the respiratory exchange with the tissues. In more highly developed types, especially in insects, the tracheal tubules ramify throughout the whole body, carrying air into direct contact with the cells of the tissues and the respiratory function of the blood is almost or quite superseded. Tracheae are possessed by Onychophora, Myriopoda (Chilopoda and Diplopoda), Insecta, most terrestrial Arachnida, and even by the terrestrial Isopoda among Crustacea. Similar structures are said to occur in certain Coelenterata (Siphonophora) and Mollusca, but with these exceptions they are peculiar to the Arthropoda.

The structure of the heart has been already alluded to. In the more primitive forms it is a long dorsal tube running throughout the greater part of the body and lying in a chamber, the pericardium, which contains blood. From the pericardium the blood enters the heart by paired openings or ostia with valvular lips which permit blood to enter but prevent its egress. Typically



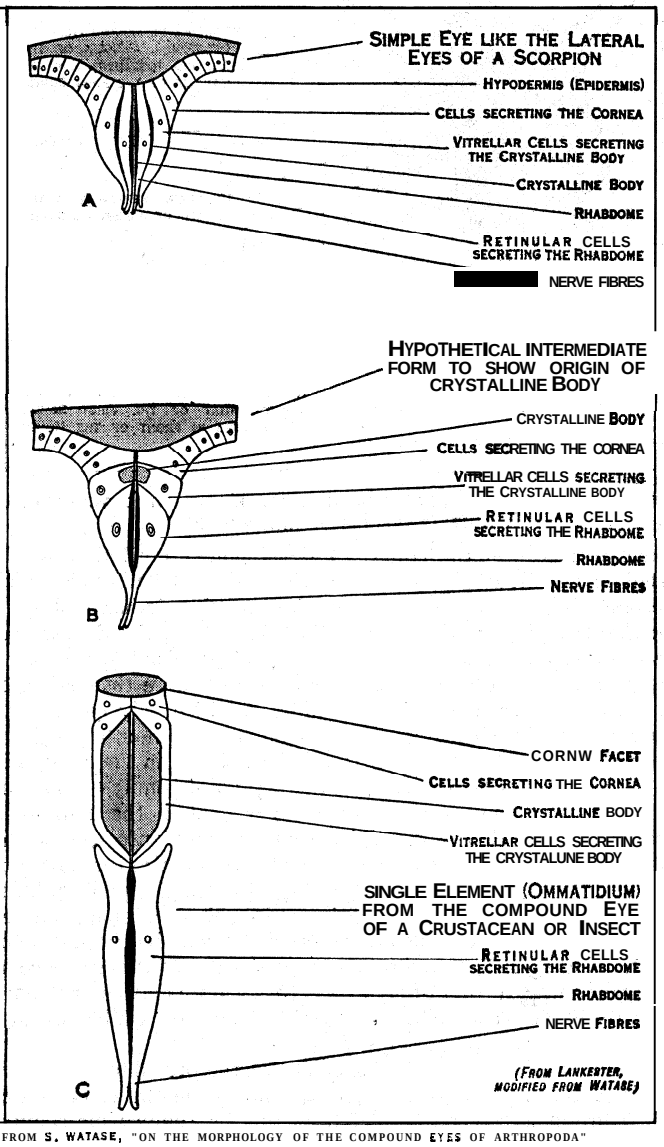
AFTER GOODRICH

FIG. 5.— DIAGRAM OF HEAD AND ANTERIOR REGION OF AN INSECT

there is a pair of ostia in each somite. The heart is rhythmically contractile and propels the contained blood towards the head where it may be discharged directly into the lacunae of the haemocoel or may pass through one or several arterial vessels before entering the lacunar system. In more specialized forms the heart-tube is shortened and the number of ostia is reduced and in some of the smaller Crustacea it forms a globular sack with a single pair of ostia. In many minute forms of Crustacea and Arachnida the heart is absent and the blood is simply driven hither and thither by movements of the body, limbs and alimentary canal.

PHYLOGENY

While the number and the importance of the characters which are common to all the classes composing the Arthropoda are such as to remove all reasonable doubt that the group is a "natural" or monophyletic one, it is not possible to say that the phyletic relations of the classes themselves have been clearly ascertained. No phylogenetic scheme has been suggested that does not involve the independent origin of similar features in different lineages. Thus, the possession of tracheae was formerly considered as clear evidence of common descent in the Onychophora, Myriopoda, Insecta, and Arachnida. The demonstration by Ray Lankester, however, of the close affinity between the air-breathing Arachnida and the gill-bearing Xiphosura and Eurypterida involved the conclusion that the tracheae of Arachnida must have arisen independ-



FROM S. WATASE, "ON THE MORPHOLOGY OF THE COMPOUND EYES OF ARTHROPODA"

FIG. 6.— DIAGRAMS ILLUSTRATING STRUCTURE OF EYES IN ARTHROPODA THE CUTICLE AND ITS DERIVATIVES ARE SHOWN IN BLACK

ently of those of the insects. The assumption of a simple phyletic series leading from the Onychophora through the Myriopoda to the Insecta became untenable when it was shown that the Chilopod Myriopods and the insects agreed closely with Crustacea in the segmentation of the head-region and that the similarity in structure of the compound eyes of insects and Crustacea was too close to be imagined as arising independently in the two groups. Again, the resemblance of the tracheae of terrestrial Isopod Crustacea to those of the other tracheate groups is not disposed of by calling them "pseudotracheae" and it is not seriously suggested that so specialized a group of Crustacea can have given rise to insects.

The suggestion that all the existing Arthropoda can have been derived from tracheate air-breathing ancestors, implying, as it does, the existence of a land-fauna in Pre-Cambrian times, cannot be considered seriously in the present state of our knowledge. The only conclusion that can be drawn, therefore, is that tracheae have been acquired at least four times in the evolution of the Arthropoda.

The fact that convergent evolution must be admitted in the case of a system of organs so characteristic as the tracheae demands a careful scrutiny of the other structural features on which classification may be based. Some uncertainties with regard to the constitution of the head have already been alluded to. Where there is a clear correspondence of somite for somite and appendage for appendage, as in the comparison of Xiphosura and Eurypterida with scorpions, a natural or phyletic relationship may be taken as proved. On the other hand, while the dismembering of the old group Myriopoda may be justified by the wide differences separating the Diplopoda and Chilopoda, it is not clear that the association of the Symphyla with the former can be sustained solely because of the anterior position on the genital openings.

The palaeontological record of Arthropoda gives some help towards understanding their phylogeny. Particularly interesting are the Trilobites, some of which are among the earliest known fossils and of which the structure is now known in considerable detail in several genera. It is clear that they are not far removed from a primitive stock which may well have given rise to the Crustacea and it is probable that the Eurypterida, and with them the Arachnida, may have come from the same source by way of the imperfectly known Cambrian Limulava. Of the origin of insects and of the Myriopod groups palaeontology has, as yet, nothing to tell us although Diplopod-like forms and probably insects occur in the Devonian.

The position of the Onychophora with respect to the other Arthropoda is quite obscure except that they must have diverged very early from the primitive stock and have acquired independently the features which they have in common with the other terrestrial groups such as tracheae and simple clawed limbs.

The Pycnogonida are another group which it is impossible, in the present state of knowledge, to link up with any of the larger groups of Arthropoda. Their traditional association with Arachnida encounters difficulties in the interpretation of the appendages and these difficulties have not been diminished by the discovery of genera which have five, instead of the usual four, pairs of legs.

The Tardigrada and Pentastomida (Linguatulida, *qq.v.*), are two small groups whose title to be regarded as Arthropoda is doubtful. If they are, the simplification of structure and the disappearance of connecting links has entirely obscured their relationships with the more normal members of the group.

It may be mentioned that, in point of size, the Arthropoda have a wider range than any of the other main groups of the animal kingdom. The same minimum of 1/100 inch (·25 mm.) is reached both among Crustacea (Cladocera) and among insects (Coleoptera). At the other extreme stands the Giant Japanese Crab *(Macrocheira* or *Kaempferia)* which can span 11ft. with its claws. Some of the extinct Eurypterida, reaching 7ft. in length of body, were probably still bulkier.

See ARACHNIDA; CRUSTACEA; INSECTS; MYRIAPODA; ONYCHOPHORA; PYCNOGONIDA; TRILOBITA. (W. T. C.)

ARTHUR, British king, and subject of the romance cycle, described below, *s.v.* Arthurian Legend. Our sources for the historical Arthur are the *Historia Britonum* of Nennius, the *Annales Cambriae,* and the *Gesta Regum* of William of Malmesbury. In Caradoc of Llancarfan and in Geoffrey of Monmouth the myth is already developed. Nennius (*fl.* 796) represents Arthur as a Christian warrior leading the kings of Britain against the Saxon kings of Kent. He enumerates 12 battles, of which the eighth battle was on the castle Guinnon, "wherein Arthur bore the image of St. Mary the ever-virgin upon his shoulder, and the pagans were turned to flight. . . . The twelfth battle was on the Mount of Badon, wherein fell 960 men in one day at a single onset of Arthur; and no one overthrew them but he alone, and in all the battles he came out victorious." There is no other record of the 12 battles, but Gildas (q *v.),* writing in 550, without speaking of Arthur, mentions the battle of Mount Badon as taking place on the day of his birth, which would be *c.* 516. We may conclude, then, that Arthur was born about the end of the 5th century, and that he was the general of royal armies fighting in South Britain. The compiler of the *Annales Cambriae* (written shortly after 956), and William of Malmesbury in his *Gesta Regum* (completed 1125), also connect Arthur with the battle of Mount Badon, the former adding that he fell with Medraut (Mordred) at the battle of Camlan (537). William further objects to the fables growing up around his name and shows that it had already been connected with Walwen or Gawain. (The famous Round Table appears as early as the *Geste des Bretons* [1155] of Maistre Wace.) Geoffrey of Monmouth, whose *Historia Britonum,* written in 1147, was one of the chief sources for later biographies, definitely introduces the mythical element by relating, among other events, the crowning of Arthur and his conquests abroad. Caradoc of Llancarfan, in his *Vita Gildae* (before 1156), has similar elaborations in his description of the quarrel between Arthur and Hueil, the brother of Gildas, and in his account of Arthur as the benefactor of Glastonbury. Glastonbury, as the hero's resting-place, is first mentioned by Giraldus Cambrensis in the first book of his De *Principis Instructione* (*c.* 1195), and the discovery of Arthur's body is first dated as 1191 by Ralph of Coggeshall in his *Chronicon Anglicanum.*

See W. Lewis Jones, *King Arthur in History and Legend* (1911): *E.* **K.** Chambers, *Arthur* of *Britain* (1927), and *Camb. Hist. of Eng. Lit.,* vol. i.

ARTHUR I. (1187–1203), duke of Brittany, was the posthumous son of Geoffrey, the fourth son of Henry II. of England, and Constance, heiress of Conan IV., duke of Brittany. The Bretons hoped that their young prince would uphold their independence, which was threatened by the English. Henry II. tried to seize Brittany, and in 1187 forced Constance to marry one of his favourites, Randulph de Blundevill, earl of Chester (d. 1232). Henry, however, died soon afterwards (1189). The new king of England, Richard Coeur de Lion, claimed the guardianship of the young Arthur, but in 1190 Richard left for the Crusade. Constance profited by his absence by governing the duchy, and in 1194 she had Arthur proclaimed duke of Brittany by an assembly of barons and bishops. Richard invaded Brittany in 1196, but was defeated in 1197 and became reconciled to Constance. On his death in 1199, the nobles of Anjou, Maine and Touraine refused to recognize John of England, and did homage to Arthur, who declared himself the vassal of Philip Augustus. In 1202 war was resumed between the king of England and the king of France. The king of France recognized Arthur's right to Brittany, Anjou, Maine and Poitou. While Philip Augustus was invading Normandy, Arthur tried to seize Poitou. But, surprised at Mirebeau, he fell into the hands of John, who sent him prisoner to Falaise. In the following year he was transferred to Rouen, and disappeared suddenly. It is thought that John killed him with his own hand. After this murder John was condemned by the court of peers of France, and stripped of his French fiefs.

See Ralph of Coggeshall, "Chronicon Anglicanum," in the *Monumenta Britanniae historica;* Dom Lobineau, *Histoire de Bretagne* (1702); Dom Morice, *Histoire de Bretagne* (1742–56); A. de la Borderie, *Histoire de Bretagne,* vol. iii. (1899); Bémont, "De la condamnation de Jean-sans-Terre par la Cour des Pairs de France," in the *Revue historique,* vol. xxxii. (1886).

ARTHUR III. (1393–1458), earl of Richmond, constable of France, and afterwards duke of Brittany, was the third son of John IV., duke of Brittany, and Joan of Navarre, afterwards wife of Henry IV. of England. His brother, John V., gave him his earldom of Richmond in England. From 1410 to 1414 he served on the side of the Armagnacs in the civil wars, and afterwards entered the service of Louis the dauphin, whose intimate friend he became. At Agincourt he was wounded and captured, and he remained a prisoner in England from 1415 to 1420. Released on parole, he persuaded his brother, the duke of Brittany, to conclude the treaty of Troyes, and was rewarded by Henry V. with the countship of Ivry.

In 1423 Arthur married Margaret of Burgundy, widow of the dauphin Louis, and thus became the brother-in-law of the regent, the duke of Bedford. Offended by Bedford's refusal to give him a high command, he broke with the English, and in March 1425 became constable of France.

He now threw himself with ardour into the French cause, and persuaded his brother, John V. of Brittany, to conclude the treaty of Saumur (Oct. 7 1425) with Charles VII. But he met with a whole series of reverses in the field; and at court, where his rough and overbearing manners made him disliked, his influence was overshadowed by that of a series of incompetent favourites. The peace concluded between the duke of Brittany and the English in Sept. 1427 led to his expulsion from the court. In June 1429 he joined Joan of Arc at Orleans, and fought in several battles under her banner, till the influence of La Trémoille forced his withdrawal from the army. On March 5 1432, Charles VII. concluded with him and with Brittany the treaty of Rennes; but it was not until June of the following year that La Trémoille was overthrown. Richmond now resumed the war against the English, and repressed the plundering bands of soldiers and peasants known as *routiers* or *écorcheurs*. On Sept. 20 1435, mainly as a result of his diplomacy, the treaty of Arras was signed between Charles VII. and the duke of Burgundy, to which France owed her salvation.

On April 13 1436, Richmond took Paris from the English; but it was not till May 1444 that the armistice of Tours gave him leisure to carry out the reorganization of the army. He now created the *compagnies d'ordonnance* and endeavoured to organize the militia of the *francs archers*. This reform had its effect in the struggles that followed. In alliance with his nephew, the duke of Brittany, he reconquered, during Sept. and Oct. 1449, nearly all the Cotentin; on April 15 1450, he gained over the English the battle of Formigny; and during the year he recovered for France the whole of Normandy, which for the next six or seven years he defended from English attacks. On the death of his nephew Peter II., Sept. 22 1457, he became duke of Brittany. He reigned little more than a year, dying Dec. 26 1458, and was succeeded by his nephew Francis II., son of his brother Richard, count of Étampes.

Duke Arthur was thrice married: (1) to Margaret of Burgundy, duchess of Guienne (d. 1442); (2) to Jeanne d'Albret, daughter of Charles II. of Albret (d. 1444); (3) to Catherine of Luxemburg, daughter of Peter of Luxemburg, count of St. Pol, who survived him. He left no legitimate children.

BIBLIOGRAPHY.—The main source for the life of Duke Arthur III. is the chronicle of Guillaume Gruel (c. 1410–74–82). Gruel entered the service of the earl of Richmond about 1425, shared in all his campaigns, and lived with him on intimate terms. The chronicle covers the whole period of the duke's life, but the earlier part, up to 1425, is much less full and important than the later, which is based on Gruel's personal knowledge and observation. In spite of a perhaps exaggerated admiration for his hero, Gruel displays in his work so much good faith, insight and originality that he is accepted as a thoroughly trustworthy authority. It was first published at Paris in 1622. Of the numerous later editions, the best is that of Achille le Vavasseur, *Chronique d'Arthur de Richemont* (Paris, 1890). *See* also E. Cosneau, *Le Connétable de Richemont* (Paris, 1886); G. du Fresne de Beaucourt, *Histoire de Charles VII.* (Paris, 1881, *et seq.*).

ARTHUR, CHESTER ALAN (1830–1886), 21st president of the United States was born in Fairfield, Vt., on Oct. 5, 1830. His father, William Arthur (1796–1875), when 18 years of age, emigrated from Co. Antrim, Ireland, and, after teaching in various places in Vermont and Lower Canada, became a Baptist minister. William Arthur had married Malvina Stone, an American girl who lived in Canada at the time of the marriage, and the numerous changes of the family residence afforded a basis for allegations in 1880 that the son Chester was born not in Vermont, but in Canada, and was therefore ineligible for the presidency. Chester entered Union college as a sophomore, and graduated with honour in 1848. He then became a schoolmaster, at the same time studying law. In 1853 he entered a law office in New York city, and in the following year was admitted to the bar. His reputation as a lawyer began with his connection with the famous "Lemmon slave case," in which, as one of the special counsel for the State, he secured a decision from the highest State courts that slaves brought into New York while in transit between two slave States were *ipso facto* free. In another noted case, in 1855, he obtained a decision that negroes were entitled to the same accommodations as whites on the street railways of New York city.

In politics Arthur was actively associated from the outset with the Republican Party. When the Civil War began he held the position of engineer-in-chief on Governor Edwin D. Morgan's staff, and afterwards became successively acting quartermaster general, inspector general, and quartermaster general of the State troops, in which capacities he showed much administrative efficiency. At the close of Governor Morgan's term, Dec. 31, 1862, Gen. Arthur resumed the practice of his profession, remaining active, however, in party politics in New York city. In Nov. 1871, he was appointed by President U. S. Grant collector of customs for the port of New York. The custom-house had long been conspicuous for the most flagrant abuses of the "spoils systems"; and though Gen. Arthur admitted that the evils existed and that they rendered efficient administration impossible, he made no extensive reforms. In 1877 President Rutherford B. Hayes began the reform of the civil service with the New York custom-house. A non-partisan commission, appointed by Secretary John Sherman, recommended sweeping changes. The president demanded the resignation of Arthur and his two principal subordinates, George H. Sharpe, the surveyor, and Alonzo B. Cornell, the naval officer, of the port. Gen. Arthur refused to resign on the ground that to retire "under fire" would be to acknowledge wrong-doing, and claimed that as the abuses were inherent in a widespread system he should not be made to bear the responsibility alone. His cause was espoused by Senator Roscoe Conkling, for a time successfully; but on July 11, 1878, during a recess of the Senate, the collector was removed, and in Jan. 1879, after another severe struggle, this action received the approval of the Senate. His business conduct of the office was not impugned, but, at that period, he was a political manager conspicuously hostile to civil service reform. However, in defence of his management, he issued a statement pointing out that the record of his immediate predecessors in the office showed seven times as many changes in appointments as he had made.

In 1880 Gen. Arthur was a delegate at large from New York to the Republican national convention. In common with the rest of the "Stalwarts," he worked hard for the nomination of Gen. U. S. Grant for a third term. Upon the triumph of James A. Garfield, the necessity of conciliating the defeated faction led to the hasty acceptance of Arthur for the second place on the ticket. His nomination was coldly received by the public; and when, after his election and accession, he actively engaged on behalf of Conkling in the great conflict with Garfield over the New York patronage, the impression was widespread that he was unworthy of his position. Upon the death of President Garfield, Sept. 19, 1881, Arthur took the oath as his successor. Coming at a period of intense factional controversy and following the assassination of Garfield, which had profoundly shocked the public mind, the accession of Arthur to the presidency created apprehensions. The widespread expressions of dismay in the press at the probable outcome of an administration in the hands of so confirmed a factionist and spoilsman as he was reputed to be, are said to have deeply wounded Arthur. But his inaugural address was clear, judicious and reassuring, and his expressed purpose, from which he never measurably deviated, to administer his office in a spirit devoid of factional animosity, established the confidence of the nation and won for him the approval of many of his severest critics. Contrary to the general expectation, his appointments as a rule were unexceptionable, and he earnestly supported the Pendleton law for the reform of the civil service. His use of the veto in 1882 in the cases of a Chinese immigration bill (prohibiting immigration of the Chinese for 20 years in contravention of the treaty of 1880) and a river and harbour bill (appropriating over $18,000,000 some of which was to be expended on insignificant streams) confirmed the favourable impression that had been made. The most important events of his administration were the passage of the Tariff Act of 1883 and of the Edmunds law prohibiting polygamy in the territories, and the completion of three great continental railways—the Southern Pacific, the Northern Pacific and the Atchison, Topeka and Santa Fe.

Among enactments made by congress on recommendation of the administration were the repeal of the stamp taxes on matches, proprietary articles, and bank cheques; the reduction of letter postage from three cents to two cents; the enlargement of fast-mail and free delivery systems; and the establishment of special letter deliveries. In 1882 a convention was made for relocating the boundary between Mexico and the United States, and in 1883 a reciprocal commercial treaty for fostering trade with Mexico was negotiated. In connection with commercial treaties President Arthur recommended the establishment of a monetary union of American countries to secure the adoption of a uniform currency basis, and to promote the general remonetization of silver. A treaty was negotiated with Nicaragua which empowered the United States to construct a canal, railway and telegraph line across Nicaraguan territory but mas not ratified by the senate. On Feb. 21, 1885, President Arthur made an address at the dedication of the Washington monument, at the national capital, which was brought to completion during his term. One of his last official acts was the appointment of Gen. U. S. Grant as general of the army, a special bill creating this rank having been passed by congress March 3, 1885. In 1884 Arthur permitted his name to be presented for renomination at the Republican National convention, but he was easily defeated by the supporters of James G. Blaine. Although a close friend of Conkling, long an implacable political enemy of Blaine, Arthur supported the latter in the ensuing presidential campaign. At the end of his term he resumed his residence in New York city, where he died on November 18, 1886.

That Arthur should have retired from the presidency with the respect of the people of the United States is the best testimonial to the way in which he had filled the office, especially in view of his earlier record. It remains only to be said that, alike in public and private life, his bearing was always dignified without being pompous; that he was easy of approach, genial in conversation and manner, and a man of many and close friends.

For an account of his administration *see* UNITED STATES: *History.*

ARTHUR, JOSEPH CHARLES (1850–1942), American botanist, was born at Lowville, N.Y., on Jan. 11, 1850. He graduated at Iowa State college in 1872, and after various periods of graduate study he received the degree of doctor of science at Cornell university in 1886. Following three years as instructor in botany at the universities of Wisconsin and Minnesota in 1879–82 and a like period as botanist in the New York Agricultural Experiment station at Geneva in 1884–87, he was made professor of botany in Purdue university, where he served until 1915. During his professorship at Purdue he was also professor of vegetable physiology and pathology in the Indiana Agricultural Experiment station. He conducted researches on plant diseases, especially those caused by fungi, and made numerous contributions regarding the life history of rusts. From 1882 to 1900 he was an editor of the *Botanical Gazette.* He wrote numerous botanical articles, and published a *Handbook* of *Plant Dissection,* with *C.* R. Barnes and J. M. Coulter (1886), *Living Plants and Their Properties,* with *D. T.* MacDougal (1898), and *Manual* of *the Rusts in United States and Canada* (1934). He died April 30, 1942.

ARTHURIAN LEGEND. By the "Arthurian legend" or *Matière* de *Bretagne* we mean the subject matter of that important body of literature which centres round the picturesque figure of the British hero, Arthur. Did Arthur ever live? Opinion on this point has been much divided, but, while the idea of a *King* Arthur whose dominions extended beyond the confines of the British Isles is now very generally rejected, we may probably accept as a fact the existence of a chieftain of mixed Roman and British parentage (witness the Latin names in his pedigree), who had learned the art of war from the Romans and successfully led the forces of the British kings against the Saxon invaders. As Nennius phrases it, *"tunc Arthur pugnabat cum regibus Britonum, sed ipse dux erat bellorum."* He was not a king, but the general of the royal armies. If we add to this the hypothesis that he was betrayed by his wife and a near kinsman, and fell in battle, we have stated all that can be claimed as an historical nucleus for his legend. But into this shadowy historic figure other elements have entered; he is not merely a possible historic personality, but a survival of prehistoric myth, a hero of romance, and a fairy king, and all these threads are woven together in one fascinating but bewildering web. Thus it is in his *mythic* character that Arthur slays monsters, the boar Twrch Trwyth, the Giant of Mont St. Michel, the Demon Cat of Losanne. (André de Coutances tells us that Arthur was really vanquished and carried off by the cat, but that one dare not tell that tale before Britons.) He never, it should be noted, rides on purely chivalric adventures such as aiding distressed damsels, seeking the Grail, etc.; his expeditions are, as a rule, military, and the character of successful general clings to him throughout.

As a *ronzantic* hero he differs very considerably from the character familiar to us through Tennyson's *Idylls of the King.* In the earlier poems he is practically a lay figure; his court is the point of departure and return for the knights whose adventures are related in detail, but he himself is a passive spectator. In the prose romances he is a monarch, the splendour of whose court, his riches and generosity, are the admiration of all; but morally he is no whit different from the knights who surround him. He has two sons, neither of them born in wedlock, one of them, Modred, alike his son and his nephew. In certain romances, *Perlesvaus* and *Diu Crône,* he is a veritable *roi fainkant,* overcome by sloth and luxury. As a *fairy* king not only does Layamon represent three ladies as appearing at his birth, and prophesying his future greatness, while, as we all know, three queens appear at his death to bear him to the land of Avalon, but in *Huon de Bordeaux* he is heir to the kingdom of the fairy king Oberon; and in the little-known poem of *Brun de la Montagne,* preserved in a unique ms. of the Bibliothèque Nationale, we are told that all fairy-haunted places, wherever they may be, belong to Arthur—

et touz ces lieux fads
sont Artus de Bretagne.

Thus in the diverse aspects of Arthur's character we have some indication of the perplexing variations of the literature which gathered round his name.

So far as the historic element is concerned it is meagre, consisting in the bare statement by Nennius, quoted above,, and in the *Historia Regum Britanniae* of Geoffrey of Monmouth, which might perhaps be more correctly characterized as the most successful work of fiction ever composed. Between these two there is an interval of upwards of 400 years, Nennius dating from the 8th century, Geoffrey writing in the middle of the 12th. Arthurian tradition is a stream which runs underground, starting as a mere trickle, and emerging at the end of its journey as a mighty river. Literature is silent, but popular tradition must have been active. William of Malmesbury, writing just before Geoffrey, refers to Arthur as one of whom the Britons "rave wildly to-day" *("hodie delirant"),* and there were certainly many more tales current than Geoffrey found room for in his history. Close upon the appearance of Geoffrey's work followed the rhymed adaptations of Wace (French) and Layamon (early English), both of which, notably the latter, contain material lacking in the prose work. That stories of Arthur and his knights had, before this, travelled as far afield as Italy is proved by the Arthurian carvings on the north doorway of Modena cathedral (early 12th century) and the fact that Signor Rajna has discovered the names of Arthur and Gawain as witnesses to deeds belonging to the first quarter of the 12th century; it is clear from the character of the documents that the persons attesting could not have been born later than 1080, which would argue a popular knowledge of Arthurian tradition in the 11th century.

The great body of verse romances which constitutes the most interesting, and from the literary point of view, the most important, section of Arthurian romance only came into existence in the latter half of the 12th century.

Its most important monuments are the works of Chrétien de Troyes *(Erec, Yvain, Le Chevalier de la Charrette, Perceval,* or *Le Conte del Graal),* and of his translator, Hartmann von Aue *(Erec, Iwein);* and the *Parzival* of Wolfram von Eschenbach, the source of which is still a subject of debate, but which has become familiar through Wagner's *Parsifal.* To the poetical succeeded the prose versions, headed by the trilogy of Robert de Borron: *Joseph of Arimathea, Merlin* and *Perceval;* and these comparatively short texts were expanded gradually into the enormous body of cyclic romances of which numerous mss. are extant. In its final form the *Joseph* became the *Grand Saint Graal,* or *Estoire del Saint Graal,* probably the last of the romances to be composed; the *Merlin* received pseudo-historic and romantic additions; the *Perceval* was replaced by the prose *Lancelot,* with the Galahad *Queste* and *Mort Artus* as concluding sections. In the final stages the prose version of the *Tristan* story was interpolated into the already unwieldy *corpus* of romance.

BIBLIOGRAPHY.—For the history of Arthur *see* Nennius, *Historia Britonum,* with the study by H. Zimmer, *Nennius Vindicatus* (1893), and Geoffrey of Monmouth, *Historia Regum Britanniae.* The *Brut* of Wace was edited by Leroux de Lincey (1835–37); that of Layamon by Sir F. Madden (1847). *See* also R. H. Fletcher, *The Arthurian Material in the Chronicles* (vol. x. of *Harvard Studies and Notes in Philology and Literature,* 1906); *W.* Lewis Jones, *King Arthur in History and Legend* (1911); *J.* D. Bruce, *The Evolution of Arthurian Romance* (Göttingen and Baltimore, 1923–24, bibl.). H. Oskar Sommer's *Vulgate Version of the Arthurian Romances* (the Carnegie Institution, Washington, 1908–16) includes all the members of the cycle.

(J. L. W.)

ARTICHOKE. The common, or "globe," artichoke, *Cynara scolymus,* is a plant belonging to the family Compositae, bearing some resemblance to a large thistle. It has long been esteemed as a culinary vegetable, the parts chiefly employed being the immature receptacle or floret disc, with the lower part of the surrounding leaf scales, known as artichoke bottoms. In Italy the dried receptacles of the cultivated plant, *Carciofo domestico,* and of the wild variety, *Carciofo spinoso,* are largely used in soups. Its origin has been traced to Asia, but because it grows wild in many parts of southern France it is often called the Paris or French artichoke. Commercially the globe artichoke is propagated by sprouts or suckers, usually 900 plants to the acre, 6 or 8 ft. apart, in rows 6 ft. apart. Rich, well-drained land, with plenty of water and manure, is necessary for its best growth. Extreme heat makes it inedible and it cannot stand frost. A foggy climate is necessary. Most of the plantings in the United States are confined to an area extending from San Francisco, Calif., on the north, southward halfway to Los Angeles, within a mile or two from the coast for most of the way. For its best flavour the artichoke bud should not be allowed to stay too long on the plant but should be cut before it opens. Although the small, compact sizes are the most tender, the larger sizes seem to be in greater demand commercially. Several hundred tons of artichokes are canned each year in California, one-third of the pack being exported to South America.

The first shipment sent east by express occurred in 1907 and amounted to a few thousand boxes. Between 1925 and 1940 United States production varied from about 7,500 to 10,000 ac., which yielded between 700,000 and 1,250,000 40-lb. boxes annually.

Fondness for this vegetable, which is rich in iron, mineral salts and iodine, is usually the result of an acquired taste. Although delicious when boiled, baked, fried, stuffed or used in soup, the French artichoke is best known in a salad form. Served whole, halved or quartered; hot, with mayonnaise or butter; each leaf pulled off separately, the large end dipped in the sauce and the soft part eaten off, the globe artichoke affords a salad that is unique in appearance and flavour.

The Jerusalem artichoke, *Helianthus tuberosus* or girasole, is quite unrelated to the globe artichoke. The edible portion consists of tubers, borne underground like potatoes, by large, coarse, generally much-branched plants 6 to 10 ft. tall, similar to the common sunflower. It has been called an "artichoke" probably because of some resemblance to artichoke in the taste of the tubers; the term "Jerusalem" is believed to be derived from mispronunciation of the Italian word "girasole," for sunflower. Although it is native to the United States, repeated efforts to establish the plant as a crop have failed, apparently because other crops have been more profitable for the farmer. In France it is grown extensively as feed for sheep, cattle and hogs, but in the United States it is grown only to a very limited extent (chiefly in Oregon) as stockfeed. It is grown occasionally in home gardens for use as a vegetable or in the making of pickles. The tubers stand hard freezing in the soil, but are very difficult to store successfully after harvesting.

The plant is adapted to medium or high latitudes having long summer days and moderate temperature. In the short days and high temperatures of sub-tropical or tropical regions the plant produces flowers and terminates its season's growth in a relatively short time, often reaching a height of only 3 feet or less. While it may survive hot, dry weather and poor soils over much of its natural range, it requires deep, rich soil with an ample moisture supply to make large growth and yields of tubers. The tops are killed by frost, but the tubers are so persistent in the soil in temperate climates that the plant tends to become a weed and can be eradicated from a field only by diligent and timely cultural practices.

The Jerusalem artichoke plant stores its carbohydrates chiefly as inulides, which yield levulose upon hydrolysis, instead of in the form of starch, which is hydrolyzed to dextrose. This fact led to studies of its use in the diet of diabetics. Medical opinion is divided as to its value for this purpose and its use remains limited. Some believe its apparent value is due to the non-availability of its carbohydrates to the human digestive system, thus furnishing the diabetic patient no harmful quantity of carbohydrates although it be eaten rather freely. The preparation of hard refined crystalline levulose in the laboratory, from hydrolysis of the inulides of the tubers, has stimulated interest in the plant. Although tubers of improved types may contain the equivalent of 12% to 15% of levulose, no practical commercial method has been developed (up to 1943) for making crystalline levulose from them. It has been studied both in Europe and America as a source of industrial alcohol, but has not competed successfully with molasses and other cheap sources of fermentable carbohydrates.

Under unusually favourable conditions the Jerusalem artichoke has yielded nearly 20 tons of tubers per acre, in France and in Oregon, but average yields are only about 5 tons per acre, too low for the plant to compete successfully with other crops. The tops are sometimes harvested for ensilage, before they become too coarse and woody for feed. Early removal of the tops prevents profitable production of tubers. Good yields of tubers can develop only if the tops are undisturbed until after they are too woody for feed. Until practical and profitable methods of producing and using the plant become established, it must remain largely an interesting subject of speculation and study. (V. R. B.)

ARTICLE, a term primarily for that which connects two parts together, and so transferred to the parts thus joined; it is used of the separate clauses or heads in contracts, treaties, etc., of a composition in a periodical; or of particular commodities, as in "articles of trade." It appears also in the phrase "in the article of death," *in articulo mortis.* In grammar the term is used of the adjectives which describe the number of individuals to which a name applies, the indefinite article denoting one or any of a particular class, the definite denoting a particular member of a class. For articles of war *see* WAR, ARTICLES OF.

ARTICLES OF ASSOCIATION: *see* COMPANY LAW.

ARTICULATA, an obsolete zoological name applied to insects, worms, etc., in which the body is jointed or segmented. (*See* ARTHROPODA; ANNELIDA.)

ARTICULATION, the act of joining together; in anatomy the junction of the bones (*see* JOINTS AND LIGAMENTS); in botany the point of attachment and separation of the deciduous parts of a plant, such as a leaf. The word is also used for division into distinct parts, as of human speech by words or syllables.

ARTIFICIAL RESPIRATION. When the normal respiratory function in man is arrested by disease or accident, it is frequently possible through external agencies to imitate the normal movements of the thorax and diaphragm and thus induce artificial respiration. The most common occasions for attempting resuscitation are asphyxia from smoke, gas, fumes or surgical anaesthesia, apparent drowning and electric shock. More rarely traumatism or disease may affect the nervous mechanism controlling the movements of respiration, particularly the "respiratory centre" situated in the medulla. If the normal ventilation of the lungs is approximated for some time through artificial means, the normal, rhythmic function of nerve centre and of muscles may be resumed. In many instances of impending death the heart continues to beat for some minutes after cessation of respiration. It is accordingly important that resuscitation measures be instituted with all possible promptness.

Various mechanical devices have been proposed for the purpose of inducing artificial respiration, but as most of them are almost ineffective or even dangerous they have been generally supplanted by the manual "prone pressure" method devised by E. A. Schafer of Edinburgh in 1903. This simple method provides for the compression of the thorax thus expelling poor air from the lungs and for the sudden release of the chest wall which by its elasticity expands, with the resultant intake of fresh air. Air is not forced in but is drawn in, as with natural respiration, between the intervals of compression. For further particulars of the Schäfer method *see* DROWNING AND LIFE SAVING.

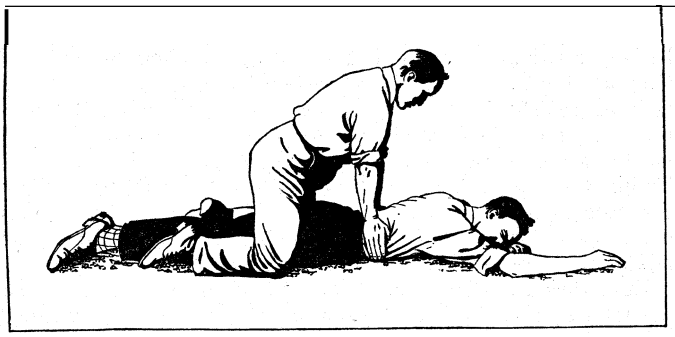
BY COURTESY OF U.S. HEALTH SERVICE

FIG. 1.—FIRST MOVEMENT OF THE SCHÄFER PRONE PRESSURE METHOD
Straddle the patient. Place your palms on the small of his back with the fingers over the ribs. Bend the body slightly forward so that the weight of the shoulders can be brought into play

In cases of gas poisoning recovery may be hastened by using an air mixture rich in oxygen. If about 5% of carbon dioxide (not to be confused with carbon monoxide) is mixed with the

oxygen, a return to normal breathing may be even more rapid as carbon dioxide acts as a stimulant upon the respiratory centre in the brain. The oxygen displaces the carbon monoxide which, in poisoning due to that gas, forms a temporary union with haemoglobin in the blood.

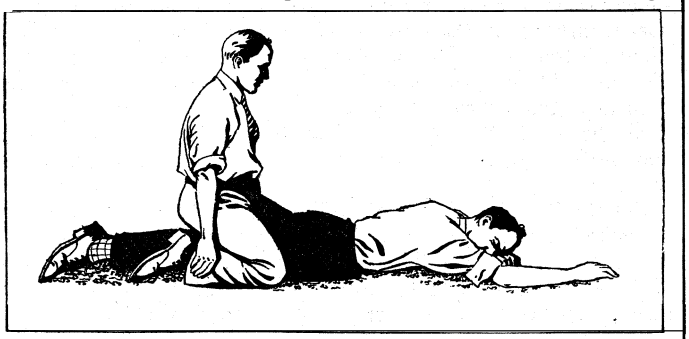
There are now widely used various forms of inhalers through which there is supplied either pure oxygen or oxygen mixed with



BY COURTESY Of U S. HEALTH SERVICE

FIG. 2.—SECOND MOVEMENT OF THE SCHÄFER PRONE PRESSURE METHOD While counting "one," "two," and with arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the patient

carbon dioxide. This apparatus is used in conjunction with the prone pressure method of resuscitation. It must be remembered that such an inhaler is not a mechanical appliance for the administration of artificial respiration, but rather a device through



BY COURTESY Of U.S. HEALTH SERVICE

FIG. 3.— THIRD MOVEMENT OF THE SCHÄFER PRONE PRESSURE METHOD While counting "three," swing backward, thus removing all pressure from the subject. After an interval of 2 seconds return to movement one

which there may be administered gases which accelerate recovery. Inhalation apparatus can usually be obtained from gas companies, fire headquarters or hospitals. (See DROWNING AND LIFE SAVING.)

(W. WR.)

ARTILLERY, as constituted today (1940), is difficult to define with exactness since the point at which the large calibre machine gun merged into the small automatic cannon was an intangible one. However, if under the artillery classification are placed all firearms with a bore diameter of over 25mm. (1in.), and firing explosive projectiles, we may somewhere approach an accurate definition. But artillery also means those who transport and serve such weapons, *i.e.,* personnel, as well as the guns themselves and their appurtenances, which are designated *matériel.* For a discussion of the latter, see ORDNANCE and AMMUNITION. The flight of artillery (and other) projectiles is the subject of studies under the science of BALLISTICS (*q.v.*) while the joint employment of personnel and matkriel is discussed in the articles on FIELD ARTILLERY and TACTICS.

Artillery (*matériel*) is subject to various classifications. A simple method is to divide it into two basic groups--mobile artillery (designed for, and capable of, comparatively quick transfer from one point to another), and immobile artillery, or artillery of position, this being a relative term applied to heavy cannon which, once emplaced (as in permanent seacoast or fortress defences) are rarely moved. But upon occasion even such pieces or (more likely) the personnel serving them, may be called upon to play a part in a war of movement. And since a fortress or coast defence may include in its armament guns of every size and calibre, all effort to subclassify this becomes abortive. In the field, however, we find such specialized types as mountain artillery, tank and anti-tank, aircraft and anti-aircraft weapons, or more comprehensive groups, such as battalion and regimental guns, divisional, corps and army artillery, etc. As their names indicate, these increase steadily in calibre, range, and effectiveness from battalion up to corps, though army artillery is a composite of all types.

Yet another nomenclature in daily use, each category of which embraces both mobile and immobile pieces, classifies artillery as guns, howitzers and mortars. Briefly, for arms of like calibre, the gun is a long barrelled, long range, weapon with a relatively flat trajectory (path followed by the projectile); the howitzer has a shorter barrel, medium range, and moderately curving trajectory, while the mortar, with very short barrel, exhibits a much curtailed range and hairpin shaped trajectory because of the high angle at which it is always fired. Intermediate types also exist, possessing some of the characteristics of both mortar and howitzer, or howitzer and gun, and hence quite difficult to classify.

Prior to the invention of gunpowder, artillery, in France and England alike, signified bows and arrows. Thus the weapons of the Genoese crossbowmen at Crkcy (1346) are referred to by Froissart in his account of the battle as "leur artillerie," while Ascham in Toxophilus (1571) says that: "Artillerie nowadays is taken for two things: gunnes and bowes." Here, again, confusion results from changes in meaning undergone by certain technical words in the course of time, changes to which may be ascribed much of the uncertainty existing as to the origin and evolution of many instruments today in use. Thus the "gunnes" of Ascham meant to Chaucer no less than three different objects, as indicated by his employment of the earlier form "gonne" to designate: a throwing machine (in his translation of the *Romaunt* of the Rose); a missile (Legende of Good Women); and finally a cannon (*Hous* of Fame). Naturally the uninitiate, discovering the word "artillerie" (or "gonne") in a work of early date, would be inclined to endow it with its present meaning, and so perhaps to surmise the existence of ordnance at a period considerably antedating that of its actual introduction.

Obviously, before artillery as it is known today could take shape, some agency for propelling missiles, at once simpler and more powerful than the physical means employed in the earlier forms of projectile weapons (see ENGINES OF WAR) had to be discovered. Such an agency was gunpowder, a mixture of three ingredients, sulphur, charcoal and saltpetre, apparently first elaborated in practicable form by the English Friar (Roger) Bacon (c. 1214–1292) who described certain of its properties in a volume written some time prior to 1249. But there is nothing in that work to indicate that he possessed any idea' of its possible use as a propellant. He realized that it could and would explode, and might, as a result, be adaptable to the arts of warfare, but further he apparently failed to speculate.

So it remained (according to most authorities at least) for another ecclesiastic, one Berthold Schwarz (or Anklitzen) of Freiburg, Germany, to be credited with the invention of the cannon. The exact date is obscure, and though 1320 is the one designated by most historians, there is good evidence to indicate that 1313 is more nearly correct. Thus among the records of the city of Ghent for that year appears, after a list of municipal officers, the significant entry: "Item, in this year the use of *bussen* (*i.e.,* cannon) was discovered in Germany by a monk."

1. **Early** Artillery (14th Century).— Numerous references are found to artillery in the early 14th century, perhaps the first of which dates from 1326, in which year the authorities of the Italian republic of Florence ordered a number of "metal" cannon for the defence of the State. Hence the battle of Crécy, commonly quoted as the most remote occasion upon which gunpowder was employed by the military in projectile weapons, yields priority to several other well-authenticated instances of the use of this destructive combination. None of these, however, which suggests the existence of artillery in the Orient. or indeed anywhere else, prior to 1300, appears to withstand close scrutiny.

Many of the earliest cannon were constructed of bundles of iron (or even wooden) staves placed side by side around a cylindrical mandrel or core and welded together more or less solidly by heat and hammer into the form of a crude tube which was given added rigidity by a series of encircling iron rings, sometimes so broad and placed so close together as entirely to conceal the staves beneath. Because of the necessity for using a core, the removal of which when the cannon-tube was completed left the latter open at both ends, the matter of securely closing the breech presented quite a problem and many of the early pieces were, as a result, produced as breech-loaders, and supplied with several interchangeable breechblocks recessed to receive the powder charge. Not all artillery of this period was so constructed, however. Thus the Florentine "metal" guns referred to above were presumably of bronze, and if so, doubtless muzzle-loading and fabricated by some sort of casting process. Indeed this method of manufacture (*i.e.*, by casting) may readily have antedated all others, the oldest ordnance drawing which has been preserved, depicting a cannon as a cast, vase-like affair, broad mouthed, narrow necked, then swelling again to a bulbous breech. The projectile, naturally enough from the evolutionary standpoint, was a metal arrow or dart, its shaft doubtless wrapped with some sort of packing to lessen the escape of powder gases.

The efficiency of these crude specimens of artillery was severely limited (were any limitation necessary) by the "serpentine" powder of the day, which was truly a powder and not the grained substance now known. This required no little skill in handling, and an experienced gunner could develop the full capabilities of a piece where a tyro was likely to blow it up (and himself and crew into the bargain) or else be plagued either with a succession of "misfires" (the charge failing to burn when the match was a p plied) or a series of "overs" or "shorts" — the missile falling beyond, or on the near side of, the target. The whole secret lay in the fact that the finely divided mixture would form into a solid mass practically impermeable to flame when rammed too vigorously, or simply "fizzle out" like a weak firecracker when seated with insufficient force. Only when put in place with the delicate touch gained from long experience, which left it loose enough for a flame to spread quickly through its fine interstices, yet packed tightly enough to build up what constituted, in effect, an explosion rather than a progressive (but ballistically impotent) conflagration, did it really perform satisfactorily.

Further. it was soon discovered that such powder, when mixed beforehand and transported for any distance, tended to separate out, the heaviest component (sulphur) settling to the bottom, and the lightest (charcoal) rising to the top. Fired in this state, it was even more than ordinarily inefficient. The result was that the gunner had to mix the several ingredients on the field of battle, a precarious manbeuvre in view of the fact that the lighted matches of the musketeers were everywhere about. Thus he became a man apart, feared and shunned by all and sundry.

2. Fifteenth Century. — Dating, however, from about 1429, we find record of an achievement only less wide in its import than those accomplished by Bacon and Schwarz — the "corning" of powder. Briefly, this involved the mechanical incorporation, in fixed proportions, of the three ingredients so firmly and intimately that there was no longer any tendency for these to become dissociated on handling, plus the added feature of turning out the finished product in "grains" of various sizes according to the purpose for which intended,—*viz.*, small grains for small guns; large grains for large ones. (Large grains fired in a small piece burned so slowly that much of the charge left the muzzle unconsumed, its effect thus entirely wasted. Small grains in a large piece burned so fast as to develop dangerous pressures in the chamber, and sometimes even to burst the tube, ere the ponderous shot ahead could fairly get started.) The grains of the new product, though of about equal weight, were irregular in shape, hence could not ball up into a conglomerate mass as did the "serpentine." Instead, the interstices so necessary to the swift propagation of the flame were thus automatically provided, and the "explosion" of each successive charge was uniform — and highly effective. So effective was it indeed that though the employment of corned powder in small arms went rapidly forward, it was a full century before its adaptation to artillery had become complete. For the cannon of the period were wholly unequal to the strains set up by this improved propellant, nor was the art of gun founding able to meet the situation thus arising for many decades yet to come.

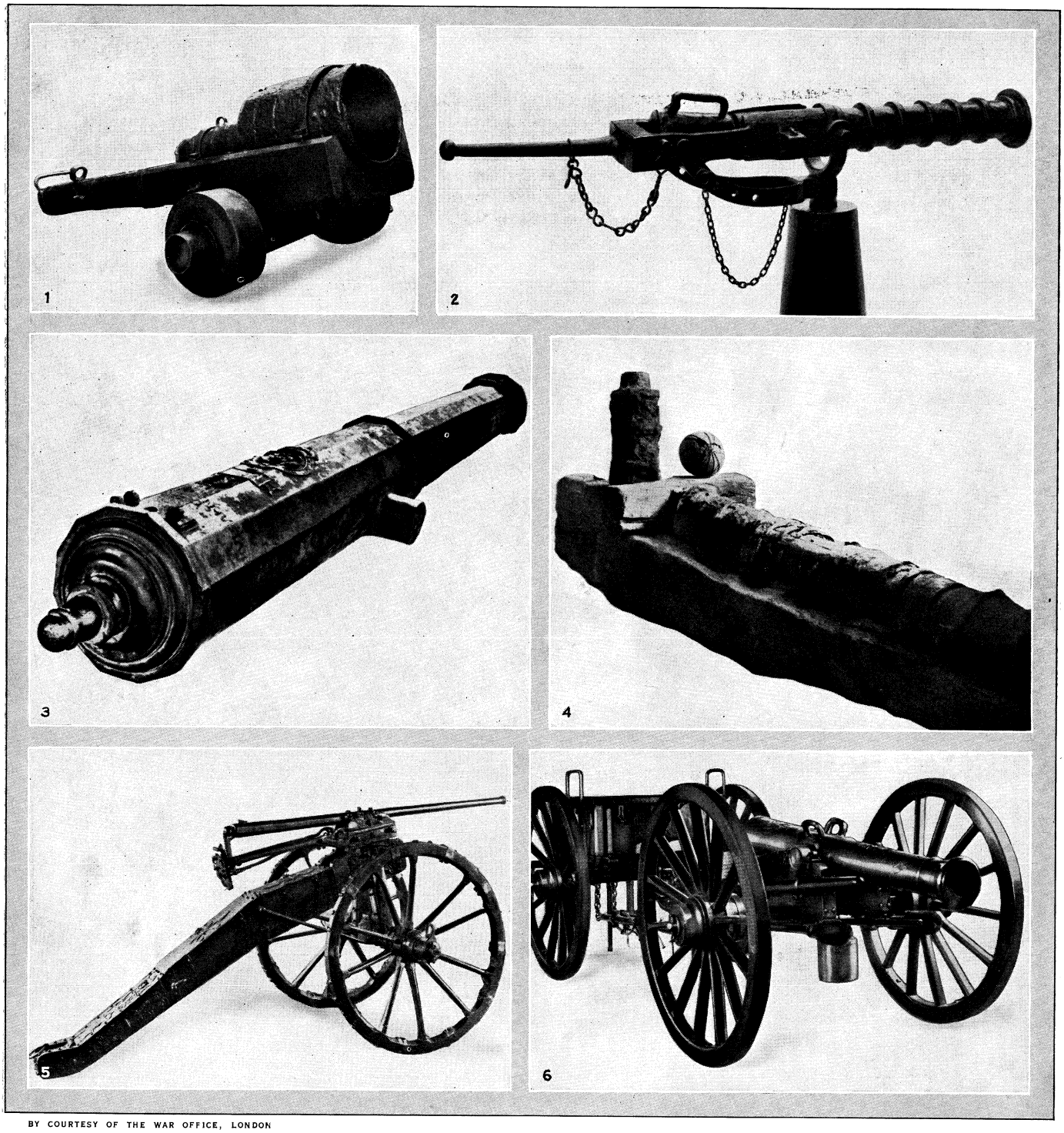
Despite the inventive genius constantly devoted to the development of firearms, artillery included, the 15th century waned and closed without these new agencies of warfare having gained sufficient recognition to receive special classification either on the basis of relative size or tactical employment. Thus Francesco di Giorgio Martini, writing a few years prior to Charles VIII's expedition against Naples (1494) describes ten different types of firearms, and adds that this by no means exhausts the list. Yet he draws no distinction between cannon and shoulder weapons. To him the bombard. 20 feet long and firing a 300lb. ball, falls in the same category with the scopietto which measured 24in.–36in. overall and discharged a missile weighing one-half to three-quarters of an ounce. All were to him, "artillery."

Nevertheless a differentiation, among the heavier pieces at least, was taking place, if insensibly, and before the 15th century ended, field artillery as distinct from the more ponderous and relatively immobile artillery of position, may be said to have been born. Prior to this time, field artillery consisted simply of such guns of its siege train as an army was able to bring into the field. But the Italian wars which Charles VIII initiated, stimulated French ingenuity to the development of means whereby guns could be endowed with a fair degree of mobility. These included the uniform mounting of ordnance on wheeled carriages (in place of the clumsy sledges theretofore prevalent) and the employment of well-trained horses, rather than the slow-footed ox, as draught animals. Thus while the Italians and Spaniards were still entrusting the transport of their artillery to that sluggish beast, and Maximilian possessed draught teams sufficient to move but half of his siege train at a time. the sturdy French horses were learning to draw heavy cannon on level roads at a pace equalling the marching speed of cavalry!

But the French were not alone in their efforts to make artillery a mobile arm. Indeed, the Italian, Bartolomeo Colleoni (d. 1475) is credited with being the first captain to develop a true field artillery tactic, locating his light guns in the rear of other elements, and firing through gaps in these which were opened at a given signal. Nevertheless, such practices were far from general, and most Italians considered Charles VIII's employment of field guns as something quite revolutionary. Fortunately for him, he so outweighed his adversaries in the quantity and quality of his artillery, not to mention pieces exceeding in calibre any yet known in Italy, all mounted on scientifically designed carriages and operated by trained gunners, that his superiority in that arm was maintained throughout all the earlier Italian campaigns, its reputation alone being in some instances, as at Fornovo, sufficient to undermine enemy morale.

It was during this century that artillery acquired a characteristic which it had theretofore lacked (to the considerable limitation of its effectiveness, withal) — namely the trunnions whereby the gun tube was affixed to its mount, about which it could be rotated when an increase or decrease in range was desired, and through which the shock of discharge was transferred in large measure to the carriage. In earlier types, the simple cylindrical tube or barrel was commonly set into a heavy wooden framework, a stout crossmember of which abutted against the breech and received from it the impulse of recoil. This crude design did not by any means yield without a struggle to the more advanced one in which trunnions figured, for the obvious reason that it was much easier to cast a plain tube than one from which two excrescences projected outwards opposite one another at right angles to the tube axis. But the advantages of the trunnions were so outstanding that the simpler but less efficient trunnionless type was finally replaced entirely by its more adaptable competitor.

3. Sixteenth Century. — Artillery continued to expand in girth and stature, — literally and figuratively. French successes stimulated others to emulate their efforts and the younger duke of Ferrara, whose father (d. 1505) had long been interested in ord-

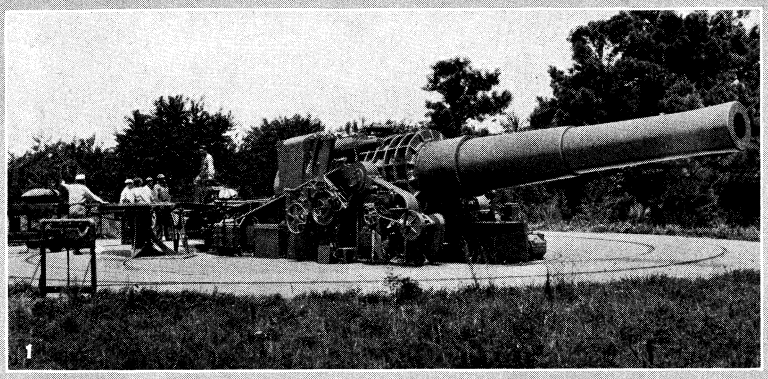


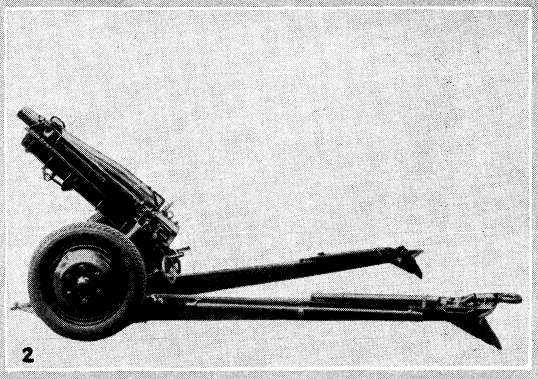
BY COURTESY OF THE WAR OFFICE, LONDON

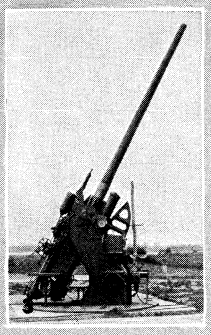
TYPES OF EARLY ARTILLERY

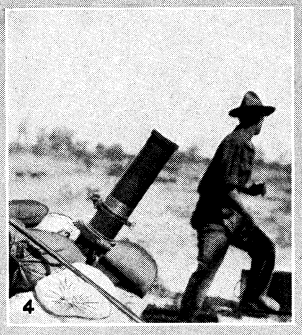
1. A 14th century wrought iron 15-inch bombard, which threw a stone shot weighing about 160 pounds
2. Peterara, an early breech loader of forged iron, 1461-1463, made of bars of iron hooped together with iron rings
3. Brass culverin bastard, of the time of Henry VIII., with rose and crown in relief
4. "Mary Rose" breech-loader, a wrought iron gun recovered in 1836 from the wreck of the "Mary Rose," which sank off Spithead in 1545
5. The falconet, a wrought iron field gun of the 17th century. mounted on a swivel carriage of the period
6. French brass field gun of the time of Napoleon III., which was presented by him to Queen Victoria in 1858

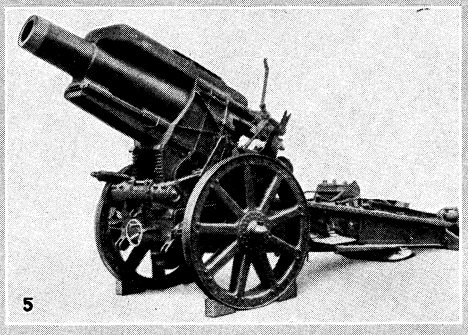
ARTILLERY

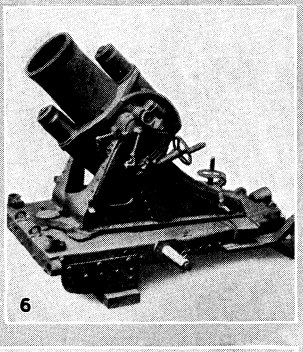


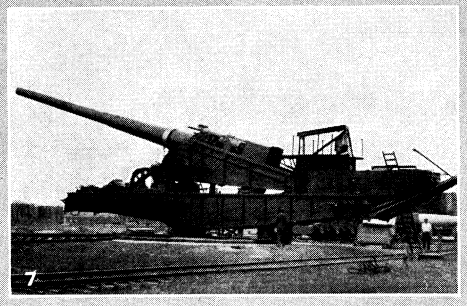


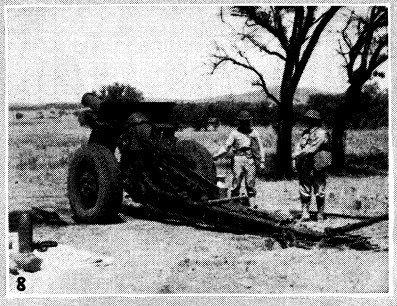


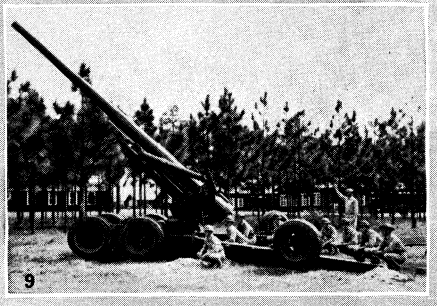


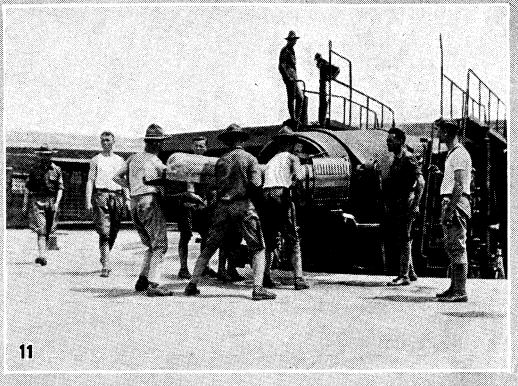












BY COURTESY OF (2, 8, 9, 10) THE U.S. ARMY SIGNAL CORPS, (3) ORDNANCE DEPARTMENT, U.S. ARMY, (4, 11) THE U.S. WAR DEPARTMENT, (5, 6) THE IMPERIAL WAR MUSEUM (CROWN COPR.); PHOTOGRAPHS, (1) EWING GALLOWAY, (7) INTERNATIONAL NEWSREEL

FIELD AND COAST ARTILLERY

1. A 16-in. howitzer at Fort Story, Cape Henry, guarding Hampton Roads and Chesapeake bay
2. American 75-mm. pack howitzer on 75-mm. carriage
3. 105-mm. anti-aircraft gun
4. A 6-in. Stokes trench mortar, an infantry weapon used principally in trench warfare during World War I. The sandbags assisted in concealing cannon and provided protection for gun crew
5. A German heavy howitzer, 21 cm. (World War I)
6. A German heavy trench mortar, 25 cm. (World War I)
7. A 14-in. rifle at Aberdeen, Md., mounted on railway carriage, readily transportable for seacoast defense
8. Firing a U.S. 155-mm. howitzer
9. Modern American 155-mm. gun
10. Battery of 12-in. disappearing rifles. Gun in background is firing, one in foreground has been fired and has recoiled and is being sponged for reloading
11. A 16-in. coast artillery gun, mounted on a disappearing carriage

nance, and was one of the few of noble birth to engage in its production prior to 1500, turned out specimens in considerable numbers, and of increasingly high quality. In 1509 was witnessed the destruction by his artillery of the dread Venetian fleet which had proceeded up the Po to within a short distance of his capital, an event which contributed enormously to the increasing prestige of artillery in general. Only the year following, the French accomplished the reduction of Legnano chiefly through the agency of two of Ferrara's guns of tremendous size, the casting of which he had personally superintended.

As the 16th century neared midpoint, the artillery policies of all great nations of that day, which had been developing without rhyme or reason for well over 200 years, appeared ready for a complete overhaul. Calibres and varieties of guns approached infinity; standardization of any kind was unknown. To reduce this chaos to some sort of system Charles V of Spain decreed, in 1544, a total of seven models of cannon which would thenceforward be made for, and used by, the armies of his empire. These included a cannon (40-pounder), a cannon-moyen (34-pounder), two types of 12-pounder culverins, two 6-pounders, and a 3-pounder falcon. (Early pieces were often named after birds of prey.) The French were quick to follow suit, and in 1550 Henri II issued an edict restricting the number of calibres to six, the heaviest a 33-pounder weighing, with its carriage, 8,000lb., and drawn by 21 horses; the lightest a a-pounder to which two horses were assigned. Later (1584) two additional types were permitted, a 12- and 24-pounder (calibres which the Spaniards had found useful in the Low Countries).

The practice of the day involved the transport of these pieces muzzle foremost, their massive trails dragging on the ground behind, and their equine motive power stretched out in single file, so that each gun when on the march must have occupied interminable yards of road space. Nor did the passage of time simplify the picture, for the 33-pounder of 1633 (83 years later) had increased in weight by 400lb., and the horses drawing it now numbered no less than 2j, though some progress could be recorded in the fact that the weapon was now hauled trail foremost.

These gestures of Charles of Spain and Henri of France, while aimed in the right direction, left much to be accomplished. Thus, among a few of the shortcomings of contemporary artillery, may be mentioned their want of limbers; carriages which boasted but two wheels and were completely lacking in uniformity; failure to provide the artillery train with any spare parts for emergency repairs (save an occasional extra wheel), and so on. No specific powder charges were established, though practice favoured the use of a weight of the (very indifferent) propellant then current which actually equalled that of the shot. Three sizes of powder were employed—large grained for the heavier guns, small grained for the lighter, and a still finer type for priming all varieties.

During this century the art of gun-founding was introduced into England by ordnance-minded Henry VIII after he had been forced, by lack of a home industry, to reach overseas and employ the famous Fleming, Hans Poppenruyter, to supply him with close to 150 pieces of varying calibres, including the celebrated set of bombards known as the "Twelve Apostles." He likewise imported (c. 1515) foreign armourers and established schools of instruction for native artificers. Nor was he entirely satisfied with the ordinary solid shot then in use, but undertook to augment these with crude types of shell described by a contemporary as: "... hollow shot of cast yron, stuffed with fire-works or wild-fire: whereof the bigger sort for the same had screws of yron to receive a match to carry fire kindled, that the fire-work might be set on fire to break in small pieces the same hollow shot, whereof the smallest piece hitting any man would kill or spoil him." Here we see (in the type "stuffed with fire-works") the beginnings of the explosive shell and (in that containing "wild-fire") of incendiary projectiles.

In the German states, calibre simplification was not then carried as far as in France. Thus we find illustrated and described in Napoleon and Favé's work on artillery, as in use during the period 1550–1600, no less than 11 varieties of mobile cannon. from a little one-pounder to a huge piece discharging a 94lb. ball. Further, there existed among all of these save the very smallest, subclassifications which brought the total to the impressive figure of 40, the heaviest of which called for no less than 60 horses to get it into motion. But far more important than the number of cannon types employed in France, Spain or Germany at this time were the premonitory rumblings then coming out of Italy to predict the birth of a new science—ballistics. Given written expression by the famous mathematician Tartaglia in his works which appeared in 1537, 1546, and 1551, these constitute the first recorded scientific approach to the theory of gunnery as distinguished from the rule-of-thumb practice theretofore prevailing. And although in large measure incorrect, this author's ideas on the trajectory of a cannon ball (previously held to be a straight line from gun muzzle to some point in space, after which the missile fell suddenly to earth) were so far ahead of his day that he justly deserves the title of first ballistician.

4. Seventeenth Century.— By this time some artillerymen were beginning to realize that certain practices, though hoary with age, lacked foundation in logic. Thus it had, from the very beginning, been customary to make the barrels of cannon (as contrasted with mortars; howitzers came along later) outlandishly long—to afford opportunity for the complete combustion of the "serpentine" powder originally employed in them. Came the introduction, and finally the general adoption, of corned powder, which burned faster and more evenly, and accomplished as much in short barrels as its predecessor had in long. Yet long they continued to be made, no one quite knew why. Similarly, though some of the earliest cannon to be cast with trunnions had these located where they properly belonged—with their long axes in the same plane as that of the long axis of the bore—practice soon departed from this and trunnions came to be set on a level with the bottom of the bore, and remained so situated for generations. As a result there was, at each firing, an undue strain on the trail of the piece which, as the strength of powder increased, frequently gave way under the force so applied. Not until the latter half of the 18th century was this patent error generally corrected.

During the first half of this century, Gustavus Adolphus of Sweden introduced (1626) his famous "leather" guns, so named because the external casing of the barrel was of that material. The bores, however, were metal (copper) tubes. Every effort was made to curtail weight, and as a result that of the gun itself, apart from its light carriage, came to but golb., and the piece could easily be drawn by two men. Designed as the last word in mobility, it possessed that qualification in high degree but embodied at the same time a deadly disadvantage. For on repeated firing it became so hot that a new charge would often ignite spontaneously. This led to its supersession (1631) by *matériel* of more substantial, if less mobile, character, and further effort to develop a truly light artillery remained in abeyance until resumed in the century following by Frederick the Great.

During this period calibres of French cannon underwent further change by reason of the adoption of various foreign pieces. This resulted in an increase in varieties from six to seven, the largest piece now being a 48-pounder, then ranging downward through 32, 24, 16, 12 and 8-pounders to one of 4-pounds. But here all order ended. For the kingdom was divided into a number of artillery districts, each commanded by a lieutenant-general of that arm. And the cannon, and all their accessories, of one district, differed from those in the next. Each calibre of gun employed wheels of a size unlike that used by any other calibre. Spare carriages were taken into the field, but those of one district would not mount the guns from another. In but one feature was simplification of the practices of the preceding century evident: powder had become standardized in grains of a single size (and ballistically speaking, this evidenced a retrogression). But here again, specimens from the several districts were likely to exhibit marked variations in strength, though, for the most part, a charge of but two-thirds the weight of the ball now accomplished what had required weight for weight a century earlier, the quality of powder having improved to this extent over the intervening years.

5. Eighteenth Century.— This was to witness a period of marked ordnance activity on the part of all major Europesn na-

tions. Among the high lights may be noted the abolition in France (1732) by General Valière of all mobile pieces above the 24-pounder, thus making that calibre the nation's heaviest field weapon. Coincidently he decreed a uniformity in the methods of fabricating cannon never before attempted. Unfortunately, his efforts ceased at this point. There remained as many different designs of gun-carriages as there were manufacturing arsenals. Axle-trees continued to be of wood. Limbers, when used at all, were too low, and draught horses were still strung out in single file ahead of the guns to which they were hitched.

Turning to England, we find the groundwork of modern ordnance theory and practice laid by Benjamin Robins (1707–50) whose Principles of Gunnery (1742) exploded ancient superstitions upon the nature and action of gunpowder and the flight of projectiles, and formed the basis of all later scientific studies in these fields. Gunners were now for the first time able to measure with considerable exactness the muzzle velocities of projectiles delivered by their pieces—due to his invention of the ballistic pendulum, a device whereby the energy of a projectile suddenly halted in its flight could be accurately estimated and translated into terms of velocity.

By the time of Robins' death, strenuous efforts were again being made on the Continent toward developing a truly efficient mobile ordnance (field artillery). Thus the Seven Years' War found Prussia in the midst of a series of experiments with pieces weighing from 80 to 150 times as much as the balls they fired, while by 1762 the Austrians had standardized on guns all 16 calibres long (*i.e.*, with tubes 16 times their diameter in length), all 115 times the ball in weight, all firing missiles carefully cast to a true spherical form, and with so little "windage" (excess in diameter of bore over that of projectile) that they achieved excellent results with powder charges not exceeding in weight one-third that of the missile.

Other nations were not insensible to these developments, and by 1765, Jean Baptiste de Gribeauval (who became chief inspector of artillery in 1776) had commenced yet one more revamping of French *matériel*. This resulted in even further reduction in the number of different calibres employed in the field, these now totalling but three, the heaviest a 12-pounder, the others carrying 8 and 4lb. balls respectively. These were all 18 calibres long and 150 times the weight of the shot for which designed, thus continuing the now well-established trend toward reducing the length and weight of field pieces. Once again, much attention was paid to securing balls of true sphericity and correct diameter, this making possible the same reduction in powder charge as had been effected by Austria, *i.e.*, to one-third that of the ball in weight.

Another innovation was the introduction, for field use, of a light howitzer of 6in. bore. Yet another, which marked a real milestone in artillery progress, was the disposition of draught horses in double files in place of the single file theretofore employed. Six horses now sufficed to draw the 12-pounder—four for the lesser sizes, a pleasing contrast with the numbers required a century earlier. Limbers, heretofore but casually in use, became standard equipment. These were large, six-wheeled affairs, but higher and more serviceable than those of Valière. The limber box (a combination receptacle for ammunition and seat for some of the gunners), failed, however, to gain acceptance despite Gribeauval's strenuous efforts, though he did succeed in establishing interchangeability of wheels (and other parts) and in introducing iron axle-trees, elevating screws, tangent scales, and prefabricated cartridges. These (which replaced the old loose powder and shot) embodied carefully weighed powder charges sewed into cloth bags, to one end of which a shot was securely affixed, the whole being swept down the bore of the piece and seated at the breech by a vigorous movement of the rammer. They were, however, in no sense a new invention, Adolphus having used them with some success in the century preceding.

Other of Gribeauval's achievements included the tlassification of land ordnance into three well-defined groups (field, siege and coast-defence) according to the purpose for which intended. In the first category he endeavoured, unsuccessfully, to educate his countrymen to the importance of "horse artillery," an ultra-mobile element first employed by Frederick the Great (1759), designed to manoeuvre with cavalry in the manner in which field artillery operated with infantry. Not, however, until after the outbreak of the French Revolution was such a unit found in the French service, its counterpart, incidentally, appearing in England at approximately the same time. The latter years of the 18th century are marked by the invention (1784) by a British Lieutenant (later General) Henry Shrapnel of a form of "spherical case" shot later destined to bear his name and to supplant (for use against personnel) most other types of artillery ammunition for well over a century to come.

6. Nineteenth Century.— This was to record a series of advances in ordnance practice so brilliant as to render the artillery in use when the century closed, probably ten times as efficient as that which marked its opening. Contributing factors included progress in chemistry, mechanics, metallurgy, optics and associated sciences which together made possible: (1) the perfection of a workable rifled cannon, an objective long sought by ordnance engineers but never before successfully attained, and (2) the adaptation to rifled cannon of elongated projectiles which (a) because of their more streamlined form were less affected in flight by wind than were the round balls they displaced; (b) by reason of the stabilizing spin imparted them by the rifling grooves, flew much straighter, and *(c)* being decidedly heavier than a ball of like diameter, ranged much farther than the spherical form. But to propel these heavy bolts, more and better powder was required. This was made available through the researches of Captain (later General) T. J. Rodman, U.S.A., whose "mammoth" brand was produced in large hexagonal prisms, perforated to permit the flame burning from within outward as well as from outside inward. Thus the initial violent evolution of gas from the burning grains, followed at once by a progressive decrease in gas production as the surface of unburned powder exposed to the flame was steadily curtailed, gave way to a situation where, though the external surface of the grains constantly shrank, internal surfaces (provided by the perforations) were enlarging with each instant. The final effect was to stretch out materially the period of mass evolution of gas (and of high pressures on the chamber walls), and so to develop, in effect, a prolonged steady push against the base of the projectile, rather than a sudden blow, with maximum stresses much moderated. But before this achievement had been recorded, workers in other fields, attacking the problem from different angles, had succeeded in producing guns both of bronze and cast-iron (the two materials used almost exclusively in the founding of cannon for centuries past) possessing such high physical characteristics as to enable them to withstand pressures formerly unthought of. In the case of bronze, this result was attained by the admixtures of certain proportions of phosphorus to the copper-tin alloy. [The achievement came too late (1870). The day of the bronze cannon was over.]

Toward enlarging the capabilities of iron pieces, two Americans offered solutions. One, a civilian engineer, Daniel Treadwell (1791–1872) designed (1841) a built-up, muzzle-loading cannon which he evidently believed his exclusive invention, though his claims have been disputed in favour of a Frenchman (Thiery), said to have developed a similar piece in the 1830s. Treadwell's gun, in its final form, consisted of a central tube of cast-iron or steel, surrounded by a series of wrought iron or steel hoops, shrunk on after heating, and in some instances united also by screw-threaded joints. This basic method of construction was later successfully adopted in the United States by Parrott, and in England by Armstrong and Blakely, and, save for improvements in means and materials, remains accepted practice today. But Treadwell received no adequate encouragement from the military, and died disappointed and discouraged.

The other system (Rodman's), developed about 1845, was quite different. Instead of casting guns as solid cylinders of iron, later to be bored out, the ancient and honourable method. he cast them hollow about a removable core through which a stream of water was slowly passed. Cooling thus took place from within outward (the external walls were kept warm meanwhile), succeed-

ing layers of metal from bore to surface undergoing compression as those overlying slowly shrank, thus accomplishing, but by a radically different method, just what Treadwell had done. But cast-iron, like bronze, had had its day as a material for gun construction, and though Rodman's process saw active application for two or three decades, it eventually was forced to give way to others in which the piece was built up (à la Treadwell) from successive layers of steel. The advantages of this material for cannon fabrication had long been recognized, but until the mid-19th century, no methods of producing it in the quantities, and qualities required, had been evolved. As soon, however, as these were devised, steel moved rapidly to the position of ascendancy which it has since maintained.

The military world was now enjoying rifled cannon which projected heavy, elongated missiles to what were then considered stupendous ranges, this as a result of the improved powders and stronger gun tubes. Thanks to Capt. LeBoulengé of the Belgian Army it had now acquired an instrument (chronograph) which constituted a material improvement, for measuring velocities, over Robins' ballistic pendulum. But it still lacked accurate means of estimating the forces exerted by the burning powder gases against the breech of a weapon. As a result, current methods of determining the strength of the walls required to withstand these were based more on trial and error than anything else. But here again Rodman stepped into the breach by designing a gauge which permitted very accurate calculation of the pressures engendered.

But three factors were now lacking to make the gun the super-efficient engine it became with the advent of the 20th century. These were (1) a successful system of breech-loading; (2) a satisfactory smokeless powder, and (3) means to dampen the forces of recoil when the piece was fired so that it could be relaid on its target quickly and accurately. In respect of the first, breech-loading cannon of fair efficiency had been produced as recently as the 1840s by Cavalli, a Sardinian officer, and Baron Wahrendorff of Sweden. And the time was ripe for such a development, for as guns became longer and heavier, the mechanics involved in getting the charges properly inserted into their ponderous muzzles, ramming them home, then returning the pieces to their firing positions and re-laying them upon their targets became increasingly complicated, and a satisfactory system of breech-loading more urgently indicated.

During the '60s and '70s, several such methods were perfected simultaneously in France (de Bange), Germany (Krupp), Spain (Freyre) and the United States (Broadwell).

In the field of propellants, black powder, which reigned supreme, produced so much smoke as to obscure both firer and target after a heavy volley, or broadside, and left such heavy fouling in a gun bore as to require frequent cleaning if accuracy were to be maintained. In addition, it was, despite the notable achievements of Rodman and others, far from under full control in the matter of the chamber pressures it developed. A new propellant, smokeless, without residue, and capable of being harnessed over a much wider range of its activity, was urgently indicated. The answer appeared at hand when, during the 1860s, Baron General von Lenk conducted a prolonged field test of guncotton (first compounded a few years previously) in the Austrian artillery. But a lack of stability, and consequent tendency to spontaneous explosion in storage, led to its eventual rejection. So it remained for the French chemist Vieille (1884) to harness this unruly substance by gelatinizing it into colloid form with the aid of suitable solvents, and thus make available to the military world the propellant it had so long awaited.

And now the science of mechanics, which had already solved the problem of breech-loading, came again to the aid of the artilleryman, and gave him a gun mount so ingeniously designed as to permit it to absorb the tremendous recoil developed when a modern piece is fired, this without rearward movement of the carriage, or displacement of the barrel from its original position once action and reaction had had their effect. This was accomplished by suspending the gun tube proper in a cradle, and interposing between the two, compression cylinders, heavy spiral springs or other means of accumulating, as the barrel swept rearward, the energy necessary to return it to its original position, once recoil effects had been dissipated, rather than transmitting these to the carriage. (Prior to the development of such a system, the gun, and its mount, to which it was rigidly affixed, used to recoil to distances varying with the calibre of the piece and charge employed, then to be brought back "into battery" by human effort —and pointed again at its target.) With the perfection of such counter-recoil mechanisms, artillery finally acquired all the more important characteristics which it possessed at the commencement of the World War (1914–18).

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THE WORLD WAR, 1914-1918

7. **Situation** in 1914.—The artilleries of the main forces were organized and equipped as follows:—

(a) Great Britain.—Each divisional artillery comprised 54 18-pdrs. in three brigades of three batteries, 18 4·5in. howitzers, in one brigade of three batteries, and four 60-pdrs. There was also a siege train of six 8in. howitzer batteries.

(b) France.—Each first line divisional artillery comprised 36 75mm. guns in three "groupes" of three batteries. There were also 20 regiments of corps artillery each consisting of four "groupes" of 75mm. guns, five regiments of heavy artillery, 11 foot regiments and some mountain artillery.

(c) Germany.—Each first line divisional artillery comprised 54 77mm. guns and 18 10·5cm. howitzers in two regiments which were subdivided into three "groupes" of three batteries of guns and one "groupe" of three batteries of howitzers. In addition there was in each corps a battalion of 12 15cm. howitzers and in each army a number of 21cm. howitzers.

The types of equipment in use by the three Powers did not vary to any marked degree. All proved deficient in range, the British equipment being initially at a particular disadvantage in this respect. The French lack of a field howitzer was due to the failure of Parliament to appropriate the money for one "groupe" per division. It will be seen that there were, however, important differences in the allotment of the artillery as between divisions, corps and armies and in the aggregate proportions of the various types of equipment. The Germans had a marked advantage in the possession of a large number of howitzers capable of assisting in both field and siege operations. Both Britain and Germany had 6-gun batteries while the French batteries were of four guns. All three countries had divisional artillery commanders, but France alone had an artillery commander at corps headquarters. Viewed in the light of subsequent experience, it would seem that both the British and French tactical doctrines of 1914 unduly emphasized the importance of mobility to the detriment of fire power. The German doctrine appears to have been better balanced in this respect and the Germans also realized more fully the necessity for co-ordination of combined action of the artillery with that of the other arms. All three countries had grossly underestimated the quantities of ammunition which would be required. The British reserve was calculated upon a basis of a probable expenditure of seven rounds per 18-pdr. per day, but in the World War the expenditure per gun often rose to 500 rounds or more per day. No country had fully appreciated the effect upon

artillery power of the development of railways, motor traction, aircraft, telegraphs, telephones, wireless and survey.

8. ***Evolution of Equipment,* 1914–1918.**—The British field artillery stood the test of the war well and the minor defects which appeared were easily remedied. The proportion of medium and heavy artillery was vastly increased, the equipments adopted being 60-pdr. and 6in. guns and 6in., 8in., and 9·2in. howitzers. Super-heavy howitzers, of rain. and upwards, and guns on railway mountings of 9·2in. and upwards, were brought into use. Mortars, which had long been discarded, made their re-appearance for the war of position. The ranges of all weapons were increased, field artillery ranges rising to some 10,000yd. and even more in the case of French and German equipments; the greatest range viz., 76 miles, was attained by the German 21cm. guns used to shell Paris. The British field guns, which had started the war with shrapnel ammunition only, were supplied with high explosive shell in addition before the battle of Loos. Shrapnel was abolished for 4·5in. howitzers, and in the heavier natures high explosive was almost exclusively used. Smoke shells were introduced for the lighter natures of guns and howitzers in 1916. In July 1915, the Germans first employed gas shells, and this type of shell came into general use in steadily increasing numbers. It is noteworthy that the supply of gas ammunition never equalled the demand and that the use of gas was still in its infancy at the end of the war. An advance in the control of fire was effected by the development of observation from aircraft. Inter-communication was improved by the more extended use of the field telephone and of wireless. Survey, sound ranging and flash spotting units were provided for co-operation with artillery. The lighter natures of artillery were still generally horse-drawn in 1918 although lorries or trucks were used, especially by the French, to transport a proportion of their field artillery. The heavier natures were drawn by motor tractors of various designs ranging from the four-wheel-drive lorry to the "caterpillar."

9. ***Evolution of Organization and Command,* 1914–1918.**—A comparison of the development of artillery organization and command in the British, French and German armies shows that, notwithstanding their initial differences and the separate lines of evolution which were followed, all three arrived at similar solutions of fundamental problems. The changes introduced may be summarized as follows:—(a) Artillery command was centralized as much as was consistent with effective control. This proved the best means of co-ordinating action, of economizing force and of concentrating fire at the right time and at the right place. Centralization of control was often carried to excess, however, in the Western theatre. This change in the system of artillery command entailed an increase of artillery headquarter staffs. (b) The necessity for a strong reserve, in the hands of the higher command, of both field and heavier natures of artillery led to the creation of large numbers of artillery units outside the organization of formations. In 1914 the proportion of field artillery to infantry in an army was about six guns to 1,000 rifles. By the end of the World War the proportion of all natures was about 10 guns and howitzers per 1,000 rifles, roughly 6 field, 2 medium, 1½ heavy and ½ super-heavy. (c) The allocation of equipments to formations was based upon their ranging powers and their degrees of mobility. Thus field artillery (in the United States light artillery) was seldom allotted to formations higher than the division; medium and heavy artillery were normally allotted to corps, while super-heavy guns were directly under armies. (d) The corps was recognized as the most suitable formation for the control of counter battery work and special staffs were provided for this task. The divisional artillery of an infantry division, U.S.A., consisted of two regiments each of six batteries of four 75mm. guns, one regiment of six batteries each of four 15jmm. howitzers and one trench mortar battery.

10. ***Evolution of Tactics,* 1914–1918.**—The evolution of equipment and organization and the evolution of tactics were, of course, interdependent. It was naturally on the Western front that artillery tactics were most fully developed. During the first operations in 1914 sharp lessons were learned. It was soon evident that owing to the hitherto unrealized power of small-arms fire in defence, attacks must be well prepared by artillery. Tactical mobility had, in fact, become dependent upon fire power, but neither side had the artillery or the ammunition to provide fire power in adequate measure. At Le Cateau the British learned the disastrous results of attempting close support of infantry with guns disposed too close to the foremost troops. The early engagements also demonstrated the necessity for distributing guns in depth in defence and for concealing them if they were to avoid destruction. The need for increased quantities of medium and heavy artillery was soon apparent.

During the trench warfare of the winter of 1914–15 new developments began to take shape. Attempts were made to engage targets by night and to provide defensive barrages, and observation of fire from aircraft rapidly found favour. The employment of barbed wire entanglements introduced a new task for artillery in the preparation of infantry attacks.

The battle of Neuve Chapelle (1915) forms a landmark in the evolution of artillery tactics. The attack was prepared by an intense hurricane-bombardment of 45 minutes and it was supported by subsequent "lifts" of fire in front of the infantry. The lessons of this operation were misapplied to some extent; in the subsequent attacks at Festubert, Givenchy and Loos, surprise was thrown to the winds and lengthy preparatory bombardments of small intensity were undertaken with the object of destroying hostile defences rather than of temporarily neutralizing and paralysing the defenders. Loos marked a development towards the "rolling" barrage which became the usual accompaniment of later attacks. The French fell into the same error as the British in their disregard of surprise in their attacks in Champagne and Artois. The first effective use of the rolling barrage for a break through on a large scale was in the German break through the Russians on the Dunajec river, Galicia (1915).

The operations of 1916 and 1917 were based upon the fact that given sufficient artillery and ammunition, limited advances of two or three thousand yards at a time could be almost guaranteed. Enormous concentrations of artillery supported every attack.[1] Thousands of tons of ammunition were fired daily during an operation on a front of a few miles. Surprise continued to be sacrificed, for the artillery carried out preliminary bombardments often lasting four or five days. Rolling barrages of great depth and heavy counter battery fire were the unvarying accompaniment of the actual advances. Such were the methods of artillery action adopted in the battle of the Somme (1916), the French attack at Verdun (1916), at Arras (1917), in Nivelle's attack on the Aisne (1917), at Messines and in the third battle of Ypres. The Germans, in their attack at Verdun in 1916, had endeavoured to obtain some measure of surprise by reducing the preliminary bombardment to ten hours and, in Allenby's attack at Gaza, measures were successfully taken to deceive the Turks who might otherwise have been warned of the British plan by the five days' preliminary bombardment. But none of the commanders had as yet appreciated the paralysing effect of the brief and intense hurricane bombardment of short duration which was adopted in 1918. It became apparent, however, that a drastic change in tactical methods must be made if decisive success was to be obtained. The defender could, in great measure, counter the form of artillery support then in vogue, heavy as it was, by suitable adjustment of his infantry tactics; the ammunition expenditure entailed proved too great a strain on industrial resources; and the effect of the fire on the ground was such as to create new obstacles for the attackers. In the defence, artillery action had

[1] At the battle of the Somme—July 1, 1916—there was approximately a gun or howitzer to every 20 yards of front assaulted, the proportion of heavy or medium pieces being one in every three.

At the battle of the Scarpe—April 4, 1917—there was a gun or howitzer to every 10 yards of front, the proportion of heavy and medium pieces being rather more than one in three.

In the British attack at Amiens—Aug. 8, 19x8—the proportion was again approximately a gun or howitzer to every 10 yards, the heavy and medium artillery being in the proportion of 7 to 12.

In the German attack in April 1918, 9,500 pieces were employed on a front of 50 miles, *i.e.*, rather more than one piece to every 10 yards of front. On the decisive sectors of the front the artillery was concentrated to one gun to every five yards of front.

taken the form of "counter preparation" to break up impending attacks of neutralization of hostile artillery and of stationary barrages close to the foremost trenches to repel assaults once they were launched.

The advent of tanks had an important bearing on artillery tactics. At the battle of Cambrai it was demonstrated that tanks could carry out tasks which had previously fallen to the artillery. They had a very great demoralizing effect, they could create gaps in barbed wire and they could neutralize small-arm fire. The employment of tanks had a considerable influence in bringing about the abolition of lengthy preliminary bombardments and the consequent simplification of the problem of ammunition supply. The battle of Cambrai further proved that effective artillery support could be given, by means of survey methods, without previous registration.

The German successes on the Western front in 1918 were largely due to skilful artillery tactics, for the development of which Colonel Bruchmüller was chiefly responsible, the element of surprise being thus safeguarded. Their new tactics had first been employed, and with marked success, at the battle of Riga in Sept. 1917. Secrecy was observed in the preliminary concentration and other arrangements, each attack was preceded by a short hurricane bombardment of a few hours' duration designed to produce moral rather than material effects and containing an element of surprise in the repeated withdrawal of fire to the forward defences after it had apparently passed on, gas and smoke shell were extensively used, counter battery fire was heavy. The advances were supported in their initial stages by intense concentrations on enemy strong points and the infantry were boldly followed up by field artillery.

A counter to the German artillery tactics was eventually devised by the French in Champagne. Careful artillery counter-preparation was carried out for some time before the German attack which the enemy had not been able to keep secret. Troops were thinned out in the forward zone, in which the first shock of the attack was to be absorbed, and the main line of defence was organized in rear, the artillery fire being adjusted to correspond with these arrangements.

A "hurricane" bombardment of 15 minutes, followed by a rolling barrage, was adopted with complete success by Allenby in his final break through the Turkish lines in Sept. 1918.

During 1918 the use of concentrations of fire increased. General Charles P. Summerall (U.S.A.) in 1918 first tried out concentrating the fire of all his divisional artillery in front of one infantry brigade at a time when the infantry could go no farther with the help of the rolling barrage. Later, in the November attack in the Argonne, he gave his army corps heavier artillery support than had been seen up to that time. The system of artillery command at last admitted of centralization or decentralization according to the varying situation. A return was made to a long preliminary bombardment when the British Fourth Army attacked the Hindenburg Line in September; surprise had then ceased, however, to have great value owing to the extent of the Allied offensive and the disappearance of the enemy's reserves.

When operations ceased the art of tactics was on the threshold of a new era of development which had been ushered in by the renewal of mobility, by the introduction of tanks and by the mechanization of transport.

(J. N. K.; X.)

AFTER 1914-18

The artillery has steadily increased in importance since 1914. The war of 1914–18 saw a great increase in the proportion of guns to infantry, in the numbers of types of artillery and also a number of new projectiles and fuses. From 1914 until Germany began her rearmament the French artillery doctrine, largely a continuation and development of the 1918 doctrine, was of primary importance. The British and Americans largely followed this French doctrine.

The Germans, being disarmed, had to limit their developments to theory except in so far as from time to time they found an opportunity, through relations with Russia, to carry out some experimentation with the Russians. The Russians, from the beginning of the organization and armament of their 1940 army, showed a tendency to develop new tactical ideas and therefore to modify their artillery armament to suit these ideas. In general, their artillery doctrine differed from the French one of using large concentrations of fire primarily under one command and leaned toward the splitting up of their artillery in small groups assigned directly to infantry units. The Italians, while closely following the French theory, showed a decided tendency since the war of 1914 to put into practice German theoretical solutions of artillery problems, in so far as their financial status would permit rearmament.

The Abyssinian campaign in 1935–36 gave the Italians the opportunity to test their theories with respect to the supporting artillery for infantry in mountainous countries and the relationship between artillery and aviation and the means of transport of artillery. The Italians steadily developed the idea that the infantry commander should have immediately available the lesser calibres needed for the assault. Therefore, besides small mortars which can be carried forward by the troops by hand, they had in each infantry regiment one battery of 65mm. mountain guns carried on pack mules.

As the result of their experience in Spain they were engaged in 1940 in rearming their infantry with 75mm. mountain guns carried by pack mules.

In the Spanish Civil War, the Italians found that in many instances larger calibres could not keep up with the infantry and at other times could not be emplaced where they could reach enemy positions well up on a mountain. They therefore came more and more to use bombing by aviation as a means of supplementing their artillery fire. The Italians found that pack and horse-drawn artillery were essential because the use of mechanized and motorized artillery was greatly limited by the lack of roads and the difficulties of the terrain. A large and well-equipped road-building force enabled them to make a much greater use of mechanized and motorized artillery than would have been the case with other armies with nothing more than their customary organization and equipment for this purpose.

The Spanish Civil War gave the Italians a chance further to develop the artillery practices of the Abyssinian campaign. These developments were primarily tactical and in the use of aviation as an artillery reinforcement. This because they had no new types of artillery in Spain. In fact the corps artillery of the Italian expeditionary force was composed of pieces captured from the Austrians in the World War (1914–18) or surrendered by them as the result of the Armistice.

In general the lessons of Abyssinia were confirmed. Spain is a country with a small road net and a great variety of difficult terrain In Abyssinia the Italians were fighting a semi-savage people, poorly armed and with primitive tactical and strategical ideas and practically no air service.

In Spain, on the other hand, they had to fight an inefficient army in so far as fundamental training and the leadership of many of its officers were concerned, but a force kept well supplied from foreign sources with modern armament of all types including tanks and aviation.

The Germans by this time had largely built up their new army and aviation, armed with the latest type of weapons which their theories had evolved during the period of their disarmament. Germany sent to Spain a sufficient number of artillery officers, signal corps or communication officers, and officers from different branches of their services, to enable them to become thoroughly acquainted with the lessons learned on the battlefield by the Italians and Spanish. Germany sent anti-aircraft artillery with enough officers and men to man it, different types of aviation with enough officers and men to man them, enough officers and men of the signal corps of communication troops to test thoroughly different means of communication on the ground, in the air, and between the air and the ground. Germany sent different types of tanks and some tank officers and specialists.

The result of the German, Italian and Spanish experimentation in battle in the Spanish Civil War showed the need for increase in all types of artillery and, in general, larger calibres. The cannon

as an aviation weapon was shown to be a necessity. The cannon as the principal tank weapon was shown to be an essential for all heavy combat. In other words, just as artillery weapons have steadily increased as essential parts of the armament of infantry units so has the artillery become an essential part of aviation and tank armament. There is little doubt that the experience in Spain with a few aeroplanes armed with a cannon of around 20mm. was the reason for the large use of aeroplanes armed with cannon by the Germans in the Polish (1939) and all subsequent campaigns.

The Spanish Civil War proved conclusively the benefit accruing from the use of aviation to supplement artillery fire or in some instances to furnish a substitute.

In all assaults in Spain in 1938 and 1939 the artillery bombardment was followed by a bombardment from heavy bombers upon the same targets as those upon which the artillery had fired. The accompanying artillery fire during the infantry assault was dispensed with. There were no rolling barrages and no concentration on the first objectives of the infantry. Artillery concentrations were on the rear of this objective. The accompanying artillery fire was furnished by the aviation and by tanks armed with cannon. The aviation attacked with light bombs and machine guns by dive bombing, one plane after another from one flank of the objective to the other. It repeated this continuously until the infantry had reached the point where it became dangerous.

Tanks with cannon were distributed at intervals in the infantry assault wave. Their guns furnished fire on all critical points encountered by the infantry during their advance. Wherever the infantry was held up, a number of tanks with cannon and dive bombers would make a concentrated attack. The use of tanks with cannon of around 47mm. and up frequently resulted in the 37mm. anti-tank guns proving ineffective, this because of the longer range of the tank cannon and its bigger bursting charge. The consequence was that the 65mm. mountain gun was more and more used as an anti-tank gun. Besides its greater range and bigger bursting charge it could, because a much smaller target, be emplaced in positions which an ordinary field gun of 75mm. or 77mm. could not use. This because the latter was such a large target it would be destroyed by the enemy's fire.

The first German anti-aircraft artillery used in the Spanish Civil War was a 77mm. gun. These guns were in mechanized batteries of four pieces each. It was soon found that the range was not great enough, the trajectory not flat enough and the bursting charge not large enough. Therefore a new piece of 88mm. calibre, and more calibres in length than the 77mm., was constructed in Germany and shipped to Spain. This piece could reach any bomber with a war load. All sighting apparatus was set and corrected by remote control from a range-finding party some distance from the guns and in a position such that it had a good view of the target. These guns, instead of being emplaced in line, were emplaced at the four corners of a square probably 100 metres to a side. When not firing on targets in the air the guns were used to fire at targets on the ground. Their long range made them particularly effective not only against positions well up on mountains but also against the rear areas including ail the roads over which enemy tanks, artillery and supplies had to advance. The guns were field artillery in that they could be put in or out of battery in a relatively short period of time and could move easily over roads and also over terrain which was not too difficult.

The Italians in Spain relied primarily upon wireless for communications. The Germans used wireless but relied largely upon telephone communications. The Germans in Spain stated that in the war of 1914–18 their communications were not sufficiently developed and therefore frequently were the cause of defeat.

As the result of their experiences in Spain the Germans and Italians made a number of changes in their armament and tactics. It may be said that these changes had to do with increasing the proportion of artillery to infantry, making cannon a part of aviation armament, increasing the number of tanks with cannon, and the calibre of these cannon and improving the communications between all parts of their armed forces so that the maximum benefit could be derived from their artillery fire for both offensive and defensive purposes. By the use of cannon in aviation and in tanks it can be said that in addition to "fire and movement," that is, fire to cover movement, there is "fire in movement." "Fire in movement" was the basis of the success of the German armoured or panzer divisions in 1939 and 1940.

From such data as is available, it is indicated that defeat of the Poles, the Allies in Norway, Holland, Belgium, Flanders and France in 1939–40, was due to their failure to provide sufficient artillery of all types, that is, infantry artillery; horse-drawn, motorized and mechanized field artillery; anti-tank and anti-aircraft artillery, and artillery in aeroplanes and in tanks, to stop by its fire the German blitzkrieg (lightning war) attack. The Allies also failed to have adequate communications and adequate ammunition supplies for such artillery as they possessed. The Allied use of aviation as an independent force with missions away from the battlefield instead of using it to support troops in advance guard-work in battle and in pursuit as an accompanying artillery also contributed largely to their defeat.

The war of 1914–18 proved that the most difficult artillery problem was to give the infantry at all times the amount of accurate supporting artillery fire necessary to ensure its advance by smashing enemy machine gun nests and other strong obstacles to its advance. One of the methods used was the rolling barrage by which a line of bursting shells moved forward at a definite rate of advance determined by a rigid time-table. In addition, the infantry were given small mortars called trench mortars by the Allies and minenwerfer by the Germans; and small cannon generally of the one-pounder type. The rolling barrage did not always prove effective, because the infantry could not always keep up with it. Also, it was not always sufficiently strong to dispose of enemy strong points, with the result that these points would continue to resist after the barrage had passed by. In other words, by holding up the infantry while the barrage passed on they separated the infantry from its barrage. This meant the dislocation of the attack. The first time a full-fledged German attack was stopped during 1918 was during the Champagne battle of July 15 and 16. The same German methods which had hitherto proved so successful failed. The primary reason was that General Gouraud commanding the Fourth French army had, under instructions from Marshal Pétain, thoroughly carried out the echelonment of his defence in great depth with the result that the German infantry lost contact with its barrage. This dislocation of the German attack allowed the French and American infantry to keep down in their trenches until the barrage had passed over and then come up to meet the German infantry attack.

The consequence was that more and more the conclusion was drawn that artillery support to the infantry should be in a greater proportion of mortars and small cannons in the hands of the infantry and a supporting artillery fire consisting primarily of concentrations of fire. The invention and development of the tank came about as the result of this necessity to increase the number of weapons which could be used at close range and without any means of communication such as telephone or wireless, to fire immediately on the targets holding up the infantry advance. The war ended in 1918 without the question of adequate artillery support to the infantry having been fully solved.

The German blitzkrieg methods in 1939 and 1940 have proved that a large increase in the proportion of infantry artillery, tanks with cannon, aviation with cannon, and an increase in the proportion of light and heavy field artillery, puts the infantry in the position where its advance can only be stopped if the artillery of the defence is more powerful in all categories than is the artillery of the offence. In order to provide this increased proportion of artillery and the ammunition necessary to enable it to give its maximum fire while at the same time not robbing the infantry of its mobility, the tendency is to decrease the size of infantry combat units.

In general this is gotten at in two ways: one the German-Russian method, the other the Italian method. In the first the division is cut from four to three regiments of infantry. The artillery of the division is so organized that it can readily be split up to give each of the three infantry regiments its necessary artillery support when operating independently. In other words, the division

during an advance or in battle can be operated as three small but completely armed infantry and artillery units of march and combat. In Italy the division was first reduced from four to three regiments of infantry. In Spain divisions of two regiments of infantry, each with the artillery necessary for their habitual missions, were found mobile on the march and easily handled in combat. In consequence the Italian army was reorganized into such divisions. From three to four of these divisions make an army corps. This corps is flexible both on the march and in combat. The amount of corps artillery has been greatly increased so that the corps commander will always have available the maximum amount of artillery needed for any situation, while his division commanders will never be burdened on the march or in ordinary combat with more than they habitually need. Such information as has been received (1940) from French battlefields indicates that this technique, developed in Spain from previous peace time theories, was the technique used.

The American division for the Regular Army consists of three regiments of infantry; for the National Guard of four. The type of divisions is still being experimented with. An important point in determining the size of the division and its organization is based on the recommendations of the artillery that the proportion of artillery to infantry be increased.

Comparison of Divisional Artillery

			Total
U.S. (3 regt.)	36 75mm. guns	16 155mm. howitzers	52
(4 regt.)	48 75mm. "	24 155mm. "	72
Germany	36 105mm. howitzers 4 105mm. guns	8 150mm. howitzers	48
France	36 77mm. guns 6 75mm. anti-tank guns	24 155mm. howitzers	66
Britain	72 25pdr. 3.45in. gun-howitzers		72
Italy	12 75mm. guns	12 75mm. pack howitzers 12 100mm. howitzers	36
Russia	16 76mm. guns	40 122mm. howitzers	56
Japan	36 75mm. guns	12 105mm. howitzers	48

This table does not show the infantry-artillery of mortars from 45mm. to 81mm.; howitzers 75–150mm., mountain guns 47mm. and anti-tank guns 2j–up millimetres.

The army corps artillery, army and G.H.Q. artillery, including railway artillery, varies greatly in the different countries. See Kurt Passow, *Taschenbuch* der *Heere* (J. F. Lehmanns Verlag, München, 1939). (H. J. RE.)

TYPES OF ARTILLERY

The function of land artillery is to kill troops at a range beyond that of a hand weapon, and to destroy material, obstacles and defences. Various natures of artillery have been developed, suitable to the tasks to be fulfilled. The four main classes are:— field artillery (of which mountain, infantry-accompanying and horse-artillery are lighter varieties); heavy artillery (which is subdivided according to power of foe and of movement); anti-aircraft artillery; trench artillery or mortars.

Thus British artillery is classified, in detail, as follows:—

Light (in India, Mountain) artillery (2·75in. guns and 3·7in. howitzers).

Horse artillery (13-pdr. guns).

Field artillery (18-pdr. guns and 4·5in. howitzers).

Medium artillery (60-pdr. guns and 6in. howitzers).

Heavy artillery (6in. guns, 8in. and 9·2in. howitzers).

Super-heavy artillery (guns of 9·2in. and upwards, and howitzers of 12in. and upwards).

Anti-aircraft artillery (gin. guns).

Field Artillery.- his is capable of accompanying the advanced fighting line of an army. It consists of light guns and howitzers able to keep pace both on the road and across country with the arm it is supporting, and to come into action without previous preparation of the ground. The field gun is, in all armies a piece throwing a shell of from 15 to 18lb. to a distance of at least 10,000yd., although effective ranges are generally less, and weighing less than 30cwt. in action. Before the introduction of mechanical traction the weight was limited to 24cwt. and the range to 6,000yd.

The limit of approximately 30cwt. is due principally to the fact that this weight is as much as a gun-detachment of six men can man-handle.

All modern field guns are quick-firing; that is, the gun recoils on the carriage and returns to the firing position, while the carriage remains steady. This saves the delay due to running up and relaying the gun after each shot, and increases the rate of fire from two rounds a minute to 25. It also enables the gun-detachment to remain behind the gun-shield, instead of having to stand clear of it during the recoil of the carriage.

The field howitzer differs from the field gun in that it throws its shell high into the air, so as to descend at an angle in excess of 45°. This enables it to reach targets, such as men in deep trenches, protected from the direct fire of guns. As this high-angle fire requires less effort than direct fire, the field howitzer is able to fire a shell double the weight of that of the field gun, without exceeding the same weight of equipment. The proportion of howitzers to guns has steadily increased. In the German army (1940), the 77mm. gun in the divisional artillery has been replaced by the 105mm. howitzer.

Special natures of field artillery are:—(a) Horse artillery, which can keep pace with cavalry across country. For simplicity of ammunition supply, the gun may be the same as that of the ordinary field artillery, but in any case the weight behind the team is reduced by mounting the gunners on horses, instead of carrying them on the limbers and ammunition wagons (caissons in American usage). (b) Light or Mountain artillery, which is divided into separate loads which can be carried on pack animals or transported for short distances by hand. It is used in country impassable to wheeled carriages, and has been adapted to serve the newly found need for artillery of accompaniment (*i.e.*, the close support of infantry).

The number of small mortars carried forward by the infantry in an attack has steadily increased.

Medium Artillery.— This consists of guns and howitzers of greater range and shell-power than field artillery, yet sufficiently mobile to accompany the infantry advance. The usual types are a gun of approximately 5in. firing a shell of about 60lb to a range of 16,000yd. and a howitzer of about 6in. firing a shell of about 100lb. to a range of 12,000yd. The 60-pdr. gun is designed to fire upon distant road crossings, railway junctions and other important points which have to be engaged without delay, and before the heavy artillery can come up. The 6in. howitzer fires a powerful shell capable of demolishing buildings and of destroying entrenchments other than those of a semi-permanent nature. It is the principal weapon used in trench warfare. Both pieces are available for counter-battery work, that is, for attacking entrenched guns which have been located by aircraft or by sound-ranging.

The medium gun is an enlarged edition of the field gun. The 6in. howitzer was formerly a short, handy piece, but owing to the increased range now required of it the length of the modem type is as much as 25 calibres.

Heavy Artillery.— This term is applied to pieces heavier than medium artillery including guns up to 8in. calibre and howitzers up to 9·2in. calibre. In modern war it is necessary to attack objectives at least 10mi. behind the fighting front and accordingly road-mobile heavy artillery, which can engage targets beyond the range of medium artillery, has been introduced. The principal gun of this type is the 6in. gun, the latest pattern of which ranges 15mi. with 100lb. shell. It can be fired from the ground without the delay entailed by building a platform; wire mats or similar appliances are used to prevent the wheels from sinking. Modern 6in. guns have split-trail carriages to enable them to be traversed quickly.

A howitzer heavier than the 6in. is required for destroying bridges and semi-permanent entrenchments. The 8in. howitzer fires a 200lbw shell and ranges 18,000yd.; the British 9·2in. howitzer, kno n in the war as "Mother," fires a zgolb. shell ranging 12,700yd.; and the new American 240mm. (9·45in.) how-

itzer, a type of gun used also by the French, fires a 356-lb. shell to a range of 25,000yd. This piece is accepted as the typical modern heavy howitzer, and is about the largest piece likely to be transported by road in future warfare, as it is considered that heavier natures are better transported by rail.

Super-heavy Artillery.— As the size of a shell is increased, the effect increases in a higher ratio. Much of the destructive effect of a 1,000-lb. shell is due to the blast, not to the local destruction caused by the high-explosive charge. The effect of the blast is to bring down walls as much as joyd. from the point of burst, to cause roofs to fall in, and generally to wreck a great building such as a railway station or factory. A single hit from a 12-in. shell might destroy a bridge altogether, whereas ten hits from 6-in. shells, equal to the same weight of ammunition, would only cause easily reparable damage. A further advantage gained by the use of very heavy guns is the greatly increased range. Thus the British 9.2-in. gun throws a 380-lb. shell 14m. while the new U.S. 14-in. gun ranges 22m. with 1,560-lb. armour-piercing shell, and nearly 30m. with a somewhat lighter stream-lined shell. These considerations have led to the extensive employment of super-heavy pieces in land warfare.

Gun versus Howitzer.— Formerly a howitzer was a low velocity weapon fired at a high angle of elevation, while a gun was a high velocity piece with a flat trajectory. The howitzer conveyed the shell to the target with a much smaller propelling charge than the gun, and consequently lasted much longer than the gun before it was worn out. At present all guns are mounted so as to fire at high angles of elevation, in order to attain their extreme range, and use reduced charges as well as full charges and super-charges in order to save wear. On the other hand, the range required of howitzers is now greatly increased so that the 1914 pattern, 12 calibres long, has been superseded by howitzers of 25 calibres and over, firing much heavier charges. The distinction between gun and howitzer is therefore tending to disappear.

Super-heavy pieces are usually fired from railway mountings or at least are transported by rail. But an invader may find it necessary to bring up large howitzers, for the reduction of fortresses near the frontier, before the captured railways can be made available. The difficulty in the way of transporting these pieces by road is the limit of the weight which bridges can carry. Even on the great main roads of western Europe this weight is not more than 30 tons, and on country roads it may be as little as 5 tons. This implies a special type of howitzer, comparatively short and light, capable of throwing a heavy shell to a short range. The German 42-cm. (16.5-in.) howitzer brought up for the siege of Antwerp was only 12 calibres long, and weighed 21½ tons, or about 29 tons on its special wagon. It threw shell of 15·7cwt. to a range of 10,300yd. It was drawn by three traction engines with a fourth in reserve for hills. The recoil gear, carriage, platform (in two parts) and gear for mounting the howitzer formed separate loads, and the piece required 13 traction engines altogether.

The French have a 370-mm. (14.6-in.) howitzer, only 8 calibres long, throwing an 8cwt. shell 11,500yd. It is rendered road-mobile by being carried on two road trucks, one following the other, with an arched girder between them from which the piece is suspended. The United States has an experimental 9·45-in. howitzer on a caterpillar mounting, driven by electricity from a separate vehicle which carries the 150h.p. power unit. The total weight of the vehicle carrying the howitzer is 13 tons.

Long-range Guns.--During the World War the Germans bombarded Paris from a distance of 76m. with specially built long-range guns, throwing 265-lb. shells. This long range was obtained by using a velocity of 5,000ft.sec., and firing at an elevation of 55 degrees, so that the shell passed through the layer of dense air nearest to the earth, and reached the comparatively thin air at a height of 10m. which opposed little resistance to its flight. In this case the greatest height of the trajectory was 24m. Guns of this type cannot fire more than about 30 rounds before they are worn out. Owing to uncertain weather conditions, the accuracy is poor; while the gun is new the shells may be expected to fall within a space of 2m. long by ¾m. wide, but as the gun becomes worn these limits are soon exceeded. Aeroplanes are far more efficient than guns for this kind of bombardment.

Anti-aircraft Artillery.— The problem of hitting a target moving in three dimensions is a difficult one and the additional complication due to a curved trajectory has to be eliminated as far as possible. All A A. guns are therefore flat-trajectory weapons with high muzzle velocities. Ordinary field guns mounted on lorries or trucks, as employed in the war of 1914–18, are of little use. Mobile A.A. guns used in the fighting line, are usually on low wheeled platforms which can be drawn behind a lorry. On coming into action, the platform is lowered to the ground, and levelled by screw-jacks at each corner, so as to bring the pivot exactly vertical. Semi-mobile guns, used in sedentary warfare, are on heavier platforms which are carried in sections and put together before firing; and non-mobile guns, for the defence of fortresses and cities, are on solid concrete or caisson platforms.

The ammunition used with A.A. guns is shrapnel or high-explosive shell; a proportion of the shells are fitted with tracers. These are necessary, since an ordinary shell fired into the air disappears until it bursts, and there is nothing to show whether it has passed close to the target or otherwise. The shell is fused so as to avoid endangering one's own troops by the shell falling among them.

Fire at aeroplanes is entirely by prediction; the course and speed of the target are measured by optical instruments, and the gun is fired at the point where the aeroplane is expected to be, making due allowance for the time of flight of the shell. If the first shot or salvo misses, the plane will at once begin to dodge, and it is useless to fire at it until it has again settled down to a regular course. As the bombers with war loads fly at steadily higher altitudes it has been necessary to increase the power of anti-aircraft weapons. Therefore the 3in. 7jmm. and 77mm. are being replaced by 3·6in., 88mm. and 90mm. guns.

Trench Artillery.— When two opposing forces are entrenched, they tend to press forward till their advanced works are within 100yd. or less of each other. The same thing occurs in siege warfare, when the besieger extends his front trench till it is close to the fortress. The need then arises for a weapon capable of throwing a heavy bomb to a short distance, yet which is so small and light that it can be carried through the trenches. The original piece of this type is the Coehorn mortar used in the sieges of the 18th century. The modern type was introduced by the Germans at the beginning of the war of 1914–18. The Krupp Minenwerfer was a light gun of 2-in. calibre mounted on a short plank. The 50-lb. spherical bomb rested on the muzzle. and had a tubular steel "stick" which extended down the bore of the gun. The piece was fired at an angle of 45 to 7j degrees of elevation, and its extreme range was about 450yd. The 50-lb. bomb, with its high-explosive charge, was capable of wrecking a "dug-out" or blowing in the walls of a trench so as to block it.

As the weight of the jo-lb. bomb rendered ammunition supply in the front trenches a laborious proceeding, the British introduced the light Stokes trench mortar, firing a 10-lb. bomb. This is a weapon of a different type. It is a light steel tube of 3-in. calibre, with a spike projecting into the breech end of the bore. The cylindrical bomb has a small cartridge and percussion cap fixed to its base; it is dropped into the muzzle and slides down till the percussion cap strikes the spike, when the cartridge is ignited and the bomb blown out. The extreme range is about 1,200yd. This enables it to be used from a point well back in the trench system where it is safer and less likely to draw fire than in the advanced works. A 25-lb. Stokes mortar was afterwards introduced, and was used principally for firing smoke shell. Later on, the bombs were fitted with air-vanes to increase their accuracy. The 3-in. Stokes proved such a handy weapon that it was used in mobile warfare as an infantry gun, for the reduction of "strong points" encountered in the infantry advance. Being a high-angle weapon, it was useless against moving tanks.

Heavy Trench Mortars.— Owing to the difficulty of supplying heavy ordnance in sufficient quantities trench mortars were introduced in 1915, capable of throwing a 200-lb. shell about 1,200 yards. The principal piece of this type was the Gatignolles 240-mm. (9.45-in.) mortar. This was in two pieces screwed together,

and was fired from a mounting fixed on a bed of wooden balks. The total weight was about a ton, and it was divisible into five barrow loads. The Allies used this weapon for firing from positions towards the rear of the trench system, where it could be turned on the front trenches in case the enemy invaded them. The Germans used, for the same purpose, a rifled 1 jo-mm. (6·69-in.) trench mortar, firing a shell of 110 lb. to a range of 1,250 yards.

TRANSPORT OF ARTILLERY

At the present time the draught horse is in process of being replaced by mechanical transport for all heavier types of artillery. This change is necessarily a gradual one, and its nature and progress in different countries are partly determined by the extent to which the mechanical transport which has replaced the horse in civil life can be rendered available for military purposes.

Artillery may be mechanized in several ways. The self-propelled gun-carriage has the gun-mounting built into it, and is preferably of the "caterpillar" type. The artillery tractor pulls the gun behind it, and carries the detachment and first supply of ammunition. The artillery carrier or transporter carries the gun on a platform from which it is dismounted, by a ramp, for firing. From the tactical point of view, the self-propelled gun-carriage is not yet satisfactory, as it is too vulnerable and too large for concealment, and requires an undue amount of labour to entrench. The motor is useless while the gun is in action, when, if it were separable from the gun, it would be most useful in bringing up ammunition. Against these defects, however, may be put the asset of its power to move forward instantly if blinded by a hostile smoke cloud. Further it is better suited than other forms of artillery for the support of a rapidly moving force of armoured fighting vehicles.

Tractors and Carriers. — The artillery tractor may be a caterpillar or a vehicle of the lorry type. Both forms are open to the objection that the complicated mechanism of a Q.-F. gun is damaged by rapid travelling on the road, even if the wheels be provided with rubber tyres. This, however, can be obviated by the use of low 2-wheeled travelling platforms, as employed in the Italian artillery for road travel. The caterpillar tractor is good across country, but on roads inherently less rapid and less economical, for its power, than the wheeled vehicle. Various attempts have been made to construct tractors and carriers having both road wheels and caterpillar tracks. The American Christy tractor, now no longer in use, travelled normally on road wheels, and had a caterpillar band which was put on round the wheels for cross-country work. The French St. Chamond carrier-tractor is a complete caterpillar vehicle, with an extra pair of road wheels on extensions of the chassis at each end, which can be raised well clear of the ground, allowing the vehicle to rest on the caterpillar tracks.

Another vehicle, of a different type, is the "4-wheel-drive" lorry, in which the wheels are driven independently. This is excellent on the road, and is capable of moving over easy country. The Pavesi agricultural tractor is a small 4-wheeled vehicle with a flexible connection between the fore and hind carriages, which enables it to adjust itself to irregularities of the surface of the ground. Its four wheels are driven independently and have removable "spuds" which are put on for cross-country work. It has a 16h.p. engine burning paraffin or petrol. The road speed is about five miles an hour, and the machine is therefore unsuited for the rapid transport of reserve field artillery.

The artillery carrier saves the gun from road strains, but entails delay in lowering the gun on to the ground when it comes into action, and in hoisting it up again with a ramp and winch. Many tractors, such as those of the American caterpillar type, can be fitted with platforms and used as carriers. It is not practically possible to fire the gun from the carrier, as this would entail a considerable increase of weight and complication. Any commercial lorry or truck of sufficient capacity can be adapted to carry light artillery. Its movement, however, is generally restricted to hara-surfaced roads. As regards the difficulty of combining a road vehicle, and a cross-country vehicle, the carrier is subject to the same disadvantages as the tractor. Experiments are now being carried out in a number of countries with six-wheeled motor vehicles which may be adapted as tractors or carriers for the lighter natures of artillery. These vehicles are considerably cheaper to manufacture than most of the tractors which have previously been tried, they are good across country, and it seems likely that they will be suitable for commercial purposes in peace, especially in undeveloped countries.

Practice in Other Armies. — The French, in 1920, proposed to introduce an agricultural tractor, encouraged by a Government subsidy, which should be available for the transport of artillery. But it was found that owing to the small size of fields in France there was little demand for the tractor, and no immediate prospect of its superseding the horse. On the other hand, the use of motor lorries is extending rapidly. The French now carry the field artillery, which is required to be highly mobile, on lorries, thus accepting the principle of the carrier, not the tractor. These lorries cannot move off the road, except on favourable ground; therefore each battery carries on its lorries some draught horses or small tractors of the Klectrac or Pavesi type to take the guns into position. The French had 83 of these *batteries portées* at the end of the war.

The Italians are tending to a somewhat different solution. No draught horses are bred in Italy; they have to be imported from Germany. It is therefore proposed that the divisional field guns should be drawn by the Pavesi agricultural tractors already described. The Italian army field artillery, which is required to be highly mobile, will be carried on low platforms, which have springs and rubber-tyred wheels, pulled by fast lorries. When the guns have to leave the roa 1, they will be taken into position by the divisional Pavesi tractors.

In the United States the caterpillar tractor, generally of standard commercial type, has been adopted for tractor-drawn artillery. For rapid movement over good roads experiments are being made of truck transport of light and medium field artillery, both wholly by truck and by combined truck and trailer.

Heavier Natures **of** Artillery. — Medium guns are usually tractor-drawn, the gun being shifted to a "travelling" position in which the weight is divided between the gun wheels and limber wheels. Heavy guns are transported on special wagons, drawn by tractors, which carry the piece itself, while the empty carriage is drawn by a second tractor.

Super-heavy artillery is transported almost entirely by rail, though in 1914 the Germans brought up their siege howitzers, divided into separate loads, on special road-wagons. The railway mounting consists of a massive platform supported by bogies, on which the gun mounting is built. *(See* Pl. II-7.) In the English Elswick type the gun is fired while the mounting is "alive" on its wheels; in other types the central platform is lowered on to the rails before firing. All-round fire from the truck, without special preparation, is only possible with medium guns; for heavier natures the gun is laid for direction by running the truck up or back along a curved siding. Or, in some railway mountings, the gun track is supported laterally by heavy "outriggers" sunk in the ground.

For the heaviest natures the railway is used for transport only, and the gun is lowered on to a previously built platform. Permanent concrete platforms were used in 1914, but these were superseded by "caisson" platforms consisting of iron boxes bolted together and filled with earth, surmounted by a steel platform plate which carried the mounting. Recent American platforms dispense with the caissons, and consist of the platform plate only; this is divided into sections for transport, bolted together on the spot, and pegged down with a number of steel stakes. These platforms can be laid in a few nours, this being a great addition to the value in the field.

Railway mountings can be used for the transport of artillery on light railways, and even on trench railways. Additional narrow-gauge wheels are fitted to the gun track for this purpose. In this case a platform must be used for firing. The limit of the height and width of a railway mounting is the loading gauee of the railways on which it may have to be used; this depends principally

on the size of the tunnels. Practically there is no limit to the length or weight. (X.)

ORGANIZATION

Artillery, unlike other arms, is not fully committed once it has become engaged with the enemy, but retains, in great measure, its liberty of action. Without change of position, its fire can be concentrated or dispersed at will, at varying degrees of intensity, on widely distributed targets. It can be disengaged from the combat with greater facility than any other arm, and, being capable of manoeuvre within striking distance of the enemy, it can be brought again into action in other parts of the battle-field while the fight is still in progress. These important characteristics govern the organization and distribution of artillery in the field. The system must be elastic in order to permit of centralization or decentralization of control according to the situation; and it must allow of the main strength of the guns being collected at points where decisive blows are to be struck.

The **Battery.**—The smallest unit of artillery is the battery, the composition of which is calculated on the assumption that its guns are normally worked together. A battery of artillery comprises three elements, viz.—*matériel*—guns, carriages, ammunition and stores; *personnel*—officers, non-commissioned officers, gunners or cannoneers, drivers and artificers; and *transport*—horses or other animals, motor or other mechanical vehicles, or rail. The number of guns in a battery varies in different countries and in different types of artillery between four and eight though some railway batteries have only two guns (howitzers or mortars); in the British army horse and field batteries have six guns or howitzers in war, anti-aircraft batteries eight, and all others, except super-heavy batteries, have four. Mixed batteries of howitzers and guns no longer exist. The vehicles of a battery include carts, wagons or lorries for the transport of ammunition, stores, provisions and forage. The organization and interior economy of a battery are much the same in all artillery. In the British army the command is held by a major; the second in command is a captain. The battery is divided into sections of two guns each, each under a subaltern officer. A section consists of two sub-sections each comprising one gun with its transport and men, and at the head of each sub-section is the "No. 1" of the gun detachment, usually a sergeant. In horse-drawn artillery the drivers ride the near horses of their respective pairs, each gun and each wagon being drawn by teams of from four to eight horses. On the march the gunners are usually seated on the battery vehicles. In horse artillery, however, the gun detachments are mounted and in light or mountain artillery, drivers and gunners march on foot. In addition to the gunners and drivers there are men specially trained in signalling, range taking, etc., in all batteries, who are either mounted or provided with some form of independent mechanical transport such as motor bicycles or cars.

Higher Organization.— In Great Britain the unit next above the battery is the brigade. In the United States two or three batteries are combined in a battalion commanded by a major; two or three battalions into a regiment commanded by a colonel; and two, three or four regiments into a brigade commanded by a brigadier general. The higher units in other armies are groups or battalions of three or more batteries, two or more groups or battalions usually forming a regiment. These units are distributed to armies, corps and divisions in the same way as units of other arms. Horse artillery is the artillery which supports the cavalry; in Great Britain one brigade of three batteries is allotted to each cavalry division; in the United States one regiment of six batteries (two battalions) is allotted to a cavalry division at war strength. In Great Britain field and light artillery together form the artillery of the infantry division. The British divisional artillery consists of three field brigades, each of three gun batteries and one howitzer battery, and one light brigade of three batteries. Non-divisional field brigades, called army field brigades, are also provided to form a reserve of field artillery at the disposal of the commander-in-chief. Army field, medium, heavy, super-heavy and anti-aircraft artillery are at the disposal of the commander-in-chief. Medium and heavy artillery are normally allotted to corps, super-heavy artillery to armies. Heavy and super-heavy artillery have not usually the complete and permanent organization that distinguishes the lighter natures of artillery and are generally organized, on mobilization, from units of coast artillery. (For natures of guns and howitzers in each class of artillery, see page 469B, TYPES OF ARTILLERY.)

In the United States pack and light field artillery are assigned to the cavalry division; light field artillery to the infantry division; medium and heavy field artillery to the army corps; light and heavy field artillery to the G.H.Q. artillery. The field army has no organic field artillery. The approved organization of the division field artillery brigade comprises two regiments of light guns and one regiment of light howitzers.

In the French Army one regiment of 75-mm. guns and one regiment of 155-mm. howitzers is allotted to each division, two "groupes" of 105-mm. guns and two "groupes" of 155-mm. guns to each army corps, and the remainder of the artillery forms a *réserve générale d'artillerie* which is commanded by a *général de division*. The infantry organization includes 37-mm. guns and Stokes mortars for close support. In the United States army two regiments of field guns (75mm. or 18pdr.) and one regiment of 155mm. howitzers, forming together one brigade, are allotted to each infantry division of four infantry regiments. This assignment of artillery to a three-infantry regiment division continued in 1940 to be under discussion. The infantry organization includes 37-mm. guns as well as mortars for close support. The corps and higher organization is similar to that of the British and French armies. It is obvious that there is variation in the number of field pieces allotted in different countries to an infantry division. Thus 72 are provided per division in the American, 60 in the French and 72 in the British army. On the other hand the number of pieces at the disposal of corps and army commanders generally varies in inverse proportion to the strength of the divisional artilleries, so that the total numbers available per 100 rifles do not differ greatly. In each British division an artillery officer of the rank of brigadier is in executive command of the artillery of the division. There is also a brigadier in command of the artillery of each corps and under him is a commander of the corps heavy and medium artillery. The corps artillery commander commands the divisional artilleries for special deliberate operations only. He is provided with a counter-battery staff whose task is to deal with the hostile artillery. At each army headquarters there is a major-general R.A. whose duties are mainly advisory. The system of command in Continental armies is similar. In the United States each brigade is commanded by a brigadier general. In addition to the brigade commander, there is a chief of artillery both in the corps and army.

Certain auxiliary organizations are now required by artillery. In the British army artillery survey work is carried out by survey companies which are also responsible for sound-ranging and flash-spotting. Signal units are provided down to headquarters of brigades, batteries being responsible for their own signal communications. Searchlight battalions co-operate with anti-aircraft artillery. In the U.S. flash and sound ranging are functions of the field artillery, as are signal communications within the field artillery brigade. The German divisional artillery has as an integral part of its organization one sound, one meteorological, one survey and one communications platoon. The organization for the supply of ammunition is described in a separate section. In addition to the normal chain of artillery command provision is usually made for technical control of the *matériel*, and a variety of training and experimental establishments, such as schools of gunnery, are maintained in most countries.

In the British army all the personnel of the artillery arm in the field, as well as of the coast artillery, is provided by the Royal Regiment of Artillery. Officers and men are transferred from one class of artillery to another at intervals of a few years in order that their training may be comprehensive. In some armies as, for example, the army of the United States, the artillery service is divided into two branches, the field artillery being distinct from the coast artillery corps.

TECHNIQUE

Occupation of a Position. — The actual process of coming into action may be described in a few words. The guns are "unlimbered" at or near the battery position and the gun limbers and teams or tractors sent back under cover. An ammunition wagon (caisson) or lorry is then placed, as a rule, by the side or in rear of each gun, an arrangement which simplifies the supply of ammunition. According to the British practice a battery in action is thus distributed: first the "firing battery" consisting of the guns, each with its ammunition vehicle; then, under cover in rear, the "first line of wagons" comprising teams or tractors of the firing battery, the gun limbers and the remaining ammunition vehicles. The non-combatant vehicles form the "second line of wagons."

Choice of a Position. — The nature of the position to be occupied depends primarily upon the task which is to be carried out. Although "open" positions may have to be occupied on occasions, they are generally to be avoided since guns are quickly silenced in modern war if they come into action in full view of the observing posts of the hostile artillery. As a rule, therefore, artillery use positions concealed from view behind a ridge or other cover, the elevation and direction necessary to hit the target being signalled by an observer who may be either on the ground or in the air. The choice of the position varies to some extent with the nature of the equipment; for instance, an elevated position is better adapted than a low one for high velocity guns on account of their flat trajectory. Other factors which have to be considered are (a) the desirability of a field of fire immediately in front of the guns for shooting at hostile tanks; (b) concealment from air observation; (c) avoidance of ground in which pockets of gas might lie; (d) approaches for ammunition supply. It is usually possible, however, to satisfy only the more important requirements in each particular situation. Cover from hostile fire, as distinct from observation, cannot often be obtained from the configuration of the ground, because, if a gun can shoot over a covering feature, the hostile shells can also clear it. Most of the lighter types of artillery are therefore provided with shields which, with the armoured ammunition wagons (caissons), afford some measure of protection to the guns and detachments. Guns are usually brought into action about 20 to 25 yd. apart, this interval being considered sufficient to minimize the damage which may be done by hostile shell fire.

Ranging.--This process serves to determine the elevation at which a gun will hit the target, or, more correctly, the elevation at which the greatest possible number of shells will fall on the target. This elevation is not necessarily that due to the map range, as it is affectedby the temperature, height of barometer, strength of the propellant, degree of wear of the gun and other factors. When a number of shells are fired from a gun which is pointed at a given elevation, they do not fall in the same place, but are distributed over a space which, at medium ranges, may be 100 yd. or more in depth. The centre of this space is termed the "mean point of impact." The first step in ranging is to determine, by observation of the fall of the shells, two elevations, usually 300–400 yd. apart, at the higher of which shells will fall beyond the target, and at the lower of which they will fall short. These two elevations constitute the "long bracket," within the limits of which the true elevation must lie. This bracket is then "split" by firing at the two intermediate hundreds of yards, and observing the results, thus obtaining a closer approximation to the elevation required called the "short bracket." Finally, corrections of 50yd. or less are made until an equal proportion of rounds are observed to burst over and short. Ranging for line, that is, for lateral direction, is carried out in the same way, and generally simultaneously with ranging for elevation. When time shrapnel is used it is also necessary to determine by observation the length of fuze which will give bursts at the most effective height above the ground.

Ranging by Map or Survey Methods. — It is possible to open effective fire by surprise without preliminary ranging, if the range and line can be obtained by measurement from accurate large scale maps or, in the absence of such maps, by "fixing" the positions of guns and targets by survey methods. For such "predicted" shooting certain meteorological and other information is necessary to determine the corrections which must be applied to the true range and line. A special section in each army corps, known in the British Army as "Meteor." keeps the batteries informed as to atmospheric conditions. The guns must be carefully "calibrated," a process which consists in determining the error due to wear at a known range. Survey methods cannot generally be used in very mobile operations owing to the time required to carry out the necessary preliminary work.

Sound Ranging. — This is effected by observing the moment at which the sound of the burst of the shell reaches each of a chain of recording instruments. It has recently been improved so as to give very accurate results under suitable weather conditions from a set of instruments occupying as little as 2,500 yd. of front. The setting up of the instruments takes the rather lengthy time of from 24 to 48 hours, which limits the employment of this method in mobile warfare.

It is of particular value in trench warfare for locating hostile guns by means of their reports.

Laying. — "Elevation" may be defined as the vertical inclination of the gun, "direction" as the horizontal inclination to the right or left, necessary to direct the path of the projectile to the object aimed at. In order to lay the gun in the "line of sight," *i.e.*, the line joining the sights and the point aimed at, the gun has to be "traversed" right or left so as to point in the proper direction, and also adjusted in the vertical plane. The simplest form of laying is called the "direct" method, which is employed if the point aimed at is the target and can be seen by the layer. He has then merely to look over or through the sights. But the point laid on is rarely the target itself. In war, the target, even if visible, is often indistinct, but in most cases, it cannot be seen at all from the gun position. An "aiming point," a conspicuous point quite apart and distinct from the target, has then to be employed ("indirect" method). When the guns are behind cover and no natural aiming point can be seen, an artificial aiming point is often made by placing a line of "aiming posts" in the ground. An alternative to aiming posts is now provided by the "paralleloscope" which is a mirror set up a few feet from the gun. When this device is used the layer keeps the gun in the correct line of fire by laying upon the reflection of the sights in the mirror. Finding the "line" in the case of indirect laying involves the calculation of the angle at which the guns must be laid in order that, when the sights are directed upon the aiming point, the shell will strike the target When a gun is laid for elevation by the indirect method, two angles to the horizontal plane have to be allowed for, viz., that due to range and that due to the difference in level between the gun and the target. The latter is called "the angle of sight." When the target is above the level of the gun, the angle of sight has to be added to the elevation due to the range; when the target is below the level of the gun the angle of sight has to be deducted. In all cases the actual elevation of the gun to enable the shell to strike the target is a purely mechanical adjustment, the gun being moved to the required angle with the aid of an elevation indicator or a clinometer. Frequently the battery commander directs the guns from a point at some distance, communication being maintained by signallers or by field telephone. Instruments of precision and careful calculation are, of course, required to fight a battery in this manner, many allowances having to be made for the differences in height, distances and angle between the position of the battery commander and that of the guns.

Fire. — In the British service three methods of fire for effect are used within the battery. These are: —

Gun fire, in which the guns fire independently at any rate which may be ordered;

Battery fire, in which the guns fire in succession throughout the battery;

Salvo fire, in which the guns are fired simultaneously on the order of the gun position officer.

The application of fire by batteries acting in combination is dealt with in section on TACTICS.

Use of Various Natures of Ammunition. — Shrapnel, which is fired by most guns and in some cases by howitzers, is used against troops in the open, for offensive and protective covering fire and for general harassing purposes. The forward effect of the bullets makes it especially effective when fired in enfilade. High

explosive shells with instantaneous fuzes, which are usually fired in addition to shrapnel by all natures of guns as well as by howitzers, are also used against troops in the open and for covering and harassing fire. They are further employed for wire cutting, for engaging troops under light cover and against tanks. High explosive shells with graze and delay fuzes, are used against troops in trenches and for the destruction of buildings and other strong cover. High explosive shells with time fuzes are used against aircraft. Smoke shell are employed for screening effect, to mask hostile fire and to deny observation to an enemy. Star shell are sometimes used for purposes of illumination, but they are not of great value in mobile warfare. (For description of the various types of projectiles see AMMUNITION.)

Signal Communications. — The methods at present employed on the ground are line telephony, using voice or buzzer, and visual signalling. Aircraft communicate with batteries by means of wireless telegraphy and batteries with aircraft by means of wireless telegraph and panels, *i.e.,* strips of white cloth which are laid out on the ground. Radio telephony is being developed by most countries but it has not yet reached the stage of practical utility in the field.

Observation of Fire may be done by the battery commander himself, by a special "observing" party or by an observer in an aeroplane or balloon. The difficulties of observation vary considerably with the ground, etc , for instance, the light may be so bad that the target can hardly be seen, or again, if there he a hollow near the target, a shell may burst in it so far below that the smoke appears thin to a ground observer, the round then being wrongly judged "over" or "short," or lost altogether. Smoke is often used in ranging with air observation to facilitate picking up the rounds. Observations from the air are signalled to batteries by wireless, some form of code being employed by which the fall of rounds can be plotted on a chart.

SUPPLY OF AMMUNITION

In 1914 it was considered that 500 rounds per field gun should be in hand in the theatre of war at the beginning of a campaign, with a reserve of 1,000 rounds per gun in the arsenals. It was found that this allowance was absurdly inadequate even in the more mobile phases of the World War. For great attacks on entrenched positions it was necessary to employ one field gun per 10yd. on fronts of many miles, and each gun was frequently required to fire 500 rounds or even more in a day. It was therefore essential to increase the scale of manufacture and to revise the methods of supply. The solution of the problem of supply was found in the development of the use of motor transport and, for periods of trench warfare, of light railways and specially laid trench railways.

Since 1918 a new system of ammunition supply has been introduced in the British army which will allow of a more abundant and rapid supply of ammunition in mobile warfare than ever before. Maintenance companies, under corps control, carry ammunition from railheads to ammunition companies, under divisional control. These, in turn, deliver to batteries or, alternatively, to horse-drawn divisional ammunition columns. Maintenance and ammunition companies are composed of motor lorries and have respectively a radius of action of 25 m., so that guns can be served over 50 m. from railhead. The divisional ammunition column (horse-drawn) is regarded as a mobile reserve of ammunition for the divisional artillery and is used as a link in the chain of supply only when lorries of the ammunition companies cannot deliver direct to batteries, *e.g.,* when the battery positions are on difficult ground away from roads. Army field brigades and horse artillery brigades have special brigade ammunition columns whose functions are similar to those of the divisional ammunition columns.

Some ammunition vehicles, which are usually lightly armoured, are also included in the batteries themselves. The number of rounds carried by them varies from 100 to about 300 per gun in different types of artillery. The greater the amount of ammunition a battery carries with it, the more independent it is; on the other hand, every additional wagon or lorry makes the battery more cumbrous and, by lengthening columns, increases difficulties of manoeuvre and deployment. Formerly the artillery was hampered by having to carry the reserve of small arms ammunition for infantry and cavalry, but this is no longer the case. When it is anticipated that the expenditure of ammunition in an operation will be greater than can be replaced immediately, dumps are usually placed at the guns or in suitably advanced positions; and, in a retreat, ammunition should also be dumped where it can be picked up by batteries as they withdraw. This latter expedient was used successfully by the British in the retreat from Mons in 1914.

In the army of the United States the field artillery battalion has a combat train which carries reserve ammunition; the field artillery brigade has an ammunition train; and the corps and army have ammunition trains. Ammunition supply is normally from the army to divisions.

In the French Army ammunition is conveyed from railheads (gares de *ravitaillement*) to delivery centres (centres de *livraison*) or advanced depots by motor transport units of armies. It is then conveyed to batteries by lorries of the corps artillery park (*parc d'artilleries* de corps *d'armée*), transport of the corps heavy groups, horsed and motor vehicles of the divisional artillery park sections and group ammunition columns. The main feature of the French system is its flexibility, the various transport units in the forward area usually being under the control of corps for use in the way best suited to each situation. In the American army corps trains of motor transport supply ammunition to brigade ammunition columns which may be mechanized or horsed.

TACTICS

In modern war it is found that infantry, in face of opposition, are immobilized and driven to seek cover as soon as they get within the zone of the enemy's aimed rifle and machine gun fire. Attacking troops can only continue to advance — (and without advancing no decision can be gained) — by enlisting the aid of an arm which is capable of keeping down the enemy's fire while itself remaining sufficiently immune by reason of the distance from which it can operate, or by armoured protection as in the case of tanks. At present the artillery affords the principal means of dominating the enemy's fire. The advent of tanks has, however, profoundly affected the rôle of artillery in battle and the new tactics have not yet been fully evolved. Tanks are capable of relieving the artillery of various forms of support required by infantry and cavalry, but tanks themselves require artillery support if they are not to suffer heavy casualties. The capabilities of the tank have not yet been completely determined, nor can they be until design has reached a greater degree of finality and further war experience has been gained. Further, the relative position of tanks and artillery is becoming confused since some of the most modern types of armoured artillery on self-propelled carriages are themselves but tanks under a different name. The process of mechanization of artillery transport, which is still in progress, also affects the employment of artillery. Artillery tactics are, therefore, at the present day in the midst of a period of evolution. Many of the statements which this article contains will be subject to considerable modification in the near future.

Developments during and since the World War have greatly increased the range, accuracy, fire power and mobility of artillery. A further important advance has been in methods of survey. There are certain limitations to the full development of the power of artillery, the most serious of which is perhaps the difficulty of including in mobile formations sufficient artillery to break down modern defences, and of supplying it with ammunition. Another important limitation which is still engaging the attention of military authorities in all countries is the unsatisfactory nature of the means of signal inter-communication at the disposal of modern artillery. Good signal communications between artillery commanders, their guns, and the troops they are supporting are of vital importance.

Application of Fire. — The principles of surprise, concentration and economy of force (*i.e.,* economizing strength while compelling dissipation of that of the enemy) are generally held to be

of special importance in the application of artillery fire. To obtain surprise it is necessary first to conceal the concentration of the guns and the occupation of positions. In order to evade detection by hostile aircraft, large movements of artillery are now generally carried out at night. Should they be carried out by day, skilful use of cover is necessary to screen movement from observers on the ground. Once the guns are in position, care has to be taken not to disclose their position by firing prematurely and, to this end, the survey methods of working out lines of fire and ranges, already alluded to, are of particular value, as the warning which used to be given by preliminary registration can be eliminated by their adoption in certain circumstances. There is, further, considerable scope for exploiting the value of surprise after the presence of the guns has been disclosed by the opening of fire. Stereotyped systems of shooting should be avoided and damage and casualties increased by bringing fire to bear on the enemy at unexpected times and places and in unexpected ways.

Concentration of effort is as essential in the employment of artillery as in the case of any other arm. The maximum amount of fire must be directed upon the targets which are of greatest importance, and bombardments should be intense and short rather than weak and prolonged. The best means of securing concentration is to centralize command, and it is thus a general principle that control should be vested in the highest commander who can exercise it effectively in any given situation. For effective control, a commander must be in communication with the guns and in touch with the ever-changing situation of the troops he is supporting. When operations are of a deliberate character, inter-communication is comparatively easy to maintain and information is fuller. Control may then be exercised from divisional or even corps headquarters. In very mobile operations, however, artillery brigade or battery commanders will often have to act upon their own initiative, subject to broad instructions from their superior commander.

The maintenance of the principle of concentration involves a strict observance of the allied principle of economy of force. Artillery should be economically allotted to its various tasks and where possible a reserve should be formed. The various types should be employed against the targets they are designed to engage. Thus it would be wrong to use a powerful weapon for a task which could be equally well performed by a less powerful one the life of which is longer and its ammunition more easily supplied. Fire should never be opened without a definite object, and the expenditure of ammunition should be proportionate to the tactical importance of the task. Economy is further obtained by accuracy of fire, but occasions arise when some degree of accuracy may have to be sacrificed to save time and to ensure surprise.

Observation. — Whenever possible, artillery fire is directed by observation. Observation may be carried out from the ground or from the air. Ground observation is most suitable for shooting on targets on the immediate front of friendly troops, and observation posts are selected, whenever possible, so that they may overlook the foremost elements of the troops who are being supported as well as the areas in which targets are to be engaged. Observation from air-craft is largely used for counter-battery work, for fire on distant targets and for dealing with vulnerable and fleeting targets which cannot be seen from the ground. In the British army the requirements of the artillery in air observation are met by army co-operation squadrons of the Royal Air Force. These squadrons also provide photographs of the enemy's positions and rear organization which are of great value in the discovery and selection of targets. Balloons are also used for purposes of observation, but they are handicapped by their vulnerability and the distance from the enemy at which they must operate (see also under TECHNIQUE).

Co-operation with Other Arms. — As the rôle of the artillery is to support the other arms, its action is governed by their requirements. The question of co-operation with the other arms is, therefore, one of special importance. Artillery officers of all ranks have to keep themselves informed of the general situation and plans of commanders whom they are supporting. The best means of ensuring good co-operation is for headquarters of artillery and of units with whom they are co-operating to be in close proximity. Liaison officers are also used to aid in keeping touch, and artillery patrols may be sent forward to supplement personal reconnaissance and the information iurnished by artillery observers. The artillery frequently has to rely on close reconnaissance aeroplanes or on rockets or other special signals for information of the situation of the forward troops. The other arms are trained to supply constant information to the artillery as to their movements and the obstacles which they encounter; this information is essential if artillery support is to be effective. Another important aspect of co-operation lies in the co-ordination of the action of the artillery with that of the weapons of the other arms. For example, artillery fire must be directed in such a way as best to supplement the fire of machine guns and the action of tanks.

ATTACK

In the attack the object of the artillery is to assist the other arms .to maintain their mobility and offensive power. Its tasks may be summarized as follows: — (i.) artillery preparation, (ii.) covering fire, (iii.) close support, (iv.) counter-battery work, (v.) harassing fire, (vi.) co-operation in pursuit.

Approach March. — An army advances against the enemy covered by the advanced guards of its several columns. During the approach march some light, field and possibly some medium artillery will usually be allotted to the advanced guards whose duty it is to drive in the enemy's protective troops by bold and vigorous action. If the artillery allotted to the advanced guards proves insufficient to overcome the enemy's resistance it may be reinforced from the main bodies. If the enemy is in strength a stage will be reached when the advanced guards will no longer be able to advance and when the main bodies or portions of them will be deployed. A plan of attack will then be formed by the commander of the force. If the enemy has been met on the move, or found in a hastily occupied position, the situation will call for rapidity of action, as the dominant need will be to prevent him from seizing the initiative or strengthening his defences. If, on the other hand, he is in an organized position strengthened by artificial defences such as wire entanglements, trenches, field works, etc., the attack cannot be launched without deliberate and methodical arrangement and it must be supported by a strong concentration of artillery,

Dispositions. — In disposing the artillery, the governing considerations are (i.) concentration of the maximum fire to assist the decisive phases of the attack; and (ii.) ability to support the advance to as great a distance as possible without moving the guns. This last requirement entails siting the guns well forward, the most advanced field guns being as a rule no further behind the leading troops than is necessary to obtain cover and to clear the heads of the infantry.

Plan. — The artillery plan comprises the scheme of fire and the arrangements for command, control, communications and movement of artillery in support of the advance. A commander will often have to decide whether it is important or not to use the full power of his artillery in his attack. To develop its full strength the artillery may often require more time for preliminaries than the other arms, and a plan of attack may suit it which does not best suit the other arms. In such a case a commander will generally treat his artillery as the predominant arm if the enemy's defences are strong.

Artillery preparation consists of the bombardment of the enemy's defences before the attack is launched, its objects being to inflict loss and damage, to cut wire obstacles — if tanks are lacking — and to undermine *moral.* If the enemy's positions are not strong or if tanks are available, artillery preparation may be dispensed with and surprise ensured thereby. If it is undertaken it should be as short and heavy as possible.

Covering fire may take the form of a barrage (*i.e.,* a belt of fire) moving ahead of the assaulting troops; of concentrations upon successive localities; of smoke screens; or a combination of any or all of these forms of fire. A barrage has some measure of destructive and neutralizing effect on all troops on the ground over which it passes. It is the simplest method of giving support when the enemy's positions cannot be located with accuracy — and in

modern war this is the normal state of affairs, owing to the difficulty of seeing machine-gun posts, etc. Objections to the barrage are that it is wasteful of ammunition and that the guns available in modern armies permit of this form of support in very inadequate measure. A very thin barrage can be provided by one field gun to 30yd. of front, but even this diluted form of barrage cannot be provided by the divisional artillery for more than a very short time nor over more than a small fraction of the divisional front, *e.g.*, in the case of the British division it could be provided on about one-eighth to one-tenth of the frontage occupied by the deployed infantry, the remainder of the frontage being denuded meanwhile of artillery support. It is therefore obvious that, in face of strong opposition, reliance would have to be placed upon considerable reinforcements of army artillery units or upon tanks to supplement the action of the artillery. In the provision of covering fire, field guns are used as a rule to shoot nearest the assaulting troops, who are trained to move as close to the bursting shells as possible; field howitzers and medium artillery are used to give depth to the fire and to shoot on more distant targets. As a rule covering fire is arranged in its early stages according to a time-table based on the expected rate of advance of the troops, subsequent support being given by observed fire from guns advanced if necessary during the fight. The Spanish Civil War developed the use of aviation as a reinforcement, by its fire, to the artillery. From Poland, to include the Battle of France, the habitual use of this method by the Germans gave them a great advantage over their adversaries who had no such support.

Smoke shells are fired by artillery in conjunction with other types of ammunition or alone. The principal use of smoke is to furnish concealment to attacking troops in order to enable them to move unobserved for the purpose of effecting surprise. By its use an attack can get to close quarters without being seen and smoke clouds can often be so disposed as to enable the assault to be launched from an unexpected direction. Smoke screens may also be used to conceal the movement of reserves. Smoke is also of great value to reduce casualties among the assaulting troops by preventing the enemy's fire from being aimed or observed, and it should therefore be the object of the attacker to use it in such a way as to blind artillery observation posts and to mask machine gun positions, strongly defended localities, and anti-tank weapons. Smoke screens may also be put down by artillery to protect open flanks, or to prolong a front of attack and so induce the enemy to disperse his fire.

The tendency of an enemy, when a smoke cloud is put down, is to pour a heavy fire into it and this fact has to be borne in mind in evolving plans for its employment. The actual production of a smoke screen requires great skill and the wind and weather have to be carefully considered. If smoke is fired indiscriminately it may interfere seriously with observation from both ground and the air, with reconnaissance during battle, with signalling or with operations of troops on the flanks.

Close Support. — The prearranged covering fire may not be sufficient to nvercome all resistance to the advance and leading units therefore have to be accompanied by some artillery to obviate the delay which would be entailed in signalling to guns at a distance. So much is generally admitted; but the nature, command and organization of the accompanying artillery are matters on which opinions differ. Moreover, the infantry are not satisfied with guns of accompaniment, but demand a weapon of their own in the actual firing line to deal with tanks. It is impossible to go into the whole controversy in this article.

The British gun of accompaniment is at present the 3.7-in. light howitzer, but this weapon is generally considered too large and its shell is so heavy as to present serious difficulties in ammunition supply. Field artillery is also used for close support to replace or reinforce the light howitzers. The French infantry organization includes 37-mm. guns and Stokes mortars, but they also favour the employment of the 75-mm. field gun which may be provided with a special low carriage and taken into action by a small tractor. Other nations have introduced pack guns or special light guns or howitzers which can be drawn as far forward as possible by small tractors and can then be divided into loads and carried up by hand. Experiments with various kinds of equipment are being carried out in most countries. It will be difficult if not impossible, to combine in one weapon the requirements of close support, which call for a comparatively heavy shell and a curved trajectory, and those of an infantry anti-tank gun, which demand a flat trajectory, a rapid rate of fire and comparatively small calibre. It therefore seems probable that two weapons will be evolved, both mobile, and possibly carried or drawn by small armoured tractors, but one in the nature of a small howitzer for close support and the other in the nature of a heavy machine-gun capable of stopping tanks up to 1,000yd. or 1,500yd. range.

Counter-battery Work comprises the location, neutralization and, when possible, destruction of the enemy's artillery. The problem of dealing with the hostile guns is given much greater attention in all armies than was the case before the war of 1914–18. It now enters into operations of every kind and in varying degrees lies within the sphere of responsibility of every artillery commander. Special counter-battery staffs are generally provided at corps headquarters. The chief sources of information as to the enemy's artillery are (i.) observers in aircraft; and (ii.) flash-spotting and sound-ranging units on the ground. In addition, artillery and infantry observers are trained to send back information. A portion of the attacker's field and medium artillery is usually allotted the task of engaging the hostile guns before and during an action with the object of keeping down their fire and so facilitating the advance of the assaulting troops.

Harassing Fire. — The objects of harassing fire are to wear down the enemy's fighting spirit, to inflict casualties and damage upon him, to prevent movements of reinforcements and ammunition and generally hinder the conduct of the defence. Harassing fire has to be reduced to a minimum in mobile war owing to the small quantities of ammunition which are available; in deliberate operations or static warfare there is great scope for its development.

Pursuit. — During an advance artillery is pushed forward to support the infantry and to assist them in pressing the enemy, batteries usually being moved alternately within brigades so as to ensure that the covering fire will be continuous. But to obtain decisive results in a pursuit it is necessary to launch against the enemy a special pursuing force, composed of mobile troops. Mechanized artillery is of special value with such a force, and it should be handled with the greatest boldness, risks being accepted which would not be justifiable at other times.

DEFENCE

In defence the artillery assists in the protection of the other arms and co-operates with them in repelling the enemy's assaults. Its tasks may be summarized as follows: — (i.) counter preparation, (ii.) fire to repel assaults, (iii.) anti-tank defence, (iv.) counter battery work, (v.) harassing fire.

Dispositions. — In defence the artillery has to be sited in such a way that it will be able to bring the full weight of its fire to bear in front of the line of infantry defences on which the commander intends to stop the enemy. In mobile war the infantry defensive position will generally consist of a chain of defended localities, and it will usually be in front of this line that the artillery will be required to shoot in order to break up an assault. In more deliberate operations, however, time and resources may permit of the defensive position being more highly organized. It may then consist of a lightly held forward zone, intended to absorb the first shock of a heavy attack, and a strongly held main zone in which the battle is to be fought out. In this type of defence the bulk of the artillery has to be sited further back with the object of bringing the main weight of its fire to bear in front of the main zone, a small proportion only of guns being allotted to support the troops in the forward zone. This method of defence was exploited by Pétain in stopping the final German offensive of July 15, 1918, and it has found much favour in the eyes of soldiers. The bulk of the guns are not sited in such advanced positions in defence as in attack for two reasons, firstly, that they may not be easily neutralized by the attackers' artillery, and, secondly, that they may not be over-run in the first rush of an assault. A proportion of the guns must be in forward positions, however, for the purpose of

engaging the enemy's artillery and rear communications and of hindering arrangements for an attack. The fulfilment of these requirements results in the defender's artillery being distributed in depth. An important factor which must also be considered in disposing the artillery is the problem of anti-tank defence. This is discussed below. An essential requirement of defensive positions to be occupied by infantry, besides facilities for siting the guns, is suitability for artillery observation. It is always desirable that there should be some rising ground from which observation can be carried out, and such localities should be so far behind the foremost defences that they will not be captured, and the eyes of the defence blinded, by a minor penetration by the enemy.

Plan.—The artillery plan of defence comprises, besides the arrangements for dispositions, which are discussed above, the scheme of defensive fire and the policy which is to govern counter-battery action. Surprise is as important in defence as in attack and it is therefore important that the fire plan should not be disclosed prematurely. A favourite device is to keep as many as possible of the defending guns silent until an attack develops and then to engage the enemy with an unexpectedly heavy fire. In order to conceal the battle positions of the defending artillery, guns which are required to be active often shoot from temporary positions which they vacate before the enemy's attack is launched. It is important to make arrangements to concentrate as much as possible of the available artillery fire on any particular portion of the front which may be attacked by the enemy and to make all possible preparations to support counter-attacks. Smoke has to be used with caution in defence as it is liable to obscure the view of the defenders and so to hamper their fire.

Counter-preparation is the term applied to fire which is delivered with the object of breaking up an attack before it can be launched. It is directed against probable forming-up places and forward communications in order to disorganize the enemy's troops when they are suspected of being about to assault. A plan of predicted fire is usually arranged as soon as a defensive position is occupied but, if the enemy's troops can be seen and signal communications can be maintained, it is more effective to shoot with direct observation.

Repulse of Assaults.--Once an attack is launched it becomes the aim of the artillery to direct fire on the assaulting troops and reserves. It is desirable that, as in the case of counter-preparation, such fire should be controlled by observation, but this is not often practicable. Attacks may be launched under cover of smoke or in the half light of dawn, and signal communications may be cut by hostile fire; even when other conditions are favourable, observation will be rendered impossible when there is such a force of artillery that observers are unable to distinguish the shells of their own batteries. It is therefore a rule to detail targets to be engaged by all batteries with predicted fire. Such targets will generally be the most probable lines of approach for the enemy and other vulnerable portions of the front, and the fire of the guns must be carefully co-ordinated with that of the infantry weapons, especially with that of machine guns. The artillery resources of present armies will not permit of continuous belts of artillery fire being placed in front of the infantry positions as was done in the war of 1914–18, and it is not to be expected that sufficient resources will be forthcoming in the future for the resuscitation of the "standing barrage" unless periods of static warfare recur.

Anti-tank Defence.—A considerable share of the responsibility for anti-tank defence falls upon the artillery. The anti-tank weapons of the infantry are generally reinforced in the forward defences by some light or field pieces which are sited in concealed positions from which they can deliver a sudden fire at short range. A serious nbjection, however, to the employment of artillery in this task is that guns sited in forward and exposed positions are of little use for general purposes of defence. A second line of defence is formed by the main force of the artillery, all battery positions being chosen as far as possible so as to provide a field of fire against tanks. In addition, some guns have to be disposed for the protection of headquarters and other important points in rear.

Counter-battery work is generally carried out by the defenders with the object of weakening the hostile artillery before an assault can be launched. Once the attack develops, however, it may be preferable to direct the full power of the defending artillery for a time upon the assaulting troops.

Harassing Fire.--In a defensive action of a temporary nature this form of fire will not generally be developed owing to the necessity for economizing ammunition. When resources permit, however, an enemy's offensive preparations may be considerably hampered by a well devised scheme of harassing fire.

Withdrawal.—When a force is retiring in face of an enemy, mobile artillery is of particular value for covering the withdrawal of the other troops. Thus rear guards usually contain a large proportion of guns. Enemy columns should be engaged at long ranges with the object of forcing them to halt and deploy as frequently as possible. Command of the artillery will generally have to be decentralized to infantry brigades or corresponding units in this form of operation, and batteries should retire alternately in order that continuous support may be provided.

ANTI-AIRCRAFT DEFENCE

The problem of anti-aircraft defence enters into all forms of action against a well-equipped enemy, and anti-aircraft artillery is now provided in most armies. Anti-aircraft artillery may act in co-operation with fighting aircraft, when its main task will be to assist them by breaking up formations of hostile aircraft and by indicating their whereabouts by shooting at them. It may also act independently; its rôle is then to destroy hostile aeroplanes and to deny them opportunities of bombing and detailed observation. Anti-aircraft artillery will usually be employed for the protection of columns on the march and of forward areas when an army has deployed. Owing to the great radius of action of modern aircraft, anti-aircraft artillery has also to be provided for the air defence of bases, headquarters and other important points on the lines of communication of an army. Searchlights and sound detecting apparatus form part of all anti-aircraft regiments.

POSITION WARFARE

Military opinion is divided as to the likelihood of a recurrence in the future of periods of position warfare such as were experienced in the war of 1914–18. Modern armies are being trained for mobile operations, but in most countries the lessons of siege warfare which were learnt between 1914 and 1918 are recorded in military text-books. A modern entrenched position consists of an elaborate system of trenches, strong field works and barbed wire entanglements and it is arranged in successive zones in great depth so that it cannot be penetrated by a single attack. The work of the artillery in routine trench warfare is to exhaust the enemy's strength by harassing and counter-battery fire. The tactics of the attack on a fortified position are much the same as those of the attack on a position in mobile warfare. The main points of difference are: (a) the details of the defences are definitely known from aerial photographs: (b) the obstacles, such as barbed wire, are more formidable; (c) the defenders will have better cover from fire in their trenches and in deep dug-outs so that the barrage and bombardment will be less effective. The first point implies that the bombardment can he concentrated on definite points, instead of being more or less spread over the country; the second requires that field guns and, if possible, tanks, must be pushed forward to cut the wire; the third entails the employment of a strong force of field and heavy artillery.

Savage Warfare.—While the general principles outlined in the foregoing sections also govern operations in undeveloped and uncivilized countries, considerable modifications have to be made in the methods of their application. The difficult nature of the country and the absence of roads often make it impossible to use wheeled transport. In mountainous or bush country it is therefore usual for the bulk of the artillery to consist of light guns and howitzers which can be carried in pack. When field and medium guns can be employed, however, they are often of special value for the distant bombardment of villages and towers. The difficulties of ammunition supply are generally great and the artillery has therefore to be used economically. In savage warfare accurate large scale maps are seldom available and reliance has to be placed chiefly upon fire observed either from the ground or the air. In

bush country it is usually necessary to provide escorts for all artillery both on the line of march and in action.

Gas Warfare.—Though all civilized nations have condemned the employment of poison gas in warfare it is considered necessary to take measures for defence against it and to reserve the right to freedom of action in case an enemy refuses to give an undertaking not to use it. The chemical composition and effect of such gases is described under CHEMICAL WARFARE; we are here concerned with their tactical employment by artillery.

Gas shell bombardment has been, up to 1940, the most usual of the very many forms of gas attack. Bombardments in the World War (1914–18) were of various natures according to the object in view. Short concentrated bombardments with non-persistent gas were employed with the object of inflicting casualties by surprise. In such bombardments it was necessary to fire at a rapid rate from a number of batteries simultaneously, in order to produce a strong concentration of gas so quickly that casualties would be caused before respirators could be put on. Bombardments with persistent gas, such as mustard gas, were generally used if it was desired to render certain areas of ground dangerous to occupy for considerable periods of time. A third type of bombardment took the form of harassing fire in short bursts at irregular intervals. This type of fire was employed to interfere with the hostile artillery or to interrupt traffic and generally to reduce the efficiency of troops by compelling them to wear their masks for long intervals. In all types of bombardment high explosive shells were frequently used in combination with gas shells to increase disorganization as well as to conceal the presence of the gas as long as possible.

Gas shells require a special range table, as they are lighter than ordinary shell. They may be employed with any calibre of gun or howitzer and usually contain gas in liquid form. They are fired either entirely by map or after preliminary ranging with ordinary shell, as their impact cannot be observed. Hot sunshine causes volatile gas to disperse quickly, and a strong wind blows it away; gas is therefore most effective on a cloudy, still day. The shells are pitched to windward of the target so that the breeze will carry the gas in the required direction. In this respect guns are more efficient than gas cylinders, as they are not obliged to await the coming of a favourable wind. The number of gas shells required for an effective bombardment varies according tp the weather, the calibre of the piece, and the nature of the gas used, but it is always large, as the gas content of shells is small for their weight. The difficulty of supplying the ammunition in adequate quantities, therefore, considerably restricts the use of gas shells in mobile warfare. (See AMMUNITION; BALLISTICS; EXPLOSIVES; ORDNANCE; for naval guns *see* GUNNERY, NAVAL.) (J. N. K.; X.)

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ARTILLERY SCHOOLS, U.S. The artillery of the United States army is divided into two separate arms, the Field Artillery and the Coast Artillery corps, and for each the War department maintains a special school. That of the coast artillery was established in 1824 at Ft. Monroe, Va. as the "Artillery School of Practice" and is the oldest of the army's special service schools. The course for regular army officers lasts nine months, that for National Guard and Reserve officers three months. There is also an advanced technical course of nine months for regular army officers and special courses in clerical training. For graduates of the regular army courses, the school offers refresher courses. In 1939 the staff of the school consisted of 25 regular army instructors and 21 enlisted instructors.

The field artillery school is located on a reservation of 51,000 acres at Ft. Sill, Okla. The main departments of instruction are animal transport, gunnery, matériel, tactics and communication, and extension courses. The courses offered annually are as follows: the regular course of nine months for army officers; two National Guard and Reserve* officers' courses which last three months each; an advanced course in horsemanship which lasts nine months; an advanced course in motors which lasts four and a half months, an advanced course in communication which lasts four and a half months, and a refresher course of one month principally for officers who have been detailed away from the field artillery. The school offers in addition several courses for enlisted men. In 1939 the school's teaching staff included 31 officer instructors and 58 enlisted instructors. The attendance at all courses except the refreshers in that year was about 450.

The strength of the Coast Artillery corps on June 30, 1939 was 10,747 officers and 32,939 enlisted men; that of the Field Artillery was 18,772 officers and 59,739 enlisted men.

ART INSTITUTE OF CHICAGO was incorporated on May 14, 1879, for the "founding and maintenance of a school of art and design, the formation and exhibition of objects of art, and the cultivation and extension of the arts of design by any appropriate means." The building, of Italian Renaissance design, faces Adams street on the lake front, and houses more than 150 galleries, schoolrooms, studios and offices, the Ryerson art library (35,969 volumes), the Burnham architectural library (8,249 volumes), Fullerton Memorial hall and the Kenneth Sawyer Goodman Memorial theatre. The 1,300 paintings include pieces from the Italian, Netherlandish, French, British, American schools, notably the Birch-Bartlett, Coburn, Eddy, Kimball, Palmer and Ryerson collections. The print department contains over 30,000 drawings, engravings, etchings, lithographs and a library of graphic arts. The Japanese print collection is the third most important in the world, numbering 3,500. The Buckingham collection of ancient Chinese bronzes and ceramics is outstanding, also unusually fine are the Cambodian and Chinese sculptures, Persian and Japanese textiles. There are also collections of sculpture, both originals and casts, classical objects, furniture, ceramics, textiles, a children's museum and a restaurant. The Art Institute school is the largest in the country, having an annual registration of 4,000, and giving instruction in all phases of art, including the theatre.

The institute has 14,700 (Jan. 1940) members, and holds 60 or 70 current exhibitions a year. Educational work is carried on

through lectures, in co-operation with the city schools; special courses by the department of museum education, extension lectures, the Florence D. Bartlett (free) and Scammon lectures. The yearly attendance averages 1,000,000. The museum is open for visitors every day in the year on payment of a small fee, free on Wednesdays, Saturdays, Sundays and public holidays.

An amended charter (1925) covers exhibitions, libraries, theatres, lectures and lecture halls, workshops, lunchrooms, entertainments, the granting of diplomas, the receiving and administration of trust property.

ARTIODACTYLA. To some of our domestic animals the term "cloven-hoofed" is commonly applied. These are the cow, the sheep, the goat and the pig. Deer are also "cloven-hoofed" animals, as are giraffes, camels, antelopes and certain other animals less well-known to us. Scientifically speaking, however, "cloven-hoofed" is not a good term; it suggests that these animals have, like a horse, a single hoof, and that this hoof is cleft down the middle. If the foot and its skeleton are examined more carefully it will be seen that each half of the so-called "cloven hoof" is really a little hoof in itself, flattened on the side which faces its fellow and belonging to a different toe. These two toes are equal in size and carry the weight of the animal, which always stands, as it were, on tip-toe, with ankle and wrist raised high off the ground, the terminal hoof-clad joint of the toe alone resting on the latter. Some "cloven-hoofed" animals have only these two toes, but some, such as the pig, have another pair of similar toes outside the central pair, while the hippopotamus has four toes of almost equal breadth, all but one of the ancestral five. In the pig each of the small lateral toes has its full complement of toe bones and a perfect little hoof at the end, but they are much shorter than the central toes and so only come into use when the animal is walking on soft swampy ground—then they help to prevent it from sinking in too far. In the cow and sheep vestiges only of these lateral toes are left, the so-called "dew claws"; in a giraffe they have quite disappeared. Intermediate conditions are found in a peccary, in a chevrotain, and in deer (see fig 1). All these forms agree, however, in having the axis of symmetry of the foot passing between the third and fourth toes of the ancestral five, these two forming an equal and symmetrical pair on either side of it. The hind foot fundamentally resembles the forefoot in construction, but the reduction of the lateral toes in the former has generally gone further, since the hind foot is of greater importance in propelling a running animal, while the forefoot is mainly concerned with supporting its weight. Fig. 2 shows the arrangement of the bones in a pig's hind foot. Of seven small ankle or *tarsal* bones the two upper ones form a joint, the "hock joint," with the-long bones of the shin, while the lower ones support a row of four metatarsals, one to each toe. The metatarsals in their turn each support three phalanges, the lowest of which are flattened and pointed and covered by the horny hoofs. The inner of the two bones at the ankle joint, the *astragalus,* is of a very characteristic shape, since it not only has a pulley-shaped surface for articulation with the shin bone or tibia, as in all mammals, but also a similarly shaped surface at the lower end, almost equally divided between the two small tarsal bones beyond it, the *navicular* and cuboid. An astragalus of this peculiar shape is found in nearly all cloven-hoofed (artiodacfyl) mammals, and appears to be a consequence of the tendency to make the two enlarged central toes do all the work of the foot. The outer bone of the shin (*fibula*) is very reduced, so that nearly all the animal's weight is transmitted through the tibia to the astragalus; half the weight then passes through the cuboid to the outer of the central toes, half through the *navicular* to the inner toe by way of the *ectocuneiform*. Stresses are transmitted from the ground upwards by the same path. In the more advanced cloven-hoofed mammals, such as the deer and sheep, the underlying plan of the hind foot remains the same, but the ankle is strengthened by fusion of *navicular* and cuboid, and the central *metatarsals* are joined to form a "cannon-bone" whose upper end is broadened out to support the whole tarsus. Fossilized *astragali* of the double-pulley shape have been found in strata of Lower Eocene age associated with teeth of the "tritubercular" pattern common to the primitive members of nearly all mammalian orders. The artiodactyl type of foot symmetry is therefore clearly of very ancient origin It may well have been evolved independently in more than one group of primitive mammals, but so far no *astragalus* has been found intermediate in shape between the double pulley and the type with a rounded lower end which appears to have been that of the original mammalian stock.

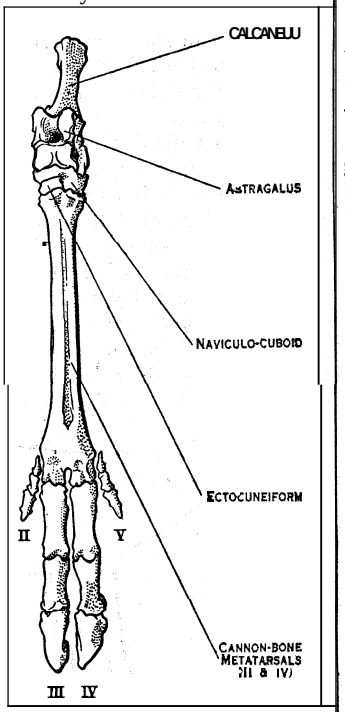


FIG. 1.—HIND FOOT OF A DEER Instead of four toes like the pig, Artiodactyla accustomed to running long distances have only two, though sometimes the others remain as useless vestiges

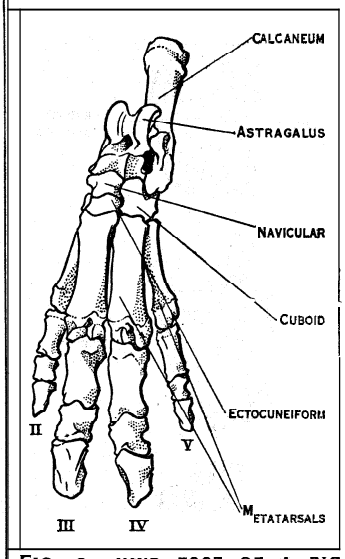


FIG. 2—HIND FOOT OF A PIG SHOWING THE TWO CENTRAL TOES WHICH MAKE IT A MEMBER OF THE ARTIODACTYLA GROUP

Classification.—The "cloven-hoofed" mammals were first grouped together as an independent order by Richard Owen in 1847, mainly on account of the structure of their feet. He termed them Artiodactyla (Gr. ἀρτιος, even, and δάκτυλος, a finger or toe) to distinguish them from those other hoofed mammals, the horses, tapirs and rhinoceroses (PERISSODACTYLA, *q.v.*) in which a single central toe does the main work of each foot, the other toes being smaller and grouped symmetrically on either side of this central one, or reduced to mere vestiges. A conservative classification of the living Artiodactyla is as follows:

I. SUINA (pig-like animals).
   1. Suidae—pigs and peccaries.
   2. *Hippopotamidae*—hippopotami.

II. RUMINANTIA (ruminant-like animals).
   1. *Tylopoda*—camels.
   2. *Tragulina*—chevrotains.
   3. Pecora (or true ruminants)—deer, giraffes, antelopes, goats, sheep, oxen, etc.

The Ruminantia are a well defined group united by characters of the skull, dentition and stomach, as well as by the structure of their feet. The *Suina,* on the other hand, except for their foot structure, have almost no important characters In common with the Ruminantia, nor are the Suidae very closely related to the *Hippopotamidae*. Indeed. before Owen established the order *Artiodactyla* the Suina were kept apart from the Ruminantia, which constituted an order in themselves. The *Suina* shared Cuvier's old order Paclzydermata ("thick-skinned" animals) with the rhinoceroses, tapirs and elephants, on no better grounds than that all were thick-skinned, massively built, hoofed mammals, with a number of toes to each foot and of an omnivorous diet. Owen was not a believer in evolution, at any rate in the Darwinian sense, but his rearrangement of the *Pachydermata* fitted in well with the new way in which people began to look at the problems of classification when once the idea of evolution had taken root in their minds.

That one animal had four toes and another only two now seemed no longer a sound reason for putting them in different orders, for

it was realised that every two-toed animal must once have passed through a four-toed stage and it appeared of much greater importance that in one group of animals there was a tendency to make one central toe do all the work of the foot, while in another group the tendency was to utilize two equally developed central toes.

From 1850 onwards discoveries of fossil mammals became more and more numerous. Among these were many new types of *Artiodactyla* which would not fit into the old subdivisions of that order, some being intermediate while others were entirely novel. The parts of fossil animals most commonly preserved in good condition are the teeth, owing to their hard protective coat of enamel, and so it came about that the many new attempts to subdivide the order were largely based on characters of the teeth alone, especially of the molar teeth.

One such classification (see Schlosser in Zittel's *"Grundzüge"*) is based on the shape of the cusps of the molar teeth, whether they be all crescentic (selenodont) as in the ruminants, all conical (*bunodont*) as in the pigs, or a mixture of the two types (*bunoselenodont*) as in some extinct animals (see fig. 3). Another classification, that of Dr. H. G. Stehlin, is based on the number and position of the molar cusps (see Abel's Die *vorzeitlichen* Saugetlziere).

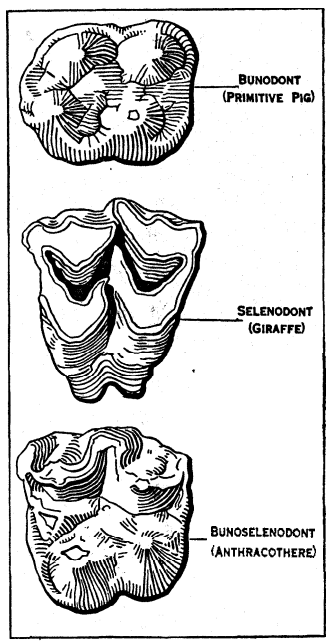


FIG. 3.— GRINDING TEETH OF ARTIODACTYL ANIMALS
The shape and pattern of the grinding teeth vary according to the animal's diet. Some extinct Artiodactyla had teeth of intermediate pattern between those of the pigs and ruminants

Each of these classifications produces an entirely different grouping of the *Artiodactyla,* indicating that the use of molar characters alone is not sufficient to express the inter-relationships of living and extinct animals. The grouping into Suina and Ruminantia given in the present article follows the old division of the living families. In allotting the extinct families to one or the other group attention has been paid to the structure of the skull as well as to the characters of the dentition. The name *Ruminantia,* suggesting a capacity to ruminate ("chew the cud"), suffers from the defect that we know nothing about the digestive processes of the extinct forms.

SUINA.—The relationship of the pigs and peccaries to the hippopotamus is very remote and no known fossil forms bridge the gulf. The two families appear to be all that has survived of a once much larger assemblage. We know practically nothing of the origin of the group, but find it richly represented in beds of Upper Eocene and Oligocene age by several not very closely related families, each of which had evidently already passed through a long period of evolution along its own particular lines. Most *Suina* have well developed incisor teeth, powerful *canine* tusks, a strong mandible articulating far back on the skull, and no mastoid exposure of the ear bone.

I. *Suidae.*—The pigs of the Old World (Suinae) and the peccaries of the New World (*Tayassuinae,* or an older name, *Dicotylinae*) resemble one another in general appearance. Both have fleshy discs on the end of their snouts which they use for rooting in the ground. Peccaries are smaller than most species of pig, have shorter snouts and short downwardly directed tusks in the upper jaw, forming efficient biting organs; the tips of their lower tusks project outwards from the mouth and can be used for ripping an enemy with a quick, upward jerk of the snout. In a pig the upper tusks as well as the lower curl outwards from the mouth; both are much longer than in a peccary and very effective ripping organs. Associated with this difference in the upper tusks are a whole series of small differences in the superficially very similar skulls. Further, the grinding teeth of peccaries are smaller, squarer and simpler in pattern than those of pigs, while in the feet the lateral toes are much reduced and the metatarsals partially fused into a "cannon-bone." The stomach of a peccary is incompletely divided into three compartments by folds of which there are only vestiges in a pig. Peccaries usually associate in very large herds, pigs in smaller groups termed "sounders."

The first true pigs are known as fossils in the Oligocene of Europe, the first true peccaries contemporaneous with them in both Europe and North America. At that period they were so alike that it is only just possible to recognize in each the characters that so clearly separate their descendants to-day. In the later Tertiaries of Europe we find only one form that possibly is allied to the peccaries, whereas there is a rich variety of pigs, of all sizes up to veritable giants, whose true relationships are very difficult to trace. Of living *Suinae* there are only five genera: Sus, represented by a number of ill-defined species widely spread over Europe, northern Africa, Asia and the East Indies; Porcula, a pigmy form in the forests at the foot of the Eastern Himalayas; *Potamochoerus,* the African river hog, hardly more than another species of *Sus; Phacochoerus,* Africa wart-hog; Hylochoerus, in the forests of Equatorial Africa; and Babirussa of the Celebes Islands (see SWINE, RIVER-HOG, WART-HOG, BABIRUSSA). From the later Tertiaries of North America there are so far known only one or two rather curious genera of peccaries which do not form good intermediate links between the modern genera and the ancestral peccaries of the Oligocene. To-day there are no peccaries in North America, but two genera, each represented by a number of ill-defined species roam in the forests of Central and South America (see PECCARY).

II. *Hippopotamidae.*—Now found only in Africa, this family during the later Tertiary had a far wider range to the north. Of its early evolution we know nothing; the hippopotami of the Indian and European Pliocene were not very different from the modern species. In marked contrast to the pigs, the hippopotamus has a very broad muzzle in which the enlarged, rootless incisor teeth and canines form deadly lacerating weapons. The crowns of its cheek teeth have a distinctive trefoil pattern when partially worn. To help it in swimming, and to support its clumsy form on the soft ground along the borders of the rivers in which it spends much of its time, four broad toes are retained in each foot. *Choeropsis,* the pigmy hippopotamus of Liberia, lacks the trefoil pattern on the molar teeth and is allied to a small fossil hippopotamus from the pleistocene of Cyprus.

III. *Cebochoeridae.*—These small animals from the Middle and Upper Eocene of Europe have been regarded as primitive Suidae because their *bunodont* molar teeth would make so good an ancestral stage in the evolution of those of a pig. The structure of their skull, however, suggests a nearer relationship to the hippopotamus or *anthracotheres.*

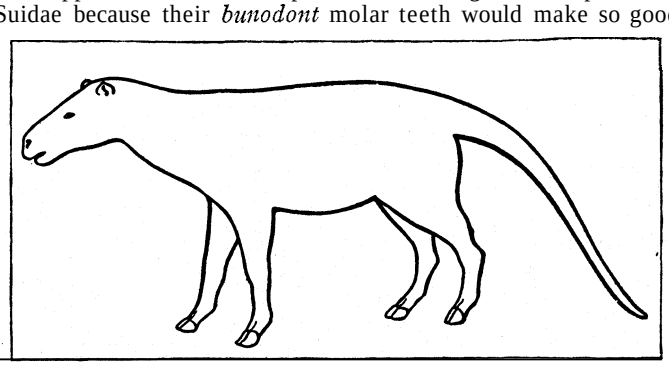
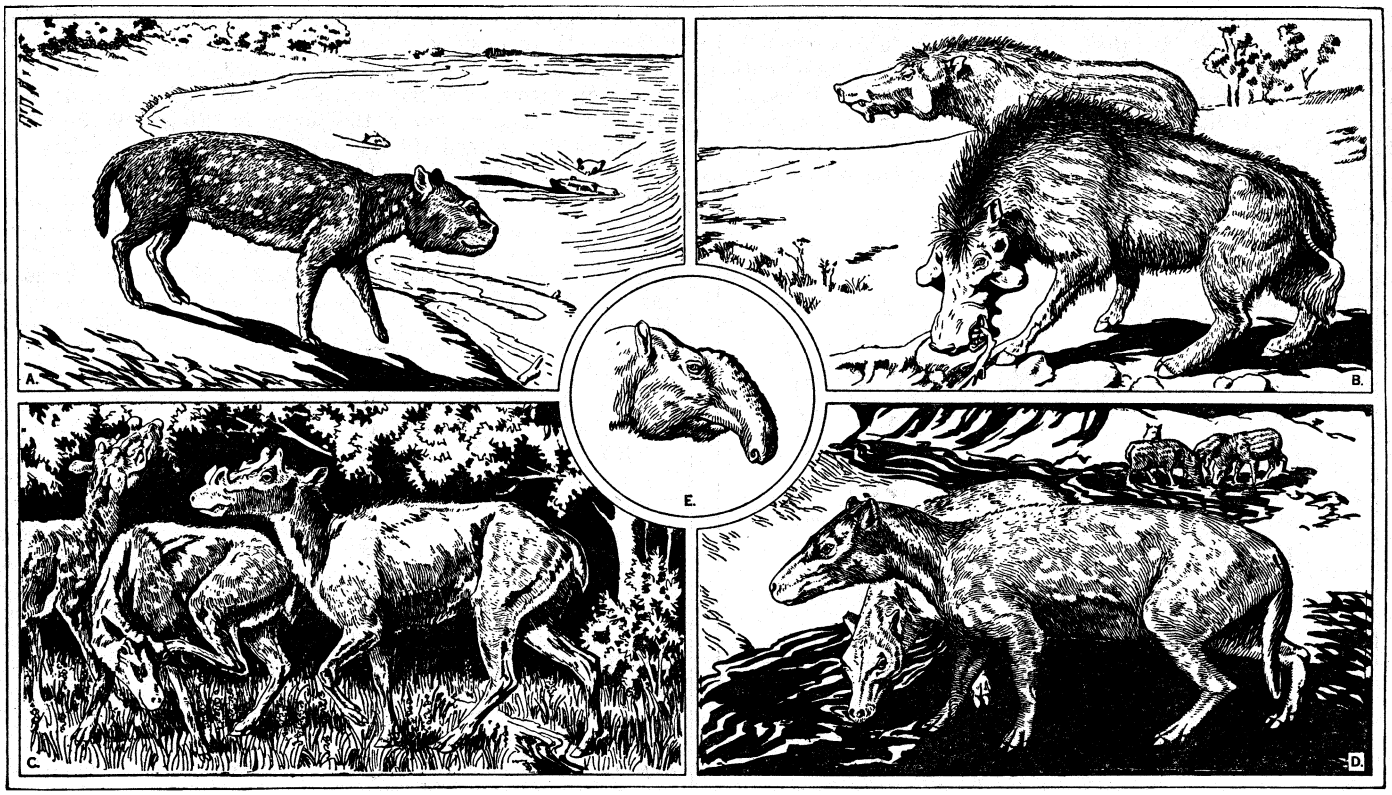


FIG. 4.— THE EXTINCT ARTIODACTYL ANOPLOTHERIUM AS RECONSTRUCTED BY CUVIER WHO BELIEVED THAT IT RESEMBLED AN OTTER

IV. *Anthracotheriidae.*—A very widespread and important family in the early Tertiary, branching out into a number of different lines of evolution adapted (if one can judge by their dentition) to very different kinds of diet. Some became gigantic and retained heavy, crushing, bunodont cheek teeth; others remained of a lighter build but developed a long slender snout and selenodont cheek teeth; apparently chewing their food with a sideways movement like a ruminant. Some retained five toes in the fore foot, four in the hind foot; in others the number was reduced.



FROM SCOTT, "HISTORY OF LAND MAMMALS," (MACMILLAN)

FIG. 5.—RESTORATIONS BASED ON THE FOSSIL REMAINS OF FIVE EXTINCT ARTIODACTYLA

A. "Leptauchenia," a short-faced Oreodont, the position of whose eyes and ears suggests amphibious habits like those of the hippopotamus
B. "Entelodon," appears to have resembled a pig in its feeding habits
C. "Protoceras," a primitive ruminant, had horn-like projections on the nose as well as above the eyes
D. "Ancodon," an Anthracothere, had five toes in its forefeet—the primitive number
E. "Pronomotherium," another Oreodont, may perhaps have had a proboscis

V. *Entelodontidae* (or *Elotheriidae*).—These giant, pig-like animals from the Oligocene of Europe and America were not really at all closely related to the true pigs. Their heavy *molar* teeth with rounded cusps must have been very efficient grinding organs, while the grooves which are sometimes worn at the base of their powerful *incisors* and *canines* suggest a habit of digging up gritty roots, A large flange projecting downwards and outwards from the cheek bone gives a very curious look to the skull. Owing to the very long limbs the animal had a stilted appearance, enhanced by the feet having only two toes apiece.

VI. Distinct from any of these families, but perhaps most nearly related to the *anthracotheres,* is the Upper Eocene genus *Choeropotamus,* famous from Cuvier's first descriptions in the *Ossements fossiles.* Like the *Cebochoeridae,* it has often wrongly been regarded as a primitive pig because of the pattern of its molar teeth.

Ruminantia.—Most living *Ruminantia* are members of one of the numerous families of the sub-order *Pecora.* These are the dominant hooved mammals of the day *(see* PECORA). The suborder *Tylopoda* is nowadays represented solely by the camels of the Old World, mostly domesticated, and by the llamas, alpacas, etc., of South America *(see* TYLOPODA, CAMEL, LLAMA). In the third suborder, *Tragulina,* are placed the two genera of Chevrotains, *Tragulus* of South-east Asia and *Hyomosuchus* of equatorial Africa *(see* CHEVROTAIN); although these have usually been regarded as belonging to a single family (*Tragulidae*) it is nevertheless very doubtful whether there is really so close a relationship between them. From the beginning of the Miocene onwards both *Pecora* and *Tylopoda* are represented by numerous fossil forms easily recognisable as belonging to one or the other sub-order. Previous to this, during Oligocene times, lived a number of small *artiodactyl* animals which were clearly primitive *Ruminantia* but cannot usually be hailed with certainty as the ancestors of this or that particular family. It is therefore convenient to unite them into a family of their own, the *Hypertragulidae,* which can then be regarded as the primitive group from which all modern *Ruminantia* are derived. They were small animals of delicate build, with slender muzzles, four crescents on the crowns of their *molar* teeth, and usually four toes in the fore foot and two in the hind. Still more primitive *Ruminantia* have been found in strata of Eocene age, and together with them a rich variety of small *Artiodactyla* with a very similar type of skull but without the four crescents on the *molar* teeth. Besides the similarity in their skulls—which were of delicate build with slender cheek bone and mandible—these small *artiodactyls* agreed with the contemporary *Ruminantia* in possessing the primitive number of forty-four teeth, no gaps between these teeth, short *canines* looking rather like the *incisors,* compressed elongated *premolar$* and central *metapodials* not fused to form "cannon-bones," although in some cases the toes were reduced to two in each foot as in modern ruminants.

The camels on the one hand and the ruminants on the other had each an independent origin from small *artiodactyla* of this primitive type. Each then developed quite independently a number of strikingly similar characters, including high-crowned *molar* teeth. a tendency for the upper *incisors* to disappear, only two functional toes in each foot, cannon-bones formed by the fusion of the third and fourth *metapodials,* a reduction of the outer bone in both forearm and lower leg, and a complex, many-chambered stomach connected with the habit of rumination. They thus afford an excellent example of "parallel evolution" in response to similar environmental conditions. The *Tragulina* show many of the same tendencies but usually not so fully developed; they too may have evolved them independently or they may be a primitive off shoot of the *pecoran* stock.

Two rather isolated families of *Ruminantia* have still to be mentioned: the *Oreodontidae* and the *Anoplotheriidae. (a)* The *Oreodonts* (*q.v.*) were a very characteristic North American family, branching out during the Oligocene and Miocene into several phyla, some of which lasted on until the Lower Pliocene. They were animals with short necks, long bodies and tails, short limbs and

feet. They retained at least four toes in each foot and many other primitive characters, but their skulls, which to start with were very like those of contemporary *Ruminantia,* underwent some curious changes. In one phylum the animals seem to have developed a short proboscis like a tapir, and to have lived in the water like a hippopotamus. One form, Agriochoerus (sometimes placed in a distinct family) differed from the typical oreodonts in having limbs

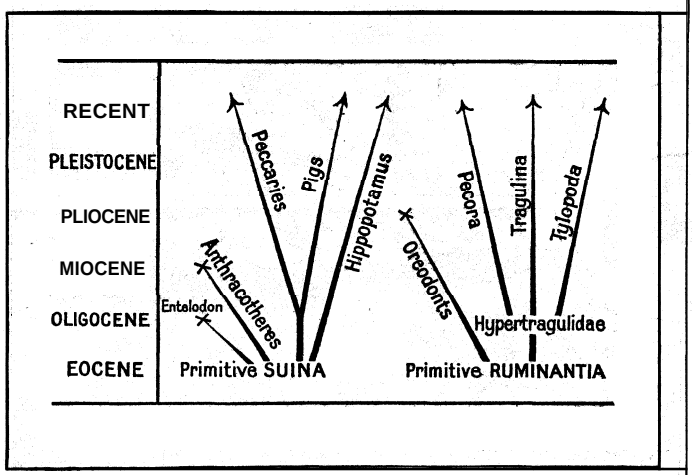


FIG. 6.—GENEALOGY OF THE DIFFERENT GROUPS OF ARTIODACTYLA
To the left are the names of the several geological periods of the Age of Mammals. Those groups marked with crosses became extinct during the period indicated. Arrows indicate that a group has continued its evolution up to the present day

and vertebrae proportioned like those of cats, as if it were an agile leaper; the feet, otherwise like those of oreodonts, were armed with sharp claws instead of narrow hoofs. The animal can hardly have been a carnivore, since its molar teeth had the four crescents characteristic of herbivores and the upper *incisor* teeth were shed in the adult. The known *Anoplotheres* were exclusively European. They were specially characteristic of the Upper Eocene and were the largest Artiodactyla of that period. Their broad feet and the very long thick tail caused Cuvier to attribute to these animals swimming habits like those of an otter.

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ARTISAN or **ARTIZAN, a** mechanic, a handicraftsman in contradistinction to an artist. The English word at one time meant "artist," but has been restricted to signify the operative workman only.

ARTOIS, an ancient province of France, corresponding to the present department of Pas de Calais, less the arrondissements of Boulogne and Montreuil, which belonged to Picardy. Its capital was Arras, and other important places were Saint-Omer, Béthune, Aire, Hesdin, Bapaume, Lens, Lillers, Saint-Pol and Saint-Venant. The names Artois and Arras are derived from the Atrebates, who possessed the district in the time of Caesar. From the 9th to the 12th century Artois belonged to the counts of Flanders. It was bestowed in 1180 on Philip Augustus of France by Philip of Alsace, as the dowry of his niece Isabella of Hainaut, and in 1237 was conferred as an appanage by Saint Louis on his brother Robert, who died in 1250. His son, Robert II., was killed at the battle of Courtrai in 1302. After his death, his son Philip having predeceased him (1298), Artois was adjudged to his daughter Mahaut as against her nephew Robert, son of Philip, who attempted to support his claim to the countship by forged titles. Banished from France (1322), Robert of Artois took refuge in England, where he became earl of Riehmond, and incited Edward III. to make war upon Philip of Valois. His descendants, the counts of Eu (*q.v.*), continued to style themselves counts of Artois. By the marriage of Mahaut (d.1329) with Otto IV., Artois passed to the house of Burgundy, in whose possession it remained till the marriage of Mary, the daughter of Charles the Bold, to the archduke Maximilian, brought it to the house of Austria. Louis XI., however, occupied portions of Artois, and the claims of Austria were contested by France until the treaty of Senlis (1493). At the end of the Thirty Years' War Artois was again conquered by the French, and the conquest was ratified in the treaty of the Pyrenees (1659) by Spain, to whom the province had fallen in 1634. The treaties of Nijmwegen (1678) and Utrecht (1713) confirmed the sovereignty of France. The title of count of Artois was borne by Charles X. of France before his accession to the throne. This new creation became extinct on the death of the comte de Chambord in 1883.

ART SALES. The practice of selling objects of art by auction in England dates from the latter part of the 17th century. Towards the latter part of the first half of the 19th century an entirely new race of collectors gradually came into existence; they were for the most part men who had made, or were making, large fortunes in the various industries of the midlands and north of England, and other centres. They were untrammelled by "collecting" traditions. and their patronage was almost exclusively extended to the artists of the day. The dispersals of these collections began in 1863 with the Bicknell gallery, and continued at irregular intervals for many years, *e.g.,* Gillott (1872), Mendel (1875), Wynn Ellis and Albert Levy (1876), Albert Grant (1877) and Munro of Novar (1878). These patrons purchased at munificent prices, either direct from the easel or from the exhibitions, not only pictures in oils but also water-colour drawings. As a matter of investment their purchases frequently realized far more than the original outlay; sometimes, however, the reverse happened, as, for instance, in the case of Landseer's "Otter Hunt," for which Baron Grant is said to have paid £10,000 and which realized shortly afterwards only 5,650 guineas. One of the features of the sales of the 'seventies was the high appreciation of water-colour drawings. At the Gillott sale (1873) 160 examples realized £27,423, Turner's "Barnborough Castle" fetching 3,150gns.; at the Quilter sale (1875) David Cox's "Hayfield," for which a dealer had paid him 50gns. in 1850, brought 2,810 guineas. The following are the most remarkable prices of later years. In 1895 Cox's "Welsh Funeral" (which cost about £20) sold for 2,400 gns., and Burne-Jones's "Hesperides" for 2,460gns. In 1908, 13 Turner drawings fetched £12,415 (Acland-Hood sale) and seven brought £11,077 (Holland sale), the "Heidelberg" reaching 4,200 guineas. For Fred Walker's "Harbour of Refuge" 2,580gns. were paid (Tatham sale) and 2,700gns. for his "Marlow Ferry" (Holland), The demand for pictures by modern artists, whose works sold at almost fabulous prices in the 70's, has somewhat declined; but during all its *furore* there was still a small band of collectors to whom the works of the old masters more especially appealed. The dispersal of such collections as the Bredel (1875), Watts Russell (1875), Foster of Clewer manor (1876), the Hamilton Palace (17 days, £397,562), Bale (1882), Leigh court (1884), and Dudley (1892) resulted, as did the sale of many minor collections each season, in many very fine works of the old masters finding eager purchasers at high prices. A striking example of the high prices given was the £24,250 realized by the pair of Vandyck portraits of a Genoese senator and his wife in the Peel safe, 1900.

Since the last quarter of the 19th century the chief feature in art sales has been the demand for works, particularly female portraits, by Reynolds, his contemporaries and successors. This may be traced to the South Kensington exhibitions of 1867 and 1868 and the annual winter exhibitions at Burlington house, which revealed an unsuspected wealth and charm in the works of many English artists who had almost fallen into oblivion. A few of the most remarkable prices for such pictures may be quoted: Reynolds's "Lady Betty Delmé" (1894), 11,000gns.; Romney's "The Ladies Spencer" (1896), 10,500gns.; Gainsborough's "Duchess of Devonshire" (1876), 10,100gns. (For the history of

its disappearance see GAINSBOROUGH, THOMAS); "Maria Walpole," 12,100gns. (Duke of Cambridge's sale, 1904); Constable's "Stratford Mill" (1895), 8,500 gns.; Hoppner's "Lady Waldegrave" (1906), 6,000gns.; Lawrence's "Childhood's Innocence" (1907), 8,000gns.; Raeburn's "Lady Raeburn" (1905), 8,500gns. Here may also be mentioned the 12,600gns. paid for Turner's "Mortlake Terrace" in 1908 (Holland sale). But during the last few years all these prices, sensational in their day, have been entirely eclipsed.

The "appreciation" of the modern continental schools, particularly the French, has been marked since 1880; of high prices paid may be mentioned Corot's "Danse des Amours" (1898), £7,200; Rosa Bonheur's "Denizens of the Highlands" (1888), 5,5jogns.; Jules Breton's "First Communion," £9,100 in New York (1886); Meissonier's "Napoleon I. in the Campaign of Paris," 12¼in. by 9¼in. (1882) 5,800gns., and "The Sign Painter" (1891), 6,450 gns. High prices are also fetched for pictures by Daubigny, Fortuny, Gallait, Gérôme, Troyon and Israels. The most marked feature of late has been the demand for the 18th century painters Watteau, Boucher, Fragonard, Pater and Lancret; thus "La Ronde Champêtre" of the last named brought £11,200 at the Say sale in 1908, and Fragonard's "Le Reveil de Vénus" £5,520 at the Sedelmeyer sale, 1907.

"Specialism" is the one important development in art collecting which has manifested itself since the middle of the 19th century. This accounts for and explains the high average quality of the Wellesley (1866), the Buccleuch (1888) and the Holford (1893), collections of drawings by the old masters; for the Sibson Wedgwood (1877), the Duc de Forli Dresden (1877), the Shuldham blue and white porcelain (1880), the Benson collection of antique coins (1909), and for the objects of art at the Massey-Mainwaring and Lewis-Hill sales of 1907. Very many other illustrations in nearly every department of art collecting might be quoted—the superb series of Marlborough gems (1875 and 1899) might be included in this category but for the fact that it was formed chiefly in the 18th century. The appreciation—commercially at all events—of mezzotint portraits and of portraits printed in colours, after masters of the early English school, was one of the most remarkable features in art sales during the last years of the 19th century. The shillings of 50 years before were then represented by pounds. The Fraser collection (December 4 to 6, 1900) realized about ten times the original outlay, the mezzotint of the "Sisters Frankland," after Hoppner, by W. Ward, selling for 290gns. as against 10gns. paid for it about 30 years previously. The H. A. Blyth sale (Mar. 11 to 13, 1901, 346 lots, £21,717 10s.) of mezzotint portraits was even more remarkable, and as a collection it was the choicest sold within recent times, the engravings being mostly in the first state. The record prices were numerous, and, in many cases, far surpassed the prices which Sir Joshua Reynolds received for the original pictures; *e.g.*, the exceptionally fine example of the first state of the "Duchess of Rutland," after Reynolds, by V. Green, realized 1,000 gns., whereas the artist received only £150 for the painting itself. Even this unprecedented price for a mezzotint portrait was exceeded on April 30, 1901, when an example of the first published state of "Mrs. Carnac," after Reynolds, by J. R. Smith, sold for 1,160 guineas. At the Louis Huth sale (1905) 83 lots brought nearly £10,000, Reynolds's "Lady Bampfylde" by T. Watson, first state before letters, unpublished, fetching 1,200 guineas. Such prices as these and many others which might be quoted are exceptional, but they were paid for objects of exceptional rarity or quality.

It is not necessary to pursue the chronicle of recent sales, which have become a feature of every season. It is worth mentioning, however, that the Holland sale, in June 1908, realized £138,118 (432 lots), a record sum for a collection of pictures mainly by modern artists; and that for the Rodolphe Kann collection (Paris) of pictures and objects of art, including 11 magnificent Rembrandts, Messrs. Duveen paid £1,000,000 in 1907. In every direction there has been a tendency to increase prices for really great artistic pieces, even to a sensational extent. The competition has become acute, chiefly owing to the unprecedented growth of private and public collections in the Gnited States. The demand for the finest works of art of all descriptions is much greater than the supply. As an illustration of the magnitude of the art sale business it may be mentioned that the "turnover" of one firm in London alone has frequently exceeded £1,000,000 annually.

The public and private art sales in Great Britain from 1911 show an extraordinary revision in values. Many of the finest works of art formerly in Britain have gone to America, and the exodus is bound to continue. There are still collectors of taste and judgment in the country, but transatlantic competition makes it impossible for most of them to purchase early works of the highest importance.

The Sargent sale in 1925 may be mentioned, although the prices paid were the result of sentiment rather than artistic appreciation. Works which he himself may have regarded merely as studio "property" fetched extravagant sums: for example, a copy by him of "Prince Batasar Carlos" by Velasquez, measuring 21½in. by 17¾in. realized £6,300, a small water-colour made £4,830, an oil painting of "San Vigilio" £7,350, and the total for 163 lots on the first day reached £145.984. Rembrandt etchings also grow in favour. In 1924 the Rudge collection, which was unknown to the experts, established a new maximum in realizing £34,000, and the £3,780 given for a first state of "Dr. Arnoldus Tholinx" broke all records for any etching or engraving, the nearest to that figure being the £3,045 paid two years earlier for Valentine Green's mezzotint translation of "The Ladies Waldegrave" by Reynolds.

As already said, many famous pictures have passed from Britain to America in the period under review, but the greatest excitement was caused by the private sale of the duke of Westminster's pictures, "The Blue Boy," by Gainsborough, and "Mrs. Siddons as the Tragic Muse," by Reynolds, for £200,000 in 1921. Previously, it will be recalled, the Reynolds was withdrawn at Christie's at £52,500 and it was said that £150,000 had been refused for "The Blue Boy" which, as Farington records, was purchased by John Hoppner for 65gns. in 1803, after having been sold for 35gns. in 1796. Up to 1919 the highest auction price for a Gainsborough was the £20,160 realized for "The Market Cart"; but this was eclipsed at the Michelham sale in Nov. 1926, when this artist's portraits of Miss Tatton and Master Heathcote each brought £46,200; while the Reynolds maximum stood at £15,520 in 1919 for the portrait of "Mrs. Freeman," it was exceeded in July 1927 by his portrait of Lady Ann Fitzpatrick as "Sylvia" which brought £19,425 at the James Ross sale. The year 1919 was memorable in the annals of art sales. For the first time in history each of 100 pictures realized not less than 1,400gns. in British auction rooms; but during the season 1926–27, 173 pictures sold for £1,000 and upwards, their total amounting to £1,016,441. The Hamilton palace sale on Nov. 6, 1919, fetched 2168,957, the highest sum ever obtained in one day at Christie's, beating the £150,000 record for a two days' dispersal, amassed earlier in the year by the Drunimond collection. Three other records were made in that sale: the £6,500 for Turner's drawing of "Zurich," a similar sum for Guardi's "Fête on the Grand Canal," which cost Sir George Drummond £800, and £26,775 for a portrait of "Joseph Coymans" by Franz Hals which, however, was exceeded by the £27,400 paid in America for the same artist's "Old Lady" that figured in the Yerkes collection.

Nor were these the only records for 1919. In the Hamilton palace sale the £54,600 paid for Romney's group of "The Beckford Children" was the highest price given in the public market for any picture. The artist received £105 for the painting of the two girls. A picture of "St. Eustace" ascribed to Carpaccio brought £33,600 in the Vernon-Wentworth sale, "The Spendthrift" by Jan Steen, £17,010; while the former record was the £3,412 10s. for "The Sick Lady" in 1910, and Ruysdael's "Landscape," £12,600. James Ward's portrait of "Miss Georgiana Musgrave" made £7,140 against £1,680 in 1905, which was then the maximum for this artist's works. The remarkable events of 1919 may be compared with the auction doings in 1913, when, by middle of June. the turnover at Christie's alone reached more than £1,000,000. Romney's "Anne, Lady de la Pole" fetched £41,370; Gainsborough's "Market Cart" £20,160, as against 24,750 10s. in

1894; Hobbema's "Woody Landscape" £15,750 as against £3,460 in 1890; a Hals "Portrait of a Gentleman" £9,000 as against a price of £5 5s. with a still-life subject into the bargain in 1884.

The two abundant years before the World War had filled the warehouses of the dealers with stock, and that fact, combined with financial depression, brought about the result that when on Friday, July 24, 1914, Christie's season ended, there were few notable things to report. Only 38 pictures, compared with 85 in 1913, realized 1,400gns. or over. Two of these works were "A Man with a Red Cap," attributed to Titian, which made £13,650 and Peter de Hooch's "Interior with Figures," which was sold for £8,610 at Robinson and Fisher's, four days before war was declared.

The War Period.—The years between that date and 1919 were memorable for the sales conducted free of charge by Messrs. Christie on behalf of the Red Cross fund. The great success of these charitable sales helped to restore confidence in the art markets, which also were affected by the Duveen purchase of portions of the Pierpont Morgan collections costing £1,000,000. One of the tragedies of the World War was the loss of Sir Hugh Lane in the "Lusitania." In 1916 Christie's celebrated the 150th anniversary of the firm's existence. Instead of opening their season in Oct. or Nov. 1914, both Christie and Sotheby closed down until well in 1915, owing to the extreme tension caused by the war. The Sydney sale (by Knight, Frank and Rutley) was held in April, a Vigée le Brun portrait selling for 6,600gns.; the Sir Walter Gilbey sale (by Christie) at Elsenham hall, Essex, in June, £18,234, and the C. T. D. Crews sale at Christie's rooms, £20,400. These sales proved that, war or no war, and whichever side won, good pictures were bringing big prices. For instance, Raeburn's "The McNab" fetched £25,410 (1917). Gainsborough's charming sketch of his daughters, which fetched £3,045 (1923), went to the National Gallery, London, and Hoppner's fine "Portrait of William Pitt" was purchased for a British peer at £7,350. It came from the Baroness Burdett-Coutts's collection (1922), as did Raeburn's "Portrait of Sir Walter Scott," which made £9,660 and went to America.

In the following year the Brownlow Van Dyck "Portrait of Anton Triest" fetched £29,400. Mention should be made of the futile auction of Sir John Robinson's pictures on July 7, 1923. The nominal total for the 114 works by famed old masters was £205,741 10s., but in most cases the large reserves were not reached, so that in no previous sale in England had such a large percentage of lots been brought in, in spite of the fact that most of those actually sold showed a profit, and that many of the withdrawn pictures were knocked down at larger prices than those originally given for them by Sir John. In the autumn of 1923 it became known that ten of the finest pictures in Lord Glenconner's collection of British masterpieces had been acquired by Messrs. Knoedler, and shipped to the United States; whilst a surprise of a much more pleasant character was provided in the autumn of 1927 when it was announced that the late Lord Iveagh had bequeathed the whole of his collection to the nation, with his residence at Kenwood, Hampstead, as a permanent home for it.

The sales from 1924 to the end of 1927 may be briefly summarized. Those of John S. Sargent and J. E. Rudge have already been mentioned. The Darnley pictures from Cobham hall, May 1, 1925, 92 lots, totalled £70,758, Hoppner's portrait of Lady Elizabeth Bligh selling for 10,200gns. and 16 others reached four figures; whilst on July 17 a companion pair of whole lengths by G. Romney, Sir Everard and Lady Every (for which the artist received 140gns. in 1780) together brought £16,230, and Lord Lathom's group by the same artist of the Bootle children £8,925. The several interesting sales of the season 1925–26 (the "season" by the way, extends from October to July) included 71 pictures which passed a £1,000 limit, at the head of all coming Romney's superb portrait of Mrs. Davenport, 1782, which (July 28) reached £60,900. Other properties included a pair of fancy subjects by F. H. Drouais, "The House of Cards" and "Blowing Bubbles," £13,650; Sir Antonio Mor's portrait of Elizabeth de Valois Queen of Spain, £11,025, and Nattier's portrait of a nobleman said to be the Duc de Senthieve, £12,075; Romney's Lady Lushington £8,715, and one of the same artist's many portraits of Lady Hamilton, £13,650. There were not many collections important as such, the most notable being that of the Bischoffsheim pictures (May 7) bringing £97,794; and the J. B. Gaskell modern pictures and drawings (April 30 and May 2), £39,150. Two or three other out of many features of the season may be mentioned—the high prices paid for the very sketchy water-colour drawings by H. H. Brabazon, a two days' sale (March 18 and 19, 1926) realizing £11,576; the increasingly high prices for sporting pictures which a quarter of a century ago had very little market value, and Sir James Dunn's long series of portraits by Sir William Orpen (July 16) of which that of President Woodrow Wilson brought £2,730.

The season 1926–27 practically began with a sensation in the Michelham sale at 20 Arlington street, London, by Hampton and Son (Nov. 23–24) with a nominal total of about £589,000 for pictures and objects of art, but it was obvious to those present that some of the reserves had not been reached. Sir Thomas Lawrence's whole length of Miss Mary M. Barrett, known from the colour of her eyes as "Pinkie," was sold at 74,000gns. to Duveens, the record auction price for a picture; the whole-length Romney, Anne Lady de la Sole, went to Agnews at 44,000 gns. (the artist's price was 80gns. in 1786), and another Romney, Elizabeth Lady Forbes, 24,000gns. and two Gainsboroughs, Miss Tatton and Master Heathcote each 44,000 guineas. The chief picture sales of 1927 included Sir James Murray's collection, £69,888, the hon. Mrs. Yorke £41,581, the Italian old masters of the late Sir George Holford, £155,951, and the Empress Eugénie £20,315, and James Ross of Montreal, £138,031, which, with other properties brought the day's total to £192,451, the year finishing (Dec. 22) with the late Marquess Curzon's small but choice collection, which with other properties totalled £38,944.

Reference has been made solely to the disposal of pictures, but numerous other works of art have been sold privately and in the open market at prices not less sensational than those obtained for paintings, notably for etchings by Sir D. Y. Cameron, J. McBey, A. Zorn and others. On the continent of Europe, too, competition has been acute, with the result that prices were abnormally high in 1911, 1912 and 1913, as they were in Great Britain. In Paris, in 1911 the Maurice Kann collection, consisting of 85 lots, realized £108,850, to which must be added the tax of 10% paid then by purchasers. With a few exceptions the profits were enormous. So, too, with the collection of his brother Rodolphe Kann, which cost him about £200,000 and fetched about £1,200,000. Rembrandts, which were bought by him for £1,600 and £2,000, brought £20,000 to £30,000 and a Vermeer of Delft, for which he gave £48, sold for £2,000.

Paris and New York Sales.—In 1912 there were five great Paris sales, the Roussel, Dollfus, Carcano, Doucet and Rouart, which together realized over £1,250,000. A few individual prices may be given. In the Doucet sale a pastel portrait of "Duval de l'Epinoy" by Quentin de la Tour made £26,400, which was eight times the previous maximum for a pastel; John Russell's "Mrs. Elizabeth Curie" sold in Paris for £3,200; H. Regnault's "Salomé," £19,000; "The Countess of Wilton" by Sir Thomas Lawrence, £19,104; "Les Danseuses & la Barre" by Degas, £19,400 (the artist sold it for £20); Chardin's "Les Bulles de Savon," £12,000, and in the following year (1913), Rembrandt's "Bathsheba," £44,000. The Degas sales in 1918 totalled 8,649,000fr., and since then the million franc totals have included such sales as the Hazard, Prince Orloff, S. Bardar, Alphonse Kann, Engel Gros, Gaston le Breton and Marquise de Ganay.

Mantegna's "Madonna and Child" in the Weber sale, Berlin (1912), fetched £31,000 against £4,000 paid for it in 1902. In Amsterdam 32 Rembrandt drawings from the J. P. Heseltine collection totalled over £25,000, the highest individual price being £2,508 paid for "The Farm." In the same city (Nov. 1925) the Castiglione collection realized £150,000. Of that sum, a signed and dated (1635) Rembrandt "Portrait of a Syndic of Amsterdam" brought £17,833, Nicholas Froment's "Resurrection of Lazarus," £12,833 and Correggio's "Mystic Marriage of Saint Catharine," £10,666.

The greatest American sales were the Yerkes, 1910, which, at $2,707,866, established a New York record, the William Salomon, 1923, which realized $1,288,705 and the Elbert H. Gary, 1928, which brought $2,297,763 of which $1,154,650 was for 39 paintings. Before the Salomon sale, Sir Joseph Duveen purchased privately 15 of the more important pictures at an estimated cost of $1,000,000. The remainder of this collection was sold by Mrs. Salomon, Jan. 1928, for $675,571. In the Yerkes sale, Franz Hals's "Portrait of a Woman" fetched $137,000; in the Gary, Gainsborough's "The Harvest Wagon" brought $270,000. Another New York sale was the C. C. Stillman in 1927 when 37 pictures totalled $716,950, $270,000 being paid for Rembrandt's portrait of his son Titus.

Lord Leverhulme's art collections, after being catalogued and advertised for sale at Hampstead, was suddenly transferred to New York and sold there in Feb. 1926, the grand total amounting to $1,274,000.

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(W. ROB.)

ARTS AND CRAFTS, a comprehensive title for the arts of decorative design and handicraft — all those which, in association with the mother-craft of building (or architecture), go to the making of the house beautiful. Accounts of these will be found under separate headings. "Arts and crafts" are also associated with the movement generally understood as the English revival of decorative art, which began about 1875. The title itself only came into general use when the Arts and Crafts Exhibition Society was founded, and held its first exhibition at the New Gallery, London, in the autumn of 1888. The idea of forming a society for the purpose of showing contemporary work in design and handicraft really arose out of a movement of revolt or protest against the exclusive view of art encouraged by the Royal Academy exhibitions, in which oil paintings in gilt frames claimed almost exclusive attention — sculpture, architecture and the arts of decorative design being relegated to what then amounted to quite subordinate positions. In 1886, out of a feeling of discontent among artists as to the inadequacy of the Royal Academy exhibitions, considered as representing the art of Great Britain, a demand arose for a national exhibition to include all the arts of design. One of the points of this demand was for the annual election of the hanging committee by the whole body of artists. After many meetings the group representing the arts and crafts (who belonged to a larger body of artists and craftsmen called the Art-Workers' Guild, founded in 1884), perceiving that the painters, especially the leading group of a school not hitherto well represented in the Academy exhibitions, only cherished the hope of forcing certain reforms on the Academy, and were by no means prepared to lose their chances of admission to its privileges, still less to run any risk in the establishment of a really comprehensive national exhibition of art, decided to organize an exhibition themselves in which artists and craftsmen might show their productions, so that contemporary work in decorative art should be displayed to the public with the same advantages as had hitherto been monopolized by pictorial art. For many years previously there had been great activity in the study and revival in the practice of many of the decorative handicrafts neglected in England and America, though on the Continent and throughout the East these were carried on without a break. The machine production of an industrial century had laid its iron hands upon what had formerly been the exclusive province of the handicraftsman, who in England only lingered on in a few obscure trades and in forgotten corners. The ideal of mechanical perfection dominated workmen, and the factory system, first by extreme division of labour, and then by the further specialization of the workman under machine production, left no room for individual artistic feeling among craftsmen trained and working under such conditions. The demand of the world-market ruled the character and quality of production, and to the few who would seek some humanity, simplicity of construction or artistic feeling in their domestic decorations and furniture, the only choice was that of the tradesmad or salesman, or a plunge into costly and doubtful experiments in original design. From the 'forties onward there had been much research and study of mediaeval art in England; there had been many able designers, architects and antiquaries, such as the Pugins and Henry Shaw (1800–1873) and later William Burges (1827–1881), William Butterfield (1814–1900) and G. E. Street and others. The school of pre-Raphaelite painters, by their careful and thorough methods, and their sympathy with mediaeval design, were among the first to turn attention to beauty of design, colour and significance in the accessories of daily life, and artists like D. G. Rossetti, themselves designed and painted furniture. The most successful and most practical effort indeed towards the revival of sounder ideas of construction and workmanship may be said to have arisen out of the work of this group of artists, and may be traced to the workshop of William Morris and his associates. William Morris, whose name covers so large a field of artistic as well as literary and social work, came well equipped to his task of raising the arts of design and handicraft, of changing the taste of his countrymen from the corrupt and vulgar ostentation of the Second Empire, and its cheap imitations, which prevailed in the 'fifties and 'sixties, and of winning them back, for a time at least, to the massive simplicity of plain oak furniture, or the delicate beauty of inlays of choice woods, or the charm of painted work, the richness and frank colour of formal floral and heraldic pattern in silk textiles and wall-hangings and carpets, the gaiety and freshness of printed cotton, or the romantic splendour of arras tapestry. Both William Morris and his artistic comrade and life-long friend, Edward Burne-Jones, were no doubt much influenced at the outset by the imaginative insight, the passionate artistic feeling, and the love of mediaeval romance and colour of Dante Gabriel Rossetti, who remains so remarkable a figure in the great artistic and poetic revival of the latter half of the 19th century. To William Morris himself, in his artistic career, it was no small advantage to gain the ear of the English public first by his poetry. His verse-craft helped his handicraft, but both lived side by side. The secret of Morris's great influence in the revival was no doubt to be attributed to his way of personally mastering the working details and handling of each craft he took up in turn, as well as to his power of inspiring his helpers and followers. He was painter, designer, scribe, illuminator, wood-engraver, dyer, weaver and finally printer and paper-maker, and having mastered these crafts he could effectively direct and criticize the work of others. His own work and that of Burne-Jones were well known to the public, and in high favour long before the Arts and Crafts Exhibition Society was formed, but though largely helped and inspired by the work of these two artists, the aims and objects of the society rather represented those of a younger generation, and were in some measure a fresh development both of the social and the artistic ideas which were represented by Ruskin, Rossetti and Morris, though the society includes men of different schools. Other sources of influence might be named, such as the work of Norman Shaw and Philip Webb in architecture and decoration, of Lewis Day in surface pattern, and William de Morgan in pottery. The demand for the acknowledgment of the personality of each responsible craftsman in a co-operative work was new, and it had direct bearing upon the social and economic conditions of artistic production. The principle, too, of regarding the material, object, method and purpose of a work as essential conditions of its artistic expression, the form and character of which must always be controlled by such conditions, had never before been so emphatically stated, though it practically endorsed the somewhat vague aspirations current for the unity of beauty with utility. Again, a very notable return to extreme simplicity of design in furniture and surface decoration may be remarked; and a certain reserve in the use of colour and ornament, and a love of abstract forms in decoration generally, which are characteristic of later taste. Not less remarkable has been the new development in the design and workmanship of jewellery, gold and silversmiths' work and enamels. Among the arts and crafts of design which

blossomed into new life during this active period—and there is hardly one which was not touched by the new spirit—book-binding must be named as having attained a fresh and tasteful development through the work of Mr. Cobden-Sanderson and his pupils. The art and craft of the needle also must not be forgotten, and its progress is a good criterion of taste in design, choice of colour and treatment. The increase of late years in these exhibitions of designs worked out in the actual material for which they were intended is very remarkable, and is an evidence of the spread of the arts and crafts movement (fostered no doubt by the increase of technical schools) of which it may be said that if they have not turned all craftsmen into artists or all artists into craftsmen, they have done not a little to expand and socialize the idea of art, and (perhaps it is not too much to say) have made the tasteful house with its furniture and decorations a model for the civilized world. (W. CR.)

The craftsmen, having successfully revolted against the crushing influence of academic thought, perhaps carried their spirit too far in the resentment toward the machine and its influences. A new trend is distinctly perceptible—that of making use of the machine for the accomplishment of better arts and crafts—and there is no doubt but that this trend will lead to a most interesting new era of art.

Along with this trend another movement occurred, attributed by many to the World War. The younger generation who were involved in the conflict, naturally questioned the old standards—in religion, in ethics as applied to daily life, and in speculative philosophy. With this doubt came a questioning of the standards of art, alike in Germany, France and later England and America. As a result nearly every art school in these countries laid chief stress upon originality as opposed to the teaching of technique or old standards, and a further reason for this spirit of revolt was that the machine introduced so many new elements into consideration.

Not, for the most part, until the 20th century did artists learn to master the machine and to make it turn out works of art which they desired and had foreseen, and with this mastery of the machine there became evident the tendency toward the greater stressing of technique. The days of William Morris are past and the hand-craftsman will ever find it more difficult to compete with the machine, and the modern craftsman of intelligence does not attempt this competition but turns the machine to his uses. By "the machine" we do not mean only mechanical contrivances, but all of those scientific aids such as photography, moving photography, etc., which are now available. The one loss is the lack of that delicately personal touch which the artist's hand can give to a piece of craftsmanship, but daily we see new evidence of the possibilities which the machine has for the expression of this touch. Modern potters in Copenhagen and elsewhere are turning out vases which, though different, are just as beautiful as those which were executed by hand in China. Modern glass is equally fine and shows a mass of new technical possibilities. Modern textiles show a range of colour and techniquenever before possible. Moreover, in bookbinding and also in printing the various presses prove almost daily that real beauty can be obtained through the use of the machine. Modern jewellery has benefited by the advanced methods of treating metals and of cutting precious stones. Thus, we may be in the midst of what may possibly be one of the greatest periods in the history of art, and craftsmanship and the use of the machine are the two keynotes of this period, no longer warring with each other, but collaborating to a better purpose. (W. E. Cx.)

ARTSIBASHEV, MIKHAIL PETROVICH (1878–1927), Russian novelist, was born in south Russia, Oct. 18, 1878, and died at Warsaw March 3, 1927. His family was of Tartar descent, and on the mother's side he mas a great-grandson of Kosciusko. He at first followed an artistic career and attained some fame as a caricaturist, but subsequently began writing short stories, followed by novels. In 1912 he was imprisoned for several months by the Imperial Government as a revolutionary. His first novel, *Sanin*, 1907 (Eng. trans. 1915), showed him in revolt against all social restraints, and both it and his later novels exhibit a society in dissolution and give a grotesquely exaggerated picture of crime and folly. He was a violent misogynist, even more violent than Tolstoi in the *Kreutzer* Sonata. His novels had a great vogue in Russia in their time.

His collected works published in Moscow (1912–17, 10 vols.) contain:—Razskazi (Tales); *U* poslednei chertiy ("At the Extreme Limit," translated into English as The Breaking Point, 1915); Zakon dikurya ("The Law of a Misanthrope"); *Revnost* ("Jealousy"); a play Voina ("War," translated into English 1918 under the same title) and Sanin (translated into English as *Sanine,* 1915).

ART TEACHING. As art lost touch with production art teaching inevitably grew in importance in the national consciousness. The story of State systems of art education is mainly an endeavour to reunite the personality of art to the processes of industry. In simpler forms of society, education was parental and productive. Theories of art education have evolved since the Renaissance, and before this, productive education was carried on in the workshops of the craft gilds, which, put simply, were corporate bodies of workers, who handed down the experiences of generations, in the making of things of the highest standard of quality. Gild circles were inevitably outgrown by municipal organizations, and gradually, with the growth of national life, and its ever widening range of intercourse and interchange, the traditional processes of production were lost, and the experimentation of individual genius took their place.

The Renaissance.—The Renaissance stands for the emancipation of the individual, in matters of art teaching, as in scientific, literary and artistic expression. This emancipation of the individual, together with the weakening of the craft gilds, finally resulted in the separation of the so-called "Fine Arts" from the crafts. Painting, sculpture, architecture, engraving were associated with the studio and the artist, and all other products were relegated to the workshop and the craftsman; and finally, with the advent of mechanized production, in the 19th century, the factory despoiled the craftsman of his traditional birthright as an independent creator of beautiful things for the needs of life.

Professional Art Teaching.—With this disintegration of the autonomy of the arts, and the change from a productive and traditional process of education, art teaching as a profession became a protective necessity, first, so that the "Fine Arts" might maintain their new and aristocratic appeal to the wealthy connoisseur, and later, so that the arts might survive the inroads of commercial production. So long as masters of art engaged in voluntary and private teaching, of special pupils, the system of small studio schools was efficient within such needs. It was a specialized professionalism with a specialized appeal. Art had lost control of the necessities of life, and had yielded its traditional prerogative to the industrial producer. Professional art teaching accepted the definition of art training introduced by the Italianized revival of classic art, in the 16th century. The human figure, through the media of antique statues, claimed the dominant place in such training. Styles, associated with "schools" and "periods" were dominating influences, and coincident with certain national characteristics we have ebbs and flows between naturalism in its manifold expression and conventional severities. With the development of experimentation the "Fine Arts" fully occupied educational interests until the demands of industry and international rivalry began to claim attention. From the early 19th century to the present time is a long story of experimental attempts, through systems of education, to reinstate the artist in his right position relative to production.

Art teaching has been accepted as a State responsibility, and is developing on lines of scientific psychology in close relationship with other branches of education, which function as a very highly synthesized antidote to organized processes of devitalizing if not dehumanizing interests. The claims of human life and human expression are becoming the paramount stimulus in the new theories of all education.

Great Britain.—State art education in Great Britain commenced in earnest in 1827, under the control of the Board of Trade, governed by a council of royal academicians, when an art school was opened at Somerset House, and provincial schools multiplied to fill the need.

The Exhibition of 1851, at the Crystal Palace, seemed to emphasize further this national necessity. The influence of this exhibition was felt on the Continent, and Germany and Austria responded to the call. France was already ahead of other countries; the productions of French art industries appearing in London at this time showed to much advantage, and it was evident that organized training of workers for English art trades was imperative. All three countries undertook the re-organization and strengthening of schools already in existence, and the development of new foundations. Special attention was also given to industrial art museums. In view of the absence of specialists in industrial design at this time, these museums were vitally important factors in the dissemination of standards of taste, though the inevitable tendency to accept period productions as unquestionable guides to the design for industrial processes is a danger that is only now beginning to be fully recognized. State art education in its early years leaned too much on the authority of traditional work, as exemplified by historical collections of fine examples intermingled with doubtful ones.

The general dissatisfaction with the training given in industrial design in the schools, the passing of the Technical Instruction Act of 1889, the re-organization of the National Art Training school and the inauguration of the Royal College of Art in 1897, are the factors which brought about more vigorous and vital methods in English art teaching generally. The Royal College of Art may be rightly considered the centre of stimulus in the directing policy of our national art education. Dating from its re-organization, a wider view as to what constitutes right training for the designer, whether for industry or crafts, has gradually evolved, consisting of a process of practical productive work, in the various schools and workshops, wherein theories have given place to experience in the realization of the possibilities of material; coincident with this the training of teachers has been established on a wider interpretation of principles of teaching. There is also the recognition of the principle that designers for industries are best trained locally, in touch with the industry as far as possible, and that manufacturers may best be helped not by sacrificing the artist's ideals, but by conserving the mentality of the artist; that a concentration on the problem of training the designer and the teacher to the detriment of the wider view cannot be successful.

Art teaching has tried to discover permanent principles upon which to base a reasonable standard of training. The authority of great masters and great periods seemed to offer permanency to some, hence we have traditionalists who mainly look to the past for inspiration. But the art teacher has to interpret tradition in terms of progress and the authority of past achievements indicates the way. A living art must express contemporary life. A change in technical processes must influence methods of teaching. It is hardly questionable that oil painting as distinct from tempera has done more to alter the artist's visualization of his subject than more abstract theories of aesthetics. Processes of printing have revolutionized book production, and ferro-concrete is changing conditions of building and architectural ideas. The modern teacher of art will be constantly alive to new conditions and new traditions which are evolving through them; for tradition in art is a living force, for ever progressing, developing and governing creative work.

If art is to reflect and express the age which brings it forth, then nothing in the cosmos of our existence is outside the realm of interest for the artist. Something of this wider view is permeating educational systems. With the commencement of the present century organization became the watchword. The consciousness of a more scientific co-ordination, induced by a better understanding of the psychology of education promoted a healthier relationship between the pupil and teacher, and inspired a more comprehensive interweaving of subjects of study; much still has yet to be done. The Education Act of 1902, which gave the county council control of elementary and secondary education, helped the co-ordination of a progressive scheme, and whilst drawing had been included previously in the syllabus of elementary schools, it was from this period onwards that art became a definite subject in the curriculum of English elementary and secondary education. An increasing interest in the arts and crafts about this time promoted the development of a scheme for technical schools, which subsequently included "Day Continuation Schools," "Evening Institutes," "Junior Technical Schools," Trade Schools and later "Junior Art Departments of Art Schools." All these included courses of art study for vocational training in the trade crafts. They were intended as progressive steps from elementary education through courses of an apprenticeship character to the skilled trades.

The formation of the junior art department of art schools has already proved its efficacy in offering a field of employment in the arts and crafts to boys and girls who had previously looked for work of a commercial character or of an unskilled nature. Scholarships from the elementary and secondary schools into art schools as well as trade schools are offered. The junior art student is a growing factor in the schools, and may be accounted a healthy influence in re-establishing that serious application to vocational training which the trend of modern life, with its passion for saving time, and desire for "short cuts," is only too apt to undermine. These juniors, at the age of 17, have been sent out into commercial studios and industrial workshops as draughtsmen and designers, in ever increasing numbers. A more specialized value of the junior department is in the opportunity it offers more talented students to continue their studies in the higher branches of art, and thus the personnel of the schools is recruited from a new and invigorating source.

It has been said that the further education in technical schools has been planned so as to enlarge, so far as is reasonable, the educational discretion of the responsible school authorities, and it would therefore appear to be an organization, which has almost unlimited powers of expansion, under sympathetic regulations of the Board of Education. A much more comprehensive scheme is in process of maturing, to form part of the curriculum of elementary, secondary and public schools. Success will depend on having teachers of the widest possible educational outlook. Something much more than specialized technical skill is needed in such teachers. The value of a wide humanistic quality, which will interpret life through art, is incalculable.

The establishment of the Burnham scales of salaries for teachers in 1921, and the Pension Act of 1925, have raised the economic status of the art teacher, with the result that increasingly large numbers are taking up secondary school work, which now offers professional security.

The training of teachers is being handled on the broadly conceived plan that art can best be taught by the technician, with specialized ability, encouragement being given to those taking a course in pedagogy and psychology, as endorsement to their art qualifications. This course is organized as "Methods of Teaching," and in so far as it widens the outlook of the student in training, and breaks down the barriers which have separated art from other phases of culture, it is entirely necessary. Art in the elementary schools is handled by the teacher of general subjects with a special bent towards drawing. The pedagogic value of such lessons is to some extent safeguarded by the issue of Board of Education "Suggestions," as to methods, but the most beneficial offer to such teachers is the course of training arranged by art schools, in relation to the school drawing certificates for elementary teachers, offered by the National Society of Art Masters. The fact that such teachers spend some time in close touch with vocational art students in the atmosphere of an art school, is of very real worth.

Art and Industry.—A more liberal recognition by industry that the training offered should be something more than technical, would place art schools on a really healthy basis. Trade has yet to learn that whilst there is much for the student to acquire in the matter of mere skill in the handling of mechanical processes, on the other hand these processes might well evolve an art which possessed aesthetic qualities peculiar to themselves, and were in no way poor plagiarisms of hand crafts. But this would mean greater freedom allowed to the designer, and 2 more enlightened attitude by the producer.

It is probably in this that Germany has taken the lead. A closer

relationship exists between the factory and the school; the directors of the latter are often men of noteworthy excellence in some practical field of art. If salaries paid to professors in Germany are not large, allowances for house rent increase this value and opportunities for outside practice are offered and encouraged. Private studios adjoining class-rooms are often supplied in which the professor may pursue his profession. The amount of time required in actual teaching is limited, but the honour attached to the position is considerable. Again, there is no fetish worship of numbers. The classes of the industrial art schools are never large, and it is not unusual in the more advanced courses to find but half-a-dozen students at work.

France recognized earlier than any other nation the value of encouraging art as a national asset. Louis XIV. established the Manufacture Royale des Gobelin, which brought together workers in furniture, ceramics, metal and tapestry. This stimulus to designers and craftsmen soon placed France in the van of European nations. Since 1824, one of the cabinet offices has been a Ministry of Public Instruction and Fine Arts, exercising supervision over all art schools in France.

Germany believes that a nation cannot afford to refuse art training to the few, if the quality is high enough; France puts her faith in a Ministry of Fine Arts, controlling her educational destinies; and England believes mainly in individual enterprise. The prevailing idea that art should serve industry threatens to become a fetish. That Industry needs inspiration from the artist is true; but industries should be controlled in the interests of art. To train artists for industry is rather like hitching the star to the wagon. The great problems of art teaching will ever remain in a state of fluidity and growth. How far can technical skill in representational accuracy help or hinder the expression of emotional qualities? Concentration on representational accuracy has been proved a failure, the reaction in favour of so-called "free expression," without the disciplinary training of grammatical study would seem uncultured licence. For the time the sane path appears to tend towards representational accuracy restricted by the material and implements of expression, in the hands of the individual. Individual interpretation through material is the basis of modern art teaching, on the technical side. This would neither debar training in manual dexterity or formal exercises, nor does it deny the personal vision. (D. HE.)

THE UNITED STATES

Drawing, as a subject of instruction, was introduced by thoughtful teachers into their own schools in several States in the early part of the 19th century, without public recognition. The chief aggressive spirit of that period was "Master Fowle" of Boston. About this time Henry Barnard, editor of the *Connecticut School Journal,* was urging that drawing be taught in the common schools throughout the country. In 1842 Rembrandt Peale, an artist in Philadelphia, agreed to superintend without charge the introduction of drawing into the elementary schools of that city. Horace Mann introduced drawing into the grammar schools of Massachusetts in 1848, and in that same year drawing was being taught in the high schools of Baltimore by William Minifie. One of his published manuals was used for some time as a text-book in England after 1852.

In 1864 John D. Philbrick, superintendent of schools, Boston, secured the vote of his school board to make drawing a required study in grammar grades, and William Bartholomew's text-books were introduced. In 1869 the Massachusetts State board of education was directed to arrange for free instruction in drawing in all cities and towns of 5,000 inhabitants and upward. In 1870 drawing was required in every Massachusetts city and town having more than 10,000 inhabitants, for all scholars over 15 years of age, either through day or evening school. That same year the State authorized the establishment of free technical schools for the leading industries.

In 1870 Walter Smith came from South Kensington, England, to Boston. This was made possible through the co-operation of Boston merchants and the Boston school committee. Smith came as supervisor of drawing for the Boston schools, and director of drawing for the State. Later he became the principal of the Massachusetts Normal Art school, established by act of legislature in 1873. For 12 years Smith taught, lectured, published text-books and circulated exhibitions everywhere. To him more than to any other one person credit is due for laying the foundation for American art education.

Walter Smith's exhibit at the Centennial, 1876, included work from the Normal Art school and 24 towns in Massachusetts. Shortly thereafter cities and towns in all parts of the United States began to foster art instruction. In 1879 the National Association of school superintendents resolved that "Industrial drawing should form one of the fundamental branches of study in all grades." In 1895 the Committee of Fifteen of the N.E.A. recommended that "drawing be taught for at least an hour a week from the second to the eighth year." Since that date few communities have opposed the introduction of drawing, and it is now regarded almost universally as a desirable subject of instruction in the public schools throughout the United States.

Behind all this development stands first in influence, as the alma mater *par excellence,* the Massachusetts Normal Art school, organized by Walter Smith and developed by Otto Fuchs and George H. Bartlett. Next to the Massachusetts Art school in its influence upon art education in the United States stands Pratt institute. Its graduates are found in positions of commanding importance in city school systems, normal schools, colleges and art schools in almost every State in the Union. Other art schools of outstanding importance in the art educational development of the country are Columbia university; the Carnegie institute, Pittsburgh; the New York school of fine and applied art; the Maryland institute; the Cincinnati Art academy; the Cleveland school of art; the Chicago Art institute; the San Francisco Art institute; the California school of arts and crafts; and Newcomb college, New Orleans.

The Eastern Arts association, the Western Arts association and the Pacific Arts association, supplemented by the American Federation of Arts, together with the College Art association, the American Institute of Architects and the Association of Museum Directors, have recently organized the Federal Council on art education which seems destined to have a potent and salutary influence upon all future development in art education.

Dr. H. H. Powers, through the organization of the Bureau of University Travel, initiated a programme combining travel with scholarly instruction, which has been imitated and promoted by an ever-increasing number of travel companies, with a total annual membership of thousands. These travellers, returning to their States, have leavened with higher ideals all the population.

The museums of art have had an influence on art education, especially since the militant advocacy of aggressive educational work for museums by John Cotton Dana, of Springfield, Mass., and Newark, New Jersey. In the field of circulating exhibitions the pioneer work of Mrs. Melville Johnstone of Richmond, Ind., and the more extensive activities of the American Federation of Arts, are of primary importance.

The *American Art Annual,* founded by Florence N. Levy, and published by the American Federation of Arts, gives data for 1927 concerning organizations which are promoting art education in the United States as follows: national organizations 24, State organizations 928, art schools 419, summer schools 107, art magazines 91.

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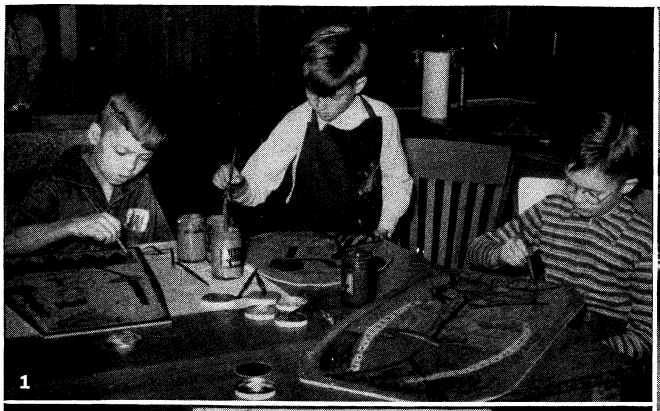
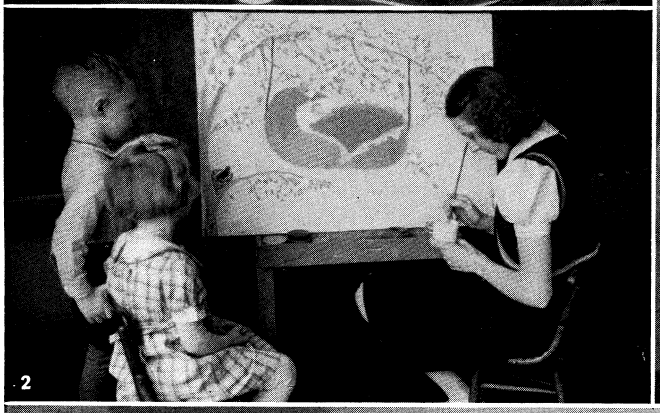
MODERN VIEWS

In the teaching of art, it must first be realized that the artistic sense cannot be acquired by instruction; it can only be awakened and fostered. The qualities on which an art teacher's value depends are the power to recognize artistic talent where it exists, and the desire to respect it as a rare phenomenon. So much depends on the personality of the teacher that no systems of instruction can

ART TEACHING





BY COURTESY OF (1) GRAND RAPIDS, MICHIGAN PUBLIC SCHOOLS, (2) OMAHA PUBLIC SCHOOLS, (3, 4) WPA ART PROGRAM, FEDERAL WORKS AGENCY

ART CLASSES IN THE UNITED STATES

1. Fourth-grade students of Grand Rapids, Mich., designing shields for an African jungle ceremony. Art is closely correlated with social and industrial studies in many American primary schools
2. An eighth-grade student painting a panel for a kindergarten in the Omaha public schools
3. Children's class at WPA art gallery, Fairfax, Virginia
4. Clay-modelling class sponsored by the WPA art program at Washington, D.C.

be adopted without this being borne in mind. It has never been found a good plan to lay down strict rules regarding previous studies for the admission of students. Real talent, once it is awakened, will always find means, in civilized countries, of making up deficiencies in past instruction. A gifted student in such circumstances feels a natural urge towards knowledge which makes study a necessity to him and no burden. The teacher should encourage him in his work, and try to win his full confidence by discussing his plans with him in a frank and friendly way. His first efforts, no matter what direction they may take, gradually help him to understand himself, and enable him to choose his own course. It is an advantage if the teacher's own work is well known, and also if he is in sympathy with the efforts of the younger generation. This will make his work very much easier, for the mere fact of his presence will spur the pupil on to greater efforts, provided he does not do more harm than good by exercising too exclusive an influence over him or leading him into direct imitation.

Experience shows that gifted students of architecture may develop into excellent draughtsmen, fashion artists or even sculptors. The students should be allowed to do their individual work. Nothing must be done under compulsion; to work against the grain dries up the secret springs of talent. A student learns an immense amount from the work of his fellow-pupils, and, conversely, it often happens that one student of unusual talent will inspire the others to do better work than their own powers would warrant. Such considerations show how necessary it is for a good teacher to keep a close watch over all that happens in his school, and to give full scope to students of exceptional gifts. He must be able to set a standard, and to keep away all disturbing elements, whether internal or external.

A teacher who is at the same time one of the leaders of the artistic movement of the day can do much to shorten the way for his pupils, for he can indicate to them the questions which are of the greatest importance at the moment and thus help them to advance farther. The realization that artistic movements in all countries are working towards a common aim will greatly assist the students. They must be made to feel that they are taking part in a great common effort to which they can devote their whole energies. Progressive and creative work must be a genuine pleasure to them. They must acquaint themselves with all the most up-to-date movements, and must try not to look backwards, but to press forwards with energy, even at the risk of occasional failures.

Instead of being subjected to the strict discipline of the older schools, which was such a bugbear to young people, students must discipline themselves by their own sense of responsibility, by setting themselves definite aims and by taking their work seriously. It is most valuable for them to try their hand at real work, *i.e.*, work which is actually required by outside people. They should enter for open competitions and work for industrial purposes whenever possible. With the old educational methods it was impossible, in the time available, to give students a thorough knowledge of building construction, interior finishing and the various other technical matters required in architecture. A student trained by the stimulating methods of the present day will, however, try to approach any task which may beset him in the proper way, and deal with it according to his capacity.

Creative Art.—In the study of architecture the older system of training tried to achieve its objects by detailed study of historical styles. The industrious pupil with a good memory had the greatest chance of success, and it was the man who had the best grasp of some historical style who won the teacher's approval. The results of this system may be seen in many a town where buildings with Gothic, classical and Renaissance facades, all built at the same period, stand side by side. Most of them have considerable technical merit, but they are spoilt by the half-hearted and insincere spirit in which they were designed. At this period no one appreciated the greatness of the old building guilds, and the marvellous unity of spirit which prevailed among their members even at great distances apart. The true nature of their creative activity was entirely unrecognized.

Only a man of extraordinary powers could succeed in doing good and original work in circumstances such as these. It was quite forgotten that there had been ages in which it seemed almost impossible for bad work to be done at all—when even the humblest craftsman, even the inhabitant of a remote mountain district, was inspired by the same marvellous artistic sense, and when the same imaginative and inventive power was displayed in the making of the simplest articles as in the construction of great buildings. To-day we are intensely interested in the characteristics of such periods; we want to release the same creative forces as existed then; we try to understand how it was that the men of those days could continue to do such magnificent work in spite of the intense misery and distress into which the nations were plunged by the political vicissitudes of the time. We are gradually coming to understand that we have sunk to so low a level in our own period that our work has been imitative—sometimes indeed nothing less than counterfeit—and we are hastening to return to the right path.

Ruskin, much as he added to our knowledge of art, had no real conception of purely creative work; hence his constant reference to models. It was for the same reason that he regarded Chinese art, for example, as barbaric; indeed he did not really recognize any kind of art except the Gothic. Although a thinker of genius and a wonderful connoisseur, he knew nothing of the true nature of artistic creation and of the hidden processes by which inspiration works—the powers which lie almost entirely outside a man's control, but which are born with him and are quite independent of study, so that they may be found in the African negro as well as in the Greek of the classical age.

In our own age, too, original work has been done outside the official province of art. Technical progress has been made in all branches,, and new forms have been invented in the sphere of costume and of articles of daily use of all kinds. The feeling which produced these changes was unconscious, but we must become fully conscious of it. It would be ridiculous to decorate a motor car in the Gothic or classical style, and it is just as ridiculous for us, in our modern clothes, to live in buildings which were designed for mediaeval knights and ladies. We shall always admire them for their marvellous beauty, but our very reverence for them should prevent us from imitating them when we are designing new buildings; though at the same time we should protect them from the criminal attempts at restoration made by those whose business it should be to understand ancient art.

We are now beginning, driven perhaps by the necessities of the age, to recognize the beauty of simple technical work perfectly adapted to its purpose, and to make such work not merely a matter of calculation, but to bring it within the sphere of creative and expressive work. In short, we want to deal with work of all kinds from the standpoint of the cultivated and modern-trained engineer; we attach as much importance to the manufacture of a good box as to the building of a railway carriage or a skyscraper. We do not want either our box or our skyscraper to be plastered over with a sham ornamental facade; we feel that if our work is adapted to its purpose, and if materials and workmanship are thoroughly good, we are in harmony with the spirit of the age. We must not play tricks with these new inventions; we must use them as natural and inevitable forms. The one way in which our work represents an advance on that of the engineers of the preceding period is that in our constructional work we do not leave beauty out of account. Something similar may be seen any day in the work of a good tailor. The beauty of a tailor's work depends on fine tact in the choice of materials, good cut and perfection of workmanship; and this is very similar to what we want from a modern constructional engineer.

Machine Work **and Hand** Work.—We live in an age when the great masses of the population have little to spare for luxuries, and this makes it our special duty to see that all objects manufactured for use are well and simply made without unnecessary additions. They can be made beautiful without any increase in cost if their shape and proportions are beautiful and if the material is treated in a suitable way. It is an elementary principle that machine work ought not to try to imitate hand work. The machine is a well-contrived means of enabling man to do work in a rapid

and reliable manner; it is not meant simply to reproduce what was designed to be made by hand. The machine can produce a given object out of a given material, but without individuality. It is thus suitable for making things like well-designed and well-executed metal saucepans, handsome motor cars—in short, anything which must be produced in large quantities in a standardized form in order to bring it within the purchasing power of the population. Again, anything which cannot be made by ordinary means, but requires special machinery to handle the great masses of material involved, would look ridiculous if antique forms were artificially grafted on to it. Radiators decorated in antique style would be hideous.

When an object is made by hand, the material can be treated much more freely, and the artist will unconsciously impress his own characteristics on it, thus giving it originality. For example, it is possible to recognize the maker of a vessel of beaten or repoussé metal simply from his characteristic hammer strokes. Handwork allows of free and sensitive design, and creates a living surface, which will delight the connoisseur if its refinement is not destroyed by bad ornament. Workmanship will constantly improve, and its effect need not be lost even if richer treatment is adopted for special purposes. Objects which are intended to be the property of the community, such as ceremonial vessels of all kinds, sports cups and so on, may be of considerable value. Frequently it is necessary for them to symbolize their origin and purpose in an original and yet generally recognizable way; if so, they lend themselves to creative and imaginative treatment.

If a modern student is to become fully acquainted with all these questions, he must have an opportunity of working in well equipped workshops. He must, of course, not work mechanically as in the old technical schools; he must constantly be receiving intellectual stimulus and food for thought, and be encouraged to use his inventive faculties. In the actual work he must, of course, first learn all the known methods. The teacher will not expect him to discover for himself the tools and ways of using them which have been known and been in use for hundreds of years. A few hints such as are given in any good workshop will teach what would otherwise need long study.

Young people delight in working for themselves in this way; it acts as a stimulus, and it teaches them both to understand ancient art and to judge it properly. Interest in modern discoveries is awakened, new things are attempted, and new inventions aimed at. An architectural engineer who has been trained on this system would never think of designing electric chandeliers to imitate lighted candles. He would realize the difference between the open candle flame which used to make the crystal lustres glitter, and the electric bulb, which also burns upwards, but with a still, unflickering light. Once the student realizes why considerations of this kind are necessary, the battle is won. He will no longer feel himself superfluous, but be happy because he has a place in the scheme of modern production. Even minor talents can do good and useful work in such circumstances. There is little danger that such detailed work will injure the student's capacity for work on a large scale.

Schools where the curriculum is excellent on paper, but is in the hands of dull and uninspiring teachers, will be useless and sterile, however well equipped they may be. To find the right staff must always be the first concern. It should be emphasized that women often make very inspiring teachers. If women attend an architectural school it is because they have an intense enthusiasm for art, while men often come because their parents have selected a profession for them, and not because they have any genuine vocation.

Technical and artistic work, pure and applied, is so important that it is absolutely essential to be able to complete one's studies, up to the most advanced stage, at the same institution; intermediate schools, technical schools and colleges should not be three separate institutions. Unfortunately, other less desirable schemes are still in existence, under which architecture, in itself a somewhat abstract conception, is taught at three different institutions: at a technical college, an academy of plastic arts and at a school of applied arts. Thus there is an immense amount of duplication of work for no purpose. The same absurd position may exist in schools of painting and sculpture, although these are surely subjects where the teacher's personality matters more than questions of formality.

With the money which this threefold organization costs, it would be possible to set up one institution of the first rank, which could meet all the requirements of modern art education. The various subsidiary courses could be thorough and would not have to be triplicated. The history of art, the technical subjects relating to the properties of the materials used, and the various branches of engineering could be taught thoroughly and in their entirety. A proper basis would at the same time be provided for the teaching of the history of art at the universities, and the disastrous gulf which exists between artists and art critics would be bridged. The very fact that the art critics of the future would have been in close contact with practising artists would make them better fitted to carry out their important functions.

The same school would provide for the education of the future clients of the artistic professions, and more particularly of business men. A business man is not really fit for his work unless he has a full appreciation of quality, and has learned as a young man to abominate all the artistic horrors which he would otherwise perpetrate without scruple, to the waste of valuable labour and material, and to the injury both of the individual and of the community as a whole. Unity in all the branches of art education is the only thing which can make national art flourish as in former days. It is useless if the artist, on completing his studies, feels himself solitary, misunderstood and unwanted, and surrounded by an atmosphere of hostility.

It should be realized how necessary a single complete educational system of this kind is, and it should be carried out thoroughly. The kind of education given in old-fashioned art schools means nothing to the man of the present day, and he instinctively avoids it. Technical skill can make up for a good deal, but the present generation needs men of outstanding ability in the sphere of art as well as in that of literature.

The Public Attitude. — The modern theatre, the cinema, advertisement, men's and women's dress—in short, everything which modern man uses or sees around him, stands in constant need of reform. It is most important that the great masses of the population should be brought to realize what happiness can be derived from the various forms of artistic expression, and induced in their millions to collaborate in the work. It would then be found that, as in all great movements, the natural leaders would emerge. Every school child in the lower forms of the elementary schools ought to be made to realize what art may mean to him individually; we might then once more see a race of happy men and women. But real success cannot be attained until the whole population has been drawn into the movement, and until we cease to cast discredit on all that is done, however well meant it may be.

The old systems of examinations must give place to a thorough study of the student, his work and his characteristics. His capacities should be judged by his achievements as a whole, and not by a mere test. If however his powers are to find no outlet in his future life, as is so often the case to-day, all efforts are in vain, and it would almost be better to lay aside the whole system of education for a time and wait until something new was spontaneously created. Isolated attempts, even if they are entirely on the right lines as in the case of the *Bauhaus* at Dessau, must inevitably remain mere attempts which cannot cover the whole field; and they are unfortunately unlikely to endure, as bitter experience has shown. The belief that the present generation has no feeling at all for art, whether ancient or modern, and regards it as quite superfluous, is surely false, and is due to confusion between the artistic and the creative. As long as we have to use all the various objects with which we are surrounded, we must inevitably want to make their form better, purer and freer. Even if we build fewer churches to-day, we build more orphanages, baths, hospitals, schools and dwelling-houses. We believe that a child who is well cared for and lives in a healthy, suitable and dignified environment is likely to grow up into a good citizen, and that such a citizen will

do his work better and with more self-respect if he is provided with the right equipment and clothing.

Artists are often accused of preaching simple form but practising ornamentation. Surely, however, there is no real contradiction if what we care about is not ornament in itself, but a new and creative treatment of ornament. Men are made so differently that there will always be some who like to wear patterned ties; but then the simplicity, colouring and fabric of the ties should be such as to reflect the age. Materials for curtains and upholstery, and so on, cannot always be made in plain colours; and to be able to understand the feeling for such things is a sign of a fresh mind and of vitality. The modern designers' aim has been to satisfy requirements such as these as long as they exist. They are satisfied if they can produce objects of all these different kinds which it will be possible to recognize hundreds of years hence as being the product of our age, and which cannot be dismissed as mere superficial and imperfect imitations of bygone styles. It is absurd that intensive art study should have no other aim than the production of imitations.

All that has been said above holds good from the economic standpoint. When it is remembered that mere industrialism has produced little that is not worthless, and that quantities of material have been simply wasted, instead of having been used properly so that their value was preserved or indeed heightened, it will be realized how much the old system has to answer for. To-day as 1,000 years ago we can only dignify our existence by the creation of beauty. Beauty in all departments of our life, from the highest to the lowest, is the only thing which can really make us better and happier.

See ARCHITECTURE; AESTHETICS. (J. Ho.)

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ARTUSI, GIOVANNI MARIA, Italian composer and theorist (born in Bologna during the second half of the 16th century; died 1613) is to-day remembered only for his attacks upon Monteverde (*q.v.*) embodied in his *Delle imperfezioni della musica moderna* and other controversial works.

See Dr. G. Vogel and O. Riemann, *Vierteljahrsschrift fzir Musikwissenschaft* (Leipzig), vol. iii., pp. 326, 380, 426.

ARU ISLANDS, in the government of the Great East ("Groote Oost"), Netherlands Indies, between 5° 18′ and 7° 5′ S. and 134° and 135° E. The group lies on the edge of the submarine continental shelf of Australia and New Guinea. They are composed of one large island, Tana-besar, 122 mi. long and 58 mi. wide, and nearly 100 smaller islands, the total area of the group being 3,244 sq.mi. Tana-besar, of irregular, oblong form, traversed by three narrow channels of varying width and less than three fathoms in depth, is almost divided into several separate islands. A. R. Wallace held that the land between the Arus and southwest New Guinea had subsided—the sea between is still very shallow—and that these rivers were once connected with present-day rivers in southwest New Guinea, and formed their mouths. All the islands are low, mostly of coralline limestone, and covered with a dense forest; the coast is often very swampy, The vegetation includes screw pines, palm trees, kanari and tree ferns; in Tarangan, the southern portion of Tana-besar, there are grassy plains, and along the coast and river banks are mangroves. Pop. (1930) 18,176, of mixed Papuan blood, as in Tenimber, but of darker colour, smooth rather than curly-haired; the skin less dark than that of Papuans proper; and lips thin. The natives, divided into *Pata-lima* and *Pata-siwa*, showing influence af Tidor and Ternate, are mostly pagan, though Christianity has made a little headway, and some are Mohammedans. In the western islands, the Voormal, where the Mohammedans and Christians mostly live, including Chinese, Buginese, and Macassarese settlers, the villages are as in Amboina; near the coast and nearly hidden amongst clumps of trees. In the eastern islands, the Achterwal, they stand on high rocks. The houses of the pagans are often of rough wood and *atap*, crowded together, and crowded; they are entered by a trap-door in the middle of the floor.

Usually a shed in the centre of the village harbours the protective spirit of the community, to whom offerings are made. The Aru islanders are a gentle quiet race; there is little crime among them, and they retain their old laws and customs, and are largely governed by their own chiefs under Dutch surveillance. Many of the men wear a single short garment round the waist, and the women a very short and tight *sarong*, home woven, but they decorate themselves with bead necklaces, anklets, bracelets, ear-rings of copper, and plaited leaves, and combs of bone or wood. The fauna is quite Papuan and includes several birds of paradise, including the king bird of paradise. Many natives find occupation in hunting this magnificent bird for its plumes, which are used for ornaments. Little ground is tilled, except by the Christians and Mohammedans, and the communally owned uncultivated ground is hunted and explored for sago and other food products. Wives are purchased, a man becoming absolute master of his wife, and his brother having the right to marry her on his death. The principal means of subsistence are agriculture (amongst the Voorwal peoples), sale of bird of paradise plumes, and collection of trepang and pearl and tortoiseshell for Chinese and Macassar traders.

The capital, and practically the only port, is Dobo, on the small island of Wamar in the west, though few Aru islanders live on it, only visiting it to take their produce there for sale. It has a very small population. All trade centres there, and there is much pearl fishing. The islanders retained certain rights in the pearl fishing of the east coasts, but it was leased by the Dutch government to an Australian concern, the Celebes Trading company. The headquarters of the fleet of over 100 luggers are at Dobo: pearls and mother-of-pearl of the value of about 150,000 guilders are obtained annually.

The Aru Islands were occupied by Japan in Aug. 1942, during World War II.

See A. R. Wallace, *The Malay Archipelago* (1890).

ARUM, a genus of monocotyledonous plants of the family Araceae (*q.v.*), containing 12 species found in Europe and the Mediterranean region, and represented in the British Isles by the well-known lords-and-ladies, cuckoo-pint (*q.v.*) or wake-robin (*A. maculatum*), native to Europe and northern Africa. The black calla (*A. palaestinum*), native to Syria and Palestine, is occasionally grown by gardeners. Many plants formerly referred to *Arum* are now placed under other genera, and numerous plants belonging to other genera are popularly called arums, as the water arum or wild calla (*Calla palustris*), cosmopolitan in the northern hemisphere, and the arum lily, calla lily or calla of the gardeners (*Zantedeschia aethiopica*), native to South Africa. (*See* CALLA; CUCKOO-PINT.)

ARUNDEL, EARLS OF. According to Cokayne (*Complete Peerage*, i. *p.* 138, note *a)* there is an old Sussex tradition to the effect that

> —Since William rose and Harold fell
> There have been earls of Arundel.

This, he adds, "is the case, if for 'of' we read 'at'."

RICHARD FITZALAN (1267–1302), earl of Arundel, fought for Edward I. in France and Scotland, and died March 9, 1302.

He was succeeded by his son, EDMUND (1285–1326), who married Alice, sister of John, earl de Warenne. A bitter enemy of Piers Gaveston, Arundel was one of the ordainers appointed in 1310; he declined to march with Edward II. to Bannockburn, and after the King's humiliation he was closely associated with Thomas, earl of Lancaster, until about 1321, when he became connected with the Despensers and sided with the King. He was faithful to Edward to the last, and was executed at Hereford by the partisans of Queen Isabella on Nov. 17, 1326.

His son, RICHARD (c. 1307–76), who obtained his father's earldom and lands in 1331, led one of the divisions of the English Army at Creçy and took part in the siege of Calais; he also fought in the naval battle with the Spaniards off Winchelsea in August 1350. He was regent of England in 1355, and died Jan. 24 1376, leaving three sons, the youngest of whom, Thomas, became Archbishop of Canterbury.

Richard's eldest son, RICHARD (1346–97), earl of Arundel and Surrey, was a member of the royal council during the minority of Richard II., and about 1381 was made one of the young King's governors. As admiral of the west and south he gained a victory over the French and their allies off Margate in 1387. About 1385 the earl joined the baronial party led by the King's uncle, Thomas of Woodstock, Duke of Gloucester, and in 1386 was a member of the commission appointed to regulate the kingdom and the royal household. Then came Richard's rash but futile attempt to arrest Arundel, which was the signal for the outbreak of hostilities. The Gloucester faction quickly gained the upper hand, and the earl was again a member of the royal council. After a personal altercation with the King at Westminster in the same year Arundel underwent a short imprisonment. In 1397 he was tried, was attainted and sentenced to death, and was beheaded on Sept. 21 1397. His tomb in the church of the Augustinian Friars, Broad-Street, London, was long a place of pilgrimage.

His only surviving son, THOMAS (1381–1415), was a ward of John Holand, duke of Exeter, from whose keeping he escaped about 1398 and joined his uncle, Archbishop Thomas Arundel, at Utrecht, returning to England with Henry of Lancaster, afterwards King Henry IV., in 1399. After Henry's coronation he was restored to his father's titles and estates. Arundel joined the party of the Beauforts, and was one of the leaders of the English Army which went to France in 1411; then after a period of retirement he became lord treasurer on the accession of Henry V. He died Oct. 13 1415. His wife was Beatrix (d. 1439), a natural daughter of John I., king of Portugal, but he left no children, and the lordship of Arundel passed to a kinsman, JOHN FITZALAN, Lord Maltravers (1385–1421), who was summoned as earl of Arundel in 1416.

John's son, JOHN (1408–35), did not secure the earldom until 1433, when as the "English Achilles" he had already won great distinction in the French wars. He was created duke of Touraine, and continued to serve Henry VI. in the field until his death, June 12 1435, at Beauvais from the effects of a wound. The earl's only son, Humphrey, died in April 1438, when the earldom passed to John's brother, WILLIAM (1417–88).

HENRY FITZALAN (1517–80), 12th earl of Arundel, son of William, 11th earl, by Anne, daughter of Henry Percy, 4th earl of Northumberland, was born about 1517 and succeeded to the earldom in 1554. He was one of the council of 12 appointed by Henry VIII. to assist the executors of his will during the minority of Edward VI. He was twice arrested and twice released on various charges at the instigation of Northumberland. In June 1553 he alone of the council refused the "engagement" of the council to support Edward's "device" for the succession which passed over his sisters, Mary and Elizabeth, as illegitimate, in favour of Lady Jane Grey, though he signed the letters patent. On Edward's death, while pretending to support Northumberland, he secured the proclamation of Mary as soon as Northumberland had left London. Under Mary he held a series of high appointments, and retained the lord-stewardship under Elizabeth. But as one of the leaders of the Catholic nobility he fell under suspicion, and was more than once disgraced. In 1569 he was implicated in the Norfolk plot, but although he appears to have received money from Spain, the evidence against him was insufficient, and he was released in March 1570 and even recalled to the council. After the discovery of the Ridolfi plot he was once more arrested, and only liberated after the execution of Norfolk in 1572. He died Feb. 24 1580. At his death the title passed through his daughter Mary to the Howards.

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PHILIP HOWARD (1557–95), 1st earl of Arundel, eldest son of Thomas Howard, 4th duke of Norfolk, executed for high treason in 1572, and of Lady Mary, daughter and heiress of Henry Fitzalan, 12th earl of Arundel, was born on June 28 1557. He was married in 1571 to Anne, daughter and co-heiress of Thomas Dacre, Lord Dacre (1566). On the death of his maternal grandfather in Feb. 1580 he became earl of Arundel. In 1582 his wife joined the Church of Rome, and was committed to the charge of Sir Thomas Shirley by the Queen. He was himself suspected of disloyalty, and was regarded by the discontented Roman Catholics as the centre of the plots against the Queen's government, and even as a possible successor. In 1583 he was with some reason suspected of complicity in Throgmorton's plot and prepared to escape to Flanders, but his plans were interrupted by a visit from Elizabeth at his house in London, and by her subsequent order to confine himself there. In Sept. 1584 he became a Roman Catholic and made another attempt to leave England. He was then brought before the Star Chamber and condemned to fine and imprisonment for life. He was released for a time, but again arrested on a charge of high treason and condemned to death. The sentence was not executed, and he died in the Tower on Oct. 19 1595. Arundel wrote three treatises on Virtue. In 1929 he was beatified.

BIBLIOGRAPHY.—Article in the *Dict. of Nat. Biography* and authorities there collected; the contemporary *Lives of Philip Howard, Earl of Arundel and of Anne Dacre his Wife*, ed. by the duke of Norfolk (1857); M. Tierney, *History of Arundel* p. 357 (1834); C. H. Cooper, *Athenae Cantabrigenses* (1861), with bibliography, ii. 187 and 547; H. Howard, *Memoirs of the Howard Family* (1824).

THOMAS HOWARD (*c.* 1585–1646), 2nd earl of Arundel, and earl of Surrey and of Norfolk, son of Philip, 1st earl of Arundel and of Lady Anne Dacre, was born in 1585 or 1586 and educated at Westminster school and at Trinity College, Cambridge. At the accession of James I. he was restored to his father's earldoms of Arundel and Surrey, and to the baronies of his grandfather, Thomas, 4th duke of Norfolk. He had a chequered career under James I. and Charles I., holding many high offices and being more than once imprisoned. In 1641 as lord high steward he presided at the trial of Strafford. This closed his public career. He again became estranged from the court, and in 1641 he escorted home Marie de' Medici, remaining abroad, with the exception of a short visit to England in 1642, and taking up permanent residence at Padua. He contributed a sum of £34,000 to the king's cause, and suffered severe losses in the war. On June 6 1644, he was created earl of Norfolk. He died at Padua, when on the point of returning home, on Sept. 14 1646, and was buried at Arundel.

Lord Arundel's claim to fame rests upon his patronage of arts and learning and his magnificent collections. He employed Hollar, Oughtred, Francis Junius and Inigo Jones; included among his friends Sir Robert Cotton, Spelman, Camden, Selden and John Evelyn, and his portrait was painted by Rubens and Vandyck. He is called the "Father of vertu in England," and was admired by a contemporary as the person to whom "this angle of the world oweth the first sight of Greek and Roman statues." He was the first to form any considerable collection of art in Great Britain. His acquisitions, obtained while on his travels or through agents, and including inscribed marbles, statues, fragments, pictures, gems, coins, books and manuscripts, were deposited at Arundel House, and suffered considerable damage during the Civil War; and, owing to the carelessness and want of appreciation of his successors, nearly half of the marbles were destroyed. After his death the treasures were dispersed. The marbles and many of the statues were given by his grandson, Henry, 6th duke of Norfolk, to the university of Oxford in 1667, became known as the Arundel (or Oxford) Marbles, and included the famous Parian Chronicle or *Marmor* Chronicon, a marble slab on which are recorded in Greek events in Grecian history from 1582 B.C. to 354 B.C., said to have been executed in the island of Paros about 263 B.C. Its narration of events differs in some respects from the most trustworthy historical accounts, but its genuineness, challenged by

some writers, has been strongly supported by Porson and others, and is considered fairly established.

Other statues were presented to the university by Henrietta Louisa, countess of Pomfret, in 1755. The cabinets and gems were removed by the wife of Henry, 7th duke of Norfolk, in 1685, and after her death found their way into the Marlborough Collection. The pictures and drawings were sold in 1685 and 1691, and Lord Stafford's moiety of the collection in 1720. The coins and medals were bought by Heneage Finch, and earl of Winchelsea, and dispersed in 1696; the library, at the instance of John Evelyn, who feared its total loss, was given to the Royal Society, and a part, consisting of genealogical and heraldic collections, to the College of Heralds, the manuscript portion of the Royal Society's moiety being transferred to the British Museum in 1831 and forming the present Arundel Collection. The famous bust of Homer reached the British Museum after passing through various hands.

Lord Arundel married in 1606 Lady Alethea, daughter and heir of Gilbert Talbot, 7th earl of Shrewsbury, by whom, besides three sons who died young and one daughter, he had John, who predeceased him, Henry Frederick, who succeeded him as 3rd earl of Arundel and earl of Surrey and of Norfolk, and William, Viscount Stafford, executed in 1680. In 1849 the Arundel Society for promoting artistic knowledge was founded in his memory. Henry Frederick's grandson Thomas, by the reversal (1660) of the attainder of 1572, succeeded to the dukedom of Norfolk, in which the earldom has since then been merged.

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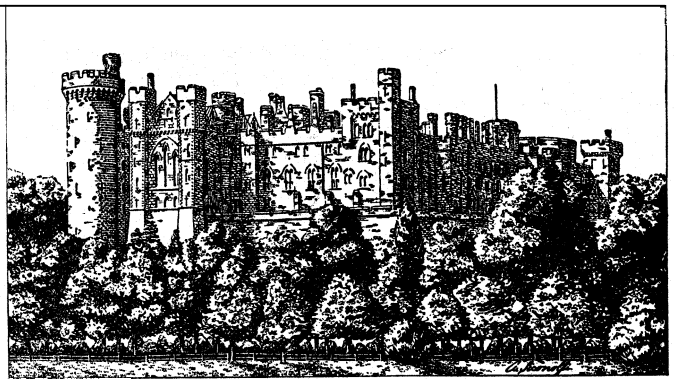
ARUNDEL, THOMAS (1353–1414), archbishop of Canterbury and lord chancellor of England, was the third son of Richard Fitzalan, earl of Arundel and Warenne, by his second wife, Eleanor, daughter of Henry Plantagenet, earl of Lancaster. In 1373 he became archdeacon of Taunton, and in April 1374 he was consecrated bishop of Ely. In 1388 he became archbishop of York, and in 1396 archbishop of Canterbury. During the early years of the reign of Richard II. he was associated with the party led by Thomas, duke of Gloucester, Henry, earl of Derby, afterwards King Henry IV., and his own brother Richard, earl of Arundel. He was three times lord chancellor under Richard II. After the arrest of Gloucester, Warwick and Arundel, the archbishop was impeached by the Commons, with the king's consent, although Richard held out hopes of safety to him. He was charged with assisting to procure the commission of regency in derogation of the royal authority, and sentence of banishment was passed, 40 days being given him during which to leave the realm. Towards the end of 1397 he started for Rome. He then became associated with Henry of Lancaster, but did not return to England before 1399, and the account which Froissart gives, telling how he was sent by the Londoners to urge Henry to come and assume the crown is thought to refer to his nephew and namesake, Thomas, earl of Arundel. Landing with Henry at Ravenspur he took his place at once as archbishop of Canterbury, witnessed the abdication of Richard in the Tower of London, led the new king, Henry IV., to his throne in presence of the peers, and crowned him on Oct. 13, 1399.

The main work of his later years was the defence of the Church and the suppression of heresy. To put down the Lollards he called a meeting of the clergy, pressed on the statute de *haeretico comburendo,* and passed sentence of degradation upon William Sawtrey. He resisted the attempt of the Parliament of 1404 to disendow the Church, but failed to induce Henry to pardon Archbishop Scrope in 1405. In 1407 he became chancellor for the fourth time, and in 1408 he summoned a council at Oxford, which drew up constitutions against the Lollards. In 1411 he went on an embassy abroad, and in 1412 became chancellor again, his return to power being accompanied by a change in the foreign policy of Henry IV. In 1413 he took a leading part in the proceedings against Sir John Oldcastle, Lord Cobham. He died on Feb. 19, 1414, and was buried at Canterbury.

See the Monk of Evesham, *Historia* vitae et regni Ricardi *II.*, ed. T. Hearne (1729); *Eulogium* historiarum *sive* temporis, ed. F. S. Haydon (1858–63); W. F. Hook, Lives of the Archbishops of Canterbury, vol. iv. (1860–76); T. Walsingham, *Historia Anglicana,* ed. H. T. Riley (1863–64).

ARUNDEL, municipal borough in the Chichester parliamentary division of Sussex, England, 58 mi. S.S.W. of London by the Southern railway. Pop. (1938) 2,368. Area 3.2 sq.mi. It lies on a hill slope above the river Arun, which is navigable for small vessels to Littlehampton at the mouth, six miles south. Arundel Castle, rising from the summit of the hill, was admirably placed to guard the passage along the river, through the South Downs on the north. The town takes its name, according to a whimsical etymology, from *hirondelle* (a swallow) as shown on the corporation seal. The first mention of Arundel (Harundell) comes as early as 877. In the time of Edward the Confessor the town seems to have consisted of the mill and an earthwork probably thrown up by Alfred as a defense against the Danes; but it appears in Domesday as a thriving borough and port. It was granted by the Conqueror to Roger de Montgomery, who built the castle on the site of the ancient earthwork. From very early times markets were held within the borough on Thursday and Saturday, and in 1285 Richard Fitzalan, earl of Arundel, obtained a grant of two annual fairs on May 14 and Dec. 17. The town was half destroyed by fire in 1338, but was soon rebuilt. The stronghold was frequently assaulted and greatly damaged in the 17th century civil wars; but it was restored by Charles, 11th duke of Norfolk (d. 1815), who made it one of the most splendid baronial mansions in England. The borough returned two members to parliament from 1295 to 1832, and one member until 1868. There are no early charters extant but in 1586 Elizabeth acknowledged rights claimed to have been exercised from time immemorial. The borough was incorporated in 1688. The church of St. Nicholas, founded about 1375, is Perpendicular. In the north aisle of the chancel there are several ancient monuments of the earls of Arundel. The church is otherwise remarkable for its reredos and iron work. The Roman Catholic church of St. Philip Neri was built by the duke of Norfolk (1873). Some remains of a *Maison Dieu,* a hospital, erected in the time of Richard II., still exist.



THE CASTLE AT ARUNDEL IN SUSSEX, ENGLAND. OVERLOOKING THE RIVER ARUN IS POPULARLY BUT ERRONEOUSLY SUPPOSED TO CONFER UPON ITS POSSESSOR THE EARLDOM OF ARUNDEL, THE PREMIER EARLDOM OF ENGLAND. WHICH DATES FROM HENRY I'S TIME

Arundel is now a quiet market town. It was formerly a flourishing seaport, having canal connection (1813) with London. The borough is under a mayor, four aldermen, and 12 coun-

cillors. Water for domestic purposes is supplied free by the Duke of Norfolk.

See also ARUNDEL, EARLS OF.

ARUNBELL OF WARDOUR, THOMAS ARUNDELL, 1ST BARON (*c.* 1562–1639), son of Sir Mathew Arundell of Wardour Castle, Wiltshire, served with great distinction as a soldier of fortune under the Emperor Rudolf II. against the Turks, and was created a count of the Holy Roman Empire. His assumption of a foreign title was strongly resented by Elizabeth, who sent him to the Fleet Prison on his arrival in England in 1596. He was soon released, but next year was again imprisoned for a short time on another charge. James I. gave him his English peerage in 1605, but he repeatedly fell under suspicion on account of his Catholic faith under James I. and Charles I. He died on Nov. 7 1639. Arundell was a devout Catholic, but the accusations of disloyalty made against him appear to have been unfounded.

Henry Arundell, 3RD BARON (*c.* 1607–94), grandson of the preceding, succeeded in 1643. He fought on the Cavalier side in the Civil War, and at the Restoration the family estates were restored to him, and he became an officer of the Queen's household. He was employed by Charles II. in negotiating the Treaty of Dover. Denounced by Titus Oates as a participator in the "Popish Plot," Arundell, with four other Roman Catholic peers, was impeached and imprisoned. He was released in Feb. 1684. After the accession of James II., the charge was annulled, and Arundell was for a time keeper of the privy seal. He died Dec. 28, 1694, leaving a reputation for piety and of benevolence to his co-religionists.

ARUNTA. In Central Australia, around Alice Springs, are still found representatives of the Arunta tribe—a typical stone age hunting people with peculiar beliefs, ritual and customs. The tribe is divided into two patrilineal, exogamous intermarrying sections which are split into two, and in some cases into four. The natives believe that the tribe is composed of two groups with differing physical characters. They are totemic in their own fashion. A child has the totem from the spot where its mother believes the child to have been conceived. The totems are therefore localized in distribution. Marriage is regulated by the child's position in the moiety, section, or sub-section to which he or she belongs by birth, and a man marries the daughter of his mother's mother's brother's daughter. Complicated ceremonies, closely associated with the breeding of the totem animals or the flowering of the totem plants, are held when conditions seem to be favourable—as when there is promise of the approach of a good season. Initiation rites—circumcision, sub-incision and headbiting are practised in prolonged ceremonies. Women have their analogous rites. The authority of custom—the power of the elder men—the belief in magic, the presence of a quasi-hereditary local headman (Inkata) with a vague, indefinite power, which, if he possess personality and ability, may be great, the belief in the sacred nature and magically efficacious association of the Churinga, are among the more prominent features of this group, whose peculiarities have lent weight to the criticism that in them we approach most nearly to primitivity. They may, however, be degenerates, or freaks, whose philosophizings have drawn them to strange conclusions. (See AUSTRALIA: Ethnology.)

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ARVAL BROTHERS, in Roman antiquities, a college or priesthood (Fratres Arvales, "brothers of the field"), consisting of twelve members, elected for life from the highest ranks in Rome, and always apparently, during the empire, including the emperor. Their chief duty was to offer annually public sacrifice for the fertility of the fields. There is proof of the high antiquity of the college, which was said to have been older than Rome itself, in the verbal forms of the song with which, down to late times, a part of the ceremonies was accompanied, and which is still preserved. No mention of the Fratres occurs in Cicero or Livy, and literary allusions to them are very scarce; but we possess a long series of the *acta* or minutes of their proceedings, drawn up by themselves, and inscribed on stone. Excavations (1570–1869) in the grove of the Dea Dia about 5m. from Rome, have yielded 96 of these records, dating from A.D. 14 to 241. The brotherhood, almost forgotten in republican times, was revived by Augustus. In his time the college consisted of a master ('tagister), a vice-master (*promagister*), a *flamen* and a praetor, who were assisted at the sacrifices by four chorus boys, sons of senators, having both parents alive. Each wore a wreath of corn, a white fillet and the praetexta. The election of members was by co-optation on the motion of the president, who, with a *flamen,* was himself elected for one year.

The great annual festival was held in honour of the anonymous Dea Dia, probably identical with Ceres or Acca Larentia, on three days in May. It is a matter of dispute whether this festival was identical with that called *Ambarvalia* (*q.v.*). The ceremony of the first day, on which a sumptuous banquet took place, followed by a distribution of doles and garlands, was held in Rome itself. On the second and principal day of the festival the ceremonies were conducted in the grove of the Dea Dia. They included a dance in the temple of the goddess, at which the song of the brotherhood was sung, in language so antiquated that it was hardly intelligible (text and translation in Mommsen, *Hist.* of Rome, bk. i.-ch. xv.) even to Romans of the time of Augustus Special mention should be made of the ceremony of purifying the grove, which was held to be defiled by the felling of trees, the breaking of a bough, or the use of any iron tools. The song and dance were followed by the election of officers for the next year, a banquet and races. On the third day the sacrifice took place in Rome, and was of the same nature as that offered on the first day. The Arvales also offered sacrifice and solemn vows on behalf of the imperial family on the 3rd of January and on other extraordinary occasions. The brotherhood is said to have lasted till the time of Theodosius. The British Museum contains a bust of Marcus Aurelius in the dress of a Frater Arvalis.

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ARVALS, ARVELS or **ARTHELS,** primarily the funeral dinner, and later, a thin, light, sweet cake, spiced with cinnamon and nutmeg, served to the poor at such feasts. The funeral meal was called the Arvel-dinner. The custom, of British origin, seems to have been to hold on such occasions an informal inquest, when the corpse was publicly exposed, to exculpate the heirs from all accusations of foul play.

ARVERNI (ahr-vur'ni), an ancient Gaulish tribe in the Auvergne, which still bears its name. It resisted Caesar longer than most of Gaul; when once vanquished it adopted Roman civilization readily. Its tribal deity, the god of the mountain, the Puy de Dôme, rechristened in Roman phrase Mercurius Dumias, was famous far beyond its territory. Part of his temple has been excavated.

ARVICULTURE is that branch of agronomy (*q.v.*) which relates to the culture of field crops specifically and to their actions and reactions under agronomic or horticultural conditions. Derived from L. *arvum,* field, and *cultus,* cultivation.

ARYABHATTA (b. 476), Indian astronomer and mathematician, was born at Pâtalipatua on the upper Ganges. He was the author of the *Aryabâthíyam,* written in verse couplets, which gives the rules of mathematics as known in his time. The greater part of this work is astronomy and spherical trigonometry, the remainder being 33 rules in arithmetic, algebra and plane trigonometry, including quadratic equations, the sums of powers of the first *n* natural numbers, and a table of sines. The work was published in Sanskrit at Leyden in 1874 (French trans. 1879).

See L. Rodet, *Leçons* de *calcul d'Aryabhata.*

ARYANS. This word is used by some of the "Satem" speakers of Indo-European languages with the meaning "noble" and is the name of one of the tribes of these people. As Sir George Grierson points out "Indians and Iranians who are descended from an Indo-European stock have a perfect right to call themselves Aryans but we English have not." (Report of *the* Linguistic Survey of India, vol. i., p. 96, 1927.) Max Müller, who used the term, was always cautious and distinguished clearly between the data which fall to the physical anthropologist, those

which the student of culture investigates, and the linguistic material which demands the scrutiny of the philologist. It takes time to eradicate the errors of enthusiasm, but scientific and careful workers accept the view expressed by Boas (Mind *of* Primitive Man, 1927) "that a people may remain constant in type and language and change in culture: that it may remain constant in type but change in language: or that it may remain constant in language and change in type and culture." There is no better nor more striking example in science than this of the danger of affixing labels without due scrutiny and intelligent discrimination.

ARYA SAMĀJ, a Hindu reforming sect, founded by Dayanand Saraswati, a Brahman of Guzerāt, who, born in 1825, was brought up as a Shiv-worshipper, but renounced idol-worship. He sought in the Vedas a solution of the problems of human misery and final salvation. After 1866 he gathered disciples and assailed the Christian scriptures, maintaining that the Rig Veda not only supported his own beliefs but that in it all modern discoveries in science were described. Thus he discerned the endowment of true learning, the arts of manufacture, chemistry, popular instruction, etc., all in the *yajna* or sacrificial cult. While denying that the Vedas recognized Caste, he retained the four classes as social units into which entrance was to be dependent on examinations. Such ideas naturally antagonized the Brahmans, so he turned to the masses, and founded numerous *samājes,* "associations," the earliest at Bombay ih 1875. He died at Ajmere in 1888. The Arya Samāj is not eclectic, like the Brahma Samāj, but narrower in scope and intenser in conviction. It attracted educated men whose Hinduism had been undermined, but who were opposed to the teachings of foreign creeds, while they wished to reconcile modern science and Western ethics with the faith of the Vedas.

ARYBALLOS, a Greek vase, sometimes used as a drinking-vessel, with a wide base and small, flaring mouth. One variety has a jug-like handle near the mouth. The decorations on these vases were often executed in the Asiatic style, the designs including fantastic animals, monsters and winged goddesses.

ARYTENOID, a term meaning "funnel-shaped," applied to cartilages, such as those of the larynx.

ARZAMAS, (1) a district, (2) a town in the Nizhegorod province of the R.S.F.S R. The district has an area of 8,040 sq.km. Pop. (1926) 350,964: urban, 18,535, *i.e.,* the town of Arzamas, rural 332,429. The town, 55° 22' N., 43° 50' E., is at the confluence of the rivers Tesha and Arsha and is also a railway junction. It is thus a centre for local products, with cold storage facilities. Its chief occupation is timber-milling, with tanneries, tallow and soap works and flour mills. It trades in sheepskins, sailcloth and the products of koustar (home) industries, especially knitted goods.

AS, the Roman unit of weight and measure, divided into 12 *unciae* (whence both "ounce" and "inch"); its fractions being deunx $\frac{11}{12}$, dextans $\frac{5}{6}$, dodrans $\frac{3}{4}$, bes $\frac{2}{3}$, septunx $\frac{7}{12}$, semis $\frac{1}{2}$, quincunx $\frac{5}{12}$, triens $\frac{1}{3}$, quadrans $\frac{1}{4}$, sextans $\frac{1}{6}$, sescuncia $\frac{1}{8}$, uncia $\frac{1}{12}$. *As* really denoted any integer or whole; whence the English word "ace." The unit or as of weight was the *libra* (pound= about $11\frac{4}{5}$ oz. avoirdupois); of length, *pes* (foot=about $11\frac{3}{5}$in.); of surface, *jugerum* (= about $\frac{2}{3}$ac.); of measure, liquid amphora (about $5\frac{3}{55}$gal.), dry modius (about $\frac{9}{10}$ peck). In the same way as signified a whole inheritance; whence heres ex asse, the heir to the whole estate, heres ex *semisse,* heir to half the estate. It was also used in the calculation of rates of interest.

As was also the name of a Roman coin (see NUMISMATICS: *Roman*). The old as was composed of the mixed metal aes an alloy of copper, tin and lead, and was called as *libralis,* because it nominally weighed 1 lb. or 12 oz. (actually 10). Its original shape seems to have been an irregular oblong bar, which was stamped with the figure of a sheep, ox, or sow. This, as well as the word *pecunia* for money (pecus, cattle), indicates the fact of cattle having been the earliest Italian medium of exchange. The value was indicated by little points or globules, or other marks. After the round shape was introduced, the one side was always inscribed with the figure of a ship's prow, and the other with the double head of Janus. The subdivisions of the as had also the ship's prow on one side, and on the other the head of some deity. The weight and value of the as steadily diminished. Before silver coinage was introduced (269 B.C.) the value of the as was 6d. or 12c., in the time of Cicero less than a halfpenny. In the time of the emperor Severus its weight was lowered to about $\frac{5}{24}$ of an ounce. During the commonwealth and empire aes grave was used to denote the old as in contradistinction to the existing depreciated coin; while *aes* rude was applied to the original oblong coinage of primitive times.

See J. E. Sandys, Companion to Latin Studies (1925).

ASA, in the Bible, son (or perhaps, rather brother) of Abijah, the son of Rehoboam and king of Judah (I. Kings xv. 9–24). He was a contemporary of Baasha, Zimri and Omri of Israel, but little is recorded of his long reign except some religious reforms and conflicts with the first-named. Baasha fortified Ramah (*er-Rām*), jm. north of Jerusalem, and Asa was compelled to use the residue of the temple-funds, to bribe the king of Damascus to renounce his league with Baasha and attack Israel. Galilee was invaded and Baasha was forced to return, the building material which he had collected at Ramah being used by Asa to fortify Geba, and Mizpah to the immediate north of Jerusalem. The Book of Chronicles relates a story of a sensational defeat of Zerah the "Cushite," and a great religious revival in which Judah and Israel took part (II. Chron. xiv.–xv. 15). Asa was succeeded by his son Jehoshaphat.

ASAFOETIDA, a gum-resin obtained chiefly from an umbelliferous plant (*Ferula* foetida), allied to the giant fennel (*q.v.*), native to Persia and Afghanistan. It grows to 5 or 6 ft., and when four years old is ready for yielding asafoetida. The stems are cut down close to the root, and a milky juice flows out which quickly sets into a solid resinous mass. A freshly exposed surface of asafoetida has a translucent, pearly-white appearance, but it soon darkens in the air, becoming first pink and finally reddish-brown. In taste it is acrid and bitter and emits a strong onion-like odour, due to the presence of organic sulphur compounds.

Asafoetida is found in commerce in "lump" or in "tear," the latter being the purer form. Medicinally, given in doses of 5 to 1j grains, it stimulates the intestinal and respiratory tracts and the nervous system, and is sometimes useful in hysteria and malingering. The gum-resin is relished as a condiment in India and Persia, and is in demand in France for use in cookery, In the regions of its growth the whole plant is used as a fresh vegetable, the inner portion of the full-grown stem being regarded as a luxury.

ASAF-UD-DOWLAH, nawab wazir of Oudh from 1775 to 1797, was the son of Shuja-ud-Dowlah, his mother and grandmother being the begums of Oudh, whose spoliation formed one of the chief counts in the charges against Warren Hastings. When Shuja-ud-Dowlah died he left £2,000,000 sterling buried in the vaults of the zenana. The widow and mother of the deceased prince claimed the whole of this treasure under the terms of a will which was never produced. When Warren Hastings pressed the nawab for the payment of debt due to the East India Company, he obtained from Asaf's mother a loan of 26 lakhs of rupees, for which he gave her a *jagir* of four times the value; he subsequently obtained 30 lakhs more in return for a full acquittal, and the recognition of her jagirs without interference for life by the company. These jagirs were afterwards confiscated on the ground of the begum's complicity in the rising of Chai Singh, which was attested by documentary evidence. The evidence now available seems to show that Warren Hastings did his best throughout to rescue the nawab from his own incapacity, and was inclined to be lenient to the begums.

See G. W. Forrest, The Administration of Warren Hustings, *1772–1785* (1892).

ASAPH: see PSALMS.

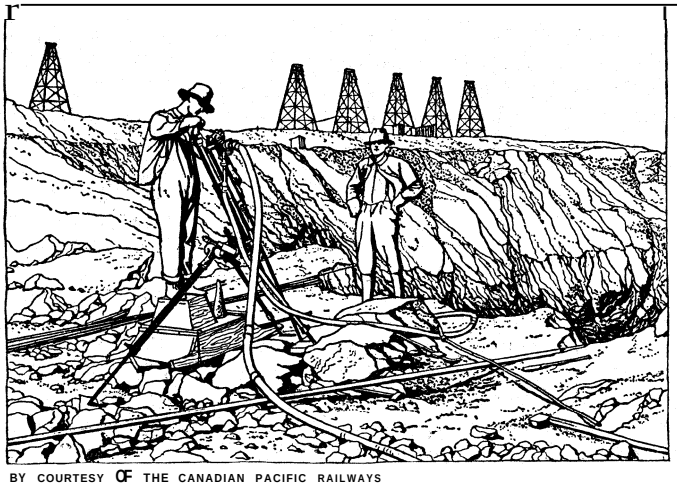
ASARABACCA (*Asarum europeum*), a low, stemless, perennial plant of the birthwort family (Aristolochiaceae), native to the woods of Europe and north temperate Asia, and occurring wild in some English counties. It is a small creeping herb with a pungent-aromatic rootstock, kidney-shaped leaves and small pur-

plish bell-shaped flowers. It was formerly grown for medicinal purposes, the underground stem having cathartic and emetic properties. The allied North American species are commonly called wild ginger (*q.v.*).

ASBESTIC, a fine ground serpentine sand containing small quantities of short fibred chrysotile asbestos. This is a trade name for the mill-treated residue from which the shortest commercial fibre has been extracted; the product, almost white in colour, is used to strengthen certain plasters and stuccos, and can be used in many places where a coarse ground mineral filler is required.

ASBESTINE, LOOMITE, SNOFIBRE, synthetic trade names used in the United States to describe short fibred talc products (*q.v.*) produced in New York State and used as mineral fillers in many industries. *See* also MICRO-ASBESTOS.

ASBESTOS, a generic name for a group of minerals possessing crystalline fibrous structure and which can be spun or felted

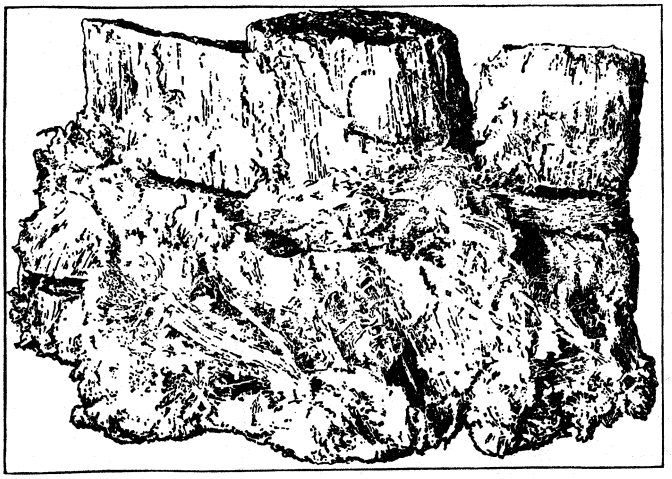


BY COURTESY OF THE CANADIAN PACIFIC RAILWAYS

HOW ASBESTOS IS MINED WITH THE AID OF MODERN ENGINEERING. PNEUMATIC DRILLS ARE BORING HOLES FOR DYNAMITE CHARGES

to make non-combustible fabrics for heat insulation and for other purposes where resistance to fire is essential. The name is derived from the ancient Greek name (ἄσβεστος) for a fabulous stone which once set on fire could not be quenched, probably unslaked lime.

The non-combustible character and spinning qualities of asbestos fibre were undoubtedly known to the ancient world. Plutarch



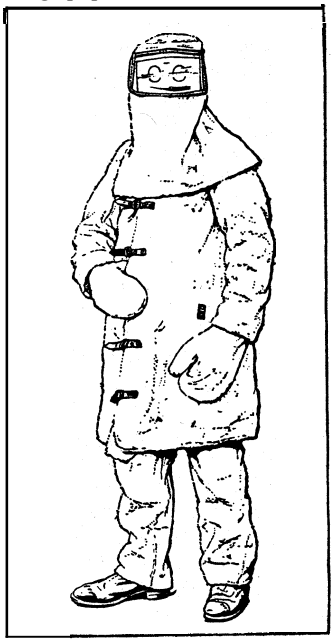
CANADIAN ASBESTOS FIBRE AS IT COMES FROM THE MINE. ITALY PROVIDED THE FIRST ASBESTOS FIBRE USED COMMERCIALLY IN 1871. IMPORTANT DEPOSITS WERE AFTERWARDS DISCOVERED IN QUEBEC AND RHODESIA. WHILE YET ANOTHER SOURCE OF SUPPLY IS THE URAL MOUNTAINS

mentions "perpetual" lamp wicks used by the Vestal Virgins, and Pausanian records a lamp that had a wick which was not consumed, being made of "Carpasian linen," or mineral fibre from Carpasius in Cyprus; shrouds of woven asbestos appear to have been used in ancient times for cremations. Pliny refers to it as *linum vivum*—"the funeral dress of kings."

Varieties.—Three minerals possess varieties known as "asbestos." These are anthophyllite, amphibole and serpentine. The first two are silicates of lime and magnesia, with or without the presence of iron and related elements; the last named is a hydrous silicate of magnesia, with or without iron.

Anthophyllite is a magnesium-iron silicate which in some localities occurs in long thin plates and fibres. It is of mineralogical importance only.

Amphiboles include five principal types characterized by fibrous structure: (1) *tremolite,* a calcium-magnesium silicate, occurs in long blade-like crystals or in long thin fibrous or columnar masses, grey to almost white in colour, and rather brittle; (2) *actinolite* which is an iron-calcium-magnesium silicate that occurs in fibrous and radiating crystalline masses, bright green in colour, used for weighting paper, and as an inert adulterant. Both these and other varieties of amphibole which are free from alumina, pass by insensible gradations into (3) *asbestos,* otherwise called "amphibole-asbestos" or "hornblende-asbestos," which consists of fine flexible fibres resembling flax, usually of a dull green colour and nacreous lustre; (4) *mountain leather* and *mountain cork* consist of flexible sheets of interlaced fibres, difficult to separate; *mountain wood* is compactly fibrous, grey to brown in colour, and resembles dry wood or petrified wood; (5) *blue asbestos* or *crocidolite,* found in Griqualand, South Africa and in Australia, possesses a very silky lustre, is of a dull blue colour, and its fibres are elastic and occasionally several inches in length. Chemically it is a soda-iron silicate; it possesses higher tensile strength than chrysotile *(see* below) but is less resistant to high temperatures.



BY COURTESY OF BELL'S CO., LTD.

AN ASBESTOS SUIT FOR FIREMEN

Unburnable, material woven from asbestos is applicable to any fireproof purpose, and is much used in modern industry

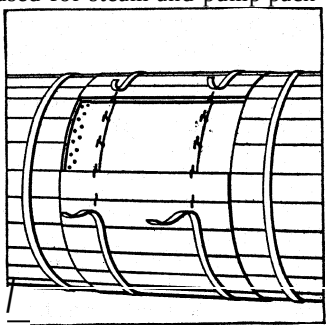
Serpentine is a hydrous silicate of magnesia, generally found in massive forms but also occurring with a banded or slaty structure; closely related to serpentine is *talc* (*q.v.*) which is, however, soft and brittle. There are two fibrous minerals derived from serpentine: (1) *Picrolite* occurs in fibrous masses in fissures of the massive serpentine. The fibres are sometimes 12in. in length but they are not flexible nor easily separable; (2) *Chrysotile* occurs in narrow veins traversing the serpentine rocks as a mass of fine silky crystals. These veins are usually various shades of green but amber to brown shades also occur. The crystals are easily separated into fine, white, silky, flexible fibres. This mineral constitutes the great bulk of the commercial asbestos.

To be of commercial value asbestos must possess length and fineness of fibre combined with infusibility, toughness or relatively high tensile strength and flexibility. Asbestos fibre resembles fine polished wire, free from serrations of any kind. This adds to the difficultiesof spinning. In cross section, fibres are either circular or polygonal. Under high magnification a fibre is seen to consist of numerous fine threads crowded together. The smallest fibre yet measured had a diameter of 0·00075mm., according to Dr. H. T. Barnes, McGill university.

INDUSTRIAL USES

The incombustible and insulating properties of asbestos make it invaluable to industry. The first modern experiments in weaving asbestos were made in Italy. The longer fibre can be carded and spun into yarns, either alone or with additions such as cotton or small sizes of brass or copper wire. Spun products are woven into

fabric of varying weights, thickness and densities to meet numerous industrial needs. Some of the principal uses are for drop curtains in theatres, for fireproof wall linings and for boiler pipe packing. Yarns spun with fine wires are used for fabric for brake linings; woven asbestos belts convey cement clinker and other hot products; when impregnated with rubber, asbestos is utilized for heat insulation and for gaskets; asbestos yarns, impregnated with graphite and suitable greases are used for steam and pump packings; ropes, cords, twine and threads are made for various purposes; various products are used to insulate electric conductors; fibre shorter than spinning stock is used for making steam pipe, hot water pipe and boiler coverings. Certain classes of short asbestos fibre are mixed with cement and moulded into various shapes for special purposes or pressed into millboard, wallboard, shingles or tiles. Asbestos sheets deaden sound and asbestos papers are used where damp-proof and fireproof coverings are required.



BY COURTESY OF BELL'S UNITED ASBESTOS CO., LTD

ASBESTOS BOILER PACKING USED AS A PROTECTIVE AND HEAT-CONSERVING PACKING BETWEEN BOILERS AND THEIR OUTER CASING

Consumption.—The world's present rate of consumption of asbestos of all grades is about 358,000 tons per annum, of which approximately 78% is produced in Canada, 9·4% in Rhodesia, 5·6% in Russia, 4% in the Union of South Africa, 1·7% in Cyprus and the balance in Italy and the United States, with a very small production elsewhere. About 93% of this production is chrysotile asbestos.

Asbestos products are manufactured in England, the United States, France, Germany, Austria, Russia, Italy, Spain, Belgium, Canada and Australia. The production of the raw material has risen from 200 tons (Italian) in 1868 to a total from all sources of over 250,000 tons a year. The United States is the largest consumer, and the asbestos factories there absorb about three-fourths of the output of the raw material from the Canadian mines. In 1926, the exports of asbestos manufactures from the United Kingdom were 24,889 tons, valued at £1,116,000, while the imports of raw asbestos, including fibre and waste, were 27,720 tons, valued at £709,708.

In 1927, 199,726 tons of unmanufactured asbestos were imported into the United States, valued at $8,150,000; and the manufactures 135,441 tons, valued at $2,177,000. The exports comprised a small amount of unmanufactured asbestos, and miscellaneous manufactures. with a total value of $1,918,000. (See Statistical Abstract of the United States, U.S. Department of Commerce.)

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ASBJÖRNSEN, PETER CHRISTEN (1812–85), and **MOE, JÖRGEN ENGEBRETSEN** (1813–82), collectors of Norwegian folk-lore, so closely united in their life's work that it is unusual to name them apart. Asbjornsen was born in Christiania on Jan. 15 1812; as early as 1832 in his twentieth year, he had begun to collect and write down all the fairy stories and legends which he could encounter. Later he began to wander on foot through the length and breadth of Norway, adding to his stores. Moe, who was born at Mo i Hole parsonage, in Sigdal Ringerike, on April 22 1813, met Asbjörnsen first when he was 14 years of age. A close friendship began between them, and lasted to the end of their lives. In 1834 Asbjornsen discovered that Moe had started independently on a search for the relics of national folk-lore; the friends eagerly compared results, and determined for the future to work in concert. By this time, Asbjornsen had become by profession a zoologist, and with the aid of the university made a series of investigating voyages along the coasts of Norway, particularly in the Hardanger fjord. Moe, meanwhile, having left Christiania University in 1839, had devoted himself to the study of theology, and was making a living as a tutor in Christiania. In his holidays he wandered through the mountains, in the most remote districts, collecting stories. In 1842–43 appeared the first instalment of the great work of the two friends, under the title of Norwegian Popular Stories (Norske Folkeeventyr), which was received at once all over Europe as a most valuable contribution to comparative mythology as well as literature. A second volume was published in 1844, and a new collection in 1871. Many of the Folkeeventyr were translated into English by Sir George Dasent in 1859. In 1845 Asbjornsen published, without help from Moe, a collection of Norwegian fairy tales (Huldreeventyr og *Folkesagn*). In 1856 Asbjornsen was appointed forest-master, and was sent by Norway to examine in various countries of the N. of Europe the methods observed for the preservation of timber. He died in Christiania on Jan. 6 188 j. From 1841 to 1852 Moe travelled almost every summer through the southern parts of Norway, collecting traditions in the mountains. He took holy orders in 1853 and he was appointed in 1875 bishop of Christiansand, after holding various cures. In Jan. 1882 he resigned his diocese on account of failing health, and died on the following March 27. Moe has a special claim on critical attention in regard to his lyrical poems, of which a small collection appeared in 1850. He wrote little original verse, but in his slender volume are to be found many pieces of exquisite delicacy and freshness. Moe also published a delightful collection of prose stories for children, In the Well and *the Churn* (I Bronde og *i* Kjaernet), 1851; and *A* little Christmas Present (En *Liden Julegave*), 1860. Asbjornsen and Moe had the advantage of an admirable style in narrative prose. It was usually said that the vigour came from Asbjornsen and the charm from Moe, but the fact seems to be that from the long habit of writing in unison they had come to adopt almost precisely identical modes of literary expression.

ASBURY, FRANCIS (1745–1816), the second bishop of the Methodist Episcopal Church and the first consecrated in the United States, was born in Handsworth, Staffordshire, England, on Aug. 20, 1745. His parents gave him a good elementary schooling of about seven years while he was between the ages of six and thirteen. Apprenticed in his 14th year to learn the business of making "buckle chapes," he devoted his odd moments to the study of Methodist theology and sermonic literature. At 18 he was licensed as a local preacher. At 21 he was received into the Wesleyan Conference and four years later was sent as a missionary by 'Wesley to America. The Methodists in America in 1771 numbered a little less than 400, chiefly in the neighbourhood of New York and Philadelphia. In 1772 Asbury was appointed by Wesley "general assistant in America" but this assignment lasted only one year.

At the outbreak of the Revolutionary War Asbury cast in his lot with the Americans. His loyalty to America, however, was under so much suspicion that he was forced into hiding in Delaware for two years, 1778–79. But the discovery of a letter which he had written to England revealed such devotion to the Colonies that he was thereafter recognized as ardently American. In 1784 Wesley appointed him a superintendent of the Methodist work in America. Wesley's selection was confirmed by the meeting of all the Methodist preachers in conference. From the outset Asbury was known as bishop, though Wesley objected strenuously to this title. Asbury however, with his keener discernment of the realities 3,000 miles distant from England, saw that Methodism could succeed only by highly centralized organization, and accepted the title of bishop as indicating such centralization.

From 1784 until his death in 1816 Asbury threw all his energy

into the Methodist work. At the time of his death the Methodist Episcopal Church in the United States numbered about 214,000 members with 2,000 ministers. Asbury travelled on horseback between 5,000 and 6,000 miles every year during the term of his bishopric. His duties made it imperative for him to supervise all the conferences between Maine and southern Georgia, and between the Atlantic coast and the settlements in Kentucky. It was said of him that he had been seen by more people in America than had any other person up to the time of his death. Though he insisted upon keeping supervisional power almost wholly in his own hands, he won and kept the regard of the Methodist ministers and laymen to a greater degree than any other leader in the history of the Church. Throughout his life he suffered from a stubborn disease of the throat which added greatly to the discomforts of his task, but he never relaxed in a Spartan self-control, which makes the story of his life an almost incredible narrative of triumph over hardship. After coming to America he learned to read the Scriptures in the original Hebrew and Greek. At his death he left a *Journal* which has proved an indispensable source-book for American social history for the first 40 years of the independence of the new nation. The style of Asbury's writing was simple and direct, with a tendency to over-seriousness, and yet with shrewd insight into the central issues in the successive ecclesiastical crises which he faced. He died in Spottsylvania, Va., March 31, 1816.

In addition to his *Journal see* W. P. Strickland, *The Pioneer Bishop; or, The Life and Times of Francis Asbury* (1858); Simpson's *Cyclopaedia of Methodism* (Philadelphia, 1878); Henry Mellard Du Bose, *Francis Asbury* (Nashville, Tenn., 1909); E. S. Tipple, *The Prophet of the Long Road* (1916); Henry King Carroll, *The Francis Asbury Centenary Volume* (Cincinnati, New York, 1916); Aaron W. Haines, "The Humor of Francis Asbury," *Methodist Review*, Ser. 5, vol. xxxvi., p. 776–779 (1920); Henry King Carroll, *Francis Asbury in the Making of American Methodism* (Cincinnati and New Yorli, 1923); and Herbert Asbury, *A Methodist Saint; the Life of Bishop Asbury* (1927). (*F.* J. McC.)

ASBURY PARK, a city of Monmouth county, N.J., U.S.A., on the Atlantic ocean, about 35m. S. of Kew York city (50m. by rail). It is served by the Central railroad of New Jersey, the Pennsylvania and the New York and Long Branch railways. The population in 1920 was 12,400, and in 1940 it was 14,617. It is a popular seaside resort, with 42 hotels in 1927, and numerous boarding-houses and private cottages. Fresh-water lakes and an abundance of green vegetation add to its attractions. Even in the winter months there is a large transient population. The beach, bordered for a mile by a "board walk," is owned and controlled by the municipality. The city had 15 manufacturing establishments in 1937, which produced commodities valued at $1,668,256.

Asbury Park was founded in 1869, and named after the Rev. Francis Asbury. It was incorporated as a borough in 1874 and chartered as a city in 1897. In 1915 a commission form of government was adopted.

ASCANIUS or IULUS, in Roman legend, the son of Aeneas (*q.v.*) by Creusa or Lavinia, and ancestor of the gens Iulia. On the death of Aeneas, the government of Latium was left in the hands of Lavinia, Ascanius being too young to undertake it. After 30 years he left Lavinium, and founded Alba Longa.

See references under AENEAS.

ASCARIS, the generic name of certain round worms, which are parasitic on various animals. *A. lumbricoides* is found in the human intestine, the closely allied *A. suilla* in the pig and *A. megalocephala* in the horse. *Ascaris,* which belongs to the Nematoda (*q.v.*), has only two chromosomes (*q.v.*) in the fertilized egg, and is therefore often used in the study of cytology (*q.v.*).

ASCENSION, a small island in the South Atlantic, 700m. N.W. of St. Helena. Area, 34 sq. miles. The island lies within the influence of the south-east trades (8° south lat.). The lee side is subject to "rollers," which break on the shore with great violence. The island is of volcanic origin. Green mountain, a huge elliptical crater, is 2,820ft. above the sea, while the surrounding tablelands vary from 1,200 to 2,000 feet. Steepravines, linedwithmasses of lava and ending in small bays, are typical. Ascension was originally bare, save for the summit of Green mountain, but the lower hills have been planted with grasses and shrubs. The climate is remarkably healthy. The average rainfall is about 20in., March and April being the rainy months. The island is the resort of the sea turtle, who come in thousands to lay their eggs on the shores between Jan. and May. The turtles are caught and kept in large ponds. The coasts abound with a variety of fish of excellent quality. Like St. Helena, the island does not possess any indigenous vertebrate land fauna. Rabbits, wild goats and partridges are fairly common. The "wideawake" birds (sooty tern) frequent the island in vast numbers to lay their eggs. The flora includes purslane, rock roses, ferns and mosses.

The island was discovered by the Portuguese João da Nova, on Ascension Day, 1501. In 1701 William Dampier was wrecked on its coast. It remained uninhabited till after the arrival of Napoleon at St. Helena (1815), when it was garrisoned by the British government. A settlement named George Town (locally known as Garrison) was made on the north-west coast, water being obtained from "Dampier's springs" in the Green mountain, 6m. distant. The island was under the rule of the Admiralty till 1922, when it was transferred to the administration of the Colonial Office and annexed to St. Helena. There are cable connections with Europe and Africa, and the island is in the postal union. The population (1931), 188, consists of seamen, marines, and Krumen from Liberia. Phosphates and guano are collected, and about 10ac. under cultivation produce vegetables and fruit. It was at Ascension that Mr. (aftenwards Sir) David Gill determined, in 1877, the solar parallax.

See C. Darwin, *Geological Observations on the Volcanic Islands visited during the Voyage of H.M.S. "Beagle"* (1844); *Report of the Scientific Results of the Voyage of the "Challenger"* vol. i. part 2 (1885); *Africa Pilot,* part ii. 5th ed. (1901).

ASCENSION, FEAST OF THE, known also as Holy Thursday in the Anglican Church, the 40th day after Easter, commemorating Christ's ascension to heaven; one of the oecumenical festivals of the Christian Church, ranking with Christmas, Easter and Pentecost. St. Augustine (*Ep.* 54 *ad Januar.*) mentions it as having been kept from time immemorial and as probably instituted by the apostles. Chrysostom mentions its celebration in a church outside Antioch, and Socrates (*Hist. eccles.* vii. 26) records that in the year 390 the people of Constantinople "of old custom" (ἐξ ἔθους) celebrated the feast in a suburb of the city. Adamnan, abbot of Iona, describes a pilgrimage at Jerusalem in the 7th century, when the feast was celebrated on Mount Olivet *(de loc. sanct.* i. 22). The *Peregrinatio* of Etheria (Silvia), *c.* A.D. 385, says that the festival was held in the Church of the Nativity at Bethlehem (Duchesne, *Chr. Worship,* p. 515). In the West, in the middle ages, a procession with candles and banners outside the church symbolized Christ's triumphant entry into heaven. In the East the festival is known as ἀνάληψις, "taking up," or ἐπισωζομένη, "salvation."

In the Roman Catholic Church the most characteristic ritual feature of the festival is now the extinction of the paschal candle after the Gospel at High Mass. Other customs, *e.g.,* the blessing of the new beans (Duchesne, p. 183) were formerly associated with the liturgy of this feast. In some churches an image of Christ was raised from the altar through a hole in the roof, through which a burning straw figure representing Satan was immediately thrown down.

In the Anglican Church Ascension Day and its octave continue to be observed as a great festival, with a special preface in the communion service. The Lutheran churches also retain the Feast.

See Herzog-Hauck, *Realencyklopadie* (1900), s. *"Himmelfahrtsfest"; L.* Duchesne, *Christian Worshzp* (2nd Eng. ed., London, 1904); *The Catholic Encyclopaedia* (London and New York, 1907).

ASCETICISM, the theory and practice of bodily abstinence and self-mortification, generally religious. The word is derived from a Greek word (ἀσκέω) meaning "to practice," or "to train," and it embodies a metaphor taken from the ancient wrestling-place, where victory rewarded those who had best trained their bodies. The ultimate origin of asceticism is the antithesis between sacred (or holy) and profane, from which comes the idea that he who belongs to the former sphere, or seeks to enter it, must refrain as much as possible from, or even destroy, all that belongs

to the latter. This is originally a non-moral idea *(see* CONSECRATION; *TABU)*. It is the note of every great religious reformer, Moses, Buddha, Paul, Mani, Mohammed, St. Francis, Luther, to enlighten and direct it to higher aims, substituting a true personal holiness for a ritual purity or *tabu,* which at the best was viewed as a kind of physical condition and contagion, inherent as well in things and animals as in man.

It is useful, therefore, to begin with the facts as they can be observed among less advanced races, or as survivals among people who have reached the level of genuine moral reflection; and then to proceed to a consideration of self-denial consciously pursued as a method of ethical perfection. The latter is, as a rule, less cruel and rigorous than primitive forms of asceticism. Under this head fall the following:—Fasting, or abstention from certain meats and drinks; denial of sexual instinct; subjection of the body to physical discomforts, such as nakedness, vigils, sleeping on the bare ground, etc., vows of silence; avoidance of baths, of hair-cutting and of clean raiment, living in a cave; actual self-infliction of pain, by numerous, often ingenious, modes of torture. Such customs repose on various early ideas: for example, the self-mutilation of the Galli or priests of Cybele (*q.v.*) was probably a magical ceremony intended to fertilize the soil and stimulate the crops.

Fasting (*q.v.*) is used in primitive asceticism for a variety of reasons, among which the following deserve notice. Certain animals and vegetables are *tabu; i.e.,* too holy, or (what among Semites and others was the same thing) too defiling and unclean, to be eaten. Thus most or all of the creatures which are unclean in the Jewish law are holy (possibly in origin totemic) animals among many Semites. Such abstinences are ascetic in so far as they involve much self-denial. Examples are the ritual prohibitions of pork and beef. Similar prohibitions are common in primitive groups. That such dietary restrictions were merely ceremonial and superstitious, and not intended to prevent the consumption of meats which would revolt modern tastes, is certain from the fact that the Levitical law freely allowed the eating of locusts, grasshoppers, crickets and cockroaches, while forbidding the consumption of rabbits, hares, storks, swine, etc. The Pythagoreans were forbidden to eat beans.

Another widespread reason for avoiding flesh diet altogether was the fear of absorbing the soul of the animal, which especially resided in the blood. Hence the rule not to eat meats strangled, except in sacramental meals when the god inherent in the animal was partaken of. It is equally a soul or spirit in wine which inspires the intoxicated. The mediaeval Jews held that there is a cardiac demon in wine which takes possession of drunken men; and the Mohammedan prohibition of wine-drinking is based on a similar superstition. Belief in transmigration of souls often arouses a scruple against flesh diet. Examples of both ways of thinking will be found in Porphyry (*q.v.*) *De Abstinentia* (neo-Pythagorean).

The same fear of imbibing the soul of animals, and thereby reenforcing the lower appetites and instinct of the human being, inspired the vegetarianism of the Jewish Therapeutae. An early belief long survived among the Manichaean sects that fish, being born in and of the waters, and without any sexual connection on the part of other fishes are free from the taint which pollutes all animals *quae copulatione generantur.* Fish, therefore, unlike flesh, could be safely eaten.

The Manichaeans held that in every act of begetting, human or otherwise, a soul is condemned afresh to a cycle of misery by imprisonment in flesh—a thoroughly Indian notion, under the influence of which their perfect or elect ones scrupulously abstained from flesh. The prohibition of taking life, which they took over from the Farther East, in itself entailed fasting from flesh. A fully initiated Manichaean would not even cut his own salad, but employed a catechumen to commit on his behalf this act of murder, for which he subsequently shrived him.

We come to a third widespread reason for fasting, common among savages. Famished persons are liable to morbid excitement and fall into imaginative ecstasies. Among the North American Indians ecstatic fasting is regularly practised. All over the world fasting is a recognized mode of evoking, consulting, and also of overcoming the spirit world. This is why many primitive races distrust a medicine man who is not an ascetic and lean with fasting. In the Semitic East it is an old belief that a successful fast in the wilderness of *40* days and nights gives power over the Djinns. From the first, fasting was practised in the church for similar reason. In the *Shepherd of Hermas* a vision of the church rewards frequent fasts and prayer; not a few saints were rewarded for their fasting by glimpses of the beatific vision.

Among the Semites and Tartars worshippers lacerate themselves before the god. So in I. Kings xviii. 28, the priests of Baal engaged in a rain-making ceremony, gashed themselves with knives and lances till the blood gushed out upon them. The Syriac word *ethkashshaph,* which means literally to "cut one-self," is the regular equivalent of to "make supplication." At first sight these rites seem intended to call down the pity of heaven on man, but as Robertson Smith points out, their real import was by shedding blood on a holy stone or in a holy place to tie or renew a blood-bond between the god and his faithful ones. But such practices may develop into penances like those of the Flagellants (*q.v.*) of *1259* and 1349.

Asceticism then, in its origin, was usually not ascetic in a modern sense; that is, not ethical. It was rather of the nature of the savage *tabu* (*q.v.*). Above all, fasting was a mode of preparing oneself for the sacramental eating of a sacred animal, and as such often assisted by use of purgatives and aperients. Indian and Buddhist asceticism, in its essence is a more ethical and philosophical product than some of the forms so far considered. The keynote is deliverance from life and its inevitable suffering. The hermit, or wandering beggar, was a familiar figure in India. Such ascetics were common, and their life was and is recommended for those who have lived the life of a householder and, having begotten sons according to the sacred law and offered sacrifices, desire in their old age to abandon worldly objects and direct their mind to final liberation. Very similar is the self-portrait of a Manichaean adept of about A.D. *400* as given in St. Augustine *(Contra Faustum* v., i.).

The Greek Cynics *(see* **CYNICS)** played a great part in the history of asceticism, and they were the precursors of the Christian hermits. In striving to imitate their master Socrates, they went to such extremes as rather to caricature him. They affected to live like beggars, bearing staff and wallet, owning nothing, renouncing pleasures, riches, honours. For Plato and Aristotle the perfect life was that of the citizen and householder; but the Cynics were individualists, citizens of the world without loyalty or respect for the ancient city State, the decay of which was coincident with their rise. Their zeal for renunciation often extended not to pleasures, marriage and property alone, but to cleanliness, knowledge and good manners as well, and in this respect also they were the forerunners of later monks.

Philo *(20* B.C.–A.D. *40)* has left us many pictures of the life which to his mind impersonated the highest wisdom, and they are all inspired by the more respectable sort of cynicism, which had taken deep root among Greek Jews of the day. His own favourite ascetics, the Therapeutae, whose chief centre was in Egypt, had renounced property and all its temptations, and fled, irrevocably abandoning brothers, children, wives, parents, throngs of kinsmen, intimacy of friends, the fatherlands where they were born and bred *(see* THERAPEUTAE). Here we have the ideal of early Christian renunciation at work, but apart from the influence of Jesus. In the pages of Epictetus the same ideal is constantly held up to us.

In the Christian Church there was from the earliest age a leaning to excessive asceticism, and it needed a severe struggle on the part of Paul, and of the Catholic teachers who followed him, to secure for the baptized the right to be married, to own property, to engage in war and commerce, or to assume public office. One and all of the permanent institutions of society were condemned by the early enthusiasts, especially by those who looked forward to a speedy advent of the millennium, as alien to the Kingdom of God and as impediments to the life of grace.

Marriage and property had already been eschewed in the Jewish Essene (*see* ESSENES) and Therapeutic sects, and in Christianity the name of Encratite was given to those who repudiated marriage and the use of wine. They did not form a sect, but represented an impulse felt everywhere. In early and popular apocryphal histories the apostles are represented as insisting that their converts should either not contract wedlock or should dissolve the tie if already formed. This is the plot of the *Acts of Thecla,* a story which probably goes back to the 1st century. Repudiation of the tie by fervent women, betrothed or already wives, occasioned much domestic friction and popular persecution. In the Syriac churches, even as late as the 4th century, the married state seems to have been regarded as incompatible with the perfection of the initiated. Renunciation of the state of wedlock was imposed on the faithful during the lengthy, often lifelong, terms of penance imposed upon them for sins committed; and later, as monasticism took the place, in a church become worldly, partly of the primitive baptism and partly of that rigorous penance which was the rebaptism and medicine of the lapsed, celibacy and virginity were held essential thereto.

Together with the rage for virginity went the institution of *virgines subintroductae,* or of spiritual wives; for it was often assumed that the grace of baptism restored the original purity of life led by Adam and Eve in common before the Fall. Such rigours are encouraged in the *Shepherd of Hermas,* a book which emanated from Rome and up to the 4th century was read in church. They were common in the African churches, and in Antioch in 260; in the Celtic church of St. Patrick, and, as late as the 7th century, among the Celtic elders of the north of France. In the Syriac Church as late as 340 such relations prevailed between the "Sons and Daughters of the Resurrection." It continued among the Albigenses and other dissident sects of the middle ages, among whom it served a double purpose; for their elders were thus not only able to prove their own chastity, but to elude the inquisitors, who were less inclined to suspect a man of the catharism which regarded marriage as the "greater adultery" (*maius adulterium)* if they found him cohabiting (in appearance at least) with a woman. There was hardly an early council, great or small, that did not condemn this custom. In the Catholic Church, however, common sense prevailed, and those who desired to follow the Encratite ideal repaired to the monasteries.

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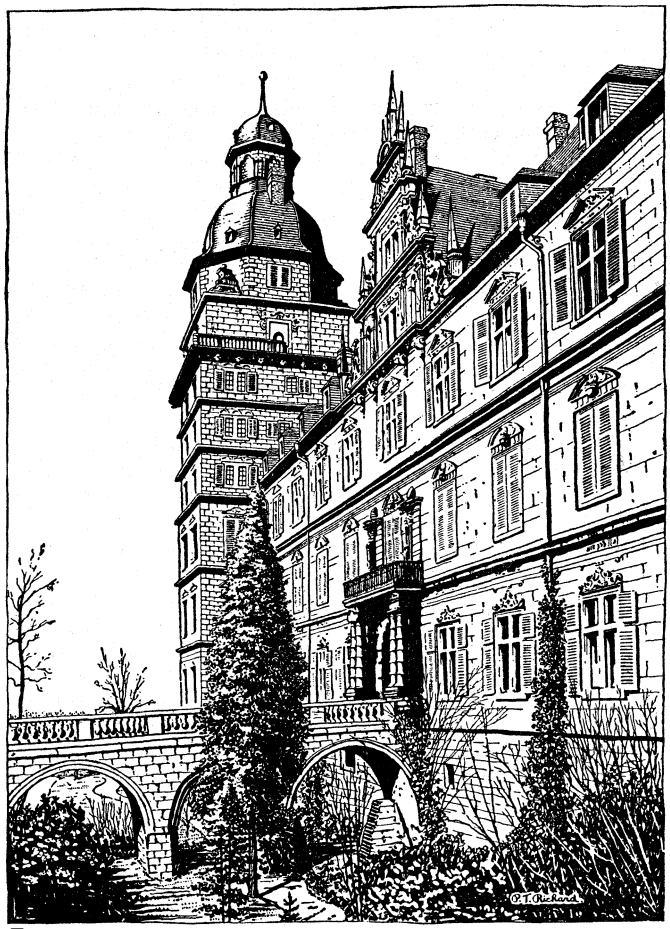
ASCHAFFENBURG, Bavaria, Germany, on right bank of the Main, near the foot of the Spessart, 26 mi. S.E. of Frankfurt. Pop. (1939) 45,370. Called in the middle ages Aschafaburg (or Askenburg), it was originally a Roman settlement. On the site of the *castrum* the Frankish mayors of the palace built a castle. Bonifacius erected a chapel and founded a Benedictine monastery. A stone bridge over the Main was built by Archbishop Willigis in 989. In 1292 a synod was held here, and in 1474 an imperial diet, preliminary to that of Vienna, in which the *Aschaffenburg Concordat* was decided. The town suffered greatly during the Thirty Years' War. In 1866 the Prussians defeated the Austrians in the neighbourhood.

The principality of Aschaffenburg formed part of the electorate of Mainz in the middle ages. In 1806 it was annexed to the grand-duchy of Frankfurt; and in 1814 was transferred to Bavaria. Its chief buildings are the Johannisburg, which has some of the earliest examples of printed books, the *Stiftskirche,* or cathedral, founded in 980 by Otto of Bavaria, but mainly 12th and 13th centuries, with various monuments by the Vischers; a theatre, formerly the house of the Teutonic order; and several old mansions. The town has been remarkable for its educational establishments since the 10th century. There is an archaeological museum in the old abbey buildings. Coloured and white paper, ready-made clothing, cellulose, leather, beer and spirits, electrical



THE CASTLE AT ASCHAFFENBURG. ONCE THE RESIDENCE OF BAVARIAN NOBLES, NOW USED AS AN ART MUSEUM

apparatus and machinery, wax, chemicals and liqueurs are the chief manufactures, and there are smithies and brickworks and an important harbour on the Main.

ASCHAM, ROGER (c. 1515–1568), English scholar and writer, was born at Kirby Wiske, a village in the North Riding of Yorkshire, near Northallerton, and was educated in the house of Sir Humphrey Wingfield, who became speaker of the House of Commons in 1533. Sir Humphrey "ever loved and used to have many children brought up in his house," where they were under a tutor named R. Bond. Their sport was archery, and Sir Humphrey "himself would at term times bring down from London both bows and shafts and go with them himself to the field and see them shoot." Hence Ascham's earliest English work, the *Toxophilus,* the importance which he attributed to archery in educational establishments, and probably the provision for archery in the statutes of St. Albans, Harrow and other Elizabethan schools.

From this private tuition Ascham was sent "about 1530," at the age, it is said, of 15, to St. John's College, Cambridge, then the largest and most learned college in either university. He remained there for some time after taking his degree, and became the first regius professor of Greek in 1540. He was also letter-writer to the university, and became public orator in 1546. In 1542–43 he wrote *Toxophilus,* which he presented to Henry VIII. at Greenwich soon after his triumphant return from the capture of Boulogne. He was rewarded by the grant of a pension of £10 a year, equal to some £200 of our money. A novelty of the book was that the author had "written this Englishe matter in the Englishe tongue for Englishe men," though he thought it neces-

sary to defend himself by the argument that what "the best of the realm think it honest to use" he "ought not to suppose it vile for him to write," It is a Platonic dialogue between Toxophilus and Philologus, and its chief interest for us lies in its incidental remarks. It may probably claim to have been the model for Izaak Walton's *Compleat Angler*.

Shortly after the beginning of the reign of Edward VI., Ascham made public profession of Protestant opinions in a disputation on the doctrine of the Mass, begun in his own college and then removed for greater publicity to the public schools of the university, where it was stopped by the vice-chancellor. Thereon Ascham wrote a letter of complaint to Sir William Cecil. This stood him in good stead. In Jan. 1548, Grindal, the Princess Elizabeth's tutor, died. Through Cecil and at the princess's own wish, Ascham was selected as her tutor against another candidate pressed by Admiral Seymour and Queen Katherine. He taught Elizabeth—then 16 years old—for two years, chiefly at Cheshunt. In 1550 Ascham quarreled with Elizabeth's steward and returned to Cambridge, when Sir John Cheke procured him the secretaryship to Sir Richard Morrison (Moryson), appointed ambassador to Charles V. It was on his way to join Morrison that he paid his celebrated morning call on Lady Jane Grey at Bradgate, where he found her reading Plato's *Phaedo*, while every one else was out hunting.

The embassy went to Louvain and then to Innsbruck and Venice. Ascham read Greek with the ambassador four or five days a week. His letters during the embassy, which was recalled on Mary's accession, were published in English in 1553, as a "Report" on Germany. Through Bishop Gardiner he was appointed Latin secretary to Queen Mary with a pension of £20 a year. His Protestantism he must have quietly sunk, though he told Sturm that "some endeavoured to hinder the flow of Gardiner's benevolence on account of his religion." In 1555 he resumed his studies with Princess Elizabeth, and soon after Elizabeth's accession, on Oct. 5, 1559, he was given, though a layman, the canonry and prebend of Wetwang in York minster.

In 1563 he began the work which has made him famous, *The Scholemaster*. The occasion of it was, he tells us (though he is perhaps merely imitating Boccaccio), that during the "great plague" at London in 1563 the court was at Windsor, and there on Dec. 10 he was dining with Sir William Cecil, secretary of state, and other ministers. Cecil said he had "strange news; that divers scholars of Eaton be run away from the schole for fear of beating"; and expressed his wish that "more discretion was used by school-masters in correction than commonly is." A debate took place, the party being pretty evenly divided between floggers and anti-floggers, with Ascham as the champion of the latter. Afterwards Sir Richard Sackville, the treasurer, came up to Ascham and told him that "a fond schoolmaster" had, by his brutality, made him hate learning, much to his loss, and as he had now a young son, whom he wished to be learned, he offered, if Ascham would name a tutor, to pay for the education of their respective sons under Ascham's orders, and invited Ascham to write a treatise on "the right order of teaching." *The Scholemaster* was the result. It is not a general treatise on educational method, but "a plaine and perfite way of teachyng children to understand, write and speake in Latin tong"; and it was not intended for schools, but "specially prepared for the private brynging up of youth in gentlemen and noblemens houses." The perfect way simply consisted in "the double translation of a model book"; the book recommended by this professional letter-writer being "Sturmius' *Select Letters of Cicero.*"

As a method of learning a language by a single pupil, this system (which seems to have been taken from Cicero himself) might be useful; as a method of education in school nothing more deadening could be conceived. Nor was the famous plea for the substitution of gentleness and persuasion for coercion and flogging in schools, which has been one of the main attractions of the book, novel. But Ascham's was the first definite demonstration in favour of humanity written in the vulgar tongue and in an easy style by a well-known "educationist." What largely contributed to its fame was its picture of Lady Jane Grey, whose love of learning was due to her finding her tutor a refuge from pinching, ear-boxing and bullying parents; some exceedingly good criticisms of various authors, and a spirited defence of English as a vehicle of thought and literature, of which it was itself an excellent example. The book was not published till after Ascham's death, which took place Dec. 23, 1568, owing to a chill caught by sitting up all night to finish a New Year's poem to the queen.

BIBLIOGRAPHY.—Ascham's letters were collected and published in 1576, and went through several editions; they were re-edited by William Elstob in 1703. His English works were edited by James Bennett with a life by Dr. Johnson in 1771, reprinted in 1815. Dr. Giles in 1864–65 published select letters with the *Toxophilus* and *Scholemaster* and the life by Edward Grant. Prof. Edward Arber edited *The Scholemaster* in 1870, and republished the *Toxophilus* in 1902.

ASCHERSLEBEN, a town in Prussian Saxony, Germany, 36 mi. N.W. of Halle. Pop. (1939) 31,607. The town was probably founded in the 11th century by Count Esico of Ballenstedt, ancestor of the house of Anhalt. On the death of Otto III. (1315) it passed to the bishop of Halberstadt, and, after 1648, to Brandenburg. The manufacture of woollen wares, long famed, is carried on; also industries of vinegar, paraffin, potash and beet sugar. There are also iron, zinc and chemical manufactures, and agricultural seeds are grown. Its aerodrome was bombed by the British on Sept. 29, 1940.

ASCIANO, a town in Tuscany, Italy, 19 mi. S.E. of Siena by rail. Pop. (1936) 2,075 (town), 9,268 (commune). Surrounded by walls built by the Sienese in 1351, it has some 14th century churches with paintings of the period. Remains of Roman baths, with a fine mosaic pavement, have been found in the town. Six miles south is the large Benedictine monastery of Monte Oliveto Maggiore (1320), famous for frescoes by Luca Signorelli (1497–98) and Antonio Bazzi, called Sodoma (1505), in the cloister, illustrating scenes from the legend of St. Benedict; Sodoma is perhaps nowhere better represented. The church contains fine inlaid choir stalls by Fra Giovanni da Verona.

ASCITES, the term in medicine applied to an effusion of non-inflammatory fluid within the peritoneum. It is not a disease in itself, but is one of the manifestations of disease elsewhere—usually in the kidneys, heart, or in connection with the liver (portal obstruction). Portal obstruction is the commonest cause of well-marked ascites. It is produced by (1) diseases within the liver, as cirrhosis (usually alcoholic) and cancer; (2) diseases outside the liver, as cancer of stomach, duodenum or pancreas, causing pressure on the portal vein, or enlarged glands in the fissure of the liver producing the same effect. Ascites is one of the late symptoms in the disease, and precedes dropsy of the leg, which may come on later, due to pressure on the large veins in the abdominal cavity by the ascitic fluid. In ascites due to heart disease the dropsy of the feet and legs precedes the ascites, and there will be a history of palpitation, shortness of breath, and perhaps cough. In the ascites of kidney troubles there will be a history of general oedema—puffiness of face and eyes on rising in the morning probably having attracted the attention of the patient or his friends. Other causes are chronic peritonitis, either tuberculous in the young, or due to cancer in the aged and more rarely still pernicious anaemia.

ASCLEPIADACEAE, the milkweed (*q.v.*) family, a distinctly marked group of dicotyledonous plants comprised chiefly of shrubs and woody vines, though many are perennial herbs, mostly with a milky juice. Like the Apocynaceae (*q.v.*), to which they are closely related, most of the species, about 1,700 in number and divided into some 320 genera, are tropical. The continent of Africa is the headquarters of the family. The flowers are regular, sympetalous and usually arranged in umbels, though sometimes in cymes or racemes; the fruit from each flower consists of a pair of more or less fleshy pods containing numerous seeds which are usually appendaged with a long tuft of hairs. The pollen is coherent in masses in the anther cells, forming pollinia, an adaptation, found also in the Orchidaceae, for insect pollination. The Asclepiadaceae ranks among the most unusual of plant families. Many are rope-like lianas of equatorial forests. Others are epiphytes with greatly modified leaves, which, in some species, take the form of pitchers for holding water. Cer-

tain South African species are fleshy. cactus-like plants. Still others form a cluster of leafless, whip-like stems. In some species the stems develop tuberous bases in which water is stored.

Although the family contains no economic plants of the first rank, numerous species are useful. Many are of value medicinally; the milky juice of the so-called cow-plant (*Gymnena lactiferum*), of Ceylon, is edible as is that of its South African counterpart (*Oxystelma esculentum*), and the tender shoots of various species are eaten as salads and pot herbs. Others are dye-plants, as, for example, Marsdenia tinctoria; various species produce caoutchouc, and others yield bast fibres. The juice of Gonolobus is used for poisoning arrows, and that of Cynanchum for poisoning fish. A large number are cultivated as ornamental plants, among which are the mosquito plant (Cynanchum), the silk-vine (*Periploca* graeca), the carrion-flower (*Stapelia variegata*), and the fragrant wax-plant (Hoya carnosa) and stephanotis (*S. floribunda*). The madar or oschur (*Calotropis procera*), native to southwestern Asia, is believed to be the sodom apple of the Bible; the bark of the Indian madar (C. gigantea) yields a fibre and the seeds a floss.

Of some 80 representatives of the family native to the United States and Canada, the most common and conspicuous are the milkweeds (*Asclepias*). Among the best known of these are the butterfly-weed (*q.v.*) and the swamp milkweed (*A. incarnata*), both with showy, handsome flowers. The blood-flower (*A. curassavica*), native to tropical America, and frequently grown in greenhouses, has become naturalized in the southern United States.

ASCLEBIADES, of Samos, epigrammatist and lyric poet, friend of Theocritus, flourished about 270 B.C. He was the earliest and most important of the convivial and erotic epigrammatists. The majority of his compositions are love-songs. It is doubtful whether he is the author of all the epigrams (some 40 in number) which bear his name in the Greek anthology. He possibly gave his name to the Asclepiadean metre.

ASCLEPIADES, Greek physician, was born at Prusa in Bithynia in 124 B.C., and flourished at Rome at the end of the 2nd century B.C. He travelled much when young, and seems at first to have settled at Rome as a rhetorician. In that profession he did not succeed, but he acquired great reputation as a physician. He founded his medical practice on a modification of the atomic or corpuscular theory, according to which disease results from an irregular or inharmonious motion of the corpuscles of the body, His remedies were, therefore, directed to the restoration of harmony, and he trusted much to changes of diet, accompanied by friction, bathing, and exercise, though he also employed emetics and bleeding. He recommended the use of wine. His pupils were very numerous, and the school formed by them was called the Methodical. Asclepiades died at an advanced age.

ASCLEPIODOTUS, flourished in the 1st century B.C., the supposed author of a treatise on Graeco-Macedonian tactics (Τακτικὰ Κεφάλαια), which is probably the outline of the lectures of his master, Posidonius the Stoic.

ASCOLP, GRAZIADIO ISAIA (1829–1907), Italian philologist; of Jewish family, was born at Goerz. He founded the Archivio *glottologico* italiano in 1873, publishing in it his *Saggi Ladini,* and making it in succeeding years the great organ of original scholarship on this subject. He was universally recognized as the greatest authority on Italian linguistics.

ASCOLI PICENO[1] (anc. Asculum), episcopal see, Marches, Italy, capital of province of Ascoli Piceno, 17m. W. of Porto d'Ascoli (station on coast railway, 56m. S.S.E. of Ancona), and 53m. S. of Ancona direct, on south bank of Tronto (anc. Truentus) at its confluence with the Castellano, 500ft. above sea-level, and surrounded by mountains. Pop. (1936) town, 20,665; commune, 38,111. The Porta Romana is double-arched; adjacent are remains of ancient city walls, in rectangular blocks two feet high, and remains of still earlier fortifications. The church of S. Gregorio is built into a Roman tetrastyle Corinthian temple, two columns of which and the *cella* are still preserved; the site of the Roman theatre can be distinguished; and the church and convent of the Annunziata (two fine cloisters and fresco by Cola d'Amatrice in the refectory) stand on large Roman substructures of concrete. The mediaeval castle stands high and has a fine view of town and mountains. The picturesque colonnaded marketplace contains the fine Gothic church of S. Francesco and the original Palazzo del Comune, now the prefecture (Gothic with Renaissance additions). The cathedral is in origin Romanesque, much altered, and restored in 1888. The fortress of the Malatesta (1349) is destroyed save for a part now a prison. The Palazzo Comunale contains the picture gallery, with works by local masters; while in the Palazzo del Popolo there is a fine museum, with contents of prehistoric tombs, and a large collection of acorn-shaped lead missiles (glandes) used by slingers, belonging to the time of the siege of Asculum during the Social War (89 B.C.). The Ponte di Porta Cappucina is a very fine Roman bridge, with a single arch of 71ft. span. The Ponte di Cecco (so named from Cecco d'Ascoli), with two arches, is also Roman and belongs to the Via Salaria; the Ponte Maggiore and the Ponte Cartaro are, on the other hand, mediaeval. Near Ascoli is Castel Trosino, with an extensive 7th century Lombard necropolis. The ancient Asculum was the capital of Picenum in a strong position in difficult country. Taken in 268 B.C. by Rome, the Via Salaria was continued to it (120m. from Rome). It played a prominent part in the Social War against Rome, the proconsul Q. Servilius and all the Roman citizens within its walls being massacred by the inhabitants in 90 B.C. It was captured after a long siege by Pompeius Strabo in 89 B.C. The leader, Judacilius, committed suicide, the principal citizens were put to death, and the rest exiled. Caesar occupied it, after crossing the Rubicon. In A.D. 301 it became the capital of Picenum Suburbicarium. In 545 it was taken by Totila, but it is spoken of by Paulus Diaconus as the chief city of Picenum afterwards. Prince-bishops ruled it from Charlemagne's time and had coinage rights; it became a free republic in 1185 and a papal possession in the 15th century.

See C. Mariotti, Ascoli *Piceno* (Bergamo, 1913); and Saggi di *storia* ed arte Ascolana (Ascoli Piceno, 1932).

ASCONIUS PEDIANUS, QUINTUS (9 B.C.–A.D. 76; or A.D. 3–88), Roman grammarian and historian, was probably a native of Patavium (Padua). In his later years he resided at Rome. During the reigns of Claudius and Nero he compiled for his sons, from various sources—*e.g.,* "The Gazette" (*Acta Publica*), shorthand reports or "skeletons" (commentarii) of Cicero's unpublished speeches, Tiro's life of Cicero, speeches and letters of Cicero's contemporaries, various historical writers; *e.g.,* Varro, Atticus, Antias, Tuditanus, and Fenestella (a contemporary of Livy)—historical commentaries on Cicero's speeches, of which only five; viz., in *Pisonem,* pro *Scauro,* pro *Milone,* pro *Cornelio* and in toga *candida,* in a very mutilated condition, are preserved. These valuable notes, written in good Latin, relate chiefly to legal, historical and antiquarian matters. A commentary on Cicero's Verrine orations is universally regarded as spurious.

Both works were found by Poggio in a ms. at St. Gallen in 1416. This ms. is lost, but three transcripts were made by Poggio Zomini (Sozomenus) of Pistoia and Bartolommeo da Montepulciano. That of Poggio is now at Madrid (Matritensis x. 81) and that of Zomini is in the Forteguerri library at Pistoia (no. 37). A copy of Bartolommeo's transcript exists in Florence (Laur. liv. 5). The later mss. are derived from Poggio's copy. Other works attributed to Asconius were: a life of Sallust, a defence of Virgil against his detractors, and a treatise (perhaps a symposium in imitation of Plato) on health and long life.

Edition by Kiessling-Schoell (1875), and one by A. C. Clark (Oxford, 1906), which contains a previously unpublished collation of Poggio's transcript. See also Madvig, De Asconio Pediano (1828). C. Lichtenfeldt, De Q. Asconii Pediani fontibus *ac fide* (Dissert, Breslau, 1888); J. Humbert, Contribution *à l'étude* des *sources d'Asconius* (Paris, 1925).

ASCOS, a Greek vase of the drinking-vessel type, with a handle extending over the top and connecting with a large spout, giving it a tea-kettle appearance. (See **POTTERY** AND PORCELAIN: Greek Pottery.)

ASCOT, village of Berkshire, England, in the south-east of the county, famous for its race-meetings. The station on the Southern Railway, 29 m. from London, is called Ascot and Sunninghill. The race-course is on Ascot heath, in which parish the village of Ascot is included, and was laid out by order of Queen Anne in 1711. Pop. (1931) 2,617.

[1]The epithet distinguishes it from Ascoli Satriano (anc. Ausculum, see APPIA, VIA), which lies 19m. S. of Foggia by rail.

ASCUS, a botanical term for the membranous sacs containing the reproductive spores of fungi (*q.v.*) belonging to the group *Ascomycetes* (Gr. ἀσκός, a bag). Various compounds of the word are used, *e.g., ascogenous,* producing *asci; ascospore,* the spore developed in the ascus; *ascogonium,* the organ producing it, etc.

ASELLI, ASELLIUS or **ASELLIO, GASPARO** (1581–1626), Italian physician, was born at Cremona about 1581, became professor of anatomy and surgery at Pavia, and practiced at Milan where he died in 1626. To him is due the discovery of the lacteal vessels, published in De *Lactibus* (Milan, 1627).

ASEN or **ASSEN,** the name of the greatest mediaeval Bulgarian dynasty. Its real surname was apparently Belgun. The family is said to have been of Vlach origin; Nicetas states that a prisoner spoke to Asen in Vlach, "which was also his own language"; the Crusader chroniclers (*e.g.,* Villehardouin, *Conquête,* c. xliii., sect. 202) state that Kalojan was a Vlach, and refer to him as "king of the Vlachs and Bulgars," and Pope Innocent III., in his correspondence with Kalojan, refers to him as "descended from an ancient race of the city of Rome." The Asens also claimed descent from the old (Slavonic) dynasty of the Šišmanovtsi, of Western Bulgaria.

Two brothers, Peter and Ivan Asen Belgun, were in 1185 boyars of the twin rock-fortresses of Tsarevitsa and Trapesitsa at Trnovo, on the north edge of the Balkans. In that year, on their request for a more independent position being refused by Byzantium, they called together the neighbouring Vlachs and Bulgars, proclaimed independence from Greece, and gave the signal for a general rising. Defeated at first, they allied themselves with the Cumans and soon freed almost all North Bulgaria. In 1187 they concluded an armistice with the emperor Isaac Angelos, to whom they sent their younger brother, Kalojan, as hostage; but on Kalojan's escaping they renewed hostilities and defeated the emperor completely near Stara Zagora. About 1196 Ivan Asen died, and Peter was murdered by his own boyars shortly after. Kalojan was then proclaimed tsar of all the Bulgars and Vlachs. This very able but cruel king, also known as Joanitsa, and (scurrilously) as Skulojan or "Whelp-John," completed the conquest of North Bulgaria in 1201, and opened up negotiations with Pope Innocent III., in the hope of obtaining from him the title of emperor. The pope sent a cardinal to crown him, but only as king, in 1204; but in the remarkable correspondence between them he declared to Kalojan that he "extolled him above all other Christian rulers," and "loved him so much that he thought only of his interests and glory," while the Crusaders, who captured Constantinople in 1204, were very curtly ordered to make their peace with the pope's new friend. The Latin emperor Baldwin, however, when offered an alliance by Kalojan, ordered him to approach the Crusaders, as a slave approaches his master, to renounce the throne he had usurped and return to the status of a slave. The incensed Bulgarian, after defeating the Crusaders at Adrianople (1205), captured and perhaps murdered Baldwin (see BALDWIN I.). After ravaging Thrace with his Cumans for two years, Kalojan was murdered, while besieging Salonika, by the leader of his Cuman forces, perhaps at the instigation of his own wife, who was a Cuman.

The throne was now seized by his nephew Boril, who, however, proved unsuccessful and unpopular, and was dethroned and blinded in 1218 by his cousin Ivan Asen II., son of Ivan Asen I. Ivan Asen II. was one of the greatest of Balkan sovereigns. He was a brilliant soldier and his humanity and piety were admitted by the Greeks themselves. In 1230, by defeating Theodore, despot of Epirus, at Klokotnitsa, he added to his realms Macedonia, Epirus and much of Albania; and soon after he conquered most of Serbia. He now assumed the title of "tsar of the Greeks and Bulgars." but his ambition to wear the imperial crown in Constantinople was never fulfilled. He had been virtually protector of the weak Frank empire, and his daughter Helen had been betrothed to Baldwin II.; but the contract was dissolved by the pope, who excommunicated Asen. and his siege of Constantinople in 1225–26, in alliance with the emperor of Nicaea, was abandoned on account of an invasion of North Bulgaria by the Mongols. Ivan Asen II. died in 1241. An interesting inscription in the church of the Forty Martyrs at Trnovo, his capital, records his exploits. He was succeeded by his sons Caliman I. (1241–46) and Michael (1246–57), the latter under the regency of his mother, the Greek Irene. Their sister Tamara married the Byzantine emperor Michael Palaeologos. Caliman II. (1257–58) was a cousin of the above and the last of the male line of Asen. Mitsa, nephew of Caliman and Michael, seized the throne in 1262, but was expelled, fled to Constantinople, and was settled by the emperor on an estate near Troy. His son, Ivan III., married Irene, daughter of Michael Palaeologos, and was crowned at Trnovo in 1279, but, defeated by his rival, the swine-herd Ivailo, he fled from Bulgaria in 1280.

See under BULGARIA, CRUSADES, and ROMAN EMPIRE, LATER; also Du Cange, *Familiae* Dalmatirae, pp. 318–20; and Gesta Innocent *III.,* cc. 66–82, pp. 513–25, for the correspondence between Kalojan and the pope. (C. A. M.)

ASEPSIS: see ANTISEPTICS AND ASEPSIS.

ASGILL, JOHN (1659–1738), English writer, was born at Hanley Castle, Worcestershire, the author of a tract (1700) to prove that Christians need not die. He made a considerable fortune in legal practice in Ireland, and was returned to the Irish Parliament. for Enniscorthy (1703), and the English Parliament for Bramber (1705–07), but was expelled from both because the burning of his "blasphemous pamphlet" had been ordered. In 1707 he was arrested for debt, and the remainder of his life was spent in the Fleet Prison, or within the rules of the King's Bench. He died in 1738. Asgill also wrote in 1714–15 pamphlets defending the Hanoverian succession against the claims of the Pretender.

ASH, the common name of a number of trees from several unrelated genera. The European ash (Fraxinus excelsior), belongs to the olive family (Oleaceae), a group of trees and shrubs which include also lilac, fringetree, privet, jasmine, goldenbell, and olive. The Hebrew word *Oren,* translated "ash" in Isaiah xliv. 14, cannot refer to an ash, as none is native to Palestine, but probably refers to the Aleppo pine (*Pinus* halepensis). This ash is a native of Great Britain and most of Europe and also extends to certain parts of Asia. It attains a height of from 50 to 80 ft. and flowers in March and April before leaf emergence. The inconspicuous, reddish, naked (*i.e.,* without sepals and petals) flowers are produced in dense clusters. They are usually imperfect, wanting either stamens or pistil. The large leaves, which are late in their appearance, are pinnately compound and bear four to seven pairs of gracefully tapered, toothed leaflets borne on a slender stalk (rachis). The dry, terminally winged, paddle-like fruit (samaras), the so-called keys, are a pertinent feature and remain attached to the branchlets long after the leaves have fallen in the autumn. The grayish twigs and few-scaled, black buds are conspicuous features of the tree during the winter months.

Several varieties of the European ash are recognized. One with simple leaves (var. *heterophylla*) occurs naturally in the forests of England and continental Europe. Another (var. *pendula*), with pendulous or weeping branches, is occasionally encountered, a form which has been propagated from a single sport found at Wimpole in Cambridgeshire. This variety is sometimes grafted on a tall stem of the common species to produce a tree of unusual ornamental effect. Two other types, one with curled leaflets (var. *crispa*), the other with warty stems and branches (var. *verrucosa*) are also recognized.

The flowering ash or manna, Fraxinus *ornus* (see MANNA), is a handsome tree with greenish-white flowers indigenous to southern Europe. Two other species, the small-leaved ash (F. *parvifolia*), also native to southern Europe, and the Himalayan ash (F. *floribunda*), a large tree with terminal panicles of white flowers, are both suitable for decorative purposes.

The center of distribution of the ashes appears to be in North America, where there are about 20 endemic species. Several are valuable timber trees. the most important of which are the white ash (F. *americana*), the black ash (F. *nigra*), the red ash (F. *pennsylvanica*), the green ash (*F. pennsylvanica* var. *lanceolata*), of the central, eastern and southern United States, and the Oregon ash (F. *oregona*), of the Pacific northwest. Other noteworthy American ashes include the blue ash (*F. quadrangulata*) of the Ohio and central Mississippi valleys; the Carolina ash (F. *caroliniana*), of the southeastern Atlantic coastal plain; the Florida ash (F. *paucifolia*), of southern Georgia and Florida; the pumpkin ash (F. profunda) of the southern states; and the velvet (*F. velutina*) and single-leaf (*F.*

anomala) ashes of the arid southwest. Especially interesting is the foot-hill ash (F. dipetala), a small shrub with showy white flowers, scattered along the lower slopes of California's mountains. The American flowering ash (F. cuspidata), featuring large, white, fragrant blossoms, is a small tree of Texas and New Mexico. The American ashes range in size from small shrubs to large graceful trees; the white ash, one of the finest American hardwoods, attains in the lower Ohio valley a height of 120 ft. and a diameter of 40 to 60 in.

The production of ash lumber, like most hardwoods in the U.S.A., declined after the first decade of the 20th century. In 1940 the cut of ash was estimated to be 129,183,000 ft. B.M. Of this amount, 88,238,000 ft. were cut into lumber, 376,000 ft. made into veneer, and 40,569,000 ft. of logs and bolts were used for specialty products.

The European and American mountain ashes are *Sorbus* aucuparia and S. *americana,* respectively; these belong to the rose family (Rosaceae), which includes also the apples, pears, hawthorns, and many other beautiful flowering shrubs. Poison sumac (Rhus *vernix*), a member of the cashew family (Anacardiaceae), is the poison ash of many localities. The bitter ash of the West Indies is Simaruba *excelsa,* a member of the quassia family, while the cape ash, a native of the Cape of Good Hope, is Ekebergia capensis, of the mahogany family (Meliaceae). A small armed shrub of eastern United States, the prickly ash (Zanthoxylon americanum) belongs to the rue family (Rutaceae), famous for its citrus fruits. Two Australian genera, *Flindersia* and Tarrietia are productive of silver ash and crow's ash timbers respectively. The former is also a memher of the Rutaceae while the latter is included in the cocoa family (Sterculiaceae).

(E. S. HR.)

A'SHA (MAIMUN IBN QAIS), Arabian poet, was born before Mohammed, and lived long enough to accept the mission of the prophet. He was born in Manfūha, a village of al-Yemāma in the centre of Arabia, and became a wandering singer, passing through all Arabia from Hadramut in the south to al-Hira in the north. Even before the time of Mohammed he is said to have believed in the resurrection and last judgment, and to have been a monotheist. These beliefs may have been due to his intercourse with the bishop of Nejrān (Najrān) and the 'Ibādites (Christians) of al-Hira. His best-known poem is that in praise of Mohammed.

His poems have been collected from various sources in L. Cheikho's Les *Poètes* arabes *chrétiens* (Beirut, 1890), pp. 357–399. His eulogy of Mohammed has been edited by H. Thorbecke, *Al Aša's* Lobgedicht *auf* Muhammad (Leipzig, 1875).

ASHANTI, an inland country of West Africa, annexed by Great Britain in 1901. It lies immediately north of the Gold Coast colony, and while preserving a separate entity is administered by a chief commissioner under the authority of the governor of the Gold Coast. Area 24,379sq m.; pop. (1931 census) 578,702.

Physical Features, **Etc.**—A great part ot Ashanti is covered with primaeval and almost impenetrable forest. Many of the trees, chiefly silk-cotton and hardwood, attain splendid proportions, the bombax reaching a height of over 200ft., but the monotony is oppressive, and is seldom relieved by the sight of flowers, birds or beasts. Ferns are abundant, and the mimosa rises to heights of from 30 to 60ft. All over the forest spread lianas, or monkey-ropes, their usual position being that of immense festoons hanging from tree to tree. In the north-eastern districts the primaeval forest gives place to park-like country, consisting of plains covered with high coarse grass, and dotted with occasional baobabs, as well as with wild plum, shea-butter, dwarf date, fan palms and other small trees. About 25m. south-east of Kumasi is Lake Busumchwi, the sacred lake of the Ashanti. It is surrounded by forest-clad hills some 800ft. high, is nearly circular, and has a maximum diameter of 6m. The Black Volta, and lower down the Volta (*q.v.*), form the northern and eastern frontier, and various tributaries of the Voita, running generally in a northerly direction, traverse the eastern portion of the country. In the central parts are the upper courses of the Ofin and of some tributaries of the Prah.

Inhabitants.— The most probable tradition represents the Ashanti as deriving their origin from bands of fugitives, who in the 16th or 17th century were driven before the Muslim tribes migrating southward from the countries on the Niger and Senegal. Having obtained possession of a region of dense forest, they defended themselves with a valour which, becoming part of their national character, raised them to the rank of a powerful and conquering nation. They are of the pure negro type, and are supposed to be originally of the same race as the Fanti, nearer the coast, and speak the same language. The Ashanti are divided into a large number of tribes, of whom a dozen may be distinguished, viz., the Bekwai, Adansi, Juabin, Kokofu, Kumasi, Mampon, Nsuta, Nkwanta, Dadiassi, Daniassi, Ofinsu and Adjisu. Each tribe had its own king, but from the beginning of the 18th century the king of Kumasi was recognized as paramount and was spoken of as the king of Ashanti. Under British rule the kingship has been abolished, but each tribe has its paramount chief styled Omanhene. The principal symbols of authority are the stool (chiefs are "enstooled" not crowned) and umbrella. Land is held in common by the tribes, lands unallotted being attached to the office of head chief and called "stool lands." Human sacrifice, practised among the Ashanti until the closing years of the 19th century, was founded on a sentiment of piety towards parents and other connections—the chiefs believing that the rank of their dead relatives in the future world would be measured by the number of attendants sent after them. The Ashanti are skilful in several kinds of manufacture, particularly in weaving cotton.

BY COURTESY OF THE PHELPS STOKES FUND
THE RULER OF ASSUNATSI. A SECTION OF ASHANTI, IN HIS ROBES OF STATE AND TURBAN, ACCOMPANIED BY ONE OF HIS CHIEFS

Their pottery and works in gold also show considerable skill. A large quantity of silver-plate and goldsmiths' work of great value and considerable artistic elaboration was found in 1874 in the king's palace at Kumasi, not the least remarkable objects being masks of beaten gold. The influence of Moorish art is perceptible. Unlike many West African races, the Ashanti in general show a repugnance to the doctrines of Islam; but large numbers have become converts to Christianity (chiefly to the Anglican and Wesleyan churches). Education is much sought after by the Ashanti. They are keen farmers and keen traders.

Towns, **Trade** and Communications.— The capital is Kumasi (*q.v.*); pop. (1940) 43,413. It is served by a railway, 167m. long, from the port of Sekondi (Takoradi), completed in 1903, and by another railway, 196m. long and completed in 1923, which has its sea terminus at Accra. North of Kumasi is Mampon, on the main motor road, and still farther north Kintampo, formerly a great slave and ivory mart and now the entrepôt for trade with the northern territories and the French Sudan. Sunyani and Goaso are towns in the west; Bekwai and Obuasi are south of Kumasi on the railway to Sekondi. There is an extensive system of motor roads and a public motor transport system. The chief product for export is cocoa. Cultivation began about 1905 and within 20 years the prosperity of the country had come to depend largely upon the cocoa crop, the seasonal production having reached 60,000 tons. Next in importance come the production of kola nuts, and timber; and although collection of wild rubber has now ceased, a small quantity is produced on plantations. There is also an overland trade with the north in cattle and sheep, kolas and shea butter. The production of minerals has greatly increased in later years, and the Obuasi district produced 254,983 oz. of gold in 1937–8. Manganese and diamonds are also mined. While cultivation is almost entirely in the hands of Ashantis, the traders include many Syrians, Hausas and Lagosians. Trade, as also revenue, statistics are included in those of the Gold Coast.

The administrative system of Ashanti was reorganized in 1934, and in 1935 the native Confederation of Ashanti was re-established after a lapse of 35 years. A considerable measure of authority is exercised by the Confederation either directly or through the various tribal councils. (X.)

HISTORY

When it came under the notice of Europeans early in the 18th century the Ashanti confederation had been brought under the hegemony of the Kumasi tribe. Previously other tribes, such as

the Denkera (Denkyira), had claimed the overlordship. The real founder of the kingdom of Ashanti was Osai Tutu, who is described as the fourth king of Kumasi. According to legend there came to his court a magician who affirmed that he was commissioned by 'Nyame (the god of the sky) to make of the Ashanti a great nation, and in proof thereof he drew down a black cloud from which there descended a wooden stool partly covered with gold which came to rest on the knees of Osai Tutu. This stool, the magician declared, contained the soul of the nation. Afterwards, greatly enriched, it became the famous Golden Stool of Ashanti. It had its own umbrella (another adjunct of sovereignty) and its own attendants. On great occasions the Golden Stool was placed next the king's stool and the king rested his arm upon it.

Osai Tutu was a great warrior. To him is attributed the building of Kumasi town; it is more probable that he greatly expanded an existing town. In 1719 he opposed the king of Denkera's demand for tribute; defeated him in battle and executed both him and his queen. Thereafter he greatly extended his conquests. At length (c. 1730) he was defeated and slain at Koromanti in battle with the Akims but his successor, Osai Apoko, made further conquests towards the coast. This trend of the Ashanti to the coast was marked during the reign of Osai Tutu Kwadwo (Quamina), who in 1807 made war on the Fanti (the ruling people of the coast) because they had given asylum to two Assin chiefs whom he had defeated. Kwadwo reached the coast near Anamabo, where was a British fort. A pitched battle was fought with great slaughter, but the Ashanti failed to storm the fort, though the garrison was reduced from 24 to eight men. Colonel G. Torrance, then governor of Cape Coast, concluded a humiliating peace. He agreed to surrender the Assin chiefs--one escaped, the other was executed by the Ashanti—and half the fugitives in Anamabo fort: most of the remainder were sold by Torrance and his council as slaves. Torrance also acknowledged the Ashanti conquest of Fantiland and agreed to pay rent to the Ashanti for Anamabo fort and Cape Coast Castle.

Notwithstanding this settlement disputes continued, the British alternately supporting and abandoning the coast people. In 1821 the British Government assumed direct control of the British settlements on the Gold Coast. The governor, Sir Charles M'Carthy, espoused the cause of the Fanti, but was killed in battle with the Ashanti on Jan. 21, 1824, at Essamako. He had but 500 men to 10,000 of the enemy. The skull of Sir Charles was afterwards used at Kumasi as a royal drinking cup, but not by Kwadwo, who died on the same day as Sir Charles fell. A state of chronic warfare ensued. It ended in a signal defeat of the Ashanti by the British at Dodowa, near Accra, on Aug. 7, 1826. Peace was not formally made until 1831, when by a treaty concluded with Mr. George Maclean the Ashanti acknowledged the Prah as their southern boundary.

The War of 1873–74.—Kwaka Dua I., who became king in 1838 was a rare exception among Ashanti rulers, a peace-loving monarch who encouraged trade. He could not refrain, however, from asserting authority over the Fanti, and in 1863 he went to war because of the refusal of the British to surrender a fugitive chief and a runaway slave. The Ashanti were successful in two actions and were allowed to retire unmolested. "The bush" said Kwaka Dua, "is stronger than the cannon of the white men." The prestige of the Ashanti increased and when after Kwaka Dua's death in 1867, and the usual interval of civil strife, Kofi Karikari ("King Coffee" as he was popularly called in England) was enstooled he swore that his business should be war. The chief event which caused the war which followed was the transfer (April 2, 1872) of Elmina from the Dutch to the British. The Ashanti regarded the Elmina people as their subjects, and they held the Elmina "custom note"—that is, the king received from the Dutch an annual payment, in its origin ground rent for the fort, but looked upon by the Dutch as a "dash" (present) for trade purposes. A minor cause of the war was the holding in captivity at Kumasi of four Europeans, including Mr. Fritz Ramseyer, of the Basel Mission, and his wife. In Jan. 1873 an Ashanti force crossed the Prah and advanced to the neighbourhood of Cape Coast. Fortunately for the British the Ashanti army was greatly weakened by the outbreak of small-pox and fever. Sir Garnet (afterwards Viscount) Wolseley was sent from England to deal with the situation. His force, which included 2,400 white troops, occupied Kumasi after severe fighting on Feb. 4, 1874. Kofi Karikari fled into the bush and refused to surrender. Wolseley, encumbered with many sick and wounded, with fever prevalent, provisions scarce and the rainy season beginning, was compelled to retire, having first set Kumasi in flames. On Feb. 12, however, Captain (later Sir John) Glover, R.N., administrator of Lagos, who with native levies was co-operating with Wolseley from the east, reached the deserted ruins of Kumasi. Glover's appearance induced Kofi Karikari to sue for peace and on Feb. 13 at Fomana a treaty was signed. The Ashanti king renounced all claims to Elmina, promised to pay an indemnity, pledged himself to use his best endeavours to check the practice of human sacrifice and to promote freedom of trade. The British, however, neglected to take the opportunity offered to encourage the secession of various states from the Ashanti confederation and thus the power of Kumasi was reconsolidated.

Deposition of **Prempeh.**—Shortly after the war the Ashanti deposed Kofi Karikari, and placed on the stool his brother Mensa. This monarch broke almost every article of the Fomana treaty. His rule was tyrannous and stained with repeated human sacrifices. In 1883 a revolution displaced that monarch, who was succeeded by Kwaka Dua II.—a young man who died (June 1884) within a few months of his election. In the same month died the ex-king Kofi Karikari, and disruption threatened Ashanti. After a desolating civil war, Prempeh—who took the name of Kwaka Dua III.—was chosen king (March 26, 1888), and for a time peace and prosperity came to Ashanti. However, in 1893, there was fresh trouble between Ashanti and the tribes of the Gold Coast. The British Government was forced to interfere, and in 1895 called upon Prempeh to fulfil the terms of the 1874 treaty, and further, to accept a British protectorate. The king declined to treat with the governor of the Gold Coast, and despatched informal agents to England, whom the secretary of state refused to receive. To enforce the British demands an expedition was at length decided upon. The force was placed under Colonel Sir Francis Scott, and, after most careful organization, the main column started from Cape Coast on Dec. 27, 1895. On Jan. 17, 1896, Kumasi was occupied, and on the 20th Prempeh made submission to Mr. (afterwards Sir W. E.) Maxwell, the governor of Cape Coast, in native fashion. After this act of public humiliation, the king and the queen-mother with the principal chiefs were arrested and after being kept at Elmina for some time were exiled to the Seychelles Islands. The fetish buildings at Bantama were burned, and on Jan. 22, leaving a Hausa garrison at Kumasi, the expedition began the return march of 150m. to Cape Coast. Although no fighting occurred, fever claimed many victims, among whom was Prince Henry of Battenberg, who had volunteered for the post of military secretary to Sir Francis Scott.

Siege and Relief of **Kumasi.**—After the deportation of Prempeh no successor was appointed to the throne of Ashanti. Whilst the other States of the confederacy retained their hereditary chiefs the affairs of the Kumasi were administered by chiefs under British guidance. But although outwardly submissive the Kumasi were not reconciled to British rule, and in 1900 the action of Sir Frederic Hodgson, the governor of the Gold Coast, precipitated a revolt. In March of that year Sir Frederic, in a public palaver at Kumasi, bitterly reproached the chiefs with not having brought to him the golden stool. Sir Frederic, like almost all Europeans at that time, believed the golden stool to be the king's throne. He did not know that it was regarded as containing the soul of the nation, and if it were captured or destroyed the Ashanti would perish. Hence when Prempeh surrendered, the stool had been hidden. Attempts made by Sir Frederic's orders to find the stool had failed and the rebellion*began with an attack on Hausa soldiers whose chief object was the discovery of the stool. The British at Kumasi were now obliged to take refuge in the fort (April 1900). Reinforcements brought the garrison of the fort up to 700 men in May, the 20 Europeans

in the fort including Lady Hodgson and three other women. Outside the fort were gathered 3,000 native refugees. The Kumasi chiefs and their Adansi and Rokofu allies had 40,000 warriors, They sat down to invest the fort, and famine and disease soon began to work havoc. When conditions had become desperate the governor and all the Europeans save three, together with 600 Hausas sallied out of the fort (June 23), attacked a weakly-helal stockade and, though suffering about 100 casualties, succeeded in getting clear. The governor's party, taking a circuitous route, reached Cape Coast on July 10.

Three white men—Captain F. E. Bishop, Lieut. J. C. Ralph, Dr. J. B. Hay, colonial surgeon—with 100 Hausas were left in Kumasi fort with rations for three weeks. Meanwhile a relief expedition had been organized at Cape Coast by Colonel (afterwards General Sir) James Willcocks. Carriers could scarcely be obtained, there were no local food supplies, the rainy season was at its height, all the roads were deep mire, and the enemy were both brave and cunning, fighting behind concealed stockades. It was not until July 2 that Colonel Willcocks was able to advance. There was smart fighting on the 14th, and at 4 30 P.M. on the 15th, after a march since daybreak through roads "in indescribably bad condition," the main rebel stockade was encountered. It was carried at the point of the bayonet by Yoruba troops, who proved themselves fully equal to the Hausa. Kumasi was entered the same evening, a bugler of the war-worn garrison of the fort sounding the "general salute" as the relieving column came in view. Most of the defenders were too weak to stand. Outside the fort nothing was to be seen but burnt-down houses and putrid bodies. On Sept. 30 the Kumasi were completely beaten at Obassa.

An Era of Progress.-On Sept. 26,1901, Ashanti was formally annexed to the British dominions. After the annexation the relations between the governing power and the governed steadily improved, great credit being due to the wise administration of Sir Donald Stewart, the first chief commissioner, and to Sir Francis Fuller, who was chief commissioner from 1905 to 1920. The maintenance of the tribal system and the support given to the lawful chiefs did much to win the confidence and respect of a people naturally suspicious, and mindful of their exiled king. The accidental discovery in 1921 of the Golden Stool showed how greatly understanding between the British and the Ashanti had increased. The stool. placed in a box and buried in the ground was found by native workmen and shortly afterwards was robbed of its golden ornaments by a number of Ashanti. News of the desecration of the stool caused national mourning. The culprits were arrested and were tried by the principal chiefs, who recommended their execution. This punishment was changed by the Government into banishment: the chief whose duty it had been to guard the stool was also banished. For its part the Government intimated that it no longer desired possession of the stool and that no attempt to interfere with it would be made, unless use were made of it for seditious purposes.

The changed attitude of the people was due also to improved economic conditions following the opening of the railway to Kumasi in 1903 and, later on, the cultivation of cocoa on a large scale. Education was greatly prized and Christian missions gained large numbers of converts. The loyalty of the Ashanti to the Crown was manifest throughout World War I. The Ashanti generally, and the Kumasi in particular, much desired, however, the return of Prempeh, and at length their request was granted. After 28 years' exile Prempeh, who had in the Seychelles become a Christian and had adopted European ways and clothes, came back in 1924 to Kumasi, but as a private citizen. He was received by a great crowd, the pagans joining with the Christians in singing the "Old Hundredth." In 1926 Prempeh was restored to the Kumasi stool, that is, to the position of Omanhene (paramount chief) of the Kumasi tribe, but not to the Kingship of Ashanti. He chose his sister to fill the position of "Queen-Mother." Nine years later, the old confederation of Ashanti *(see* above), which had been abolished by the British, was re-established; and a nephew of Prempeh who in the meantime succeeded his uncle as Prempeh II was placed at its head.

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ASH'ARI (Abu'l Hssan 'Ali ibn Isma'il al-Ash'ari) (873–935), Arabian theologian, was born of pure Arab stock at Basra, but spent the greater part of his life at Baghdad. Although belonging to an orthodox family, he became a pupil of the great Mu'tazalite teacher al-Jubba'i, and himself remained a Mu'tazalite until his fortieth year. In 912 he returned to the faith of his fathers and became its most distinguished champion, using the philosophical methods he had learned in the school of heresy. His theology, which occupied a mediate position between the extreme views on most points, became dominant among the Shafi'ites. He is said to have written over a hundred works, of which only four or five are known to be extant.

See W. Spitta, *Zur Geschichte Ahu 'I-Hasan al Aš'ari's* (Leipzig, 1876); A. F. Mehren, *Exposé de la réforme de l'Islamisme commencée par Abou 'l-Hasan Ali el-Ash'ari* (Leyden, 1878); and D. B Macdonald's *Muslim Theology* (1903), especially the creed of Ash'ari in Appendix iii. (G. W. T.)

ASHBOURNE, EDWARD GIBSON, 1ST BARON (1837–1913), Irish lawyer and politician, was born in Dublin Sept. 4, 1837, and was educated at Trinity College, Dublin. He was called to the Irish bar in 1860, and in 1872 became a Q.C. In 1875 he was elected for Dublin University as a Conservative, and in 1877 became attorney-general for Ireland in Disraeli's Government. In 1885 he was made lord chancellor of Ireland with a seat in the Cabinet, and raised to the peerage. holding the same office in the Conservative Governments of 1886–92 and 1895–1905. Lord Ashbourne took a prominent part in the early negotiations for land purchase in Ireland. He died in London May 22, 1913, and was succeeded as 2nd baron by his eldest son, William Gibson (1868–1942)

ASHBOURNE, urban district, Derbyshire, England, 13 mi. W.N.W. of Derby. Pop. (1938) 4,796. Area 1.7 sq.mi. It is well situated on rising ground between two small valleys opening into that of the Dove, and the beautiful scenery of Dovedale is not far distant. The church of St. Oswald is cruciform, Early English and later; a fine building with a central tower and lofty octagonal spire. Its monuments and brasses are of much interest. The town has a large agricultural trade. The making of corsets is a feature, and growing numbers are employed in the metal trades of the neighbourhood. The local streams are in favour with trout fishermen. Ashbourne Hall, an ancient mansion, has associations with "Prince Charlie," who occupied it both before and after his advance on Derby in 1745. There are many associations with Dr. Johnson, a frequent visitor here to his friend Dr. Taylor, who occupied a house opposite the grammar school.

ASHBURNHAM, JOHN (*c.* 1603–1671), English Royalist, son of Sir John Ashburnham, entered parliament as member for Hastings in 1629, and sat for the same borough in the Long Parliament. He was treasurer of the royal army during the Civil War, commissioner in the Uxbridge negotiations (1644), escaped with

Charles to the Scots from Oxford (1646), and then went abroad, being employed by Charles at the court of the Prince of Orange. After the seizure of Charles by the army, Ashburnham joined him at Hampton Court in 1647 When Charles escaped from Hampton Court on Nov. 11, he followed Ashburnham's advice in opposition to that of Sir John Berkeley, who urged the king to go abroad, and took refuge in the Isle of Wight, being placed by Ashburnham in the hands of Robert Hammond, the governor. "Oh, Jack," the king exclaimed when he understood the situation, "thou hast undone me!" when Ashburnham, "falling into a great passion of weeping, offered to go and kill Hammond." By this fatal step Ashburnham incurred the unmerited charge of treachery and disloyalty. Clarendon, however, who censures his conduct, absolves him from any crime except that of folly and excessive self-confidence, and he was acquitted both by Charles I. and Charles II. He was separated with Berkeley from Charles on Jan. 1, 1648, waited on the mainland in expectation of Charles's escape, and was afterwards taken and imprisoned at Windsor, and exchanged during the second Civil: War for Sir W. Masham and other prisoners. He was specially exempted from pardon in the Treaty of Newport. In November he was allowed to compound for his estates, and declared himself willing to take the covenant. After the king's death he remained in England, an object of suspicion to all parties, corresponded with Charles II., and underwent several terms of imprisonment in the Tower and in Guernsey. At the Restoration he was reinstated in his former place of groom of the bedchamber and was compensated for his losses. He represented Sussex in parliament from 1661 till his expulsion, in 1667, for taking a bribe of £500 from French merchants for landing their wines. He died on June 15, 1671.

A descendant of his, Bertram (1797–1878), the 4th earl, was the collector of the famous Ashburnham library, which was dispersed in 1883 and 1884.

A Letter from Mr. Ashburnham to a Friend, defending John Ashburnham's conduct with regard to the king, was published in 1648. His longer *Narrative* was published in 1830 by George, 3rd earl of Ashburnham (the latter's championship of his ancestor, however, being entirely uncritical and unconvincing); *A Letter to W. Lenthall (1647)* repudiates the charge brought against the king of violating his parole *(Thomason Tracts,* Brit. Museum, *E* 418 [41]).

ASHBURTON, ALEXANDER BARING, 1ST BARON (1774–1848), English politician and financier, 2nd son of Sir Francis Baring (the founder of the house of Baring Brothers and Co.), was brought up in his father's business. He was a member of parliament from 1806–35. He regarded politics from the point of view of the business man, opposed the orders in council and the restrictions on trade with the United States in 1812, and in 1826 the act for the suppression of small bank-notes. He was a strong antagonist of Reform. He became chancellor of the exchequer in the duke of Wellington's projected ministry of 1832; but afterwards, alarmed at the scene in parliament, declared "he would face a thousand devils rather than such a House of Commons," and advised the recall of Lord Grey. In 1834 he was president of the board of trade and master of the mint in Sir Robert Peel's government, and on the latter's retirement was created Baron Ashburton *(see* below for the earlier creation) on April 10, 1835. In 1842 he was despatched to America, and the same year concluded the Ashburton or Webster-Ashburton treaty. *(See* ASHBURTON TREATY.)

He was also a trustee of the British Museum and of the National Gallery, a privy councillor and D.C.L. of Oxford. He published, besides several speeches, *An Enquiry into the Causes and Consequences of the Orders in Council* (1808), and *The Financial and Commercial Crisis Considered* (1847). He died on May 13, 1848.

ASHBURTON, JOHN DUNNING, 1st BARON (1731–1783) English lawyer, was born at Ashburton, Devonshire, on Oct. 18, 1731. At first articled to his father, he was admitted, at the age of 19, to the Middle Temple, and called to the bar in 1756, where he came very slowly into practice. He went the western circuit for several years without receiving a single brief. In 1762 he was employed to draw up a defence of the British East India Company against the Dutch East India Company, which had memorialized the Crown on certain grievances. This masterly document procured him at once reputation and emolument. In 1763 Dunning distinguished himself as counsel on the side of Wilkes, whose case he conducted throughout. His powerful argument against the validity of general warrants in the case of *Leach* v. *Money* (June 15, 1763) established his reputation, and his practice from that period gradually increased to such an extent that in 1776 he is said to have been in the receipt of nearly £10,000 per annum. In 1766 he was chosen recorder of Bristol, and in Dec. 1767 he was appointed solicitor-general. The latter appointment he held till May 1770, when he retired with his friend Lord Shelburne. In 1771 he was presented with the freedom of the City of London. From this period he was considered as a regular member of the opposition, and distinguished himself by many able speeches in parliament. He had entered parliament as member for Calne in 1768. In 1780 he brought forward a motion that the "influence of the Crown had increased, was increasing, and ought to be diminished," which he carried by a majority of eighteen. He strongly opposed the system of sinecure officers and pensions; but in 1782, when the marquis of Rockingham became prime minister, Dunning was appointed chancellor of the duchy of Lancaster, a rich sinecure. About the same time he received his peerage. Under Lord Shelburne's administration he accepted a pension of £4,000 a year. He died at Exmouth on Aug. 18, 1783.

Besides the answer to the Dutch memorial, Lord Ashburton is supposed to have assisted in writing a pamphlet on the law of libel, and to have been the author of *A Letter to the Proprietors of East India Stock, on the subject of Lord Clive's Jaghire, occasioned by his Lordship's Letter on that Subject* (1764). He was at one time suspected of being the author of the *Letters of Junius.*

ASHBURTON, an urban district, South Devonshire, England, on a branch of the G.W.Ry. from Totnes. Pop. (1938) 2,395. Area 10.6 sq.mi. It lies under Dartmoor, in a valley surrounded by hills, at a short distance from the River Dart. Ashburton (Essebretona, Asperton, Ashperton) is a borough by prescription and an ancient stannary town. In Domesday the manor was held in chief by Osbern, bishop of Exeter. Fairs and a Saturday market were instituted in the reign of Edward II. A market for the sale of wool, and fairs for the sale of cattle, corn and merchandise were granted in 1672 and 1705 respectively. The town was represented at various times by either one or two members from 1298 to 1885. It is in the Totnes division of Devonshire. The church of St. Andrew, with its lofty tower, was built early in the 15th century and has a fine oak roof over the north aisle. The grammar school was founded as a chantry in 1314, but it was closed in 1938, separate schools for boys and girls having been opened. The town has seen many kinds of industry and there are corn mills and a malthouse. Four fairs are still held annually.

ASHBURTON, a river in the north-west division of Western Australia. It drains north-westward from the interior plateau (average elevation: 2,000–3,000ft.) which its upper tributaries dissect. The greater part of its course of 400m., however, is through wide alluvial plains traversed by low ridges, though there are gorge sections along the main stream and its tributaries. The highly-inclined and folded (Pre-Cambrian) rocks are traversed by quartz reefs in which gold, as well as some lead and copper, occur in widely scattered localities. Gold has been exploited but the yield has not been great. Along the lower course of the Ashburton, the wide coastal plains are utilised for pastoral purposes. The rainfall is here very unreliable (Onslow [1891–1910] shows a variation of 1–27in. annual fall) and the temperatures are high (mean annual 75–80°). In the area inland from Onslow is one of the hottest parts of Australia, with an average of 90° for January. These drawbacks, however, have not proved prohibitive. Artesian water is available southwards from Onslow and the provision of a railway line would stimulate development. At the mouth of the Ashburton river the port of Onslow (924m. by sea from Fremantle) has a jetty (1,120ft. long), but a shallow and exposed anchorage. Its population includes some 100 Europeans, and it exports cattle, sheep, wool, hides and skins,

and mineral ores derived from its hinterland. Pearl fishing is also carried on in the adjoining coastal waters and pearl shell is shipped from Onslow. The Ashburton itself is not navigable.

"ASHBURTON TREATY, THE," a treaty negotiated in 1842 between Great Britain and the United States of America by Lord Ashburton (see ASHBURTON, ALEXANDER BARING) and Daniel Webster.

In particular it decided the boundary dispute between Maine and Canada; and the M'Leod case which had brought the two countries to the verge of war.

ASHBY-DE-LA-ZOUCH, urban district, Leicestershire, England; on the river Mease, 21 mi. N.W. of Leicester and 118 mi. from London by the London Midland and Scottish railway. Population (1938) 5,880. At the time of the Domesday survey Ashby (Essebi) formed part of the estates of Hugh de Grantmesnie, passing later by female descent to the family of la Zouch, whence it derived the adjunct to its name. In 1219 Roger la Zouch obtained a grant of a weekly market and a two days fair at the feast of St. Helen. The manor was granted in 1461 to Lord Hastings, who obtained royal licence to empark 3,000 acres and to build and fortify a castle. At this castle Mary queen of Scots was detained in 1569. During the Civil War Colonel Henry Hastings fortified and held it for the king, and it was visited by Charles in 1645. At the close of the war it was dismantled by order of parliament. It plays a great part in Sir Walter Scott's Zvanhoe. In the 18th century Ashby was one of the best markets for horses, and had prosperous factories for woollen and cotton stockings and for hats. The church of St. Helen, a fine Perpendicular building, contains an old finger-pillory. The Ivanhoe baths, erected in 1826, are frequented for their saline waters. The springs are at Moira, three miles west. To the south of the town are the remains of Ashby Castle. There are extensive coal-mines in the neighbouring districts; *e.g.,* at Moira, whence the Ashby-de-la-Zouch canal runs south to the Coventry canal. Area 9.7 sq.mi.

ASHDOD, an ancient village in Palestine, pop. c. 4,500, about 3m. inland from the Mediterranean and about equidistant (18m.) from Gaza and Jaffa. It is now on the railway. It stands close to a large hillock of red sand (137ft.), probably the Mt. Azotus on which Judas Maccabaeus fell (I. Macc. ix., 15ff.); this may well have been the acropolis of the ancient city. Behind it extending to the shore cliffs lie dunes of sand under which in all probability are buried the remains of the Ashdod of old. At the southern entrance to the village are the ruins of a mediaeval *khan,* and amongst the houses and mosques are to be found fragments of ancient columns and walls.

History. — Ashdod was the most important of the Philistine Confederation of five towns with a commanding position on the military road between Syria and Egypt and a centre of Dagon worship. In Joshua xv. it is assigned to Judah, but still remained the refuge of the *'Anakim* (Josh. xi. 22). It does not appear that Israel ever subdued the city in spite of II. Chr. xxvi. 6. In 711 B.c., Ashdod was besieged by Sargon's army commander (or Tartan) and captured (Is. xx. 1), the reason being that the city had revolted, set up a ruler of its own choosing in place of the Assyrian nominee, and had allied itself with Philistia, Judah, Edom, Moab and the Pharaoh of Egypt against Assyria. During Assurbanipal's reign (668–625 B.C.) it was beleaguered for 29 years by Psammetichus (Herod. ii. 157). Its inhabitants showed themselves hostile to the repair of the walls of Jerusalem at the time of the return (Neh. iv. 7), and Nehemiah's curse on the Jews who had married women of Ashdod and whose children could only speak a mixture of the two languages indicates the conditions prevailing in the city at that time (Neh. xiii. 23ff.). Ashdod was captured and cleared of idols by Judas Maccabaeus (c. 163 B.c.), and later (148) taken by Jonathan, who burned the temple of Dagon. After the Jewish wars it was restored by Gabinius and enfranchised by Pompey. From the 4th to the 6th centuries it was the seat of a bishopric. With the Muslim conquest it gradually sank into insignificance until by crusading times the once mighty city had been transformed into a mean and squalid village.

ASHE, THOMAS (1836–1889), English poet, studied at Cambridge and then became a schoolmaster. Of his complete works (ed. 1886), the most notable are *Dryope* (1861), Pictures (1865), and the classical drama, The Sorrows of *Hypsipyle* (1867). Ashe is diffuse in style and at times his poetic quality is scarcely discernible.

A-SHE-HO, a town of Manchuria, China, 12; m. N.E. of Kirin, and 30 m. S. of the Sungari. It was governed by a mandarin of the second class, but is now under the administration of the local government. Pop. about 75,000.

ASHER, a tribe of Israel, called after the son of Jacob and Zilpah, Leah's maid (Gen. xxx. 12 seq.). The district held by this tribe bordered upon Naphtali, and lay to the north of Issachar and Zebulun, and to the south of Dan. Asher is blamed for taking no part in the fight against Sisera (Judges v. 17), and although it shares with Zebulun and Naphtali in Gideon's defeat of the Midianites (Judges vi. 35, vii. 23), the incorporation of the name is probably due to a late redactor. It lay in the closest proximity to Phoenicians and Aramaeans, and contained a strong Canaanite element. In the Blessing of Moses it is bidden to defend itself— evidently against invasion (Deut. xxxiii. 25).

Even in the time of Seti I. and Rameses II. (latter half of 14th century B.c.) the district to the west of Galilee appears to have been known to the Egyptians as Aser(u), so that it is possible to infer either (a) that Asher was an Israelite tribe which, if it ever went down into Egypt, separated itself from its brethren in Egypt and migrated north; or (b) it was a district which, if never closely bound to Israel, was at least regarded as part of the national kingdom, and treated as Israelite by the genealogical device of making it a "son" of Jacob.

'ASHER BEN YEHIEL (known as *Rosh*), Jewish rabbi and codifier, was born in the Rhine district *c.* 1250, and died in Toledo 1327. Endangered by the persecutions inflicted on the German Jews in the 13th century, 'Asher fled to Spain, where he was made rabbi of Toledo. A disciple of Meir of Rothenburg, 'Asher's sole interest was in the Talmud. He was a man of austere piety, profound and narrow. He was a determined opponent of the study of philosophy, and thus was antipathetic to the Spanish spirit. Compiled between 1307 and 1314, 'Asher's *Compendium* is printed in most editions of the Talmud, and it differed from previous compendia in greater simplicity and in the deference shown to German authorities. 'Asher's son Jacob, who died at Toledo before 1340, was the author of the four *Turim,* a very profound and popular codification of rabbinical law. This work was the standard code until Joseph Qaro (Karo) directly based on it his widely accepted code of Jewish law, the *Shulhan 'Arukh.*

ASHEVILLE, a city of North Carolina, U.S.A., the county seat of Buncombe county; in the southern Appalachian highlands, about 210 mi. W. of Raleigh, at the junction of the French Broad and Swannanoa rivers; on a plateau 2,300 ft. above sea level, which extends from the Blue Ridge on the east to the Great Smoky mountains on the west. Asheville is served by the Southern railway system, and is on federal highways 19, 23, 25, 70 and 74. The climate is dry and equable, with an average annual snowfall of only 10·3 in. and there is magnificent mountain scenery in every direction. The city has a land area of 14·7 sq. miles. The resident population was 50,193 in 1930, of whom 14,255 were Negroes; and was 51,310 in 1940.

Asheville has been a health and all-the-year-round pleasure resort ever since the first wooden hotel was erected about 1830. Its hotels now have accommodation for 2,500 guests; there are many boardinghouses and apartments for visitors, and many inns in the surrounding mountains. Recreation facilities include an 18-hole municipal golf course, planned by Donald Ross, and four belonging to private clubs; a municipal recreation park with a 56-acre lake; municipal swimming pools and tennis courts; a city auditorium; a fine baseball park, and a baseball team that is owned and managed by the city; and a financially successful summer season of grand opera. Within a short drive are the Pisgah Cherokee, Nantahala and Unaka national forest preserves; Mt. Mitchell (6,684 ft.), the highest peak east of the Rockies; and

the Great Smoky Mountains national park, dedicated in 1940, with many acres of primeval wilderness. There are nearly 100 summer camps for boys and girls in the region, and several religious assemblies have their permanent headquarters in the vicinity. Sanatoria for the treatment of tuberculosis were established there early, and some of them have a national reputation.

Near the outskirts of the city lies Biltmore, the home of the late George W. Vanderbilt. The grounds were laid out by Frederick Law Olmsted, and the mansion (780 by 150 ft.) was designed after the Château de Blois. Originally the estate included 125,000 ac. but part of it was deeded to the federal government as the nucleus of the Pisgah national forest, and the village of Biltmore has been incorporated as a suburb of Asheville.

Since the war of 1914–18 Asheville has made marked industrial and civic progress. The leading industries include wood-working and furniture plants, textile and paper mills, tanneries, foundries, machine shops and railway repair shops. In 1937 the value of manufactured products amounted to $6,583,175. Power is supplied by hydroelectric plants located on the waterways. A city plan was adopted in 1925; a successful method of smoke abatement is in operation; and a water system, adequate for a population of 300,000, is in use. Asheville is the centre of 10,000 sq.mi. of recreational area, and its prosperity is reflected in the use of this area. During the summer season of 1940, 132,000 campers and an additional 800,000 tourists visited Pisgah national forest alone. The city is the eastern gateway to the Great Smoky Mountains national park, which is connected to Shenandoah national park in Virginia by the Blue Ridge parkway. This highway, 480 mi. in length and extending along the crest of the Blue Ridge mountains, runs within 6½ mi. of the city.

Asheville was founded by John Burton, who in 1794 laid out a town at first called Morristown or Buncombe Court House. It was incorporated as Asheville in 1797; chartered as a city in 1835; and adopted a commission form of government in 1905. It was named after Samuel Ashe (1725–1813), chief justice of North Carolina (1777–96), and John Ashe (1720–81), a North Carolina soldier.

ASHFIELD, ALBERT HENRY STANLEY, 1ST BARON (1874–), British business man, was born at Derby Nov. 8, 1874. He spent his early years in the United States, and was educated at American technical schools and colleges. He entered the service of the Detroit City Street Railways and had a successful business career, becoming general manager of the company and subsequently of the Public Service Corporation of New Jersey, In 1907 he returned to England, and became general manager of the Metropolitan District Railway and soon after chairman and managing director of the tramc combine which included the London Underground Electric Railway companies and the London General Omnibus Company.

In 1914 he was knighted. On the formation of Lloyd George's Government in 1916 Sir Albert Stanley was elected to Parliament as a Coalition Unionist for Ashton-under-Lyne, being included in the Cabinet as president of the board of trade. He resigned in May 1919, and, Jan 1920, was raised to the peerage. He was chairman of the Underground Group of Companies from 1919 to 1933, when he became chairman of the London Passenger Transport Board.

ASHFORD, urban district, Kent, England, 56 mi. S.E. of London by the Southern railway. Population (1938) 22.590. Area 8.8 sq.mi. It lies on a slight hill in the plains under the downs near the confluence of the upper branches of the River Stour, and is a considerable road and rail centre. Ashford (Esselesford, Asshatisforde, Essheford) was held at the time of Domesday by Hugh de Montfort. A Saturday market and an annual fair were granted to the lord of the manor in the 13th century, and further annual fairs were granted by Edward III and Edward IV. The fertility of the pasture land in Romney marsh to the south caused the cattle trade to increase from the latter half of the 18th century, and a stock market was established in 1784. The fine Perpendicular church (St. Mary's) has a lofty tower and many interesting monuments. At Bethersden, between Ashford and Tenterden, marble quarries were formerly worked extensively, supplying stone for the cathedrals of Canterbury and Rochester and for many local churches. Ashford has agricultural implement works, brick yards and breweries, and large locomotive and carriage works of the Southern railway.

The parishes of Kennington and Willesborough were added to the urban district in 1934 and a town planning scheme was adopted.

ASH HANDLING. The boilers required for generation of power in a large electric or industrial plant often burn thousands of tons of coal a day; and since perhaps 10 to 15% of the average coal is incombustible ash, hundreds of tons must be removed each day. The handling of such volumes of waste material deserves careful consideration, as improper methods or apparatus may double or treble the cost. Thus, good ash handling methods and facilities may represent ½ to 1% of the total cost of power generation, whereas systems improperly applied may raise the cost to 1 or 1½%.

In designing an ash-handling system certain precautions should be taken. In the first place all material coming in contact with the ashes should be of cast iron or other corrosive-resisting substances, since most ashes are alkaline and highly corrosive. It is furthermore important that all ashes should be thoroughly quenched before handling, otherwise there is danger from carbon monoxide poisoning and burns. In general two standardized methods of ash handling are now used in most large boiler houses: the hydraulic system and the purely mechanical system.

Hydraulic **Ash** Handling.— In this method ashes are stored in hoppers beneath the furnace for a period of eight to 24 hours, depending upon conditions. Beneath these hoppers a conduit capable of carrying water for removal of the ashes to a centrally located sump, is installed horizontally and the water is introduced from pressure mains. When the ash hoppers are filled, they are, discharged into the conduit at a rate well below the carrying capacity of the flowing water. The ashes may be taken from the ash sump by centrifugal pumps, generally made of manganese steel, in which case (1) the ashes and water may be discharged to low points within half a mile of the boiler house, where the ashes are deposited and the water leaches into the ground; (2) the ashes and water may be pumped into an overhead storage bin, the water being run off the top and returned to the sump: the ashes remaining as a residue, which is dumped into cars. Alternatively, the ashes may be taken directly from the sump by means of a grab bucket or other elevating machinery, and loaded into an overhead storage bin or directly into railroad cars or motor trucks.

The hydraulic system of ash removal is applicable where coal is burned as powder. In such cases the ashes are removed either as a molten slag (which is chilled and disintegrated by the stream of water into which it falls) or as a dry powder. In the latter case it is essential to carry this material in an enclosed system, otherwise the ash dust permeates the entire boiler house with results deleterious to moving machinery. Hydraulic systems are also applicable to the continuous discharge type of mechanical stokers such as chain grate stokers or underfeed stokers equipped with mechanical grinders. The water required for a hydraulic ash removal system will vary from 3 to 6lb. of water per ton of ash moved, if the water is allowed to discharge to waste from the sump. If re-circulated, about one-tenth of a pound of water per pound of ash is required for make-up to prevent concentration.

The advantages of the hydraulic ash removal systems can be stated as follows: (1) no labour is required other than the opening and closing of the valves controlling the flow of ash and the flow of water; (2) the ashes are handled in a totally enclosed system,—they are always under water and thus no dirt, dust or vapour can escape; (3) no moving machinery in the system comes in contact with the ashes; (4) the cost of running is low, varying from 1 to 3kw. hours per ton of ash moved; (5) the height of the power house building is generally 2 to 10ft. less since no cars run beneath the ash hoppers: the saving in building often more than pays the total cost of the ash handling system; (6) where the ashes can be pumped to low outlying property, there is no rehandling of the material.

Mechanical **Ash** Handling.— This system is also in common use in large boiler houses. The ashes in the hoppers beneath the furnace are dropped into cars, the control generally being maintained by horizontal piston-operated gates. In large plants where the final disposal of ashes is to be made by railroad cars, these are often run directly beneath the ash hoppers. This entails large building expense, as the entire boiler room must be raised sufficiently to allow the railroad cars to run beneath it; however, it obviates the necessity of rehandling the ashes. In smaller plants where this expense is not warranted, industrial cars of small height may be run beneath the ash hoppers. In this case a skip hoist is installed at the end of the building. the industrial cars are dumped into the skip hoist bucket and the ashes lifted into a storage bin, which latter discharges directly into railroad cars or wagons. This system is advantageous where underfeed stokers are used and the ashes are intermittently discharged. Such practice generally results in comparatively large clinker formations, which can best be handled in cars or by skip bucket.

There are other systems of ash handling generally applied in special cases and usually in the smaller boiler houses or in densely populated sections of cities, such as in hotels and in office buildings. Steam jets, bucket conveyors and the like are then employed. (See MECHANICAL HANDLING.) These systems, however, usually entail a high maintenance and operating expense and are generally used where it is impossible or impracticable to apply either of the two systems outlined above. (F. B. A.)

'ASHI (352–427), Jewish *'amora,* the first editor of the Talmud, was born at Babylon. He was head of the Sura academy, and there began the Babylonian Talmud, spending 30 years of his life at it. He left the work incomplete, and it mas finished by his disciple Rabina just before A.D. 500. *(See* TALMUD.)

ASHINGTON, urban district, Northumberland, England, 4 mi. E. of Morpeth, on the Newbiggin branch of the L.N.E. Ry. Pop. (1938) 29,870. Area, 9.5 sq.mi. The district, especially along the river Wansbeck, is not without beauty, but there are numerous collieries, one claiming to be the largest in the world, to which is due the rapid development of the town. The population is almost entirely composed of miners. though some ironworkers are found. At Bothal on the river (from which parish that of Ashington was formed) is the castle belonging to the Bertram family in the reign of Edward III. The church of St. Andrew there has early English to Perpendicular work, and in the neighbouring woods is a ruined chapel of St. Mary.

ASHKHABAD, formerly POLTORATSK. (1) A district in the Turkmenistan S.S.R. Area 195,000 sq.km. Pop. (1926) 237,570. (2) A town, the centre of the district, in 38° N. and 58′ 20° E. Pop. (1926) 54,107. It is situated in the fertile Akkal oasis, watered by hill streams from the Kopet Dagh, which lose themselves in the desert to the north. It is a Russian town dating from 1883 and is well laid out with broad, tree-lined streets, and has cotton, tanning, brick and mineral water factories and is on the Trans-Caspian railway. An electric power station is under construction. Near it are the sanatoria of Firuza (2.800 ft) and Khayrabad (5,800 ft.). Twenty miles E.S.E. is Anau (*q.v.*), a site inhabited possibly 3900 B.C. with remains of geometrical pottery.

See R. Pumpelly, *Explorations in Turkestan* (1905).

ASHLAND, a city of Boyd county, Ky.. U.S.A., on the Ohio river, 125 mi. S E. of Cincinnati and 4 mi. below the mouth of the Big Sandy river, where Ohio, Kentucky and West Virginia meet.

Ashland is on federal highways 23 and 60 and connected with federal highway 52 by a bridge across the river at this point It is served by the Chesapeake and Ohio railway and (through the station at Coal Grove, across the river) by the Norfolk and Western.

A government system of locks and dams gives a minimum 9-ft. stage of water on the Ohio the year round, and daily packets run from Pittsburgh to Cincinnati.

Many private boats hauling coal, gasoline, oil, etc., operate regularly on the Ohio river. The population according to 1940 federal census was 29,537.

The city lies on a plain along the river, rising to hills on the south. There are beautifully shaded residence streets, and in the heart of the city is a 50-acre park, of blue grass and virgin forest.

The assessed valuation of property in 1940 was $20,184,182. Ashland is an important shipping and manufacturing town. The surrounding country is rich in coal, iron, fireclay, sandstone, asphalt, limestone, shales, oil, gas and hardwood timber. The principal manufactured product of the city is sheet steel; other important industries are refining of gasoline and oil, coke and by-products, leather, brick, hollotv tile and lumber mills. Ashland was settled in 1854 and incorporated as a city in 1870.

ASHLAND, city of Ohio, U.S.A., the county seat of Ashland county; 60 mi. southwest of Cleveland, on the Erie railroad. The population increased from 4,087 in 1900 to 6,795 in 1910, and to 12,453 in 1940 by the federal census, 97% being native-born white. Ashland manufactures pump and haying tools, rubber in all forms, poultry foods, electros, auto supplies, toys, furnaces, raincoats, and concrete vaults.

The city of Ashland is surrounded by an excellent farming, dairying and fruit-raising region.

Ashland college, a coeducational institution established by the Brethern church in 1878, is there.

ASHLAND, a city of Oregon, U.S.A., on Bear creek, in the southern part of the state. It is on federal highways 66 and 99, and is served by the Southern Pacific railway. The population was 4,544 in 1930 and 4,744 in 1940 by the federal census. It lies in a valley 1,900 ft. above sea level. with peaks of the Siskiyou mountains on every side, and has a number of mineral springs, most of which are owned by the city. Fruit is grown in the region, and there are gold mines (both placer and quartz) near by. Ashland is the home of the Southern Oregon College of Education (established 1925). The city was founded about 1852 and was incorporated in 1874.

ASHLAND, a borough of Schuylkill county, Pa., U.S.A., in the anthracite region, about 15 mi. N W. of Pottsville. It is served by the Lehigh Valley and the Reading railways. The population in 1940 was 7,045. The borough is built on the slope of Locust mountain, about 885 ft. above sea level. Coal mining is the principal occupation, but there are foundries and machine and garment factories. The Ashland State hospital is there. Ashland was laid out in 1847 and incorporated in 1857.

ASHLAND, a town of Hanover Co., Virginia, U.S.A., on a high plateau 15 mi. N. of Richmond; on the Richmond, Fredericksburg and Potomac railroad, and connected with Richmond by a bus line. The population in 1940 was 1,718. Ashland is the seat of Randolph-Macon college, the oldest member of the Randolph-Macon system of colleges and academies, established under the auspices of the Methodist Episcopal Church South to provide secondary and collegiate instruction for both sexes in separate institutions, and owned by one chartered, self-perpetuating board of trustees. The college in Ashland is for men, and has an annual enrolment of about 300. It was chartered in 1830, and opened near the village of Boydton, in Mecklenberg county, in 1832. removing to Ashland in 1868. About 7 mi. and 15 mi. respectively from Ashland are the birthplaces of Henry Clay and of Patrick Henry. The town was settled in 1845 and incorporated in 1856. It is at the intersection of federal highway 1 and the Charlottesville highway.

ASHLAND, a city in the northern part of Wisconsin, U.S.A, on the Chequamegon bay, an arm of Lake Superior; at an altitude of 660 ft., about 60 mi. E by S. of Duluth and Superior; county seat of Ashland county It is on federal highway 2, and is served by the Soo, the Chicago and North Western, and the Northern Pacific railways and by lake steamers. The high points in the city command a view of the picturesque Apostle islands, outside the bay, which were formerly a rendezvous of the Ojibway Indians. The population of the city in 1920 was 11,334; 1930, 10,622; 1940, 11,101 by federal census.

The harbour has a controlling depth of 20 ft. and a navigation season from the middle of April to the early part of December. The bulk of the vessel traffic consisted of shipments of iron ore

from the near-by Gogebic range, and receipts of coal. Major industries of the city include wood pulp and paper products, ironwork, granite polishing and dairy products. In 1933 the output of the manufactures was valued at nearly $2,000,000. Northland college (Congregational; chartered 1907) is located there.

The first house built by white men in what is the state of Wisconsin was constructed at the head of Chequamegon bay about 1661, and its site is indicated by a historical marker. Ashland was settled about 1854, incorporated as a village in 1863 and chartered as a city in 1887.

ASHLAR, also written **ASHLER, ASHELERE,** in architecture, squared stone used for facing walls; also as an adjective, of a wall built of squared stones. Sometimes the word is used of any stone wall facing which is worked or tooled, whether squared or not, but such work is usually known as "rough" or "uncoursed" ashlar. An ashlar piece in English carpentry is a vertical timber inserted between the rafters and the wall plate. *(See* CARPENTRY.)

ASHLEY, SIR WILLIAM JAMES (1860–1927), English economist, was born in London on Feb. 25, 1860, and educated at St. Olave's grammar school and Balliol college, Oxford. He was successively professor of political economy and constitutional history in Toronto university (1888), professor of economic history at Harvard university (1892), professor of commerce and finance in Birmingham university (1901) and dean of the faculty of commerce there (1902). Prof. Ashley made most important contributions to the history of English industry and the economic development of England in general in his *Early History of the English Woollen Industry* (1887) and his *Introduction to* English *Economic History and Theory* in two parts (Part i "The Middle Ages," 1888; Part ii "The End of the Middle Ages," 1893). This *Introduction* is the standard work on the subject and has been translated into German, French and Japanese. He was foremost among the economists who supported Joseph Chamberlain in his campaign for protection for British industry, His *Tariff Problem* (1903) was republished in a new and enlarged edition in 1920. In addition to his professional and literary work Sir William Ashley sat on many important public committees and commissions of inquiry — on coal prices (1915), food prices (1917), cost of living (1918), agriculture (1919–23), tariffs (1923), industry and trade (1924). He also did important work on wages and prices, and was joint author of the *Report* of the Unionist social reform committee on industrial unrest (1914).

ASHLEY, a borough of Luzerne county, Pa., U.S.A., 3 mi. S. of Wilkes-Barre. It is served by the Central railroad of New Jersey. The population in 1940 was 6.371. The name of Ashley, adopted in 1871, was the tenth under which the city had been known since it was first settled in 1810. It is named for a family of coal operators. The main industries are mining, lace manufacture and railroad workshops,

ASHMOLE, ELIAS (1617–1692), English antiquarian, and founder of the Ashmolean museum at Oxford. was born at Lichfield, the son of a saddler. In 1638 he became a solicitor, in 1644 was appointed commissioner of excise, and subsequently obtained a commission as captain of horse. In 1649 he married as his second wife Lady Mainwaring. This marriage enabled him to devote his whole time to his favourite studies. His interest in astrology, aroused by Sir George Wharton and by William Lilly, seems, in the following years, to have subsided in favour of heraldry and antiquarian research. Ashmole was in high favour at the court of Charles II. He was made successively Windsor herald, commissioner, comptroller and accountant general of excise, commissioner for Surinam and comptroller of the White Office. He afterwards refused the office of Garter king-of-arms in favour of Sir William Dugdale, whose daughter he had married after the death of his second wife in 1668. In 1672 he published his exhaustive *Institutions, Laws and Ceremonies of the Order of the Garter,* the fruit of years of patient antiquarian research. Five years later he presented to the University of Oxford the Ashmolean museum, the first public museum of curiosities in the kingdom, the larger part of which he inherited from a friend, John Tradescant. He stipulated that a suitable building should be erected for its reception, and the collection was not finally installed until 1683. Subsequently he made the further gift to the university of his library.

ASHMUN, JEHUDI (1794–1828), U.S. missionary, was born in Champlain, N.Y., on April 21, 1794. He was educated at Middlebury college, Vt., and at the University of Vermont. He first became interested in the work in which he was to spend the rest of his life when he was made editor of the *Theological Repertory,* an Episcopalian journal. Among the articles he wrote for that paper were several on the work of the American Colonization society, which at that time was attempting to settle the slavery problem by setting up a colony in Liberia for freed Negroes. Because of his interest, the society asked Ashmun to act as its agent in helping to establish the settlement at Cape Mesurado (now Monrovia). He arrived in 1822, just in time to save the small group of Negroes from almost certain extinction. Many of the original settlers had died and most of the others were ill. None of the white agents had remained, there was little food left, and the African natives were planning to attack. Ashmun's efforts saved the colony. He enlisted the help of all those capable of fighting. although one report says there were only 27, and with this handful he repulsed the attack of an estimated 800 natives. Until 1828 Ashmun remained almost continuously in charge of the colony, and when ill health forced him to leave. there were 1,200 inhabitants. He died only a few days after his return to the United States. Although Ashmun was not the first white agent in Liberia, he was the first to give the new colony enough help to enable it to survive by its own efforts.

ASHRAF (plural of Arabic *sharaf,* "noble," "revered"), a term applied throughout the Muslim world to descendants of the Prophet Mohammed, but more particularly to a small Arab tribe scattered around Suakin, who call themselves Bani Hashim, "sons of Hashim," the prophet's uncle. In India the term is said to include Muslims of foreign descent from higher Hindu castes as opposed to the Ajlaf or commonalty and Arzal (almost= "outcasts"). In Persia, too, the term is vaguely used. In Arabia. Burton limits Sharif (a singular of Ashraf) to descendants of the prophet through Hassan, Ali's elder son.

ASHSHUR: *see* ASSUR.

ASHTABULA, a city of Ashtabula county, O., U.S.A., on Lake Erie, at the mouth of the Ashtabula river, 55 mi. N.E. of Cleveland.

It is on the Yellowstone trail, and is served by the New York Central, the Nickel Plate and the Pennsylvania railways. The population was 23,301 in 1930 and was 21,405 in 1940

The city is 680 ft. above sea level, and is built on the high bank of the river. Ashtabula harbour, 2 mi. from the city but within the corporate limits, has a controlling depth of 20 ft, and a navigation season lasting from April 20 to Dec. 5.

Large quantities of iron ore are received from the northwest and sent on by rail to Youngstown, Pittsburgh and other iron manufacturing centres.

Large quantities of coal come up by rail from the Ohio and Pennsylvania coal fields for transshipment to other ports on the Great Lakes.

The leading manufacturing industries are machine shops, toolworks, shipyards and tanneries.

The name *Ashtabula* is an Indian word, meaning "fish river." The first white settlement was made about 1801. The village was incorporated in 1831 and received a city charter in 1891. In 1916 the charter was amended to provide for a city manager and proportional representation.

In 1926, after ten years of experience with these features, the citizens voted to retain them.

ASHTAROTH or **ASHTORETH:** *see* ASTARTE.

ASHTON-IN-MAKERFIELD, urban district, Lancashire, England, 4 mi. S. of Wigan, on the London and North-eastern railway. Population (1901) 18,687; (1938) 19,440. It is situated on the Lancashire coal field and its development has been entirely due to the mining of coal and iron during the last century. Most of the coal is used in the neighbouring cotton mills although

iron goods are manufactured on the spot.

ASHTON-UNDER-LYNE, municipal and parliamentary borough, Lancashire, England, on the river Tame, a tributary of the Mersey, 63 mi. E. of Manchester. Pop. (1931) 51,573; (1938 est.) 48,540. It is served by the London Midland and Southern and London and North-eastern lines. The derivation from the Saxon aesc (ash) and tun (an enclosed place) accounts for the earliest orthography, Estun. The addition *subter lineam* is found in ancient deeds because the place is below the line or boundary of Cheshire, which once formed the frontier between Northumbria and Mercia. The manor was granted to Roger de Poictou by William I, but before the end of his reign came to the Greslets as part of the barony of Manchester. The lord of the manor still holds the ancient court-leet and court-baron half-yearly. A church or chapel is mentioned there in 1261–62, but the present church of St. Michael is almost entirely modern. One of the markets dates back to 1436. The ancient industry was woollen, but soon after the invention of the spinning frame the cotton trade was introduced, and as early as 1769 the weaving of cotton yarn by machinery soon became the staple industry, and has remained so. Hatmaking and iron founding and machinery works are also important, and there are large collieries in the neighbourhood.

Stamford park, presented by Lord Stamford, is shared by the towns of Ashton and Stalybridge. The town has a technical school, a school of art and free library. Ashton-under-Lyne had long enjoyed the name of borough, but it was not until 1847 that a charter of incorporation was granted. The parliamentary borough, which includes the urban district of Hurst, returns one member. Area of municipal borough, 2.1 sq.mi.

ASHUR: *see* ASSUR.

ASH WEDNESDAY, in the Western church, the first day of Lent (*q.v.*), so-called from the ceremonial use of ashes, as a symbol of penitence, in the service prescribed for the day. The custom is still retained in the Roman Catholic Church, the day being known as *dies cinerum* (day of ashes). The ashes, obtained by burning the remains of the palms blessed on the previous Palm Sunday, are placed in a vessel on the altar and consecrated before High Mass. The priest then invites those present to approach and, dipping his thumb in the ashes, marks them as they kneel with the sign of the cross on the forehead (or in the case of clerics on the place of tonsure), with the words: *Memento, homo, quia pulvis es, et in pulverem reverteris* (Remember, man, that thou art dust and unto dust thou shalt return). He himself receives the ashes from the priest of highest dignity present, or puts them on his own head in silence.

This ceremony is derived from the custom of public penance in the early Church. At what date the custom was extended to the whole congregation is not known. A passage in Aelfric's *Lives of the Saints* (996–997) implies that it was then in common use; it certainly was so in 1091 (synod of Beneventum).

Of the reformed Churches the Anglican Church alone marks the day by any special service. This is known as the Commination, its distinctive feature being a solemn "denouncing of God's anger and judgments against sinners." In the Prayer Book of the American Episcopal Church, the office of Commination is omitted, except the three concluding prayers. The ceremonial of the ashes was not proscribed in England at the Reformation; it was indeed enjoined by proclamation in 1538, and again in 1550, but it had fallen into complete disuse by the beginning of the 17th century.

See Wetzer and Welte, *Kirchenlexikon,* and Herzog-Hauck, *Realencyklopadie* (3rd ed.) *s.* "Aschermittwoch"; L. Duchesne, *Christian Worship,* trans. *by* M. L. McClure (London, 1904).

ASHWELL, LENA (1872–), English actress, was the daughter of Commander Pocock, R.N. In 1896 she married the actor Arthur Playfair, whom she divorced in 1908; later in the latter year she married Dr. (later Sir H.) Simson. In 1895 she played Elaine in Irving's production of *King Arthur* at the Lyceum and again acted with him in 1903 in *Dante.* She made her first striking success, however, on the London stage in Mrs. *Dane's Defence* with Sir Charles Wyndham in 1900, and a few years later her acting in *Leah Kleschna* confirmed her position as one of the leading actresses in London. In 1907 she started under her own management at the Kingsway theatre. During the war Miss Ashwell formed a company for organizing entertainments for soldiers at the front; after the war she inaugurated a scheme for bringing drama to the doors of the people through the popular performances, in public halls and other places, of the "Lena Ashwell Players."

ASIA, the name of one of the great continents of the earth's surface, embracing the north-east portion of the great land mass constituting the Old World, of which Europe forms the north-west and Africa the south-west region.

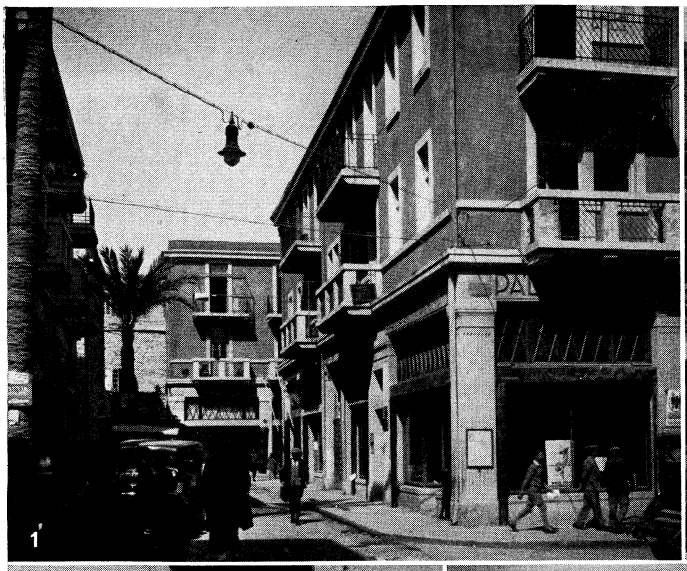
Much doubt attaches to the origin of the name. The early Greek geographers divided their known world into two portions only, Europe and Asia, in which last Libya (the Greek name for Africa) was included. Herodotus ranks Libya as one of the chief divisions of the world, separating it from Asia, but is unable to explain the origin of the name. It is probable that it has an Assyrian or Hebrew root and was used first of all with a specific or restricted local application, a more extended signification having eventually been given it, though it continued in use among the Greeks to denote the country around Ephesus.

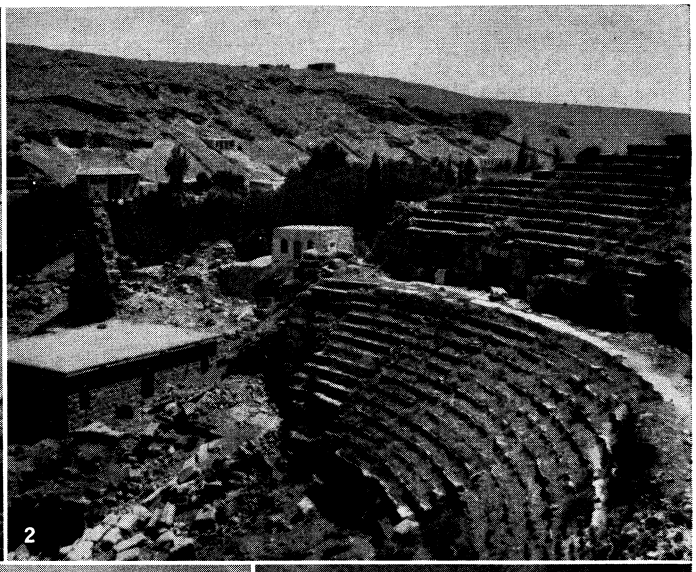
GEOGRAPHY

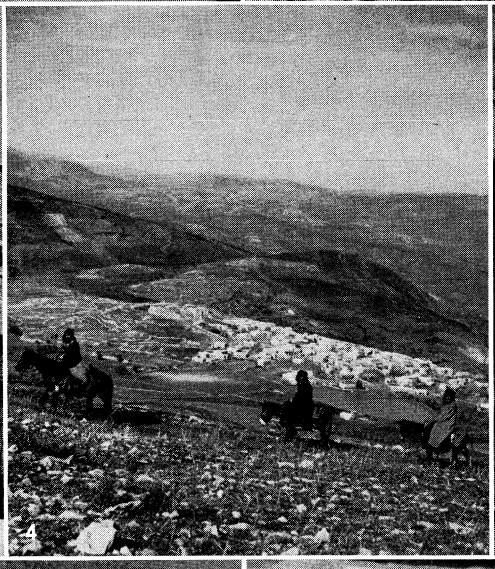
Asia, the great land-mass of the Old World, stretches from well within the Arctic Circle to 13° N. of the Equator in south Arabia, 6° in Ceylon and within a degree and a half at the tip of the Malay peninsula.

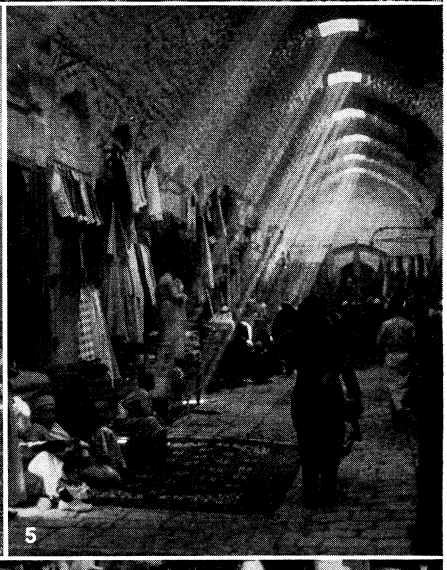
On the west the continent reaches the shores of the Mediterranean — Cape Baba in 26° E. being the outpost. The boundary passes thence in one direction through the east Mediterranean and down the Red sea to the south point of Arabia, and in the other direction through the Black sea to the Caucasus, the lower Volga and the Ural mountains to the Arctic ocean. Asia's eastern outpost is East cape at the entrance to Bering strait 190° east. The boundary from this point to the Malay peninsula follows the coast of the North Pacific and the China sea. Asia viewed as a whole (on the globe) forms a great isosceles spherical triangle, having its north-eastern apex at East cape in Bering strait; its two equal sides, in length about a quadrant of the sphere, or 6,500m., extending on the west to the south point of Arabia, and on the east to the extremity of the Malay peninsula; and the base between these points occupying about 60° of the great circle, or 4,500m., and being deeply indented by the Arabian sea and the Bay of Bengal on either side of the Indian peninsula. A great circle, drawn through East cape and the south point of Arabia, passes nearly along the coast line of the Arctic ocean, over the Ural mountains, through the western part of the Caspian and, with the exception of Asia Minor and the north-west half of Arabia, indicates, with fair accuracy, the north-west boundary of Asia. In like manner a great circle through East cape and the extremity of the Malay peninsula passes nearly over the coasts of Manchuria, China and Cochin-China.

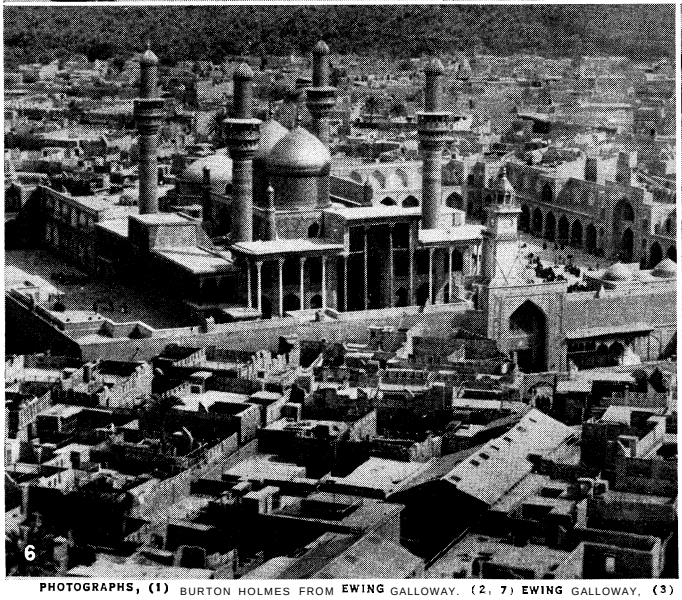
The series of highlands from Lake Baikal south-westwards to the Hindu Kush and the Elburz have on their northern and western sides the great Euro-Asiatic lowland that reaches from the Carpathians to the Yenisei and, in the form of the Angara plateau of moderate height, beyond it to the Lena river and the Verkhoyansk mountains where it abuts upon the Pacific coastal region, widely characterized by land forms arranged in steps, the edges of which are raised. South-east of the highlands from Baikal to Hindu Kush, and west of the Pacific coast region are the basins of inland drainage of the high plateaux of east central Asia, for the most part more than 3,000ft. above sea level. To its south again is the mountain land of Tibet with even valley floors near or above the 12,000ft. level in many places. The above four regions constitute what zoological geographers all agree to call the Asiatic portion of the Palaearctic region. Asia south of the line from the Armenian mountain knot and the Elburz mountains to the Himalaya we may divide into four chief regions. The first is south-west Asia with the Euphrates lowland between the

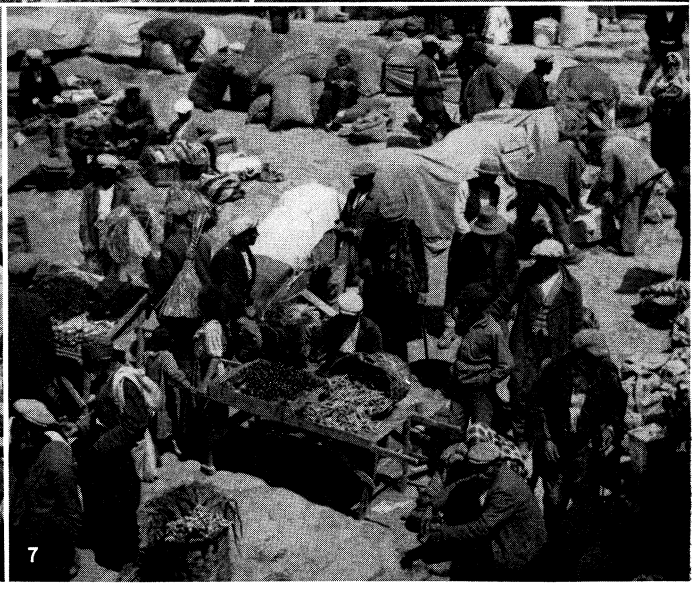










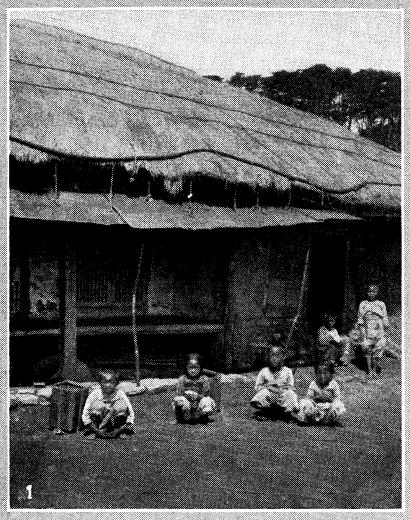


PHOTOGRAPHS, (1) BURTON HOLMES FROM EWING GALLOWAY. (2, 7) EWING GALLOWAY, (3) PAS1 FROM THREE LIONS, (4, 5) PIX FROM PUBLIX, (6) PUBLISHERS PHOTO SERVICE

COUNTRIES OF WESTERN ASIA

1. Street scene in Haifa, seaport of Palestine
2. Ruins of an ancient theatre at 'Ammān (ancient Philadelphia or Rabbath-Ammon) in Trans-Jordan
3. The Great Gate at Tehran, Iran, with Mt. Damavand in the background
4. Looking into Palestine across the Syrian border, with an Arabian village in the foothills
5. The bazaar of Aleppo, Syria
6. A Shia settlement near Baghdad, Iraq, showing the golden minarets of Kazemain
7. Open-air market in the old auarter of Angora (Ankara), Turkey

ASIA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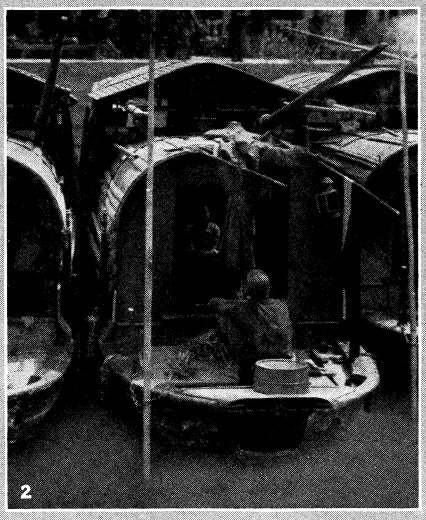
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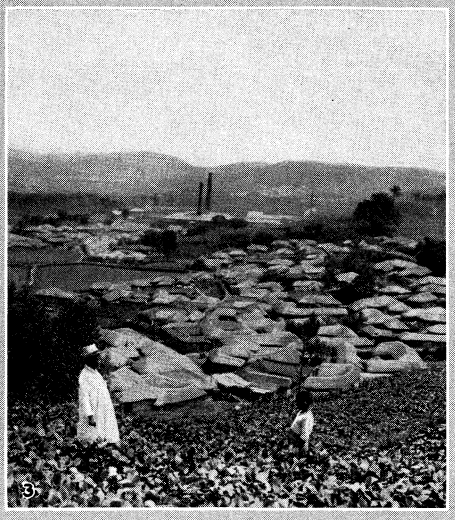
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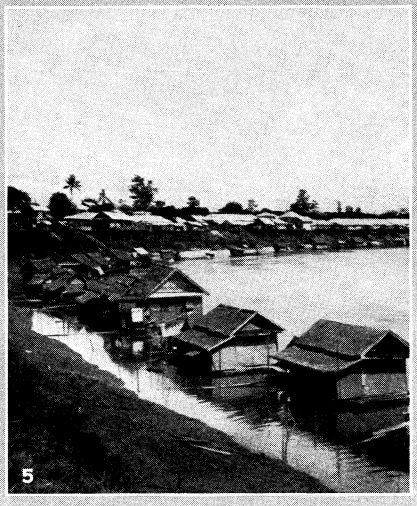
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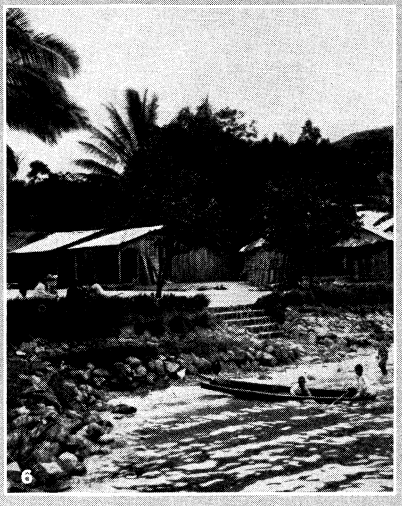
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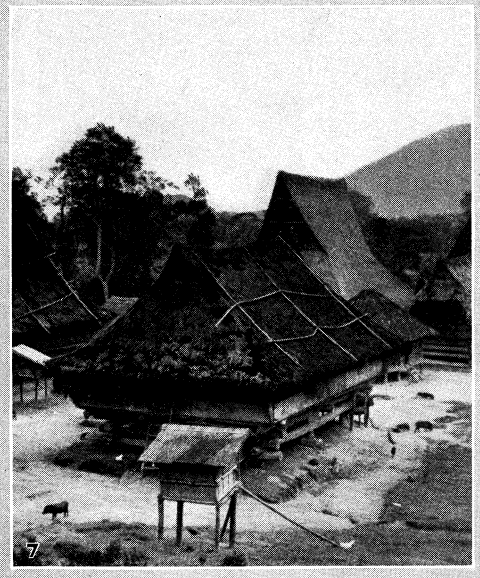
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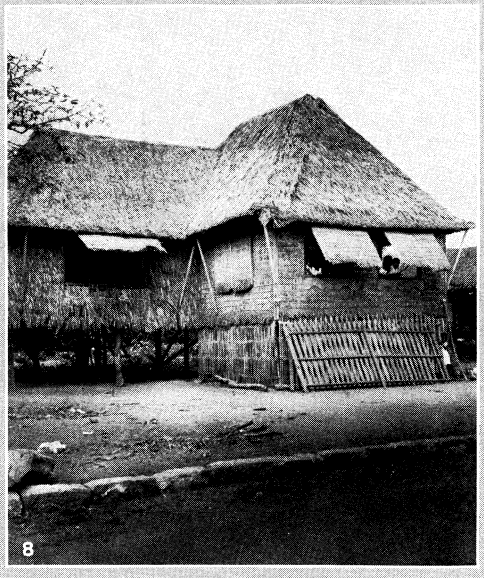
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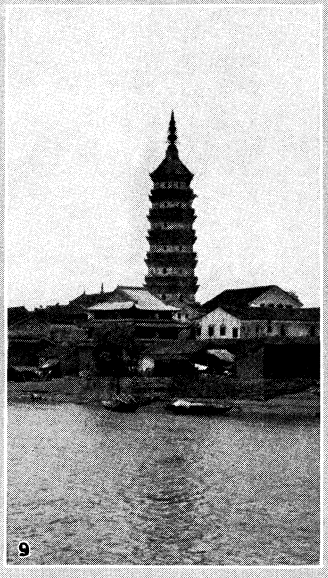
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SCENES IN THE FAR EAST

1. A Korean house which has wails of mud and a thatched roof
2. Houseboat of a river dweller in Canton, China. These boats are very numerous on the Pearl river for three or four miles opposite Canton
3. A Korean village of mud huts surrounded by country that is rolling and largely agricultural
4. A house and yard near Padang, in Sumatra, in which several families live. Community living is common in this section of the country
5. Houses built over the water by the natives of Petsanuloke, Siam
6. Landing place at a village on Lake Toba, in the northwestern part of the island of Sumatra
7. A village in the country of the semi-civilized tribe of Battaks, west of Lake Toba, on the island of Sumatra
8. A thatched house of the Philippine islands raised on piles to prevent its inundation during floods
9. Corner of a town on the Yangtze Kiang river, in China, showing the Pagoda

Arabian block and the mountains; the next is the series of basins between mountain curves complicated by fragments of old blocks and forming the countries of Persia, Afghanistan and Baluchistan; the third is India with the old block of the Deccan separated from the Himalaya by the Indo-gangetic lowland; in the fourth, the Indo-Malayan region, the great mountain folds bend suddenly southward between the old block of the Deccan on the south-west and old blocks in south-east China, Cambodia and Borneo on the east. These folds are continued as determinants of the land-forms of the East Indian archipelago.

The Euro-Asiatic lowland rarely rises beyond 1,500ft. over sea-level and huge expanses are below the 600ft. contour. The drainage, especially in the Ob basin, is thus slow and imperfect and when snows melt in the south, but ice holds fast farther north, there are wont to be widespread floods. The Arctic ocean receives drainage of a larger Asiatic area (4,367,000sq.m.) than the Pacific (Asiatic drainage area 3,641,000sq.m.) or the Indian ocean (Asiatic drainage area 2,873,000sq.m.) and by far the greater part of the drainage to the Arctic is via the Ob, Yenisei and Lena and lesser rivers, which serve the Euro-Asiatic lowland and rise on its eastern and south-eastern mountain borders. The Ob basin is one of the world's most extensive areas of pure lowland. The Yenisei, fed from Lake Baikal and the Sayan mountains, is also the collector of the drainage of the western edge of the Angara plateau. The Lena drains the east of that plateau, and the arc of highland (Verkhoyansk, etc.) which bounds our region on the east. The Lena's length is estimated at 3,000m., the Yenisei is 2,700m. and the Ob 2,400m. South of the rather higher zone of Semipalatinsk (one area above the 3,000ft. contour) the lowland is continued as the world's most remarkable internal drainage area, containing Lake Balkash and the Aral and Caspian seas, each and all now without outlet. To this part of the lowland the name of Turkistan is often applied. The general soil of the northern part of the Euro-Asiatic lowland is alluvial or glacial mud with some more stony areas on the Angara plateau, but in several parts at the foot of the mountains and elsewhere, and very notably south of the Oxus in Afghan Turkistan, there are huge accumulations of loess (*q.v.*).

To the north of the northern steppe the soil remains so cold that pine forest is the natural vegetation (this is called the Taiga) with riverside meadows, so that men have migrated, probably under pressure, in this direction along the rivers, using them for fish, as food from flocks and herds diminished. On the tundra, north of the pine forest in Asia, man has found the reindeer and with it has penetrated westward to Lapland. The Ural mountains (maximum height 5,537ft., average probably well below 3,000ft., passes in some cases 1,400ft. above sea level) form an incomplete boundary towards Europe, but to the west of them the greater amount of summer rain permits a much larger extent of oak forest, which can be cleared for cultivation, than occurs on the Asiatic side. In the south part of the Urals are important mineral resources.

The High Plateaux. — The high land stretching west from the Yablonoi mountains and the Vitim plateau includes a number of ranges of old and much denuded mountain-arcs such as the Sayan, Tannu Ola, Khangai and Altai ranges, drained partly by feeders of the Ob and Yenisei to the north-west, and the Lena and Amur to the north-east, as well as by the Selenga which flows into Lake Baikal. The depressions between the Altai on the one hand, and the Khangai and Tannu Ola on the other, have lakes without outflow, and south-west of the Altai is Lake Balkash, now also without outflow but still fresh.

This country is on the whole fairly well watered and has a good deal of pasture, and some of its better valleys have been the homes of groups dependent largely upon the horse. It contrasts strikingly with the great plateau-waste of Gobi, at a lower altitude but still almost everywhere more than 3,000ft. over sea level. Here are great undulating stretches with areas of grass here and there, and remains of ancient drainage sometimes indicated by salt swamps. Oases of relative fertility occur, but the rigours of winter make them very different from the intensively developed fertile spots of the warmer Sahara.

To the west, the Gobi plateau descends westward to the northern steppe-lowland of Turkistan by the historic Dzungarian gate, bounded on the south by the Tien Shan range, a sharp-featured, ridged range of great length and height (Khan Tengri 23,600ft.), contrasting very markedly with the older mountains north-east of the Dzungarian gate. Between the Tien Shan and the Altyn Tagh, the northernmost of the Tibetan mountain arcs, lies the Tarim basin with the Yarkand Daria and Tarim rivers draining into a northerly depression, and with the lake-swamp of Lob Nor occupying an easterly depression. Feeders of the Yarkand Daria come down from the pass between the Tien Shan and the Pamir, the pass which has the famed market town of Kashgar at the entry to the Tarim basin. This basin has been studied in much detail by Stein, who finds many indications of desiccation of what seems to have been an area of much importance. The eastern end of the great Gobi plateau is marked by the Khingan mountains, one of the steps from the high Asiatic interior down to the coasts and deeps of the Pacific; and the north-east of the plateau is drained by the Amur which goes round the north end of the Khingan mountains. Huge amounts of loess near and beyond the eastern border of this region, in Kansu, and the Wei-ho and associated valleys, have played a great part in the development of Chinese civilization, and have furnished ways into China from the desert, to bar which was built the famous wall, so that in a sense the wall of China may be considered the boundary of our region.

The Pacific Coasts. — Here is a unique series of land forms, festoons of islands, which seem to be formed largely of folds, in part submerged, but much complicated by vulcanicity. The Kuril islands, the Japanese chain, the Ryūkyū islands and the Philippines are an outer set of arcs enclosing the seas of Okhotsk, Japan, east China and south China, each with a considerable area of deep water out of which the arc of islands arises. The continental coasts of these seas show a considerable zone of shallow water from Tongking to the Korea strait, where the continent has either alluvium or fragments of old blocks along its coasts, but north of Korea strait the coast becomes marked more and more by formations akin to mountain arcs, and the extent of shallow sea is less, but there is a good deal in the sea of Okhotsk.

In the north the mountain arcs form a complex transition zone between the Pacific coastlands and the Euro-Asiatic lowlands. In the latitude of Japan a very interesting step-structure is noticeable. East of Japan are the deepest hollows of the ocean, west of Japan the sea has considerable, but by no means comparable, depth, then the edge of Korea and the Sikhota Alin rise sharply. Beyond them again are the shallow waters of the Yellow sea, the lowland of Manchuria and of the middle and lower Amur. Beyond this again is the step up to the high plateaux, marked by the Khingan mountains. South of this interesting zone of step-forms, the physiography is complicated by interaction of fold mountains and old blocks in China. The great river basins here are those of the Hwang-ho (2,400m.) and the Yangtse-kiang (3,000m. or more), cut deeply into the highlands and ending in a large alluvial area which is the great agricultural region of north China, and offers the most striking contrast to the deeply dissected plateau country of the old block of south China. Whereas the alluvium of north China has become thronged with cultivators using the soil most intensively, south China is relatively less thickly peopled, and retains remnants of pre-Chinese peoples. The social and economic contrasts based on physiographical differences, and on the varying ranges of influences of the immigrant cultures from the loess of the north-west, form the fundamental difficulty of the problem of political organization in modern China.

Formosa is essentially a continental island on the Tropic of Cancer with an axial ridge that reaches 12,939ft. near the centre. It has ancient elements and immigrant Chinese, and now also some Japanese in its population. In the Philippines and beyond we have the continuation of the festoon of mountain curves that girdles the Pacific, but in this section it is complicated by its inter-relations with the fold mountains of Indo-Malaya.

Tibet.—The southern border of the high plateaux discussed above is formed by the Nan Shan and Altyn Tagh ranges, south of which run the closely packed mountain ranges of Tibet, the Kunlun in the north being separated from the Nan Shan by the one large depression, the Tsaidaman swamp, which, however, is itself more than 6,000ft. above sea level. Apart from this, only parts of the floors of the great corridor valleys of the Indus and Brahmaputra and the Salween, Mekong and Yangtse-kiang are below 12,000ft. in height, while immense stretches are over 18,000ft. above sea level and K_2 (Godwin-Austen) in the Karakoram reaches 28,250ft., while the giant Himalayas form the southern boundary with Everest (29,140ft.) and Kinchinjunga (28,146ft.). The country, known to its people as Bod, or Bodyul, must have remained uninhabitable for a long time ere the ice-sheets had retreated enough to give men an opportunity. They have managed to inhabit the land, partly thanks to the yak as a domestic animal; partly because patches of riverside alluvium could be cultivated in summer; partly because corridors, such as that of the upper Indus and Brahmaputra valleys, and some mountain passes have permitted caravan trade and have thus contributed to the importance of Lhasa. One should note the sanctity of both Lhasa and Mecca, both stations in desolate surroundings on caravan routes.

South-west Asia.—The Armenian mountain knot is separated from the Caucasus by the lowlands of Georgia on the west, and Azerbaijan on the east, with Tiflis, the capital of the former, in the pass between them. What is, in 1928, called Armenia is but a fragment of the historic Armenia which included the mountains dominating from both sides the high corridors from Kars and Erivan to Erzerum and Erzinjan. The highest peak, Ararat, reaches 16,025ft. and the mountain system is unique in the Old World in containing great sheets of water that are bitter lakes without outlet, Lake Van and Lake Urumiya being the chief. To the west the Pontus and Taurus mountains diverge on either side of the Anatolian plateau, partly basins of internal drainage, and partly the basin of the Halys (Kizil Irmak). The sinking of the Aegean area has brought about complex inter-relations of broken folds and edges, sunken valleys and islands at the west end in Asia Minor.

South of the Armenian mountain knot is the ancient block of Arabia, with the "fertile crescent" of the Mesopotamian lowland and Syria separating the two. Relief is complicated by the fact of the great rift system (see AFRICA) which has contributed to give west Arabia a high edge with much lava. Palestine is the country between the Mediterranean and the north part of the rift system, *i.e.*, the Jordan valley and the Dead sea. Mesopotamia and the shallow Persian gulf form one depression between the Arabian block and the Persian mountain arcs. Here land and water have had varied relations, and there seems every reason to think that in early historic times (c. 4000–2000 B.C.), at least, the gulf shores were much farther north than they now are, as Ur of the Chaldees was a port; changes are due largely to silting. The contrast between the southern steppe (*i.e.*, the borders of the Arabian desert, with its proximity to the "fertile crescent," a great cradle of civilization), and the northern steppe of the Euro-Asiatic lowland is of the utmost interest in connection with the interpretation of history. In the fertile crescent, as nowhere else in the ancient world, wandering, trading patriarchal herdsmen came into contact with settled cultivators living in agglomerations near the waterside, and organization taking both into account in various ways grew **up.**

Persia, **Baluchistan,** Afghanistan.—East-north-east of the Mesopotamian lowland and the Persian gulf, the Armenian mountain knot branches, forming the Elburz mountains (Mt. Demavend, 18,600ft.) of the south coast of the Caspian eastwards, and the Zagros mountains stretching south-eastwards as the boundary between Mesopotamia, in the physical sense, and the Persian highland, though politically Persia includes the Karun basin and reaches down to the Euphrates just below Basra. Farther south the mountains turn into a west-to-east direction and proceed towards the Indian border in lines behind the Baluchistan coast, whereafter they turn north as they front the Indus lowland. Analogously, from the Pamir's south-western region the great Hindu Kush extends south-westwards, with branch mountain lines fanning out in Afghanistan, the easternmost fronting the Indus lowland while the northernmost are continued with only a slight break right to the Elburz. The Afghan and Baluch highlands of the border of the Indus basin come into relation with one another, but the famous Bolan pass (Quetta-Kandahar) is near their junction. There is thus in Persia, Afghanistan and Baluchistan a collection of mountain arcs not compressed closely as in Tibet but set round about basins, in which old blocks play their part. The basins are mostly without outlet and include the Salt desert of north Persia, the Lut desert of east Persia, the basin of Seistan and the Helmand (Registan) in south Afghanistan, the basins of Jaz Murian Hamun and Hamun-i-Mashkel in south-east Persia and south Baluchistan. These and other similar smaller basins usually have salt lakes or swamps in their desert floors. The mountain sides in many parts are far more fertile.

India.—The essential facts here are that the Deccan is a part of the ancient Gondwanaland, projecting northward on the west into Rajputana and separated from the fold mountain ranges of the Indian borders by the Indo-gangetic lowland. The mountain frame is roughly parallel to the edges of the ancient block, as though the newer folds had become set in some way in relation to it, but at a distance from it. The western coast of the Deccan is dominated by the sharp edge of the western Ghats, the hills of west Mysore and smaller hills down to Cape Comorin, and Ceylon is a continental island separated from the Deccan peninsula by the shallow Palk strait. As in Africa, so in the Deccan, there is a general tilt of the plateau, in this case down to the east, and there are basin depressions on the plateau (basins of Mahanadi, Godavari and Kistna). The heavy monsoonal rainfall of the east part of the Indo-gangetic trough against the Himalayan flanks gives rise to the many feeders of the Ganges running through what was once swamp and forest, but has been much altered by man. Rajputana and the west of the Indo-gangetic trough get little rain, monsoonal or other, at present, and the trough is watered by the Indus draining the great longitudinal valley of Ladakh and Baltistan, high between Himalaya and Karakoram and then turning sharply through great gorges down to the plains. The rivers of the Punjab, feeding the Indus on its left bank, mostly have analogous, longitudinally placed, upper valleys, that of the Jhelum being the vale of Srinagar in Kashmir, famed for its beauty. The Sutlej probably reached the sea independently of the Indus in early historic times. The Brahmaputra, after a long course through a longitudinal valley north of the Himalayas, turns south through a great gorge only recently explored, into the Assam lowland, a narrow depression between the Himalaya and the Patkoi, Naga and Khasi ranges. The south-east peninsula of Asia shows the sudden southward bending of the great Tertiary fold mountain ranges after they have formed the giant Himalayas. They bend apparently in face of the resistance of older blocks, parts of which survive as south-east China, the Cambodian region and a part of Borneo, the two latter being separated by very shallow sea, which rarely, if ever, reaches a depth of 70 fathoms. As the folds bend south they diverge on either side of Cambodia and form the corridor basins of Irrawaddy, Salween and Mekong. Still farther south one may trace these lines in the Andamans, Nicobars and in Sumatra and Java, as well as through the Malay peninsula, while the Philippines represent the scheme of folding along the Pacific border. East of the Philippines and south of Sumatra and Java the ocean is very deep, but the sea between Java and Malay on the one hand and Borneo on the other is very shallow. Beyond the zone formed by the Philippines, Borneo, Java and Bali the two fold lines approach one another and we find islands and chains of islands in complex fragmented curves around the deep basins called the Banda and Celebes seas. (See also NEW GUINEA.) (H. J. F.)

GEOLOGY

The fundamental feature in the geological structure of Asia appears to he the presence in the north and in the south of large

areas which have remained relatively rigid since the beginning of the Cambrian period, while between and around them folding of mountain-building type has taken place at different dates.

The Siberian Massif.—This is limited on the north-west by the arc of the Byrranga hills in the Taimir peninsula, convex towards the south-east, in which folding of a date not yet determined occurs. On the north and north-east it is bounded by the Verkhoyansk range and its continuations across the Lena. Here the Trias is marine and the folding belongs, perhaps, to an early phase of the Alpine system. Towards the south-east the massif sends a spur across the Lena into the Aldan region, but before the Stanovoi range is reached folding begins to affect the Palaeozoic beds. Southwards the rigid area is bounded approximately by the east Sayan range and the ranges south-east of Lake Baikal, but overthrust masses appear before this limit is reached. Westwards the massif disappears beneath the later deposits of the Ob plain and in this direction its boundary cannot be determined.

The southern portion of the region thus defined consists chiefly of a platform of Cambrian and Ordovician beds, which are generally horizontal or nearly so. The deposits are mostly marine, but red sandstones and gypsum in the Ordovician suggest salt lakes. These Lower Palaeozoic beds are overlaid in places by plant-bearing beds of terrestrial origin, to which Suess has given the general name of the Angara series. The series, which is widely spread in northern Asia, probably ranges from the Permian to the Cretaceous, but in Siberia the deposits are mostly Jurassic.

While the southern portion of the area thus seems to have been land since the later part of the Palaeozoic era the sea at times overspread it from the north at least as far as 62° N., but not continuously. Marine deposits of various Jurassic and Cretaceous horizons have been found, but there is no indication of marine Trias such as occurs in the Verkhoyansk range.

Extensive flows of basic lava cover a wide area, with little indication of actual volcanoes. The age of the flows is uncertain. They may be Cretaceous or Tertiary.

The Sinian Massif.—The limits of the Sinian massif are very imperfectly known. Over large areas in northern China, especially in Shansi, Shensi and the Ordos region, the Cambrian beds are nearly horizontal, but the Tsin-ling-shan with its strongly folded beds defines its southern border. The horizontal Cambrian beds are marine and they are succeeded by marine deposits of Upper Carboniferous age, which in turn are followed by coal measures. The coal measures are overlaid by a thick sandstone upon which rest plant-bearing beds of the Angara series. Throughout the Mesozoic era the area seems to have been land.

The Indian Massif.—This includes Ceylon and the whole of the peninsula south of the Indo-gangetic plain. The oldest fossiliferous beds are called the Gondwana series and are characterized especially by the presence of *Glossopteris* and other fern-like forms. The series is entirely of terrestrial origin, except in the upper part, in which near the present coast marine beds are sometimes intercalated. In age it seems to extend from the Upper Carboniferous to the Upper Jurassic. Throughout the peninsula no marine deposits of earlier date than the Upper Jurassic are known and these are confined to the borders of the mass. The sea reached its greatest extension in the Upper Cretaceous period. Marine deposits of this age are found about 150m. up the valley of the Narbada. Elsewhere they are limited to the coastal regions. There is thus no indication that the peninsula was ever beneath the sea excepting near its borders and there is positive evidence that the greater part of it has been land since the Carboniferous period. There is also evidence that that land was connected with the southern part of Africa throughout the greater part of the Mesozoic era.

Most of the north-westem part of the peninsula is covered by a thick series of basaltic lava flows, known as the Deccan Trap, which occupies an area of about 250,000sq in. Very little evidence of any explosive action has been found and the eruptions took place from fissures. They belong either to the later part of the Cretaceous or the early part of the Tertiary period. The fact that this series several thousand feet in thickness, is abruptly cut off at the western coast is a clear proof that the land mass formerly extended much farther in that direction than it does at present.

The Arabian Massif.—This includes most of Syria and the whole of Arabia except Oman. In Palestine Cambrian beds with trilobites near the Dead sea, and limestones with marine Carboniferous fossils over a wide area indicate that during the Palaeozoic era the northern portion was at times beneath the sea. Jurassic beds occur in Lebanon and in the north of the Sinai peninsula, but throughout the greater part of the region the earliest marine deposits belong to the Upper Cretaceous. Like the other rigid areas the Arabian massif seems to have been land through most of the Mesozoic era. Whether it was connected with the Indian massif is still uncertain, but the existence of a strongly folded zone in Oman which runs out to sea upon its southern coast and in which marine Mesozoic beds are involved, suggests that the two were independent.

In Syria and north-western Arabia several high-lying plateaux are formed of basic lava-flows, but they are not comparable with the Deccan Trap of India in extent and seem to be of later date. Probably the eruptions took place largely from fissures, but towards the western edge of the Arabian plateau there are many small volcanic cones which are still nearly perfect, and there is a record of an eruption east of Medina in A.D. 1256.

The great belt of folding which runs from Asia Minor to the coast of China occupies the site of an ancient sea which lay between the northern and the southern massifs and which Suess named "Tethys." Marine deposits play a much larger part than upon the massifs and the geological succession is much more complete. Folding took place at various periods and the effects of the different periods have not yet been disentangled. From the Tien Shan and Kunlun northwards and also in south-eastem China the chief folding took place during the Palaeozoic era. The Caledonian system of Europe may perhaps be represented in the ranges near the Siberian massif, but this is still uncertain. The Hercynian system is dominant in the Tien Shan, the Kunlun and in China. But it must not be supposed that the present mountain ranges are the direct consequence of this ancient folding. The old ranges have been worn down and broken up and the actual topography is largely due to a remarkable system of trough-faulting of much later date.

Farther south the principal folding is of Tertiary age and belongs to the Alpine System. The southern limit is marked by the depression of Mesopotamia, the Persian gulf and the Indo-gangetic plain. The whole mass is being pushed forward over the rigid regions of the south and is crumpling in the process. Similarly the Burmese ranges, which are of about the same age, were produced by crushing against the eastern border of the Indian massif.

Although the Alpine system of earth movements is believed to have culminated in the Tertiary period, there is clear evidence of an earlier and independent phase. In the Oman zone already referred to, the principal movements took place during the earlier part of the Cretaceous period. Movements of the same age occur in central Persia, and it is not impossible that the folding of the Ural mountains may have taken place about this time. The latter is usually referred to the Hercynian system but on very imperfect evidence. All that is really proved concerning it is that a part of the Russian Permo-Carboniferous is involved and that the folding was completed before the deposition of the Upper Cretaceous. Whether there was any connection with the Urals or not it seems clear that in western Asia an earlier Cretaceous folding cuts across the line of the later Tertiary movements, and much work will be necessary before the effects of the two phases are unravelled.

Movement in the Himalayas and in other parts of the Alpine system has not yet entirely ceased, but the island arcs off the east coast of Asia seem to belong to a system which has not even reached its culmination. Wegener has attributed them, in a vague way. to a dragging effect as the continent drifted westward. Judging from the history of other mountain arcs they must have been produced by the thrusting of Asia against and over the

floor of the Pacific, which seems to function as a rigid area. The great deeps which lie outside the island arcs would then correspond with the depressions common on the convex side of mountain arcs, such as the Persian gulf and the deep hollow filled by the deposits of the Indus and Ganges.

It is common ground to all geologists that the folded bell of Asia has been produced by lateral compression, and this compression implies that the rigid regions of the north and the south have approached one another; but there are differences of opinion as to the cause of this approach. Suess would attribute it to contraction of the earth's interior, Wegener to movement of sial masses floating in the sima. The former hypothesis supplies a force of ample power, but whether the amount of contraction has been sufficient cannot be finally determined until we know more about what happens in the interior of the earth. The latter allows movement of the required extent: it has not yet provided a force capable of lifting the floor of the sea to the level of central Asia against the force of gravity. **(P. LA.)**

CLIMATE

The great area of Asia and its extension from 77° N. at Cape Chelyuskin almost to the Equator at Singapore, give this continent a very great range of climates. It may conveniently be divided into four sections, Siberia and western Turkistan; south-west Asia; India and Farther India; China and Japan; but even in these smaller areas the range is still very great.

Siberia and Western **Turkistan.**—This section extends from the Urals and the Caspian to the Pacific, and from the Arctic ocean to the great mountain ranges of central Asia—Tien Shan, Altai and Yablonoi mountains. The southern part is occupied by extensive steppes, becoming true desert in Turkistan. North of this is a belt of forest, succeeded by the tundras of the Arctic coast. The climate is characterized by a remarkably clear cold winter and a hot summer, which is the chief rainy season. In the west the moderating effect of the Atlantic can be traced at times as far as the Yenisei, the Urals not being high enough to act as a marked climatic divide, but in the east a temperate maritime climate is only found in the peninsula of Kamchatka.

In winter Siberia is occupied by a vast anticyclone, in which the highest known pressure on the globe (1,072 millibars reduced to sea level) was recorded at Irkutsk on Dec. 20, 1896. The intensity of the anticyclone is mainly due to the severity of the cold, forming a great pool of cold air, but the basin-like topography of the Baikal region is also an important factor by preventing the cold air from flowing away, hence the centre of the anticyclone is found south of Irkutsk instead of at the "cold pole" near Verkhoyansk. From this anticyclonic centre an axis of high pressure extends towards the Black sea in the west and Bering strait in the east; to the north of this axis the winds tend to be westerly, and to the south of the axis, easterly. Winds are in general light in the interior, but violent blizzards termed *poorgas* and *buran* occur, often causing loss of life. In the main river valleys the cold air flows down the valleys irrespective of direction. On the east coast strong, very cold, northerly winds prevail. The anticyclone lasts from September to April inclusive; in June, July and August it is replaced by a large shallow area of low pressure over eastern Siberia and China, and south-easterly winds prevail over eastern Siberia, bringing much cloud and a moderate rainfall, while over western Siberia the winds are mainly north-westerly.

Northern Siberia is among the coldest regions on the surface of the globe, the Lena delta having an average annual temperature of 1° F, while the isotherm of 32° reaches 49° N. (the latitude of Jersey) near Kharbarovka. The annual variation is extreme over the interior, the winters being frightfully cold and the summers comparatively hot. Verkhoyansk, with an average January temperature of −59° F and an extreme of −94° F, has the coldest winter of any permanently inhabited portion of the globe. Other average January temperatures are −46° F at Yakutsk, −6° F at Irkutsk, −9° F at Yeniseisk, −14° F at Obdorsk and −5° F at Omsk, and almost everywhere extremes of −50° F are recorded. These temperatures sound appalling but are bearable because of the extreme dryness of the air and the general absence of wind. The hard dry snow surface is excellent for sleighs, and winter is the favourite season for travel. The effect of the winter on vegetation is negligible, and in parts of Siberia plants thrive in the open which in England need the protection of a glasshouse; this is because the temperature rises so rapidly in spring that once the growing season begins there is no further danger of frost. The summer is short, but in the interior it is hot, the average July temperature exceeding 60° F over most of Siberia. The mean daily range is about 15° F in winter but 25° F in summer; the highest temperatures frequently exceed 100° F and 113° F has been recorded at Olekminsk. On the Arctic coast the summer consists of two months of cool, foggy, dismal weather. Turkistan has moderately cold winters, with an average temperature of about 30° F in January, and extremely hot summers, the July temperature at Tashkent being 80° F.

The annual rainfall is less than 10in. a year over the tundras and again in southern Siberia, falling below 4in. in parts of Turkistan. The rainiest regions are the forest belt of western Siberia and south-eastern Siberia, with aoin. or more, and southern Kamchatka with 40 inches. The precipitation in winter is everywhere small, and is entirely in the form of snow; spring is the wettest season in Turkistan but is dry elsewhere. Summer has fairly heavy rains over the whole of Siberia, while southern Kamchatka has its rainy season in autumn.

South-west Asia.—This area includes Asia Minor, Syria and Palestine, Arabia, Mesopotamia, Persia and Afghanistan. We may sub-divide it into three belts, a northern belt of plateaux and mountains, an intermediate belt of steppe and desert, and the south coast. The northern belt, including Asia Minor, Armenia and the highlands of Persia and Afghanistan, has a climate resembling that of the Spanish plateaux but drier and more severe. The winters are cold, with a moderate but irregular snowfall, and the summers are hot and dry. Thus Angora has a temperature of 31° F in January and 71° F in July and August, the extremes are 100° F and −13° F and the annual precipitation is only 9 inches. The prevailing winds are north-easterly. The western and southern coasts of Asia Minor and the northern part of the Syrian coast have much warmer winters and a greater rainfall, reaching 36in. at Beirūt. Farther east the rainfall in this belt is generally between ro and aoin. a year, and the temperatures at heights of 5,000 to 6,000ft. range from 32° F in January to 80° F in July.

The steppe and desert belt includes Syria, most of Arabia, southern Rlesopotamia and the greater part of Persia. Owing to its lower elevation, the temperatures are higher than in the plateaux, but cold weather is often experienced in winter; heavy snowfalls have occurred in Jerusalem and even the northern part of the Arabian desert has been seen carpeted with snow for many miles. At Baghdad a temperature of 19° F has been recorded. In summer the heat is intense, the average temperature exceeding go° F in July and August, while the extremes exceed 110° F almost every year and 123° F has been recorded at Baghdad. The prevailing winds are northerly throughout the year (except in Palestine, where they are westerly) and are sometimes of great strength, especially in summer. Strong dust-laden northerly winds are termed *Shamal* in Mesopotamia and Persia. The province of Seistan in eastern Persia is noted for the *Seistan* or "wind of 120 days" (June to September) which often exceeds 70m. per hour and has reached 120 miles. In southern Palestine and Arabia the *Sirocco* occurs as a dry dust-laden south-east wind. The rainfall averages about aoin. a year in the west but decreases eastwards, and in Arabia, Mesopotamia and eastern Persia there are large desert areas with less than 10in., often less than zin. a year. The rainfall is limited to the winter and spring months and is very variable from year to year. The southern Red sea, the south coast of Arabia and the Persian gulf have a moister climate with frequent south-west winds in summer and some rain at that season. The winters are very mild (Aden January average 76" F) and the summers are characterized by a moist heat, which is very unpleasant, especially in the Persian gulf.

India.— In India the year falls into three seasons, the cold weather, the hot weather and the rains. The "cold weather" extends from November to March, January being the coldest month with temperatures (reduced to sea-level) rising from 55° F in the north-west to nearly 80° F over Ceylon, the average for the whole country being 67·5° F. There is some rain in the north-west, brought by storms which have come from the Mediterranean across Persia; Ceylon also has an appreciable rainfall, brought by the prevailing north-east trades blowing across the Bay oi Bengal, but the greater part of India is dry. In March and April temperature rises rapidly, and April, May and June are very hot, the average temperature of the whole country being 87" F, and exceeding 95° F in central India in May and in the north-west in June. The dry weather lasts through May and the early part of June, but heavy rain begins to fall towards the end of June; July and August are generally the wettest months. but the rain continues through the greater part of September. The cloudy skies and rain lower the temperature over most of India, and the average for July, August and September is only 83" F. In the north-west the rainfall is very small, and temperature is much higher, averaging 99° F at Jacobabad in June and 97° F in July, while a maximum of 126° F has been recorded. Owing to the vertical decrease of temperature at the rate of 3" F per 1,000ft., stations at a height of several thousand feet have a pleasant climate during the hot weather on the plains, and are employed as summer resorts. The prevailing winds are north-easterly from October to February, irregular in March, and south-westerly from April until September. The north-east winds are naturally dry (except in Ceylon); during April and May the south-west winds are also dry, because they originate as northerly winds in Persia, curving round the Arabian sea. Towards the end of June there is a change in the general pressure distribution; the south-westerly winds over India originate in the south Indian ocean and arrive heavily charged with moisture. The north-east and south-west winds are termed *monsoons,* but owing to the economic importance of the summer rains, the term monsoon is often applied to the rainy season and not to the wind. The winds are generally light, except during the passage of cyclones.

The distribution of rainfall over India is very irregular. The heaviest falls occur where the rain-bearing winds strike directly against high ground, and the amount exceeds 100in. a year over the whole streich of Western Ghats from Cochin to beyond Bombay, in central Ceylon, the whole coast of Burma, and the high ground in Assam and Bhutan. The Khasi hills in Assam are reputed to be the rainiest region on the globe, Cherrapunji having an average of 424in. a year (the average for July alone being 102in.) while a five-year record at Manoyuram gave an average of 499 inches. It may be remarked that in the western Ghats 546in. fell in one monsoon. The smallest rainfall is found in the north-west, where Jacobabad has an average of only 4in. a year; while part of the Deccan, in the rain-shadow of the Western Ghats, receives less than 20 inches.

The Malay peninsula has a uniformly hot climate, the average temperature being about 80° F throughout the pear, with a daily range of about 12°. The rainfall is generally heavy (about 100in.) and is distributed evenly through the year. In Siam and Cambodia the year is divided into a hot rainy summer and a dry winter, which is hot in the south but is relatively cool in the north. Annam has a considerable rainfall in all months, the largest amounts falling in autumn. The alternation of a north-east monsoon in the winter months with a south-west monsoon in the summer months is found over all this region.

China and Japan.— Under this heading we include the whole of the old Chinese empire from the Pacific to eastern Turkistan, Korea and the whole of Japanese territory from southern Sakhalin to Formosa. This region includes a great variety of climates, from sub-tropical in the south, where the sugar-cane and banana flourish in a mean annual temperature of 72" F, to boreal in the northern interior, with a mean of 36" F and occasional readings below —30° F, but the whole area has a regular alternation of two monsoons, the cold dry northerly monsoon of winter and the warm moist southerly monsoon of summer, which is almost everywhere the rainy season. The western and north-western parts of China have an exceedingly continental climate, with a small rainfall and great extremes of temperature, while the sub-tropical islands of Japan are highly oceanic. The main Japanese islands are greatly influenced by two conflicting systems of ocean currents, the warm Kuro Siwo and a cold current which originates in the Sea of Okhotsk. Korea and the east coast of China are for their latitude the coldest parts of the northern hemisphere; this is due in the first place to the intense cold of winter brought about by the northerly winds and the absence of east-west mountain ranges; the summers, being very cloudy, are not hot enough to balance the winter cold. Over the interior of China the northerly winds of winter are not so strong, and are warmed by compression during their descent from the northern plateau, while the summers are less cloudy than the coast, hence the interior is generally warmer than the coast throughout the year, especially in the south. Japan has comparatively mild winters on both coasts. The winter climate of the high ground of Tibet is very severe. Spring and autumn are everywhere short, the cold of minter giving place quickly to the heat of summer and vice versa.

The mean annual rainfall varies from less than 10in. a year over the Tarim basin, western Tibet and the Gobi desert to nearly 300in. in north-east Formosa. Eastern Turkistan is one of the driest regions of the earth. Generally speaking the coast and islands have sufficient rain, the interior of China too little, except in the south-east. The greater part of the rain falls in the period of the south-east monsoon or summer, the only exceptions being coasts which directly face the north-east winds—the east coast of Japan and northern Formosa—but there is an appreciable winter rain in the Yangtse valley also. Snow falls in winter over almost the whole area. In the coastal regions, especially over south-east Japan, the summer monsoon is the season of typhoons, which do a great deal of damage, not only by the strength of the winds but also by the heavy rainfall and floods which accompany them. (C. E. P. B.)

FAUNA

Sclater's Palaearctic region includes Asia, north of the Himalayas and Hindu Kush, and Europe. South-west Asia has a good many animals like those of the Mediterranean lands or those of Africa. East of Sind we enter the Oriental region, which reaches out over shallow sea to Sumatra, Java, Bali and Borneo. The Sunda islands beyond Bali, as far as Timor, and Celebes and the Moluccas are to some extent intermediate between the oriental and the Australian regions. New Guinea may be reckoned with the latter, as the island has a good number of Monotremes and Marsupials, and a pig and a mouse are the only two mammals of higher orders, save the bats. The Moluccas have only two Marsupials (*Cuscus* and *Belideus*) and only the first of these two survives in Celebes or in Timor and the eastern Sunda islands. Celebes has an ape, *Cynopithecus niger,* and the so-called pig-deer, *Babirusa,* which occur in some of the Moluccas as well, but may have been taken thither by man. It also has the pig, a peculiar bull-antelope (*Anoa*), several squirrels, and, on an island off its north coast, the lemuroid *Tarsius.* Timor has the Cuscus and a shrew as indigenous forms.

Coming west to Java, Borneo and Sumatra, one finds no trace of Australian forms, but oriental types are numerous, though on the whole less so in Java than in the other two, which share with the mainland the Indian elephant, some deer, the tapir and *Galeopithecus* (a flying Insectivore peculiar to this region). The chevrotain (*Tragulus*), the rhinoceros and the Malayan bear occur on the mainland and in Sumatra. The orang-utan and *Tarsius* inhabit Sumatra and Borneo; the gibbon also occurs in Further India, south China and south Assam, and in Java, but its relative, the siamang, occurs in the Malay and Sumatra. Some monkeys in addition to those named above have reached as far as Java and Borneo. The old-fashioned scaly anteater (*Manis*) occurs in all three islands and on the mainland as far west as India, and the same distribution holds good for some lemurs and the *Tupaiidae* or squirrel-shrews.

These examples, not a complete list for Java, Sumatra or Borneo, are given to illustrate transitions between the Australian and the oriental fauna, and to show that in the islands of the oriental region one finds several types peculiar to them, some at least of which are old-fashioned forms. One might give at least as interesting a sketch of the reptiles or of the birds, showing that the babbling thrushes are almost absolutely restricted to the oriental region and include peculiar forms in Celebes. The Australian *Megapodius,* or mound-building bird, extends to the lesser Sunda islands, the Moluccas, Celebes and the Philippines, while a supposedly indigenous form is found on the Nicobar islands. The continental part of the oriental region is especially the home of the hunting leopard and the tiger, but they have spread north and west as well. The rhinoceros and elephant have been mentioned as highly characteristic forms. The analogies between the oriental and the intertropical African fauna (see AFRICA: *Fauna*) may be followed out with profit. Though south-west Asia is in many ways a link between the two, it lacks the anthropoids, lemurs, rhinoceros, elephant, scaly anteater and other forms which might be expected to show that linkage as they occur in both. South-west Asia is also linked with the Mediterranean lands. The lion, the hyena, antelopes and the coney (Hyrax) are African forms that reach into Asia; though Hyrax does not get in very far, the lion does not go east of the Indian desert, and the hyena avoids the forested parts of India, the antelopes do stretch far into India. Deer, absent from Africa save near the western Mediterranean, are important in Mediterranean lands, south-west Asia and the Palaearctic region.

South-west Asia shares with the Palaearctic region, in which it is often included, asses, antelopes, sheep and goats and the camel, the one-humped form being apparently indigenous in Arabia, while the two-humped or Bactrian camel belongs to the plains farther north. The oxen and buffaloes belong to oriental Palaearctic, south-west Asiatic and African regions, and the antelopes, their relatives, though especially African, also range far north on the open lands of central Asia. The open lands of central Asia, or lands which formerly had similar conditions, are the primary home of the horse, and probably of the two-humped camel, and it seems to be breeds of horse, ox, and sheep from the great steppes and their borders that are most widespread among domesticated types generally. The yak of Tibet, the musk deer of north-central Asia, the ermine, sable, glutton, reindeer, lemming and lynx of the north are characteristic forms of the Palaearctic region. The mysterious seal and *Comephoridae* (related to the mackerel) of Lake Baikal should be mentioned as indicating the great changes which have separated that lake from the ocean. Belt long ago suggested that during some phases of the glacial epoch the rivers of Siberia were probably dammed up, giving immense sheets of water between Baikal and the Arctic. Seals also inhabit the Aral and Caspian seas. Eastern Asia yields a few monkeys, penetrating from farther south, a remarkable large carnivore (*Aelurus*), the raccoon dog (*Nyctereutes*) and a few special moles, deer, etc. Though some subtropical forms have reached Japan, their numbers are not very large, and this has been held to suggest that continental land connections of Japan have been rather northwards than southwards. The Philippine islands have traces of connections southwards in the presence of *Tarsius, Galeopithecus* and *Tupaia,* along with a few more continental mammals, including three deer; it is, however, remarkable that the Philippines seem to lack the gibbon, the rhinoceros, the scaly anteater, etc., which belong to the East Indies. The birds of the Philippines include many forms peculiar to those islands and a number shared with the East Indian islands.

The tiger and leopard (panther) require special mention apart in view of their remarkably wide range; the former is found over a wide area from farther India to Siberia northward and to the Caspian westward; the leopard is also very widespread and occurs in Africa as well.

Among marine mammals the dugong (Halicore) is found only in the Indian ocean and a dolphin (Platanista) is peculiar to the Ganges, which it ascends for a long distance from the sea.

Among fishes should be named especially the sturgeon, migrating up rivers from the Black and Caspian seas, and the related *Scaphirhynchus* found in the rivers of Aral, of eastern Asia and of the United States of America. (H. J. F.)

FLORA

The vegetation met with over northern Asia much resembles that of the adjacent parts of Europe. The climates are similar and the rainfall, though moderate, is still sufficient to maintain the supply of water in the great rivers flowing into the Arctic sea and to support an abundant plant life. A similar affinity exists between the southern parts of Europe and the zone of Asia extending from the Mediterranean across Asia Minor, northern Persia and Afghanistan to the Himalayas and northern China. The plants and animals along it are found to have a marked similarity in character to those of south Europe, with which region the zone is virtually continuous.

The extremely dry and hot tracts forming an almost unbroken desert from Arabia through south Persia and Baluchistan to Sind show a considerable uniformity in the types of life closely approaching those of the neighbouring hot and dry regions of Africa. The region of heavy periodical summer rains and high temperature which comprises India, the Indo-Chinese peninsula, southern China and the western part of the Malay archipelago, is also marked by much similarity in its plants. The area between south Siberia and the margin of the temperate zone of the Himalaya and north China, including what are commonly called central Asia, Turkistan, Mongolia and western Manchuria, is an almost rainless, high-level region having winters of an extreme severity and summers of intense heat. Its life has a special character suited to the peculiar climatic conditions, more closely allied to the northern Siberian tract than to the other bordering regions. The south-eastern parts of the Malay archipelago have much in common with the Australian continent, though their affinities are chiefly Indian. North China and Japan have many forms of life in common and many special forms of China and eastern Asia extend to the Himalayan zone while others clearly indicate a connection with North America.

The foregoing brief review of the principal territorial divisions according to which the forms of life are distributed in Asia, indicates how close is the dependence of this distribution on climatic conditions, and this will be made more apparent by a somewhat fuller account of the main features of the flora.

Northern Asia.—The flora of the whole of northern Asia is in essentials the same as that of northern Europe, the difference being due rather to variations of species than of genera. The absence of the oak and of all the heaths east of the Urals may be noticed. Pine, larch and birch are the principal trees on the mountains; willow, alder and poplars on the lower ground. The northern limit of the pine in Siberia is about 70° N. The whole of the far north, along the Arctic ocean is covered with tundra consisting of a low growth of flowering plants—species of *Ranunculus,* dwarf *Salix,* etc., with numerous mosses and lichens.

South-west Asia.—The flora of the rainless region of south-western Asia is continuous with the desert flora of northern and eastern Africa. It includes the peninsula of Arabia, the shores of the Persian gulf, south Persia, Afghanistan and Baluchistan. In southern Arabia the aspect of the vegetation is very peculiar, and is commonly determined by the predominance of some four or five species, the rest being either local or sparingly scattered over the area. The absence of the ordinary bright green colours of the vegetation is another peculiarity of this flora, almost all the plants having glaucous or whitened stems. Foliage is reduced to a minimum, the moisture of the plant being stored up in massive stems against the long-continued drought. Aridity has favoured the production of spines as a defence from external attack, sharp thorns are frequent and asperities of various kinds predominate. Among the more mountainous regions of the south-western part of Arabia, the rainfall is sufficient to develop a more luxuriant vegetation and the valleys have a flora like that of similarly situated parts of southern Persia, and the less elevated parts of Afghanistan and Baluchistan. partaking of the characters of that of the hotter Mediterranean region. Here aromatic shrubs

are abundant. Trees are rare and prickly forms of *Statice* and *Astragalus* cover the dry hills

The flora of the northern part of Afghanistan approximates to that of the contiguous western Himalaya. *Quercus Ilex,* the evergreen oak of southern Europe, is found in forests as far east as the Sutlej, with other European forms.

In Asia Minor and northern Persia the mountains are clothed, where the rainfall is abundant, with forests of *Quercus, Fagus, Ulmus, Acer, Carpinus* and *Corylus,* and various Coniferae. Of these the only genus that is not found on the Himalaya is *Fagus.* Fruit trees of the plum tribe abound. The cultivated plants are those of southern Europe.

Central Asia.—The vegetation of the dry region of Central Asia is remarkable for the great relative number of Chenopodiaceae, *Salicornia* and other salt plants being common; Polygonaceae also are abundant, leafless forms being of frequent occurrence, which gives the vegetation a very remarkable aspect. Species of *Caragana* and other peculiar forms of Leguminosae also prevail, and these, with many of the other plants of the southern and drier regions of Siberia or of the colder regions of the desert tracts of Persia and Afghanistan, extend into Tibet where the extreme drought and the hot sun compensate for the greater elevation, and the summer climate resembles that of the plains farther north. Assemblages*of marine plants are frequently met with growing at elevations of 14,000 to 15,000ft. above the sea in the vicinity of the many salt lakes of central Tibet.

China and Japan.—The flora of north China and Japan is related to that of Siberia and to the neighbouring American continent as would he expected from the geographical position. On the other hand there is a close connection between the flora of the Central Provinces of China and the eastern United States of America; the oaks and a number of other genera reach their greatest development in these two countries and have very closely allied species in these parts of the Old and New Worlds respectively. In Hong-Rong and the tropical parts of China some three-fifths of the species are common to the Indian region, and nearly all the remainder are local Chinese forms. The number of species common to southern China, Japan and northern Asia is small. The cultivated plants of China are, with few exceptions, the same as those of India.

The flora of west and south-west China and the bordering parts of south-east Tibet and upper Burma has only recently become well known through extensive botanical exploration. Together with that of the eastern Himalaya with which it is very closely connected, this mountainous area now comprises the richest temperate flora in the world. A striking feature is the presence of a very large number of species belonging to several genera of alpine plants; viz., *Rhododendron, Primula, Gentiana* and *Pedicularis,* many species being restricted to a very small area. Dwarf species of *Rhododendron* cover large areas of the moorlands at an altitude of 15,000ft. while the high meadow-lands are luxuriant with a very varied vegetation. In Yunnan every altitudinal zone is represented from tropical jungle to permanent snow. Formosa has largely an endemic flora, but as a remarkable example of discontinuous distribution *Taiwania cryptomerioides* may be cited. This tree is only known from this island and south-west China.

Indo-Malayan Region.—Recent research has added greatly to the number of plants known to cccur in south-eastern Asia. The principal families arranged in order of specific numerical importance are: Orchidaceae, Leguminosae, Graminaceae, Rubiaceae, Euphorbiaceae, Acanthaceae, Compositae, Cyperaceae, Labiatae and Urticaceae. With the exception of the Compositae and Labiatae these are all more tropical than temperate and but for the temperate and alpine Himalayan species the Compositae would occupy a much lower place still. Within the region, however, there are very great variations, principally under the influence of humidity and elevation, so that the above order does not hold good for individual subregions. In short we have a somewhat heterogeneous assembly of tropical, temperate and alpine plants, of which, however, the tropical are so far dominant as to give their character to the flora viewed as a whole. The Indian flora contains a more general and complete illustration of almost all the chief natural families of all parts of the world than that of any other country.

India and Ceylon.—This subregion contains a by no means homologous vegetation, but presents almost as great a diversity as the region itself. Roughly it may be subdivided into the following zones: Himalayan, characterized by conifers, oaks, rhododendrons, and a number of Compositae. Peninsular, with a large assortment of deciduous trees, including many Leguminosae, that have adapted themselves to the drier conditions, particularly of the genera *Butea, Dalbergia, Pterocarpus, Bauhinia, Cassia, Acacia* and *Albizzia,* as also some genera of other families such as: *Cochlospermum, Shorea, Sterculia, Grewia, Terminalia, Gyrocarpus, Euphorbia* and *Givotia.* The teak tree, though not confined to or characteristic of this subdivision, occurs over widespread areas in the central portion, and in the south the sandal tree appears as an outlier of the genus the focus of which lies in the middle of the Malay islands. The desert zone in the north-west with a small semi-desert zone in the south-east, characterized by a number of xerophytic species belonging to various genera among which may be cited: *Capparis, Tamarix, Balanites, Zizyphus, Crotalaria, Prosopis, Acacia* and *Euphorbia.* The humid Malabar zone, which comprises a belt running along the west coast from north Kanara to the extreme south of Travancore and includes the highest hills (8,800ft.) south of the Himalayan chain. The most distinctive feature of this zone, which is akin to the Malayan subregion, is the presence of dense evergreen forests with orders and genera almost absent in the other zones; viz., Guttiferae, Dipterocarpaceae, Anacardiaceae, Meliaceae, Myrtaceae, Melastomaceae, Ampelidaceae, Piperaceae, Myristicaceae, Araceae and several palms and bamboos; among the shrubs there is a large development of *Strobilanthes* and other Acanthaceae and Rubiaceae and of *Impatiens* among the herbaceous plants. The peculiar small plants found clinging to rocks in the stream beds belonging to the family Podostemonaceae occur in considerable number. On the higher hills there are large tracts of open grass lands with an admixture of herbaceous or shrubby Leguminosae, *Rubus,* Rubiaceae, Compositae, Labiatae and terrestrial orchids and *Curcuma.* The eastern semi-evergreen zone, which runs parallel with and close to the east coast from Orissa to the south, characterized by species of *Acacia, Albizzia, Diospyros, Mimusops* and *Strychnos,* with a considerable proportion of thorny species. The estuarial or mangrove zone, which occurs intermittently along both coasts of the peninsula as well as along those of all the other subregions.

Ceylon exhibits great affinity with the peninsula and with it some to east Africa. The drier zone lies in the north and the higher ranges of the centre together with the coastal areas of the centre and south correspond more or less with the humid zone in character but present a number of endemic forms.

Burma.—The vegetation of Burma links up that of India with the Indo-Chinese and Malayan floras. In the north there is an extension of Himalayan flora, which continues into western China, with a wealth of *Rhododendron, Primula, Meconopsis, Quercus* and *Castanopsis* as welt as some conifers. Towards central Burma a drier tract is met with and there the plant life is comparable to that of peninsular India, with, however, a larger number of Dipterocarpaceae and a far greater number of species of bamboos. Within this drier zone lies a more or less arid area which does not differ greatly from the desert zone of India. In the southernmost part the vegetation becomes more tropical and more and more akin to the Malayan flora. Here the Anonaceae, Dipterocarpaceae, Guttiferae, Meliaceae, Anacardiaceae, Myrtaceae, Melastomaceae, Myristicaceae, Euphorbiaceae and Orchidaceae abound.

Indo-China.—The knowledge of the flora of this subregion is hardly sufficiently advanced to warrant the framing of a general account. It may be said that as might, indeed, be expected, it corresponds, fairly closely with that of Burma at corresponding latitudes.

Malay Peninsula.—The best represented families in order of their specific numerical strength are: Orchidaceae. Leguminosae, Euphorbiaceae, Rubiaceae, Anonaceae, Graminaceae, Melastomaceae, Cyperaceae and Moraceae; a sequence that, except for the first two, shows a considerable divergence from the Burmese flora as a whole. In this subregion *Nepenthes* appears in increasing

numbers as also the Dilleniaceae, Flacourtiaceae, Guttiferae, Dipterocarpaceae, Meliaceae, Anacardiaceae, Myrtaceae, Melastomaceae, Myristicaceae and especially Palmaceae. A feature strongly contrasting with the Indian, and Burmese floras is the comparative poverty in species of Impatiens.

Malay Archipelago. — The vegetation of the individual islands composing this subregion shows considerable specific divergence but in general it forms a fairly homologous whole. Essentially tropical, it connects the northern portions of the region with the flora of Australia. At the higher levels there is a definite resemblance to the eastern Himalayan zone. The Monocotyledons are specially well developed, particularly the Orchidaceae, Pandanaceae and Araceae. The numerical strength of the genera Eugenia, Psychotria, Ardisia, Piper and *Ficus* is striking.

The cultivated plants of the Indo-Malayan region include wheat, barley, rice and maize; various millets, *Sorghum, Pennisetum, Panicum, Eleusine;* many pulses, peas and beans, mustard and rape; ginger, turmeric and cardamoms; pepper and capsicum; several Cucurbitaceae and brinjal; tobacco, sesamum, poppy, Crofolaria and *Cannabis;* cotton, indigo and sugar; coffee and tea; oranges, lemons of many sorts, pomegranate, mango, custard-apple, figs, peaches, vines and bananas. Of late years the Para rubber has also been extensively introduced. The more common cultivated palms are *Cocos, Phoenix, Borassus* and *Areca,* which supply coconut, toddy, molasses and betel-nut. Indian agriculture combines the harvest of the tropical and temperate zones.

North of the tropic the winter cold is sufficient to admit of the cultivation of almost all the cereals and vegetables of Europe, wheat being sown in November and reaped early in April. In this same region the summer heat and rain provide a thoroughly tropical climate, in which rice and other tropical cereals are freely raised, being as a rule sown early in July and reaped in September or October. In southern India, and the other parts of Asia and the islands having a similar climate, the difference of the winter and summer half-years is not sufficient to admit of the proper cultivation of wheat or barley. The other cereals may be seen occasionally where artificial irrigation is practised, in all stages of progress at all seasons of the year, though the operations of agriculture are, as a general rule, limited to the rainy months, when alone is the requisite amount of water commonly forthcoming.

Many of the trees of the region produce timber of excellent quality. The teak tree, Tectona *grandis,* supplies the finest timber, for certain purposes the finest in the world. It is found in greatest perfection in the comparatively humid forests of the west coasts of Burma and the Indian peninsula, where it grows to a height of 150ft. or more, mixed with other trees and bamboos. The sal, *Shorea robusta,* produces a fine, heavy, durable timber, particularly useful for railway sleepers. It is found from the foot of the Himalayas to the Central Provinces and north Madras. The Himalayan cedar, *Cedrus* Deodara, is the chief timber of that range. Among many other genera yielding excellent timber may be mentioned *Dipterocarpus, Hopea, Canarium, Chloroxylon, Gluta,* Dalbergia, *Pterocarpus, Acrocarpus,* Acacia, *Terminalia, Diospyros* and Gntelina. The cinchona, from the bark of which quinine is derived, has been introduced and grown with much success in wlantations. (C.E.C.F.; C. V. B. M.)

ANTHROPOLOGY AND ETHNOLOGY

Asia presents to the anthropologist the widest range of different types of any of the continents. So vast is its area, so varied its climate, that ethnic types of all kinds are found within its borders. This being so, no complete anthropologic or ethnologic study of Asia as a whole is yet possible; the work of research and classification is still proceeding. Old divisions are found to be unsuited to new developments in our knowledge, and surveys, official and private, are annually penetrating old fields to emerge with new data.

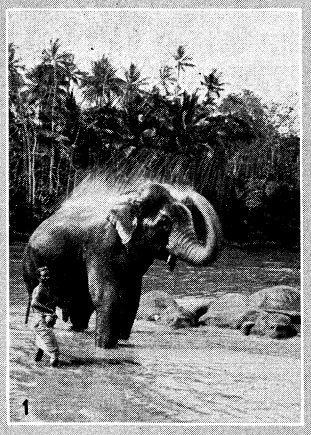
FARTHER ASIA

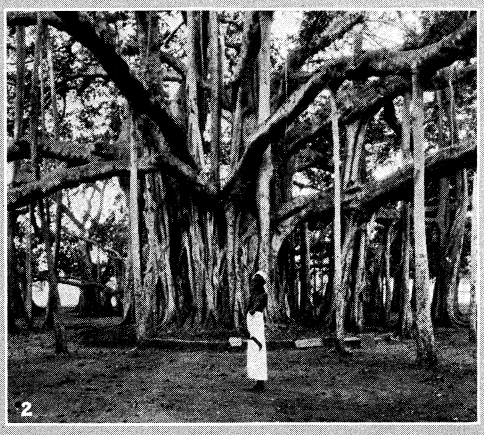
Anthropology. — In south-eastern Asia there is a heterogeneous mixture of racial elements, and a population which contains very varied elements at all stages of culture and much confused by race mixture. The wooly-haired peoples are represented by the Negrito and Papuasian races, the wavy-haired by the Pre-Dravidians, Dravidians and Xesiots, and the straight-haired by the Pareoean or south Mongoloid race, while invading elements of Chinese, Tibetans, Arabs, Portuguese, French, Dutch and British have added to the general mixture, so that owing to the absence of accurate data and to the fusion of races and types accurate classification is almost impossible. A group of Mongoloid tribes stretches from Assam to Formosa and includes the Khasi, Mikir, Bodo and Garo of Assam, the Lisu of Yunnan and the Lolos of Szechuan, who are probably more allied to white-skinned races than to yellow-skinned Mongolians. This, the protomorphus, apparently represents an unspecialized strain surviving from the original type from which both the white European stocks and the yellow-skinned stocks of eastern Asia are derived. A definite Caucasian stock appears to be present in the aboriginal population of Indo-China and has doubtless survived as a submerged element in other hill tribes in south-east Asia.

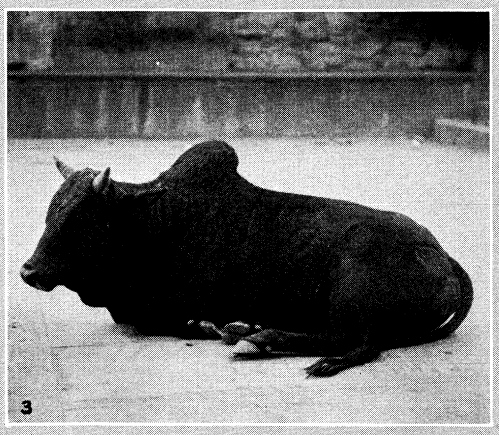
Negritos.—The earliest inhabitants of south-east Asia were probably Negrito or Pre-Dravidian in race and representatives of both these races survive in a submerged condition and generally more or less mixed in blood by contact with their neighbours. They are naturally hunters and collectors of food, not cultivators, and where they possess cultivation it seems to be a recent acquisition from outside, and is communal in character. Generally they move about in family groups where game, fish, and wild yams are easiest to obtain. The social unit is the family, and the social structure of the simplest description. Excluding the Andamanese the Negrito is represented in this area principally by the Aeta of the Philippines and the Semang of East Sumatra and the Malay peninsula. They have no domestic animals and their dwellings are of the frailest description; they have separate quarters, probably, for the bachelors and spinsters of each community, the dead are buried or exposed in trees, and religious ideas are of the vaguest, but a land of the dead is believed in and spirits on their way thither have to pass over a perilous bridge guarded by a demon. This belief is characteristic of the Indonesian area generally and extends alike to the pure Negrito of the Andaman islands and to tribes in which Negrito affinities are unsuspected. So, too, the segregation of the unmarried is typical of the area in general and the practice extends, from central India to Formosa and southwards into the Pacific. The typical weapon of the Negrito is the bow and arrow, and both Aeta and Semang poison the arro s. Though naturally kind and gentle the Negrito once embittered evinces the most implacable hostility towards his enemies. He survives, however, as a distinct tribe only in the Andamans, the Malay peninsula (Semangs) and in the Philippine islands (Aetas), though traces of his blood are to be seen elsewhere in the archipelago and the mainland. Even in Assam the physique of some of the hill tribes and their traditions of the past suggest their survival to a comparatively recent date.

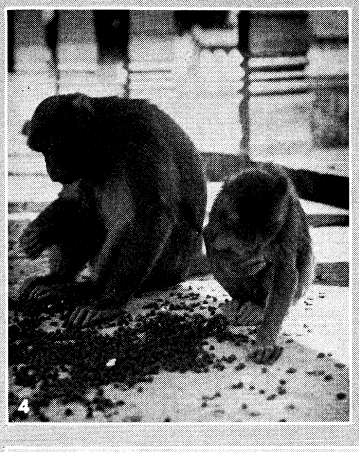
Pre-Dravidians. — The Pre-Dravidians of this area are represented primarily by the Sakai (*q.v.*) of the Malay Peninsula whose mode of life is not dissimilar to that of the Negrito, but others (Pre-Dravidians) of less pure stock survive in East Sumatra and in the Celebes, as the Toalas, and no doubt the race has contributed to other existing stocks in the East Indian archipelago, and perhaps on the mainland, where the strain is probably present in the hill tribes of Assam and Burma, and in Dutch Borneo it has been suspected in a slightly larger proportion in the Ula Ayar tribe. Their distinctive weapon for war and the chase is the blow-gun (*q.v.*).

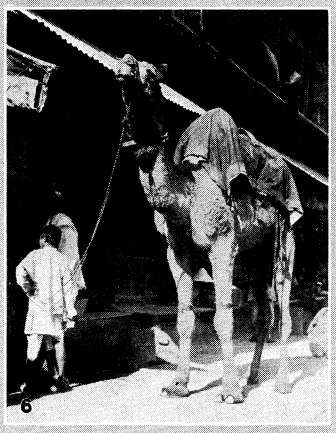
Papuasian Negroes. — The Papuasian branch of the Oceanic Negroes was perhaps a later arrival in this area than the Negrito branch, but is less definitely represented among the present inhabitants. Even in the most south-easterly islands of Indonesia where it is best represented it has generally been modified by contact with other races, but traces of its presence are to be found in Assam again both in the physique and disposition of some of the Naga tribes, particularly in the inaccessible interior of the hills, where individuals, and sometimes whole communities show decided signs of Papuasian blood in their frizzly hair, prominent or aquiline noses, in their very excitable disposition,

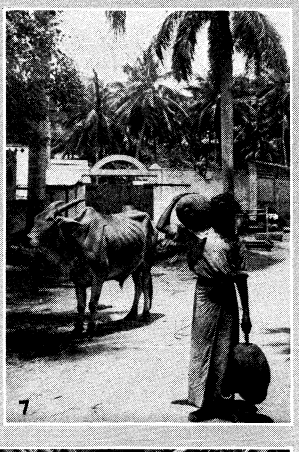


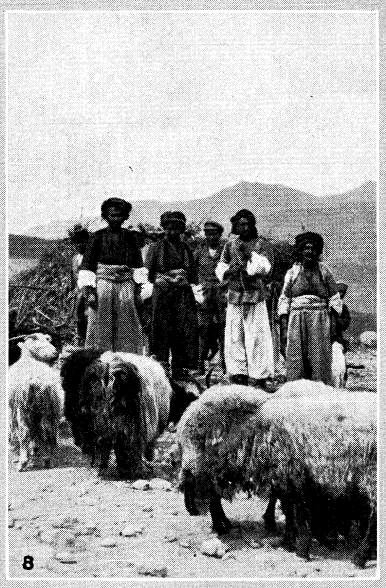


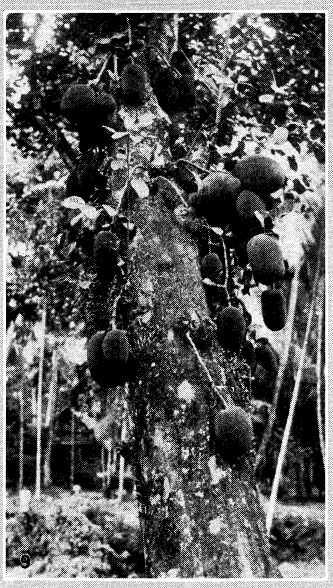


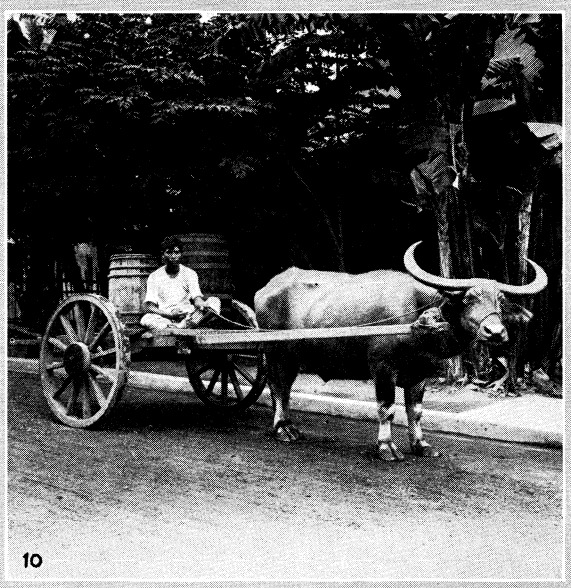












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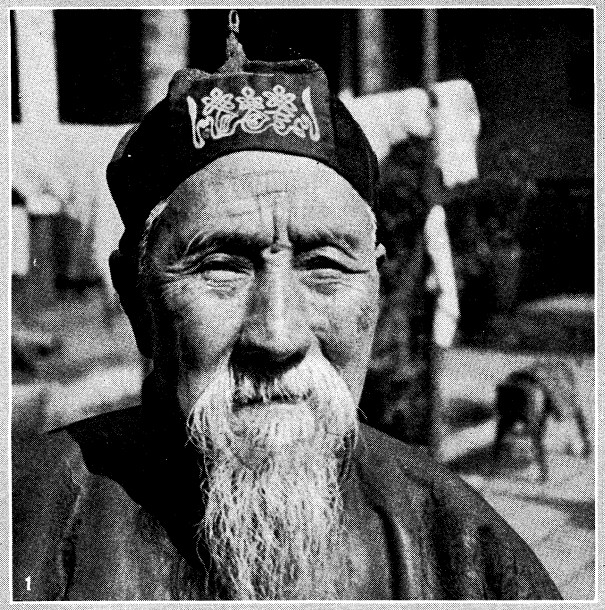
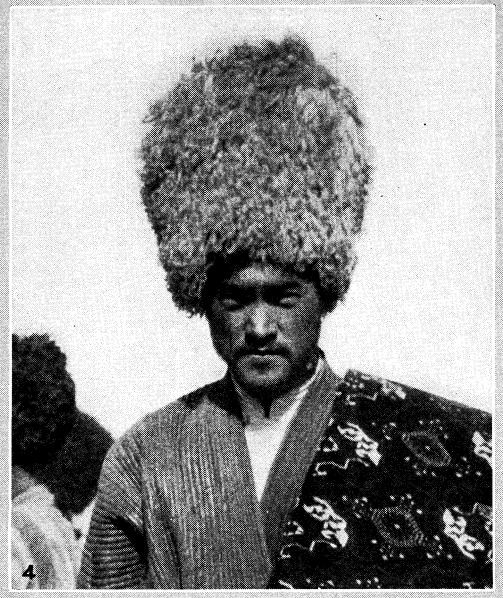
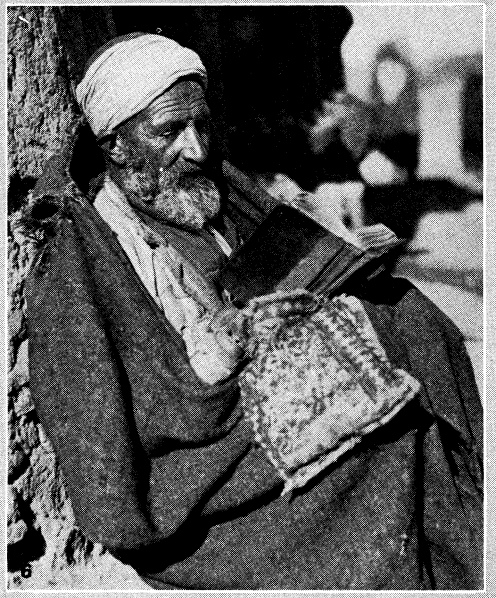
SCENES IN INDIA AND NEIGHBOURING ASIATIC REGIONS

1. Elephants cooling themselves in the evening at Kandy, Ceylon
2. A banyan tree in Madura, India. The trunks cover an acre of ground
3. A sacred ox (zebu) lying in the street at Benares, India
4. Monkeys eating nuts in the monkey temple at Benares, India
5. A native in the Himalayas of western Tibet with a sheep, which he is using as a beast of burden
6. A camel standing in the market place at Bombay, India
7. Scene in Ceylon showing Sinhalese boy carrying jack fruit, often weighing 40 to 50 pounds. A zebu is standing near him
8. Kurdish tribesmen in the Brussels Line region, Iraq, with a flock of sheep and goats
9. Tree of jack fruit near Colombo, Ceylon
10. A carabao ox, otherwise known as a water buffalo, and cart in the Philippine Islands







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RACIAL TYPES OF ASIA

1. A Mohammedan sheik of central China, descendant of an assimilated Arabian tribe
2. A Lambarda woman, typical of the Dravidian race, Mysore, southern India
3. A Lama in the Himalayas, near Darjeeling holding a prayer wheel and a rosary
4. A rug-seller of Russian Turkistan, in western Asia, displaying his merchandise
5. An elderly Japanese of Nikko, Japan, carrying his young granddaughter on his back
6. A merchant of the city of Hamadan, Persia, sitting in the sun, reading the Koran

mirthful, voluble and cruel, and in the artistic bent which shows itself in wood-carving, as well as in a number of minor items of material culture, which can be traced from Assam at any rate to Fiji. Their typical culture, however, should be sought in Papua and Melanesia (*q.v.*).

Cultural History. — The Oceanic Negroes and the Pre-Dravidians are present in south-east Asia merely as archaic survivals, and have probably contributed little to its culture. As far as can be inferred from existing data, the first known civilization of the area seems to be that of a race which may be described as Indonesian, which was probably composed of a Caucasic stock which occupied this part of Asia at a very early date, and was modified by Mongolian infiltration. This race, though now everywhere submerged by the flood of Pareoean invasion is probably responsible for certain general features still found throughout the less accessible parts of the area in societies showing every diversity of political structure. How far the general features here described are typical of the submerged Indonesian race is largely a matter of conjecture, but it is sometimes possible to indicate a definite change which has taken place or is taking place suggesting that the disappearing element belonged to an earlier culture than those which now predominate. Thus the Mon-Khmer language is now represented by isolated languages surviving in patches in Cambodia, in Yünnan, and in the Wa and Palaung lands in Burma, in the Khasia hills in Assam and in the Munda-speaking areas of Chota Nagpur in India, suggesting that the area once covered by languages of this stock stretched across the Irrawaddy river into the Ganges basin, though it has since been superseded by the tonal Tibeto-Burman tongues.

Social Structure. — So, too, the existing patrilineal society seems to have been preceded in most tribes by a matrilineal system such as survives in the Khasia and Garo hills in Assam, and the prevailing policy of government by secular chiefs is strongly associated with recent Pareoean invaders and probably superseded a highly democratic structure such as that which survives in parts of Assam, but which may itself have been merely the result of degeneration from a society dependent upon highly tabued priest-chiefs like those surviving in the Ronyak Naga tribe, where the recent tendency seems to have been to replace such chiefs by rather amorphous democratic societies, in which age-grades play a prominent part. Exogamy is everywhere the rule rather than the exception, and endogamy, where reported, appears generally to be rather a matter of linguistic or social convenience than of principle. Exogamous clans, though usually claiming to have originated in a patronymic ancestor, sometimes show what seem to be traces of a pre-existent totemism. Traces are frequent and tangible of a dual organization (*q.v.*) of society, which may perhaps be due to Chinese influence, particularly as the two moieties sometimes seem to represent the earth and sky. This dual system has perhaps been intensified by the need in founding a new village for two exogamous clans to combine in order to provide each other with marriageable women, and three-group systems may have sometimes been produced by the fusions of conquering and conquered dualities, in which the superior conquered class has been identified and fused with the inferior of the two classes of the conquerors. The "Khel" system, under which a particular class occupies a particular quarter of a village, and is more often than not in a state of avowed or latent hostility to the other clans in the other quarters of the village, appears to be another result of the same process, and gives way, under the secular chiefly rule, to a mere division into wards governed by different chiefs, the clan bond disappearing, as also the bachelors' hall, which is prominent and necessary as a local centre of clan activity under the democratic system, and appears as an important appendage of the chief's house under the sacrosanct priest-chief organization. This bachelors' hall has been shown to be by origin the communal house from which private dwellings split up (vide Peal "On the Morong," etc., *Jrnl. Anthropl.* Inst., xxii., p. 256 and pl. xviii.), and while it appears to retain its original form in the "Long House" in Borneo (q v), and to remain as an appanage of the sacrosanct *Ang's* house in the Konyak Naga country, it has become a village club house in the democratic Naga communities, and survives in the Kachari and Hinduized plains tribes in the village *Namghar* or prayer-house, while in the societies which have secular chiefs like the Semas or Thados it has almost entirely disappeared, though in some such tribes it still survives with some of its former functions as in the case of the Lushei *zawlbak*. It has already been noted that it is a widespread institution and is shared even by the Negritos of the Andamans.

Material Culture. — Another item probably to be associated with the Indonesian culture is the tanged and shouldered celt, a very distinctive form of polished stone adze which has been found in Indo-China, Malaya, the Irrawaddy basin, Assam, and in Chota Nagpur in India. It survives in the form of shouldered iron hoes still used by some hill tribes as by the Khasi and by some Nagas. The use of the throwing spear seems also typical of a pre-Pareoean people, and simple bamboo and sago-palm javelins, innocent of iron, but sometimes "feathered" like an arrow, usually with pandanus leaf, are still used in the remote interior of the Naga hills. A straight two-handed iron sword is, or was till recently, used as a sword of state by the Rings of Siam; it is depicted as carried by foot-soldiers on the bas-reliefs of Angkor Wat in Cambodia and it is still handed down as an heirloom in Naga, Khasi, and Kachari families in Assam. It is possibly an introduction from India, where the straight two-handed sword was in vogue at the time of Alexander's invasion. The carved lion, more symbolic than naturalistic, which is so popular from Assam eastwards in regions in which the lion is not known at all, may also be of Indian origin, though if so he has perhaps been hybridized by the Chinese dragon. It seems to belong to the Shan and Burman elements rather than to the Indonesian, and the true Naga tribes have no word for "lion," though the Kukis above have one. So, too, the use of the cross-bow seems to be of Mongolian origin, and it is popular with the hill tribes of Indo-China and with many of those of Burma; only some of the Assam tribes use it, and it does not reach the Western Nagas, who have only the bullet-bow, or the Khasis who, like the Thado Kukis, use a simple bow, a weapon which may perhaps be associated with Negrito survivals.

Tattooing is practised generally throughout Farther Asia, but the extent of its use varies greatly. With the Burmese it holds the rank of a fine art, and it is generally practised by all the Tai peoples and by some others. But whereas the Burmese and Shans seem to tattoo the male only, some of the Assam-Burman hill tribes tattoo the female only, and others, as in Borneo, both sexes, the operation being performed in the Naga hills as by the Kayans of Borneo by women. In Borneo as in Assam tattoo patterns usually have reference to rank, or to head-hunting exploits, or to recognition in the next world.

A feature of many hill tribes in this area, which calls for notice, is the use of a large wooden xylophone or "drum" (it has no membrane) made from a hollow top and sometimes described as a canoe-drum. Its distribution is not universal, but it is frequent in the Naga hills, and the Rhasi uses what is perhaps a degenerate form of it; it is found among the Wa of Burma, occurs in the Malay Peninsula and in Borneo, and appears to be connected with the Fijian *lali,* and with the Melanesian upright type. Some Amazon tribes in South America use a similar instrument. Its Indonesian origin is perhaps indicated by the buffalo into which its head is so often carved, even where the gayal or mithun has superseded the buffalo as the principal domestic animal, by the occasional use of a crocodile pattern (reported and depicted by Peal, *loc. cit.*) by tribes who have never seen a crocodile, and by the tradition of the "wooden drum" that belonged to the pre-Burmese king of Arakan. It may possibly be associated with the use of the war-canoe, as its construction appears to be attended in the Naga hills by tabus identical with tabus common in the construction of canoes in Melanesia, and canoes have been used, occasionally at any rate, for drumming in Manipur, in Papua and in Oceania.

Cultivation.—The buffalo appears to be associated with the Mon-Khmer culture. It appears in Borneo, used by the Murut tribe, and in the Philippines, in both rases associated with irri-

gated terraces. In Assam it is generally used in the plains, but has been superseded in the Naga hills, where it was probably once universal, by the gayal or mithun, a much more tractable animal when kept in a semi-feral state. The mithun appears very definitely to have been introduced by the Kuki-Kachin migration from the Himalayas down the Chindwin valley to the Bay of Bengal. Irrigated rice cultivation, however, though now general in the plains is far from universal in the hills. Millet undoubtedly preceded it as a staple crop as in Formosa and in Assam, and probably also in the hill tracts of Burma and Indo-China, and terracing combined with the regeneration of land by the preservation of pollarded alders appears in the Naga hills to have preceded irrigated terraces for rice, which has spread at the expense of millet faster than irrigation, and is often grown as a dry crop.

Megaliths. — The megalithic culture of this area has also been associated with irrigated terracing, but it appears to exist also where irrigation is not practised, and in some cases where rice is not grown. This megalithic culture usually takes the form of menhirs and dolmens. It is to be intimately connected with a cult of the dead, and also with a phallic cult. The general theory underlying it seems to be that the soul of the dead takes up its abode in the erect or the recumbent stone according as the sex is male or female, and that the fertilization of the crop and propagation of all life is dependent on the action of the soul which is assisted by a process of sympathetic magic dependent on the symbolic form of these megalithic erections. The survival of this idea is probably to be seen in the forms taken by the temples of the more civilized religions of the area, *e.g.*, in Assam, and which reach their culmination in the marvellous structures of ancient Cambodia and Java, such as the famous Angkor Wat. The survival of this cult in Chota Sagpur in India, in Assam, in parts of Indo-China and in Madagascar, though in the intervening areas it seems to have died out, suggests that it originated at a very early date in the history of the area, and perhaps preceded the expansion of the Proto-Malay race.

Head-Hunting. — Intimately associated with this phallo-megalithic cult is the practice of head-hunting (*q.v.*), the purpose of which is to secure souls to add to the general village stock of soul matter which is required for the successful propagation of animal and cereal life. Read-hunting is still practised by the wilder tribes of Assam, Burma, the Indonesian archipelago and Formosa. Connected with it is a conception of a material soul permeating the body, and also apt to infect any object directly associated with the body. It is, therefore, dangerous for believers in this principle to touch objects which may already be impregnated with soul matter stronger than theirs, or to allow anything likely to be imbued with their own soul to pass into the possession of a stranger who might through it be able to influence them adversely. Beliefs of this kind are strong in many of the less sophisticated tribes such as the Toradja of the Celebes, and the Konyak Nagas of Assam, while the Karen of Burma hold the theory of the soul as a fertilizer in a peculiarly concrete form. Other tribes hold a rather vague and ill-defined belief in what amounts perhaps to *mana* (*q.v.*), or a dynamic soul-principle giving the possessor power to control unconsciously the forces of nature so as to enhance his own happiness, prosperity and good luck, but this belief is probably much the same as the other in origin, this principle, called aren by the Ao Nagas, probably consisting in emanations of soul matter, which attracts other soul matter to itself.

Head-hunting also serves as an instrument of the vendetta, a feeling for which is strong throughout the area, though in places it finds expression rather in the taking of slaves than of heads, and in the Moi word *comam* means both "slave-hunter" and "avenger." Slavery, however, is generally a mild institution and the domestic slave is commonly treated as a member of the family.

Houses. — Among the less cultured communities houses are built of bamboo, and the difference of two types, one on the ground, the other on piles, is noticeable as the two forms used by different tribes exist together in Assam, as they do in Java, where the true Javanese builds on the ground, while the Malayan Sundanese builds on piles. Bridges are made of cane ropes, slung sometimes across tremendous gorges with astonishing skill, and in places ficus trees are cultivated by the riverside and their aerial roots trained so as to span the stream with living timbers. In the hills villages are concentrated and palisaded and defended with caltrops of bamboo spikes.

Religion. — The most prevalent religion is probably Buddhism, but Mohammedanism is strong in the islands and the coast, and Hinduism, at one time ascendant, has left many survivals. Probably, however, these more civilized faiths nowhere go very deep, while the whole population is steeped in ideas based on a sort of polytheistic animism, and the worship of the dead. Some of these ideas have already been alluded to, but many other beliefs, apparently more or less inconsistent, exist alongside them, and are held simultaneously. The idea of a beneficent, but remote, Creator (or Creatrix) is frequent, and so is that of a village of the dead in reaching which the soul has to travel on a perilous path guarded by a malignant demon. This is usually located underground, though sometimes the souls of the blest ascend to the sky. In the case of the islands, the land of the dead is sometimes overseas. Ideas of metempsychosis (*q.v.*) also occur independently of Buddhism, and the soul is reborn as an insect. The dead are treated with great variety, burning, burial, and platform exposure all being practised, the latter being accompanied sometimes by separate disposal of the head. Boat-shaped coffins are used, sometimes where boats are unknown, and a sort of urn burial is still common in parts of the Naga hills, the pot being covered with a flat stone. Corpses of persons dying by "bad deaths," as in childbirth, suicide, by wild animals, etc., are usually treated differently from those of persons who die normally. Burning, when practised, does not seem necessarily to have any reference to Hindu influence, as it is practised by the Maru branch of the Singphos, and in preliminary funerals by the Khasis. Some tribes, *e.g.*, the Kacharis and Manipuris, attach special importance to the frontal bone and dispose of it in running water.

Origins **and** History. — The origin of the Mon-Khmer culture is still obscure. It was much influenced by India, and the connection probably dates to the pre-Aryan epochs of the history of that country. It is now generally recognized that the (so called) Dravidian inhabitants of India, probably a branch of the Mediterranean race, had acquired a high state of culture before the more barbaric Aryans entered from the north, and it is likely that southern India was the source of the Indonesian and Mon-Khmer cultures. Certain it is that in southern India early iron age graves have been discovered disclosing items of culture which must be associated with the existing Naga tribes of Assam. So, too, on now deserted uplands in southern India round cenotaphs appear associated with terracing strongly suggesting the culture of Angami Nagas. The Karens of the Golden Chersonese seem to have a tradition of origin from the Indian coasts of the Bay of Bengal. Colonies of South Indian elements have from time to time migrated further east, and the Klings of Malaya and the Talaings of Pegu, who were absorbed by, but gave their name to, the Mons of that kingdom, are merely offshots of the Telinga peoples, Dravidians from southern India. Therefore, we may perhaps look to southern India for the first source of culture in Indonesia. The connection continued through Brahminical and Buddhist times and survived the Mongolization of south-east Asia. In the south-east, however, the Mongolian connection must have begun at a very early date. Chinese influence was felt in Annam in the third millennium B.C., and from that era, perhaps, we must date the beginnings of the movement by which the Champa race in Cambodia, with its oceanic affinities, was gradually submerged; though the Shans themselves, the most prominent of the invading Mongolians, were still located in China in the second millennium B.C., and the Khmers, who effectively invaded Siam in the sixth century, mere still powerful in the third century B.C., though very strongly influenced by China.

Of the spread of the Oceanic Mongols or Proto-Malays nothing is yet known; their range includes the oceanic domain of Farther Asia from Formosa to the Nicobars and Madagascar. Nearly everywhere also they are found forming hybrid groups

by fusion with Negritos, Papuans, pre-Dravidians or Indonesians, and the latter in particular has almost everywhere been modified by the proto-Malay stock.

The expansion of Hinduism in Farther Asia had started by the fourth century A.D., by which time it had reached Burma; it had arrived in the Malay peninsula in the fifth and in Java in the seventh century, and the seventh century saw the introduction of its off-shoot Buddhism into Siam, while the same century witnessed the advance of the Shan race towards the sea. The expansion of the true Malays from their home in Sumatra began in the 12th century, and the spread of Islam in the oceanic area took place in the thirteenth.

Mean hile on the mainland the expansion of the Burmese race had begun (in the 11th century), and their long struggle with the Shans for supremacy in what is now Burma. The Chinese invasion of the 13th century, however, led to the rise of the Shans which lasted from that to the 16th century, the 14th being that of the greatest expansion of the Siamese empire. The Burmese, however, were in the ascendant by the 17th century, and the 18th was that of their greatest expansion.

The latest of all the Mongolian movements has been that of the Kuki-Kachin racas, which is still in progress. The various branches of the Kuki race that inhabit Assam have come from the south up the range dividing Assam from Burma, but there has been an uninterrupted flow of migration from the sources of the Chindwin river down that valley to the sea, of which the northward flow to Assam is the backwash (v. Fryer, Khyeng *People* of *Sandoway,* J.A.S.B., *1878).* It appears probable that the Kayans of Borneo formed part of the advance-guard of this stream. The Thado Kukis, at the head of the Assam backwash, were still moving northwards in 1917, and the Kachins, the rear-guard of the whole movement, are still moving southwards into Burma.

With the advent of the Portuguese in the 16th century the European influence began to be felt, but it is only the Portuguese and the Spaniards who have affected the population racially, and that hardly outside the Philippines, where their half breeds may be reckoned by the hundred thousand. The climate prevents northern Europeans from taking root, and the Oceanic hlongols, modified by the Indonesian and by minor isolated strains, possess the islands, as the southern Mongolians do the mainland except where the previous populations survive in the fastnesses of their inclement hills.

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CENTRAL ASIA

The racial history of this vast central area is obscure. Up to the present, despite much archaeological work, excavators have concentrated rather on the history of the last 2,000 years than on the prehistoric period. In support of the theory that man originated in this region, Dr. Davidson Black concludes that the differentiation of the earliest human stock from the common ancestors of the anthropoid apes and man may be correlated with the progressive changes which occurred in Central Asia during recent geological periods — recent, that is, in relation to the history of life on the earth, though in actual years the period is one of remote antiquity. In the Eocene period, during which the London Clay and the Paris beds were laid down, Central Asia was low-lying and covered with semi-tropical rain-forest. During the succeeding geological periods the country became slowly higher and drier until in the Pleistocene it became a region of open plains, with only small forests. These changes either started or at any rate encouraged the separation of the prehuman stocks into two divisions, one of which, the archaic, became the ancestor of the modern anthropoid apes, and the other, the progressive, the ancestor of man. So far there is no direct evidence of this attractive theory.

No human fossils have as yet been found in Central Asia. Pères Licent and Teilhard have, however, explored certain palaeolithic rites in the great Ordos bend of the Hwang Ho (Yellow River). Here at various depths under the loess they found hearths and the implements of palaeolithic man, belonging to the middle and upper divisions of that period associated with the bones of prehistoric animals. They conclude from the evidence so far discovered that man was living in this region during and possibly before the formation of the loess, which seems to correspond to the latest stages of the glacial epoch of Europe and North America. Dr. N. C. Nelson has collected implements and pottery from the succeeding periods. They are believed to belong to the Mesolithic and Neolithic epochs. So far, however, the complete racial history cannot be written. The Chinese claim to have originated in the Tarim basin, at a period when that region was less inhospitable than now. There they developed an oasis culture and subsequently migrated down the Wei Ho into the plain of China. (*See* CHINA, section *Ethnology.*) There are reasons for believing that at one time the people who may have been the ancestors of the Nordic race of Western Europe were widely distributed, certainly over northern and possibly over Central Asia. It seems difficult to account for the present distribution of peoples of the Far East without believing that there was at one time a continuous distribution of Yellow Man over the Far East, due probably to a migration which separated the various divisions of the Proto-Nordic stock. Then, owing to ethnic movements of the peoples now known as Turks and Mongols, Yellow Man was separated into two great divisions and Central Asia became the home of tribes who, although they have mixed considerably with Yellow Man show affinities rather with the West than with the East.

The inhabitants of Central Asia, excluding the Chinese who form no inconsiderable proportion of the population, may be divided into two main groups, Turks and Mongols, who, while differing in some respects, on the whole present many close resemblances; indeed some of the characters which are considered by Czaplicka to form some of the most marked characters of the Turks are in some places at least equally characteristic of the Mongols.

Social Organization. — The differences which occur in social organization depend to a certain degree on religion. The Turks have only a lay system, organized on the patriarchal nomad household, and an increasingly large number of households, ten, a hundred, and a thousand. The Mongol system is more complicated by the dual lay and ecclesiastical systems side by side and a hereditary nobility, organized more or less on a war footing, with serfs, who may be presented by their chieftain to the ecclesiastical authority. The lamas, who must obtain permission of their chieftain to take the vows, are exempted from all civil and military duties.

Apart from the two great religions of Islam and Buddhism, a good deal of Shamanism survives among the Mongols (*q.v*). The most noticeable feature of their religious life is, however, the extraordinary hold that Buddhism has had on these people, transforming the whole of their life and possibly being responsible for the great change that has come over Central Asia since the days of the great Khan. Buddhism has transformed one of the most warlike people in the world into a small and until recently an entirely dependent nation.

In Central Asia a great ebb and flow of peoples has taken place. During the Ming dynasty most of Inner Mongolia was cultivated by the Chinese in a region which to-day is most typical nomad territory. At present the Chinese agriculturalists are advancing again and driving the nomads back. This ebb and flow has been a practically continuous process, but the sudden incursions of the nomads into cultivated land have produced at various times some of the most cataclysmic movements of history.

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NORTH AND EAST ASIA

This region includes China proper, Manchuria — now included within the borders of China — and Japan, and is most conveniently

divided on a geographical basis into two parts, the mainland and the island portion. The remoteness of the latter from other parts of the world and its geographical isolation divided it from the main currents of human migration in the past, and have given it a very different ethnological history, as far as we know at present, from its western neighbour.

Although it seems probable that man existed in China before or at the beginning of the deposition of the loess *(see* preceding section, CENTRAL ASIA), at present there is no certain evidence of palaeolithic man in Central China. Fossil remains found in Honan by Matsumoto, and at Chou Kou Tien, south-west of Peking. by Black, have been claimed to possess a high antiquity *(see* CHINA: Ethnology). It is more than possible however that the remains, if not of early man, at least of his handiwork, may lie buried under the loess. In the island region no claim has been made about discoveries of palaeolithic man.

In the neolithic period the two regions also present a great contrast. The earliest Chinese culture so far discovered is clearly of chalcolithic date, that is to say that elaborate pottery has been found but no actual trace of metal, whereas in Japan, and to a lesser extent in the coastal region opposite, in Korea and Manchuria there are remains of a different culture which can only be described as Neolithic, without any reference to actual date.

The actual human remains found with this earliest culture in China are similar, with certain differences, to the present inhabitants of modern China, whereas in Japan the earliest remains resemble those of the modern Ainu (*q.v.*), although in the middle stone age of the Japanese archaeologists there first appear in Japan racial types akin to the modern Japanese.

The racial history of the whole region then appears to have been a series of migrations eastwards. As far back as we can trace it at present the Chinese racial type, but not Chinese culture, has existed in China, whereas in the Japanese islands me find first a primitive type, whose kinsmen still survive in the northern island, and secondly a type akin to the mainlanders, who probably crossed over the sea at a comparatively recent date. It also seems probable that at various times there have been racial movements in a north-easterly direction from the plain of China to the regions north of the Amur river.

Principal Groups. — The Chinese republic claims to include within its borders five nations, three of these, Tibetans, Mongols and Chinese Muslims are discussed elsewhere *(see* TIBET; CHINA; MONGOLIA). The other two are Chinese and Manchus. Although they are considered of little worth by the Chinese, the aboriginal tribes are of great interest ethnologically. Within the limits of China proper the Chinese form the greater part of the population. The Manchus who conquered the empire in the seventeenth century were scattered throughout the land as garrisons and have to a very large extent become absorbed in the population, and even in Manchuria itself the Manchus to-day are proportionately few.

The aboriginal tribes are found in the more inaccessible mountain districts of the south and west. In the north and west there are considerable numbers of Muslims, who form, as they have always formed, a turbulent element separated from the Chinese by the almost impassable boundary of the pig, an animal so essential to Chinese culture, and so utterly repugnant to the Muslim.

Korea forms a transition region between the racial groups of the Chinese and the Manchus on the one hand and the Japanese on the other. The term Korean is rather a national than an ethnological term, and intermarriages both between the royal families and the commoners of China and Korea have taken place since an early period. The Japanese form to-day an important element along the railway line in Manchuria and more widely in Korea. The third group of people in the Japanese empire are the Ainu, to-day confined to Hokkaido, but with kinsfolk in the southern islands of Ryūkyū.

Social Organization. — The social organization of the Far East is in general based on a closely organized family, in which the father is the responsible head of the household which includes his unmarried children and married sons and daughters-in-law, the house mother being supreme wirhin the house. The father was, and still is in many places, responsible not only for the well-being of his household but also for their moral rectitude. In China the magistrate was the "father and mother" of his district, and eventually the "Son of Heaven," the Emperor, was responsible to heaven for China as though he were the head of a household. While this system in China developed into a democracy, in Japan, owing no doubt to their constant warfare with the Ainu, there grew up three classes, nobles, retainers and people, each maintaining the family system within its own limits. In China polygamy was generally practised, but the Japanese claim to have abolished the legal secondary wife at an early stage. Both countries practise the system of adoption, whereby the family can be continued in the absence of legal issue. In this way some of the old families, as for instance that of Confucius, go back to an immense antiquity.

Apart from the more highly organized religions Buddhism — (the Zen sect is most popular in Japan), Taoism, Shintoism, Confucianism, and to-day, Christianity, the religion of the greatest interest ethnographically is ancestor-worship, which is practised both in China and Japan, although in thelatter country Christianity appears gradually to be driving out ancestor-worship. In China, however, it still forms one of the most important bulwarks of the social structure, and preserves both the structure of the family and that regard for home which is so important a character of the Chinese. Ancestor worship is a definitely localized religion; all Chinese, therefore, are bound by strong ties to their ancestral home, and if possible endeavour to arrange when they die for their bodies to be carried back to the fields already sorely diminished by the graves of the previous ancestors.

The general characteristics of the culture of this area are the presence of a method of life and religion bound up with agriculture on ancestral acres. Among the Ainu this culture is only in an embryonic state, the men being still largely hunters and fishermen, and agriculture being in the hands of the women.

In China agriculture has for a long time been highly developed, and Japan has inherited much of the culture of China which she has subsequently developed along her own lines, in some cases retaining features which have died out in China. The shape of the "chop-stick" in Japan is similar to the shape of those used in China in the Han Dynasty, and quite unlike the modern Chinese. On the other hand the Chinese have retained the primitive form of the abacus, while the Japanese have developed it. But in spite of differences the two cultures are in essentials similar, and all depend ultimately on an ancient and efficient method of agriculture to support a population which, owing to social customs, always threatens to exceed the means of subsistence.

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ARCHAEOLOGY AND ANTIQUITIES

In eastern Iran, *i.e.,* Sogdiana, Bactria (including Gandhrira, or the north-west corner of the Punjab), in Chorasmia, Merv and Seistan, lie the keys to the problems of early Iranian culture and its influence on the culture of India and China. Again, southern Siberia contains antiquities, which will, undoubtedly, reveal some day the still obscure relations between its nomad "Scythian" inhabitants, the Pontus and China.

Excepting the work done in Gandhrira, the only scientific excavations on a larger scale have been made in eastern or Chinese Turkistan, a bowl-shaped depression hemmed in on all sides except the east by enormous mountain-chains with difficult passes, and in the east approached through the Gobi desert. The only safe trade routes between China and the Hellenistic Orient passed through the rich oases along the northern and the southern margin of the bowl. By them the silks of China reached the West and the products of the Hellenistic Orient, of Iran, of India, and the Buddhist religion, the most powerful propagator of Indian religious thought and of modified Hellenistic art, reached China and the Far East.

These routes were of the highest importance to China, and whenever a vigorous dynasty ruled that country, they were regularly protected by military garrisons,

There had been in the Neolithic age a movement of peoples, which can be studied in the pottery they left behind them. The Swedish geologist, Prof. Gunnar Andersson, discovered in Kansu, Honan and S. Manchuria specimens of a rather advanced ceramical art, showing peculiar ornaments in red and white, or in black and white of a type unknown in China but similar to articles found in Moldavia, Scythia in Europe, as well as in Transcaspia, Babylonia and Susa in Persia. These finds show, that before the 3rd century B.C. a stream of higher culture elements reached China from the north-west, along this great culture corridor. (See CHINA: Archaeology, and EUROPE: *Archaeology*, Eastern Europe.)

Along the northern declivity of the Tien Shan mountains, where even to-day the presence of grass and water permits the nomad Kirghiz and Kalmuks to rear their flocks, are found burial mounds or kurghans, capped, in many instances, with rude stone sculptures of men holding a drinking vessel in their hands. These sculptures resemble similar statues from the Crimea, from the districts now comprised under the name of southern Russia. The German expeditions saw many of them on their way to eastern Turkistan through southern Siberia, but could not acquire any, the Kirghiz and Kalmuk considering them as objects of veneration. It was not possible to observe whether they wore the curious strings attaching their boots of soft leather to the belt, an arrangement occurring in several such sculptures from Scythia in Europe in the Berlin museum, and again in the wall-paintings from Turfan, mainly where red-haired, blue-eyed men of European aspect are depicted. They are not worn by the Persians there depicted, and this trifling ethnographical indicium supports the belief that at one time the ruling class, the Tokharians, in the eastern oasis of eastern Turkistan, were a Scythian race.

These races were probably, in the main, of Iranian stock, but may have included other tribes of the Indo-European family, following their mode of life and imbued with their culture, such as the Tokharians, whose language was found in Central Asia. We need not suppose any Turkish tribes were among the ancient Scythians of Europe before the arrival of the Huns, who, having absorbed, probably, many of the Siberian Scyths on their road through Central Asia to Europe, had accepted, to a certain degree, many of the arts and the cultures of these conquered tribes; the old Iranian allies of the Huns, the Alans, may have been a people of Sassanian culture. These conjectures deserve mention. The misleading name of "Southern Russia" should be abandoned in favour of "Scythia in Europe," the "Pontine country," or some such term. It is to be regretted that this term is constantly employed, because it tends to create an impression that the Russians had something to do with the culture there developed by the Scythian races.

These burial mounds, which can be followed far into Mongolia, mark the route followed by migrating Scythian tribes through Central Asia. That this movement came from the West, is made apparent by the presence of the Indo-European language, Tokharian, and its cognate dialect, both in books, which might have been brought from elsewhere, and in beautifully-executed temple inscriptions in Central Asiatic Brāhmī characters, deriving from India, and in numerous *sgraffitti* in a cursive variant of this.

If they had come from the East, they would probably have used the Chinese language; both the language itself and the characters in which it is written point to the West.

Besides, the Chinese annals inform us of the invasion of China by a race of mounted archers, the Yue-chi, who were driven back by the Hiung-nu (the ancestors of the Huns and of the Turks) after a great battle (*c.* A.D. 170). They returned to the West, dislodging the Iranian Sacae from their seats in the Ili valley, and using, in all likelihood, the road by which they had reached China. The Sacae destroyed the kingdom of the Greeks in Bactria and there founded the empire of the Indo-Scythians, in which, later on, they mere succeeded by the Kushan, who are identified with the Yue-chi. Some of the latter people appear to have made themselves masters of the eastern oases of Chinese Turkistan, or, perhaps better, Serindia, for at that date that country was peopled by Iranians and Indians, and not by Turks.

But, long before these events took place and were recorded in the Chinese annals and in the works of Western historians, this route along the northern declivities of the Tien Shan evidently served as a line of communication between the Greek cities on the Pontus, the northern provinces of the Achaemenian empire and China, on the art of which latter country the peculiar style of representing animals had made a fecund and lasting impression.

No scientific excavations have been made in these Kurghans by trained archaeologists, but the objects found there by casual explorers show irrefutably, that the bronze, iron and other objects contained in them are in direct relation to similar finds in Scythia in Europe, which often show the traces of classical art. Thus quite recently, the Russian explorer, Kozlov, found important Scythian antiquities near Urga in Mongolia, amongst other things the remains of a carpet, showing plainly Greek influence. So, we may safely assume, that Greek motives were carried along this route in early times.

It appears, however, that this corridor between China and the West was only open to intertribal intercourse, ordinary traders hardly trusting themselves amongst these (probably turbulent) nomads. This, probably, is the reason why the silk-route trade roads, the via regia through Serindia, came to be frequented, in spite of the difficulty of the mountain passes intersecting them.

In later times, again, in the time of the Sassanian kings, and stimulated by the Buddhist religious propaganda evidently fostered by Iranian rulers of Bactria belonging to that faith, but imbued with Sassanian culture, a new wave of Hellenistic art elements, modified by Indian and Iranian influences, started from the vicinity of Kabul, Bamiyan being evidently an important centre, towards Serindia and China, following the routes of the silk trade and leaving manifest traces in the cave-temples of Serindia. This was first pointed out by the French explorers, MM. Foucher, Hackin and Godard, and Mme. Godard.

While the Eastern Iranian sites contain relics possibly dating back to early Iranian history, the ruined cities and monasteries of Serindia (and of Gandhāra, which is culturally indissolubly connected with Serindia) offer only remains of the period between the last century before Christ, in the West, and the 10th to 11th centuries of our era.

However, the archaeological work done in these comparatively late sites, by Russian, English, German, French and Japanese explorers, has proved that the ultimate basis of Buddhist art in China, as in all other eastern Buddhist lands, is the Hellenistic antique as developed in Gandhāra.

The Tokharians.—Until the Uighur Turks began their conquest, from the north-east, in the 8th century, the many oasis-States were occupied by Iranians (Sacae and Sogdians) in the west, south-west and north, and by Indians in the south-west and south. From the oasis of Kucha in the north, to that of Turfan in the north-east, the ruling race appears to have been a tribe speaking a language of the European (centum) group. They are called Tokharians in the Middle Turkish texts dug out from temple ruins near Turfan, and the energetic heads, on the mural paintings from these temples, of blue-eyed, red-haired men with European features, differing entirely in everything but dress from pictures of Iranian or eastern Asiatic donors, may well be portraits of men of this remarkable race.

Mss. Discoveries.—The numerous mss. finds are written on wood, leather, palm-leaf, birch-bark and paper, in Tokharian (till then unknown), in the lost languages of the Sacae and Sogdians, in Sanskrit, Pehlevi and at least two Iranian dialects, Middle Turkish in two dialects, Tangutan, Tibetan, Syriac, a few lines of Greek, in Chinese and Mongol, with yet undeciphered mss. fragments of the lost language of the Ephthalites (*q.v.*), or White Huns, and small fragments in two other unknown alphabets. All this literature is strictly religious, excepting fragments of a Middle Turkish translation of the fables of Aesopus and remains of two mss. of the legend of Barlaam and Josaphat, also in Turkish, found in the Turfan oasis, close to the borders of China proper.

The religions represented are Buddhism, Christianity, Zoroastrianism (one fragmentary leaf) and Manichaeism, which, introduced by way of China and accepted by the Uighur kings in

the 8th century, is represented by many mss., sometimes beautifully illuminated, in the Sogdian, Middle Persian and Middle Turkish languages. These remains are written in no fewer than 24 scripts. Islam is not associated with this culture. When this religion began to encroach upon it in the 10th century, the decline of the mainly Buddhist States of East Turkistan had begun.

Art Problems. — In sculpture and painting the basis of all this art is the Hellenistic antique, as developed in Gandhiira and in Bactria under Indian and Iranian influences. The Buddhist religion, and with it the modified Graeco-Buddhist art of Gandhāra, entered Central Asia by the royal road through the Rhyber pass and Bactria, through Udyana and later by the trade routes through Kashmir.

Architecture — The architecture is purely ecclesiastical; domestic buildings probably did not differ materially from similar erections in the present day. Iranian or Indian models are strictly followed. All traces of Chinese influence are absent, and of antique elements only the beautiful *caisson* ceilings occur occasionally. Two groups are found, *(a)* rock-cut temples and cells, *(b)* temples, *stūpas* and monasteries built with sun-dried bricks *(adobe)*.

Cave Temples. — The cave temple settlements follow Bactrian rather than Indian prototypes in their general plan. They are mostly crowded together, often in hundreds, on the perpendicular faces of steep cliffs, in glens of difficult access, near running water and in wild and romantic scenery. The cells of the monks are simple, small, vaulted rooms, with a fireplace, and often a bench cut out of the stone. The walls are plain white-washed, without any ornament. There are very few such cells in even extensive temple groups.

Settlements. — The cave buildings in the older settlements were connected by extensive stone-cut galleries, provided with few windows for the admission of air. Light in the temples and cells must have been mainly artificial, as proved by great masses of remains of wicker lanterns.

The commonest type of cave temple is of Indian origin. It consists of a square, vaulted anteroom, opening on a cella of the same description. The back-wall of the cella has a recess, in which the cult-statue was placed. To the right and left of the statue, two short, low, vaulted corridors were cut into the rock opening into a third corridor, at right angles to them, and parallel to the back-wall of the cella.

The square or rectangular block of stone thus resulting often contained, in a hidden receptacle, relics, manuscripts, coins and other valuables. These receptacles had always been opened and despoiled. This block stands for the *stūpa*. The corridors were used for processional circumambulation. On the walls of the cella were painted the effigies of the donors, the life story of the Buddha in a number of pictures separated by decorative borders, or rows of paintings representing certain Buddhist legends.

The vaulted roof is decorated with tiers of conventionalized representations of mountain landscapes, each containing some birth story (*jātaka*). The middle line between the two topmost tiers contained representations of flights of ducks, constellations, the sun and the moon, wind goddesses and the effigies of the sun- and moon-gods in their chariots, most of these representations following Hellenistic prototypes. In later temples (after A.D. 700) the mountains are replaced by rows of Buddhas.

Iranian Types. — Two other common types are Iranian. The first consists of a square room covered by a cupola rising from profiled mouldings at the upper edge of the walls. The second is similar but covered by a *lantern roof*, such as exists to this day in wooden houses from Armenia through Bactria to Kashmir and western Tibet, as described by Moorcroft. In later cave temples further east (Turfan) this roof was often painted only on the vaulted temple roof. These two Iranian types are used by the Chinese and Koreans as models in their cave temples (*e.g.*, Tunhwang). Another type is a long, narrow, tun-vaulted apartment, with, or without, a socle for the cult-figure.

Brick Temples. — The temples built with sun-dried bricks are erected on the same lines as the cave temples. The "lantern roof," however, never occurs in these buildings, as this construction is impossible with bricks, but the middle of the ceiling vault in the eastern oases (7th–9th centuries) often bore a painted representation of such a roof. These painted lantern roofs were commonly used to decorate ceilings in Chinese cave temples.

The **Stūpa.**—The *stūpa* is either (1) a (massive) building of pyramidal shape, plain on the outside, with a receptacle for relics, coins, mss., etc., or (a) a dome-shaped erection on a quadrangular base, or (3) in the eastern oases, a pyramid with rows of niches for Buddha statues, or (4) a remarkable quadrangular building in several tiers, diminishing in size upwards, like a gigantic staircase. A number of large, vaulted niches for Buddha statues are built in on the four faces of each tier. These erections are often of great size, one having as much as 20 metres length. Another rarer Indian type, of much smaller size generally, is a beautifully-proportioned building of polygonal cross-section.

Monasteries. — The monastery is usually a square or rectangle, surrounded by a strong wall, with towers, with one or more temples and rows of cells arranged along the inner course of the walls, built of sunburnt bricks of most excellent quality, evidently made on the spot in the required shape and size.

Paintings. — In most temples the walls and vaulted ceilings of the rooms were richly decorated with mural paintings in tempera colours. The colours vary in the different settlements, the most ancient ones being distinguished by a lavish use of true ultramarine. In some temples the floor was of stucco, often with most artistic paintings in *al fresco*.

The walls were found in all stages of preparation. Some were simply roughened, awaiting the application of a layer of smoothed, stamped clay, in others this finish had been applied, after which the smooth surface was covered with a very thin layer of stucco. On this smoothened surface the painters drew a "net" of rectangles, one within the other, into which the patterns for the pictures were fitted.

Designs. — These patterns were larger or smaller pieces of paper, on which the artist drew his pictures with India ink. The lines were then perforated, the pattern fixed to the wall and beaten with a bag containing powdered charcoal. The contours thus obtained were then traced in India ink and the colours filled in. Sometimes, in young settlements, an ancient pattern may have been used, so that critical analysis of style, in paintings and still more in sculpture, is not a safe guide to the age of the work.

Art Influence and Sources. — All paintings are intensely influenced by late antique schools of painting, originating in Gandhāra, the Punjab and Bactria. According to the province whence the painters came, or drew their inspiration, the paintings of Turkistan show Hellenistic elements modified in an Indian, or in an Iranian sense. Purely antique and purely Sassanian elements also occur, especially in friezes.

Chinese elements are wanting absolutely in the older, western oases. But China accepted the syncretistic arts of painting and sculpture produced in these regions, and, misunderstanding and modifying the forms received from the West in a Chinese sense, created the splendid art of Thang times on the basis of modified Hellenistic Buddhist art.

After Buddhism declined in India, China became the leading Buddhist power, and this new syncretistic Chinese art gained influence only in the eastern settlements (Turfan), and, as far as we can tell, not farther west than the oasis of Kutchā.

Main Styles. — Five principal well-marked styles of painting were observed by A. Griinwedel. (1) Several styles, directly containing late antique elements, such as are found in the Gandhiira sculptures, are united under the name Gandhāra. In certain temples antique elements preponderate, while others show these elements modified in Iranian or Indian sense (presumably 5th–6th century A.D.). (2) The style of the "knights with the long swords" (Tokharians), is presumably a local continuation of style No. 1 (probably 6th–7th century A.D.). (3) The older Turkish style has a pronounced syncretistic character; the forms of style 1 and 2 are incorporated, but Chinese elements begin to occur. The decorative borders of the wall-paintings and the ceilings show a remarkable and charming flower ornamentation. The costume of the donors differs completely from that of the donors

in the older styles. The inscriptions are in Chinese and Central Asian Brāhmī (presumably 7th–9th century A.D.). (4) The younger Turkish style, more properly the Uighur style, shows a further syncretistic development of style 3 in a Chinese sense—it is only found in the Turfan oasis and is the final development of the older elements into Chinese forms (8th–11th century A.D.). (5) The Lamaistic style has evident relations to Tibetan art.

Sculpture.—All sculpture in eastern Turkistan derives from the late antique school of Gandhāra and pure Hellenistic types appear even in late times in the eastern settlements, where the paintings had assumed an essentially Chinese character.

The perseverance, in sculpture, of Hellenistic forms is simply explained by the fact that, Turkistan being a loess country, without stone fit for the sculptor, the art-craftsmen were forced to use stucco moulds, of which quantities were found, mostly for the production of half-relievo figures. The larger kinds were moulded in pieces and afterwards put together, often very roughly, with straw ropes, twigs, coarse pegs, etc. The statue was prepared in the rough, its surface was remodelled, finished off with a fine layer of stucco and richly painted and gilded.

In the older western oases the material for the statues was often stucco; in the later (eastern) settlements the common clay of the country, mixed with chopped straw, vegetable fibres and animal hair. In spite of the crudeness of this material, the effect resulting is frequently imposing.

The moulds were probably imported from Gandhāra and replaced, when broken, by exact duplicates, produced mechanically from their own former products. Thus antique forms persisted long after paintings had begun to undergo Eastern Asiatic modifications. When the Sassanians cut the road to the West, no new Western influences could penetrate, while communications with China continued to be easy and frequent.

Change of Type.—In consequence, the ideal type of beauty began to change, and gradually the craftsmen deliberately changed their moulds to suit the Eastern Asiatic type of beauty. The nose became shorter, the brows were made slanting, the eyes more prominent, etc., while the late antique hairdresses, utterly incomprehensible to the Easterns, were changed.

Thus the evolution of a late antique head can be followed through many stages, until a typically Chinese head results.

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EXPLORATION

No great river, no large arm of the sea leads to Asia's vast interior. This region remained, as desert conditions spread, unknown to all save a few individuals at different times in the great civilizations that have flourished around its "golden fringe." The movements of early traders, the records of travellers and the labours of military surveyors, from all the surrounding lands, have built up the now detailed topographical knowledge of the continent and so prepared for modern geographical study of the earth as the scene of man's activities. The expeditions of R. Pumpelly, Sir M. A. Stein, Sven Hedin and de Filippi have helped to elucidate the early climates of the interior and the consequent location, distribution and movements of early men

Early Period.—The intrinsic value and religious significance of salt made it an early object of trade. The salt mines of north India were known to the West before the time of Alexander. The salt of Palmyra was traded between Syrian ports and the Persian gulf. The cultivation of silk was known during the early Chinese dynasties and its knowledge spread westwards through Khotan, Persia and Central Asia into Europe. It was imported as raw material at Cos before classical times and is mentioned by Aristotle. Later on we hear of the Chinese pilgrims Fa hien (A.D. 399–415), Song-yun and Hwei-seng (518–521) and Hsuan-Tsang (629–645) journeying in Turkistan. The advancing Mongols under Jenghiz Khan drew the attention of the later middle ages eastwards, although ships of Venice and Genoa had long met at the Levant caravans laden with silk and other commodities of the East. Two Franciscan friars, John de Plano Carpini in 1245–47, and William of Rubruk (Rubruquis), 1253, made journeys through central Asia and they were followed by another Franciscan, John of Monte Corvino, who about 1295 entered south China by way of the Indian sea. But it was the work of Marco Polo (*q.v.*) that really made the East known to the West. We read of the journeys of the brothers Polo to the court of Kublai Khan about 1260 and again in 1271. The Polos were the first to trace a route across the whole breadth of Asia and to describe what had been seen as well as to tell of Japan, Java, Sumatra, the Andaman islands and Ceylon.

Later Journeys.—Central Asia was still almost unknown when explorations from the surrounding lands became numerous about the middle of the 19th century. Father Huc (*q.v.*) 1813–60, crossed the upper region of the Hwang-ho and the terrible sandy tract of the Ordos desert in 1844 and later crossed the desert of Koko Nor and entered Lhasa in 1846. In 1871–73 the Russian explorer Nicolai Prjevalsky crossed the Gobi and made maps of the sources of the Hwang Ho, Salween and other great rivers of China, Burma and Siam. In the next forty years Bonvalot. Prince Henri d'Orleans, Rockhill, Bower, Margary, Dutreuil de Rhins, Curzon, St. George Littledale, Wellby, Deary, Wahab, Holdich, Ryder, Rawling, St. George Gore, Talbot, Schindler and others traversed Tibet and Central Asia in all directions. Many of these were military officers who mapped unknown regions by accurate triangulation. At the same time (1875–1900) the geodetic surveys of Russia in Asia moved apace and a topographical connection was established between the Indian and Russian surveys. Pundits Nain Singh and Krishna may be mentioned in connection with trans-Himalayan explorations by native surveyors (1865–82).

In 1886 Capt. (afterwards Sir Francis) Younghusband completed a journey across the heart of the continent by crossing the Muztagh between China and Kashmir, and in 1904 conducted a mission to Lhasa and extended the survey by triangulation to that city. Sven Hedin explored in Persia and Mesopotamia in 1885–86 and in 1890 he travelled through Khurasan and Turkistan, reaching Kashgar in 1891. During 1893–97 he traversed Asia leaving Orenburg near the Urals and moving over the Pamir and the plateau of Tibet to Peking. During two expeditions 1899–1902, 1906–08 he explored the sources of the Sutlej and the Brahmaputra. In 1896 he found not far from Khotan objects of terracotta, bronze images of the Buddha, coins, etc. He excavated, in Takla-Makan, ancient cities overwhelmed by sand, where he found among other things mural paintings illustrating lake scenery, pottery, etc. He also discovered (1901) the ancient city of Lou-Lan in the heart of the Lop desert. He was followed in this work by Sir Aurel Stein who had made important journeys to central Asia and west China. Stein journeyed to Endeir, Kara, Rawak and other sites where he recorded finds of pottery, images, frescoes, etc.

Modern Times.—Ellsworth Huntington's explorations in the neighbourhood of the Tien Shan and Altai systems in 1903 together with the publication of his book The Pulse of ***Asia*** (1907) brought to the fore the significance of his theory of the cyclic desiccation of the interior of Asia. His views can be more carefully studied since Dainelli in the reports (1922 onwards) of the Filippi expedition to the Himalayas and Kara Koram, besides

giving valuable anthropological and sociological data, offers important evidence suggesting various periods of glaciation for the great mountain arcs of central Asia, parallel to most of those worked out for the Alps by Penck. It is now generally thought (following the view of Stein) that even after the passing away of the ice age many large glaciers remained among the mountains and their melting gave supplies of water to the lowland regions. The increasing drought about the beginning of the Christian era would, in Stein's view, be brought about by the marked reduction of these glaciers.

Besides the works of Stein and Sven Hedin mention must be made of A. D. Carruther's books on Mongolia and Dzungaria, Baddeley's work on Russia, Mongolia and China, Dr. Legendre's work on the Upper Yalung in West China, Kingdon Ward's From *China* to *Hkamti Long* and the reports *(Geog.* Jour., 1926) of this worker's investigations of the Himalayan gorges of the Brahmaputra, J. W. Gregory and Teichman on Eastern Tibet. Pioneer work on China and the Chinese interior was done by von Richthofen who, during the latter half of the 19th century, made seven remarkable journeys covering almost the whole of the Chinese empire. He studied the geology, geography and economic resources of these regions and his great works published between 1877 and 1912 opened up in a scientific manner many problems in Far Eastern Asia. His labours have been continued by the Japanese Geological Survey, whose geological map of China is an acquisition to our knowledge of these regions. This field of exploration has recently been advanced by the American Museum of Natural History under the direction of Roy Chapman Andrews. The reports of their work east and south of Chinese Turkistan in 1922–25 abound in interest. Andersson and Arne, Teilhara, Weidenreich, Li, Wa, Pei, Criel and others have exposed ancient sites and greatly added to our knowledge both of Palæolithic China and of the dawn of civilization. As early as 1864 Prince Kropotkin journeyed in north Manchuria from Transbaikalia to the Amur, and later he investigated the Sungari river and moved into the heart of Manchuria. Baron Toll investigated the Lena basin in 1892, and much work has been done in Northern Siberia in the 20th century. The opening of the century brought the results of D. W. Freshfield's explorations in the Caucasus, and the present century may truly be held remarkable for revelations by the spade of the glories of the ancient civilizations of the Near East. Stein and Sven Hedin have worked in Central Asia, and the former notably in Iran. Woolley and others have carried out large excavations in Mesopotamia: and Prof. Dorothy Garrod and others have investigated early Palestine. Huzayyin and, later, Miss Caton-Thompson have begun the archaeological examination of S. Arabia. Bertram Thomas and H. St. J. Philby have crossed the Rub' al-Khali in S. Arabia, and the latter has contributed greatly to our knowledge (especially as regards the oasis fortress-towns) of interior Arabia, which, with the rise of the Sa'udi kingdom, has acquired added importance.

Generally speaking, primary exploration has given place to more specialized study attacking specific problems, but Russian geographers have done much primary work, notably on the north coast *(see* ARCTIC REGIONS), in the north-east, and in the Pamirs and Tien-Shan.

The outstanding features in India have been the extension of trigonometrical survey under the military authorities; the attempts, made year after year, to climb Mt. Everest (*q.v.*) and to explore its higher slopes; the publication of important studies of various peoples especially of north-east India; and the exploration of the ancient cities of Harappa and Mohenjo Daro in the Indus basin under the direction of Sir John Marshall. English, Dutch, Swiss and German works have contributed much to study of the island groups off the south-east of Asia.

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It is conceded that by far the best general account of the geology of Asia is still to be found in Suess's *Das Antlitz der Erde* (English edition, *The Face of the Earth).* The French edition. *La Face* de *la Terre,* is especially useful on account of the addition of numerous later references by E. de Margerie. Argand's "La tectonique de l'Asie" *(Comptes rendus,* Cong. Geol. Intern., xiii. Session, Belgique, 1922, pp. 171–372) is of later date but a great part of it is occupied by theoretical discussions of a general nature. *See* also F. von Richthofen, *China,* 5 vols. (1877–1912); C. M. Doughty, *Travels in Arabia Deserta* (1888); Viscount Curzon, *Persia and the Persian Question,* 2 vols. (1892); D. W. Freshfield, *Exploration of the Caucasus,* 2nd ed. (1902); Prince Kropotkin, *Desiccation of Asia* (1904) and *The Orography of Asia* (1904); *W.* **W.** Skeat and C. D Blagden. *Pagan Races of the Malay Peninsula,* 2 vols. (1906); E. Huntington, *The Pulse* of *Asia* (1907); R. Pumpelly, *Explorations in Turkestan* (1904, Pub, 1908); C. Hose and W. Macdougall, *The Pagan Tribes of Borneo,* 2 vols. (1912); A. **D.** M. Carruthers, *Unknown Mongolia, A Record of Travel and Exploration in Mongolia and Dzungaria,* 2 vols. (1913); Sven Hedin, *Southern Tibet,* 10 vols. of text, 3 vols. of maps (1917–1922); J. F. Baddeley, *Russia, Mongolia and China* (1919); Sir M. *A.* Stein, *Serindia* (1921); *A.* **R.** Brown, *The Andaman Islanders* (1922); H. St. J. B. Philby, *The Heart of Arabza,* 2 vols. (1922); Ed. G. Dainelli, *Spedizione Italiana de Filippi,* ser. 2 Geol. and Geog. (1922, etc.); **E.** Teichman, *Travels in Eastern Tibet* (1922); *J.* **W.** Gregory, *The Alps of Chinese Tibet* (1923); Sir M. A. Stein, *Memoir on Maps of Chinese Turkestan* (1923); F. K. Ward, *From China to Hkamti Long* (1924); R. A. S. Macalister, *A Century of Excavation in Palestine* (1925); Charles Hose, *Natural Man* (1927); Amer. Museum of Natural History, *Preliminary Reports of Central Asiatic Explorations;* Tokio, Geog. Socy. N.D., *Geological Map of China.* (X.)

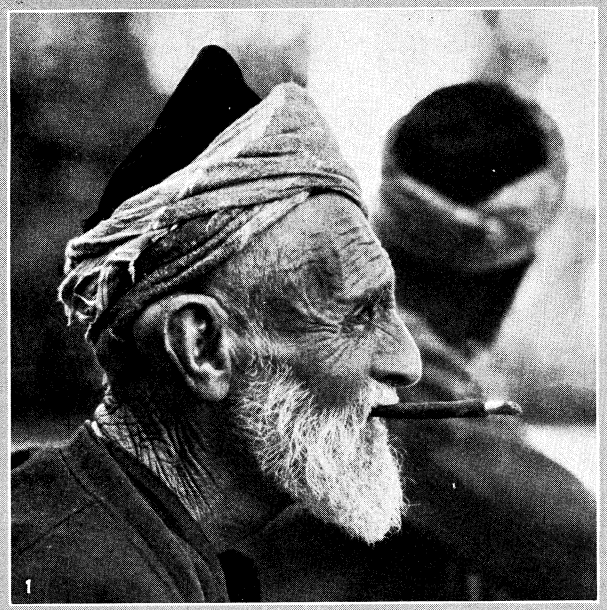
HISTORY

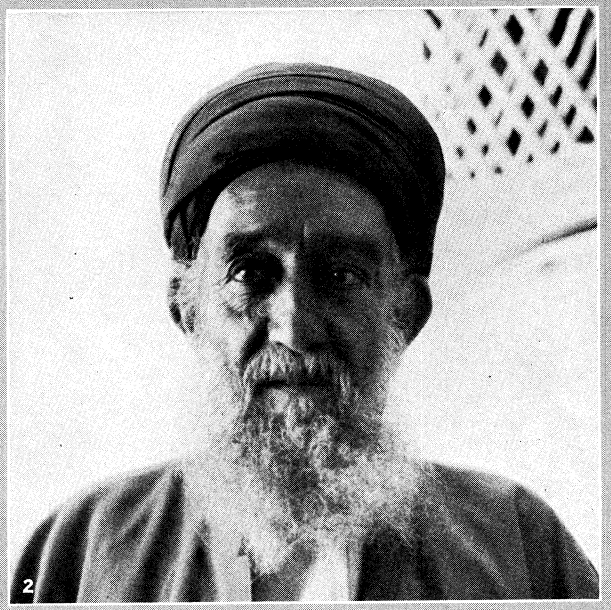
Asia, in a narrow sense, the name of the first Roman province east of the Aegean, formed (133 B.C.) out of the kingdom left to the Romans by the will of Attalus III. Philometor (*q.v.*), king of Pergamum. It included Mysia, Lydia, Caria and Phrygia, and therefore Aeolis, Ionia and the Troad. In 84 B.C., on the close of the Mithridatic War, Sulla reorganized the province. From 80 to 50 B.C. the upper Maeander valley and all Phrygia, except the extreme north, were detached and added to Cilicia. In 27 B.C. Asia was made a senatorial province under a pro-consul. As the wealthiest of Roman provinces it had most to gain by the *pax Romana,* and therefore welcomed the empire, and established and maintained the most devout cult of Augustus. In this cult the emperor came to be associated with the common worship of the Ephesian Artemis. By the reorganization of Diocletian, A.D. 297, Asia was broken up into several small provinces, and one of these, of which the capital was Ephesus, retained the name of the original province *(see* ASIA MINOR).

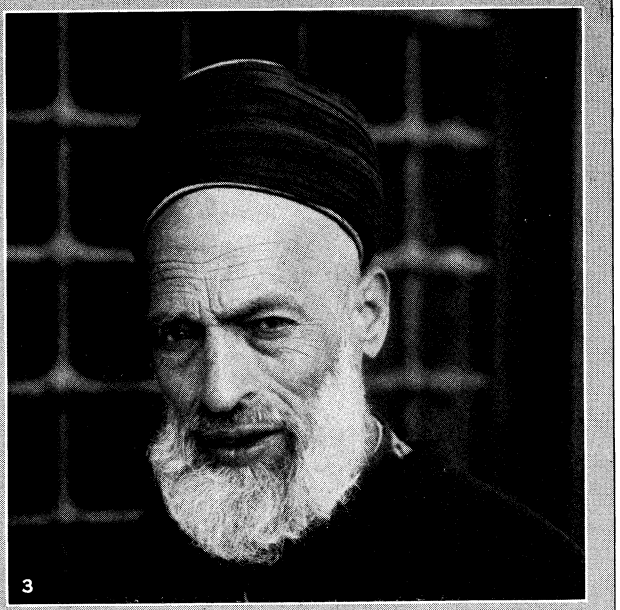
Boundaries.—The borders assigned to Asia on the west are somewhat arbitrary. The Urals indicate no real division of races and in both Greek and Turkish times Asia Minor has been connected with Europe rather than with the lands to the east. A juster view of early history is obtained by thinking of the Mediterranean countries as interacting on one another than by separating Asia Minor and Palestine as Asiatic.

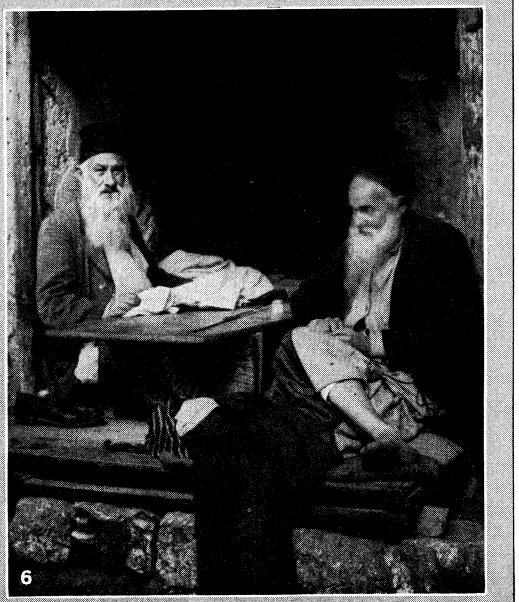
The words Asiatic and Oriental are often used as if they denoted a definite and homogeneous type, but Turks, Indians, Chinese, etc., differ in so many important points that the common substratum is small. Asiatics stand on a higher level than the natives of Africa and America but do not possess, although they are acquiring, the special material civilization of Western Europe. They have not shown the same sentiment of independence and freedom. Individuals are thought of as members of a family or state rather than as entities with rights of their own. Hence Asiatic history has large, simple outlines. Though longer than the annals of Europe, it is less eventful and offers fewer personalities of interest. But the same conditions which render individual eminence difficult procure for it, when once attained, more ready recognition. Jenghiz and Timur covered more ground than Napoleon and no one European has had such an effect on the world as Mohammed.

Religions.—Not only the great religions of the world—Buddhism, Christianity, Hinduism and Islam—but those of secondary importance such as Judaism, Parseeism, Taoism, etc., all arose on Asiatic soil. On the other hand Christianity, though Asiatic in origin, has assumed its present form in Europe and its most important manifestations—notably the Roman Church—are European reconstructions in which little of Asia remains. Christianity has made little way to the east of Asia Minor. Modern missions have made no great conquests there, and though in earlier times









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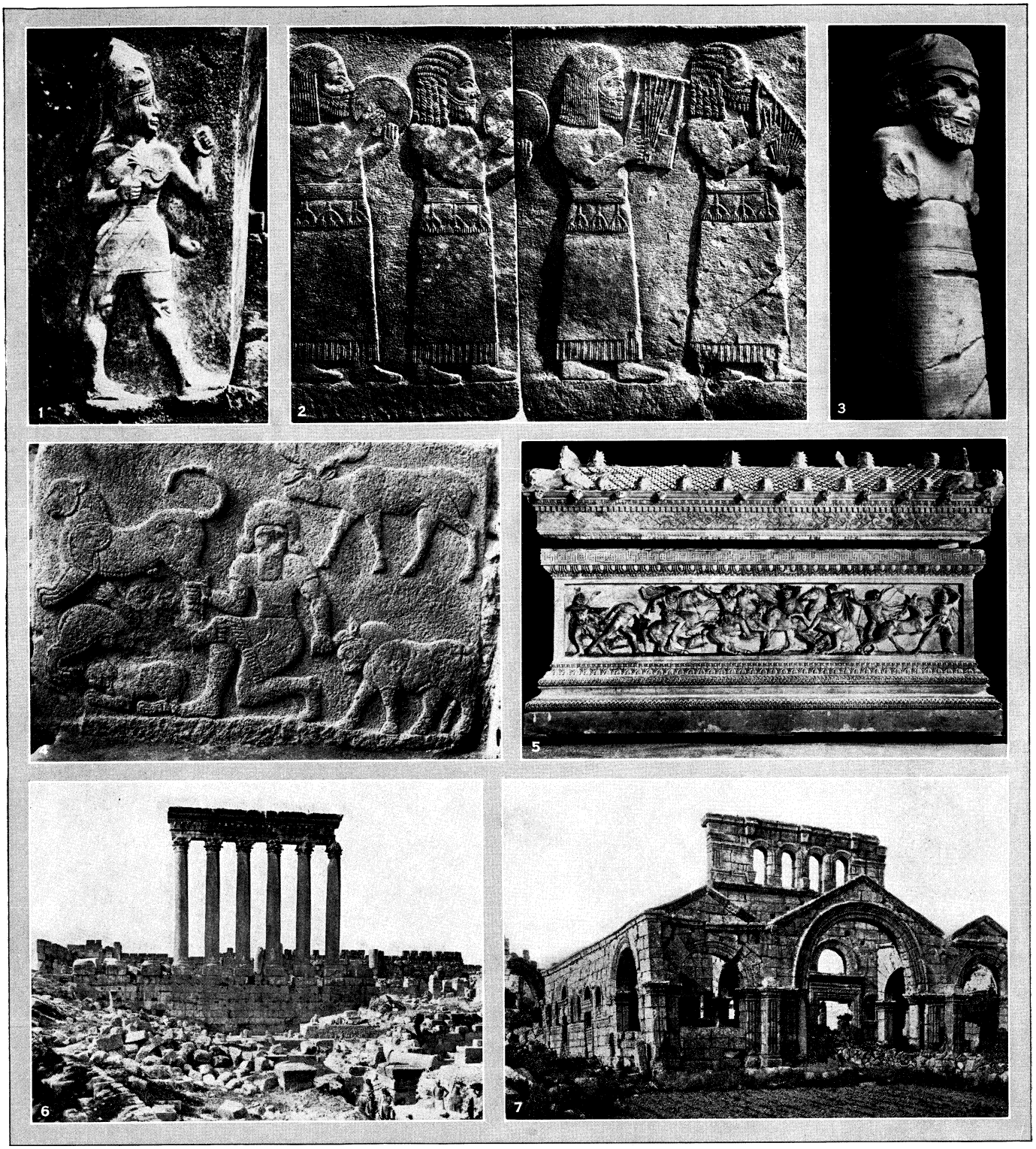
INDIVIDUALS AND GROUPS IN THE HOLY LAND AND NEIGHBOURING COMMUNITIES

1. An elderly Turk of Constantinople
2. The High Priest, leader of the small surviving sect of the Samaritans
3. The keeper of the Grand Mosque in Syria
4. A native of Cana, in Palestine
5. The grain market in Nasiriya, on the river Euphrates
6. Two Jewish tailors in a subterranean street of Jerusalem

ASIA



FROM (1) VERÖFFENTLICHUNGEN DER DEUTSCHEN ORIENT-GESELLSCHAFT, BD. 19: PUCHSTEIN, "DIE BAUWERKE BOGHASKÖI," VERLAG J. C. HINRICHS'SCHE BUCHHANDLUNG, LEIPZIG, (2, 3) "AUSGRABUNGEN IN SENDSCHERLI:' BY COURTESY OF THE DIRECTOR OF THE STATE MUSEUM. BERLIN, (4) HOGARTH. "CARCHEMISH REPORT.' BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM; BY COURTESY OF (5) THE DIRECTOR OF THE MUSEUM OF ANTIQUITIES. CONSTANTINOPLE, (6) THE STAATLICHE BILDSTELLE. BERLIN, (7) M. VAN BERCHEM AND EDMUND FATIO, "VOYAGE EN SYRIE," BY COURTESY OF L'INSTITUT FRANÇAIS D'ARCHÉOLOGIE ORIENTALE

ARCHAEOLOGICAL DISCOVERIES IN ASIA MINOR

1. Sculpture of a god or king found in the excavations at Boghaz-Keui, a small village in Cappadocia
2. Relief showing procession of musicians, discovered by German excavators at Sinjerli, Syria
3. Statue of the god Hadad discovered by German excavators at Sinjerli
4. Incised inscription on basalt, showing a man capturing animals, taken from the Djerbis ruins
5. Marble sarcophagus, found at Sidon, said to be that of Alexander the Great. His sculptured effigy appears on the lower part of the sarcophagus
6. Ruins of the temple of Jupiter at Baalbek, Syria
7. Gateway to the church of Kalat Seman, in central Syria, which was built about A.D. 500 and was dedicated to St. Simeon Stylites, the anchorite

the Nestorians penetrated even to China, they never had anything like the success which attended Buddhism and Islam. Yet Buddhism never produced much impression west of India and Islam is repugnant to Europeans, for even under Muslim rule (as in Turkey) they refused to accept it in a far larger proportion than did the Hindus in similar circumstances. There is clearly a profound difference between the religious feelings of the two continents.

The north of Asia is less important than the corresponding region of Europe, few tribes or places of note being found north of lat. 50°. In many parts of the south are semi-barbarous races representing early peoples, such as the Veddahs of Ceylon and various tribes in China and the Malay archipelago. In northern Asia are other aborigines such as the Ainus and Chukchis, but no materials are forthcoming for their history. We have some record of invasions by later races. The Chinese came from the west, though from how far west is unknown; the Hindus and Persians from the north-west; the Burmese and Siamese from the north.

The antiquity of Asiatic history is often exaggerated. With the exception of Babylonia and the West, we can hardly conjecture the condition of the continent before 1500 B.C. At that period the Chinese were advancing along the Hwang-ho and the Aryans were entering India. Babylonian influence was probably widespread. All Indian alphabets seem traceable to a Semitic original and connection between China and Babylon is suspected, though not proved.

Spheres of Influence. — Apart from European conquests the history of Asia in the last 2,000 years is the result of the interaction of four main influences: (a) Chinese, (b) Indian, (c) Mohammedan, (d) Central Asian. Of these the first three represent different types of civilization; the fourth has little originality but has been of great importance in affecting the distribution of races and political power.

China has moulded the civilization of the eastern mainland and Japan. In the sphere of direct influence fall Korea, Japan and Annam; in the outer sphere are Mongolia, Tibet, Siam, Cambodia and Burma, where Indian and Chinese influence are combined, the Indian being often the stronger. Wherever Chinese influence had full play, it introduced Confucianism, a special style of art and the Chinese script.

Indian influence may be defined as Buddhism, if it is understood that Buddhism was not always clearly distinguishable from Hinduism. Its sphere includes Indo-China, much of the Malay archipelago, Tibet and Mongolia. China and Japan themselves may be said to fall within this sphere, so far as they are Buddhist. It is noticeable that the influence was not reciprocal, and that Indian culture was not affected by Chinese art, literature or ethics. Buddhist influence is not merely religious for it is always accompanied by Indian art and literature and often by an Indian alphabet, as in Tibet, Java and Cambodia.

Mohammedanism or Islamism is perhaps the greatest transforming force which the world has seen. It has profoundly affected and to a large extent subjugated western Asia, eastern and northern Africa, as well as eastern Europe and Spain. Until recently it implied the fusion of secular and religious power, so that the Muslim Church was a Muslim state characterized by slavery, polygamy and, subject to the autocracy of the ruler, the theoretical equality of Muslims who in political status were superior to non-Muslims. Islam is still the principal religion of western Asia: in India it is strong in the north and centre but only one-fifth of the whole population is Muslim. Beyond India it has spread to the Malay peninsula and archipelago, where it overwhelmed an earlier Hindu civilization. But it made no progress in Indo-China or Japan, and though Mohammedans are numerous in some parts of China, it is there merely one of many religions and has never aspired to identify itself with the state.

Even tnore than Buddhism, Islam has carried with it a special style of art and civilization. It is usually accompanied by the use of the Arabic alphabet, and in the languages of Muslim nations a large proportion of the vocabulary is Arabic.

The great part which Central Asian tribes have played in history is obscured by the absence of any common name for them. Linguistically they fall into several groups such as Turks, Mongols and Huns, but they were from time to time united into states representing more than one group, and their armies were recruited like the Janissaries from all the military races in the neighbourhood. Soon after the Christian era, Central Asia began to boil over and at least seven great invasions can be ascribed to these tribes: (1) The early invasion of Europe by the Avars, Huns and Bulgarians, (2) the invasion of Russia by the Mongols, (3) the conquests of Timur, (4) the conquest of Asia Minor and Eastern Europe by the Turks, (5) the conquest of India by the Moguls, (6) the conquest of China by the Mongols under Kublai, (7) the later conquest of China by the Manchus. To these may be added numerous lesser invasions of India, China and Persia.

These tribes have a genius for war rather than for government, and with few exceptions (*e.g.*, the Moguls in India) have proved poor administrators. But their movements helped to keep up communications in Central Asia and to transport religions and civilizations from one region to another. Thus they are mainly responsible for the introduction of Islam into India and Europe and in earlier times they facilitated the infiltration of Graeco-Bactrian civilization into India.

Recent excavations in Central Asia have made surprising discoveries. In the Tarim basin there flourished in the early centuries of our era small states, such as Khotan and Kucha, which possessed a singularly mixed civilization comprising Chinese, Indian, Iranian and even Greek elements. Buddhist, Christian and Manichaean edifices have been unearthed, as well as libraries in many languages, two of which were previously unknown.

In the early history of both Europe and Asia small feudal or aristocratic states tended to grow into monarchies, but whereas in Europe from ancient Rome onwards royalty has often been replaced temporarily or permanently by more popular forms of government, until recently this change did not occur in Asia, where democracy was represented chiefly by remote tribes which had not developed into states. But within the last 1j years China and Turkey have abolished the imperial power and several territories in Central Asia have become republics, affiliated to the Soviet Government of Russia.

Babylonia, Assyria, **etc.**—The movements mentioned above have been the chief factors of relatively modern Asiatic history, but in early times the centre of activity and culture lay farther west in Babylonia and Assyria. These ancient states began to decline in the 7th century B.C. and gave way to the Persian empire. Recent researches have thrown much light on their history but have also shown that it was complex and that we have to deal with more nations than was supposed. Excavations at Susa and at Anau in Transcaspia indicate the existence of a very early civilization extending over south-western Asia whence probably descended the Sumerians, a race speaking an agglutinative language who have left written records anterior to 4000 B.C. In Mesopotamia they met with Semitic tribes, sometimes called Akkadian. Dynasties of both races ruled in various towns, but after 2500 B.C. the Sumerians began to decline and Babylon came to the front as metropolis under Hammurabi, the Lawgiver (2123–2081). Semitic rule however collapsed before new invaders from Elam, the Kassites, who controlled Babylon for more than five centuries (c. 1750–1200). They adopted the civilization and Semitic language of their subjects, but little is known of their original culture. The Hittites, who invaded Babylonia about 1950, developed into a considerable empire which ruled northern Syria and the greater part of Asia Minor in the 14th and 13th centuries. Their hieroglyphic inscriptions have not yet been satisfactorily deciphered. Nor is there much that is certain which can be said about the important kingdom of Mitanni in Central and Eastern Asia Minor. The ruling class were apparently Aryan, but according to most philologists the language of the people was not. The Assyrians now come to the front. They seem to have been an offshoot of the Babylonians using almost the same language, though they had an individuality which showed itself in art and religion. In the 9th and 10th

centuries they became the chief power within their sphere and the suzerain of their parent Babylon. But they succumbed before the advance of the Medo-Persian power in 606 B.C., whereas it was not till 555 that Cyrus took Babylon. Assyria, being an essentially military power, disappeared with the destruction of Nineveh, but Babylon continued to exercise an influence on culture and religion for many centuries after the Persian conquest.

China.—This is the oldest of existing states, though its authentic history does not go back much beyond 1000 B.C. The origin of the Chinese is uncertain but it is clear that they came from the west and entered their present territory along the course of the Hwang-ho, possibly about 3000 *B.C.* In early historical times China consisted of a shifting confederacy of feudal states, but about 220 *B.C.* the state of Tsin or Chin (whence the name China) became prominent and formed a brief empire. The subsequent history of China is mainly a record of struggles with various tribes commonly but not very correctly called Tartars. The empire was frequently broken up by incursions or divided between rival dynasties, but at least twice became a great Asiatic power, under the Han dynasty (*c.* 206 B.C.–A.D. 220) and the T'ang (AD. 618–907). The dominions of the latter extended across Central Asia to India, but were dismembered by the attacks of the Kitans (whence the name Cathay). China proper, minus these external provinces, was again united under the Sung dynasty, but split into the northern and southern kingdoms. In the 13th century arose the Mongol power and Kublai Khan conquered China. His dynasty lasted less than a century, but the native Chinese dynasty called Ming which followed reigned for nearly 300 years. In 1644, the Manchus, a northern tribe, captured Peking and founded an imperial house which lasted till 1912, when a republic was proclaimed.

Though the government of China has hitherto been monarchical, there have been many intervals of chaos like the present period and the divine right to rule has never been regarded as inherent in one family, for there have been ao dynasties since the Christian era. But until the advent of Europeans the Chinese were aiways in contact with inferior races. Whether they incorporated weaker neighbours or were conquered by more robust invaders, Chinese civilization prevailed and assimilated alike the conquerors and the conquered. The present situation differs from anything in the past because China is now assimilating European and American ideas, with the result that dislike of foreigners and desire to imitate them are both strong motives.

The most conspicuous figure in the literature and, indeed, the history of China, is Confucius (551–475 B.C.). Though he claimed no originality and merely sought to systematize the traditions of antiquity, his influence in the Far East has been extraordinary, and he must be pronounced one of the most powerful advocates of peace and humanity that have ever existed.

Tibet was an important power in Central Asia in the 8th century, but later became a vassal of China, though practically independent and possessing a culture of its own, which is chiefly derived from India. Its most striking feature is the religion, a form of late Indian Buddhism called Lamaism, which attained temporal power and developed into an ecclesiastical state curiously like the papacy.

The Mongols, who were once a terror to Europe and who conquered China, ceased to be a political power after the 14th century. They live on nominally Chinese territory or in Russia, and such culture as they possess is a mixture of Indian (through Tibet) and Chinese. Their alphabet is a curious instance of transplantation, being derived from the Syriac script introduced by early Nestorian missionaries.

Japan.—The oldest known inhabitants are the Ainus, who were gradually driven to the northernmost island, but though their wars with the Japanese are historical, there is no record of whence the latter came. Native tradition regards them as autochthonous, but they are probably a mixed race combining Central-Asian with Malay or Polynesian elements. Authentic history hardly begins till the 6th century *A.D.* when Chinese civilization and Buddhism were introduced from Korea. In 645 the whole government was reorganized on the model of Chinese bureaucracy, but a characteristic feature of Japanese politics—the power of great families who overshadowed the throne—also appeared. First came the Fujawaras and then the rivalry between the houses of Taira and Minamoto. The latter won and in 1192 established a dual system under which the emperor ruled only in name, and the real power was in the hands of a hereditary military chief called Shogun, or even of his deputy, for the Hōjō regents of Kamakura practically reigned from 1205 to 1333 and repulsed the invasion of Kublai Khan. The chief power then passed to the Ashikaga dynasty of Shoguns (1338–1565), distinguished for their patronage of art. The middle and end of the 16th century was a period of ferment marked by the arrival of the Portuguese, who attempted to introduce Christianity, and by the rise of some remarkable leaders one of whom, Hideyoshi, invaded Korea. Death interrupted his plans and his successor Ieyasu decided on a policy of isolation. Ideas of external conquest were abandoned, Christianity was forbidden and Japan closed to foreigners for 216 years, only the Dutch being allowed a limited commerce. It was not till 1854 that the Christian powers, beginning with the United States, asserted their right to trade. The influx of ideas caused an upheaval in which the Shogunate was abolished and the authority of the Emperor restored. Seeing that their only chance of competing with Europeans was to fight them with their own weapons, the Japanese set themselves to imitate the material civilization and to some extent the institutions of Europe, such as constitutional government. Their progress and success are without parallel. In 1895 they defeated the Chinese and ten years later the Russians.

This sudden development of the Japanese is of singular importance, since it marks the rise of an Asiatic power capable of competing with Europe. Their history is so different from that of other Asiatic states that it is not surprising if the result is different. The nation hardly came into existence until India and China had passed their prime and was free from the continual struggle against barbarian invaders which drained the energies of its neighbours. It was left untouched by Mohammedanism, and for a long period kept Europeans at bay without wasting its strength in hostilities. The military spirit was evolved, not in raids and massacres of the usual Asiatic type, but in feudal struggles which restrained ferocity and tended to create a temper like European chivalry.

Korea is peculiar in race and language but derived its civilization from China, to which it was nominally tributary at most periods, though practically independent. In the 16th century the Japanese occupied it for a short period and in 1894 they went to war with China to contest her suzerainty. As a result, Korea was declared independent, but after the Russo-Japanese War Japan's "paramount interests" in the country were recognized and she annexed it in 1910.

India.—The earliest stratum of population seems to be represented by the speakers of the Munda languages (*e.g.*, the Santals and other uncivilized tribes). Next came the Dravidians (Tamils, Kanarese, etc.) who probably entered from the north-west, but at an unknown date, and attained some degree of culture. In prehistoric times they were apparently spread over all India but were driven to the centre and south by the advance of the Aryans. These appear to have originated in Europe but one section wandered to the north of the Hindu Kush and divided into two branches, Indian and Iranian, the former of which migrated into the Punjab about 1joo B.C. But Mitannian inscriptions of 1400 B.C. which mention Indian deities have been found in Asia Minor, and are explained by supposing either that the Aryans took this route eastward or that there was a secondary migration to the west. The life of the ancient Indians as portrayed in their sacred songs, the Rig Veda, was quasi-nomadic but by the 6th century B C. settled states had been formed in the Ganges valley. They were monarchies but the power of the king was tempered by the extraordinary influence of the hereditary priestly class or Brahmans. The position of this class, which has survived to the present day, is connected with the institution of caste, a division of the population into groups founded partly on race, partly on occupation. Somewhat opposed to Brahmanism

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ASIATIC ANIMALS, BY PAUL BRANSOM

Upper panel: Leopards. Among the catlike animals leopards are surpassed in size only by the lion and the tiger, with which they vie in swiftness, courage and ferocity. Left to right: Clouded Leopard; Common Leopard; Black Leopard, a colour variant of the common leopard; Snow Leopard or Ounce

Middle panel. Upper left to right: Two White-handed Gibbons (tailless monkeys), showing the light grey and the typical colouration; Asiatic Elephant, anciently domesticated in India, differing in appearance from the African chiefly in its much smaller ears; **Hanuman** Monkey, sacred in India; **Crab-eating** Macaque. Left centre: Sambar Deer, with antlers sometimes 4 ft. **long.** Right centre: Water Buffalo, larger but less **docile** than the ox, domesticated since remote antiquity. Lower row, left to right: Tiger, the most destructive beast of prey, sometimes exceeding the lion in size; **Nilgai,** a large antelope; **Indian** mongoose, an agile, weasel-like destroyer of venomous snakes; Cobra, the most deadly of serpents

Lower panel, left to right: Tahr, a Himalayan **wild** goat; Yak, the **"grunting** ox of **Tartary,"** long domesticated **in** Tibet; Bactrian Camel, **employed** for centuries in the trans-Asian caravan trade; Takin, a Tibetan **antelope;** Giant Panda, a catlike animal allied to the **American** raccoon. For **further** details see the articles on the various animals

was the doctrine of the Indian prince, Gautama, called the Buddha, which grew into one of the greatest religions of the world. For many centuries the intellectual development of the Hindus depended mainly on the interaction of Buddhism and the old religion. Buddhism was finally absorbed and disappeared in India itself, but being a missionary religion it flourished elsewhere and spread Indian influence over all eastern Asia.

In 1924 excavations in the Punjab and Sindh discovered at two sites brick structures as well as pottery, coins and seals bearing figures and inscriptions in unknown characters. No authoritative statement has yet been made as to the probable date and origin of these objects, but they are said to be unlike anything known in Indian art and to suggest affinities with Susa or Sumerian civilization. All that is clear is that further investigation may reveal a new and hitherto unsuspected phase of early Indian history.

In 326 Alexander invaded the Punjab. The immediate result was small, but the rise of Hellenistic kingdoms in Central Asia had a powerful effect on art and culture and may also have familiarized the Hindus with the idea of an empire, which appeared among them later than elsewhere. The first empire called Maurya reached its zenith under Asoka (c. 274–236), who rultd from Afghanistan to Madras. He was a zealous Buddhist, and by his exertions the faith was spread all over India and Ceylon. No Hindu empire has lasted long and the Maurya dominions broke up soon after his death.

In the next period (c. B.C. 150–A.D. 300) India was invaded by tribes partly of Parthian and partly of Turki origin. The most important were the Kushans whose king, Kanishka, founded a state which comprised northern India and Kashmir. The date of Kanishka's accession is still disputed and variously given as 78 and 125 A.D. Another native empire known as Gupta arose on the ruins of the Kushan kingdom and embraced nearly the whole peninsula, but it broke up in the 5th century under the attacks of new invaders, the Huns. From 606 to 646 Harsha established a brief but brilliant empire in the north, but after his death Hindu history is lost in a maze of small and transitory states, incapable of resisting the ever advancing Mohammedan peril. As early as 712 the Arabs conquered Sind and by 1200 most of northern India was in Muslim hands. Two periods may be distinguished, the Turki (1000–1526) and the Mogul empire. The former comprised several dynasties of mixed race, but was wanting in coherency. In the neighbourhood of the Muslim capitals Islam spread rapidly, but in such districts as Rajputana, Orissa and Vijayanagar, Hindu civilization and religion maintained themselves.

In 1526 the Moguls descended from Transoxiana and seized Delhi. They never subjugated the south, but the Empire which they founded in the north was for about two centuries under such rulers as Akbar and Shah Jehan one of the most brilliant which Asia has seen. After 1707 it began to decline; the governors became independent, a powerful Maratha confederacy arose, Persians and Afghans made repeated invasions and the power of England and France increased (see EUROPEAN INFLUENCE). Amidst such confusion the authority of the Mogul empire rapidly disappeared but it lasted as a name till the Mutiny.

Neither the Hindu nor the Muslim rulers of northern India succeeded in completely subjugating the Dravidian kingdoms of the south nor did these ever combine into one state. Though far from unimportant for the history of literature and culture, their history presents few salient events. This indeed is true of Hindu history generally. Until Mohammedan times it is marked by the unusual prominence of religion and is a record of intellectual rather than political changes. Even the great Hindu dynasties have left few traces, and it is with difficulty that the historian disinters the minor kingdoms from obscurity. But Hindu religion, literature and art have influenced all Asia from Persia to Japan, and there were once Indian states in such remote regions as Khotan and Cambodia.

Ceylon was, according to tradition, invaded by Aryans from north-western India in the 6th century B.C. It received Buddhism in the time of Asoka and as a religious centre has influenced Burma and Siam. Its mediaeval history is a record of struggles with Tamil invaders. A powerful native dynasty ruled in the 12th century but subsequently the island mas partially subjugated, first by the Portuguese and then by the Dutch. In 1796 the Dutch were expelled by the British.

Persia.—The Persians, with whom are often coupled the Medes, appear to be Aryans in origin, and the earliest form of their language and religion offers remarkable analogies to the Vedas. Their ancestors and those of the Hindus formed a single tribe somewhere in central Asia. The religion was remodelled by Zoroaster probably once. There is no agreement as to his date, but many authorities place him in the 7th century B.C. About that time they shook off the domination of Assyria. From the 6th century onwards their empire, then known as Median, began to expand at the expense of the surrounding states. They destroyed Nineveh in alliance with the Babylonians, and half a century later Cyrus took Babylon and founded the great dynasty of the Achaemenidae. The substitution of the Persian for the Median power, which took place with the advent of Cyrus, seems to indicate the pre-eminence of a particular tribe rather than a foreign invasion. The power of the Achaemenidae, when at its maximum, extended from the Oxus and Indus in the east to Thrace in the west and Egypt in the south, but fell before Greece, after lasting for rather more than zoo years. Darius and Xerxes were repulsed in their efforts to subjugate the Greek peninsula, and Alexander the Great conquered their successor Darius III. in 329. But the greater part of the empire continued to exist under new masters, the Seleucids, as a Hellenistic power which was of great importance for the dissemination of Greek culture in the East. About the same period (250 B.C.–A.D. 22j) the Parthian empire arose under the Arsacids in Khorasan and the adjacent districts. The Parthians were probably a Turanian tribe who had adopted Persian customs. They successfully withstood the Romans, and at one time their power extended from India to Syria. They succumbed to the Persian dynasty of the Sassanids, who ruled for about four centuries, established the Zoroastrian faith as their state religion, and maintained a creditable conflict with the East Roman empire. But in the 7th century they were defeated by Heraclius, and shortly afterwards were annihilated before the first impetus of the Mohammedan conquest, which established Islam in Persia and the neighbouring lands, sweeping away old civilizations and boundaries. During the greater part of the Mohammedan period Persia has been ruled by troubled and short-lived dynasties. It attained a certain dignity and unity under Abbas Shah (1585–1628), but in later times was distracted and disorganized by Afghan invasions. The Anglo-Russian convention of 1907, which demarcated spheres of influence, guaranteed Persian independence.

Afghanistan, which is now recognized as an independent state, first became a kingdom under Ahmad Shah *c.* A.D. 1738.

The Turks.—The Turks are first heard of on the frontiers of China in A.D. 545. A Turkish state had relations with Byzantium. Inscriptions in ancient Turkish on the Orkhon river are dated A.D. 733. Among the branches of this formidable conquering race may be mentioned (1) the Uighurs, whose kingdom comprised Kashgar and Khotan in the 11th century; (2) the Seljuks, who conquered large parts of Persia, Syria and Asia Minor between the 11th and 13th centuries; (3) the Osmanlis, first heard of in 1237, who took Constantinople in 1453 and founded the Ottoman empire. It is also clear from linguistic evidence that the Mongol and Mogul armies which invaded Russia and India were largely composed of Turks. By an amazing change the Ottoman empire became the republic of Turkey in 1922. The Government moved to Angora and Constantinople, so long considered the capital of the Levant, was abandoned. Turkey thus seemed to become an Asiatic power, but the sultanate and caliphate were abolished and European customs imitated wholesale.

The Jews.—The Israelites appear to have been originally a nomadic tribe akin to the Arabs whom they resemble in their extraordinary religious genius and their want of political instinct. They have been distinguished from early times by a species of commensalism or power of living among other nations without becoming either socially merged or politically distinct. But their place is in European rather than in Asiatic history. The great majority of them prefer Europe as a residence. but anti-Jewish

excesses in Central Europe have given an impetus to colonization movements in Palestine; so that in 1939 about a third of Palestine's population was Jewish.

The Arabs.—The Arabs have hardly any history before the time of Mohammed, though their name is mentioned by surrounding nations from the 9th century B.C. onwards. They appear to have had few states and kings but rather tribes and chiefs. Language indicates their relationship to the Babylonians, Jews and Abyssinians, who were probably immigrants into Africa from Arabia. The Hyksos or Shepherd kings of Egypt, were a similar invasion.

With the rise of Islam came a sudden effervescence of the Arabs who during some centuries threatened to impose not only their political authority but their new religion on the whole known world. They invaded India, Persia and Central Asia in the east, Spain and Morocco in the west. The caliphate under the Omayyads of Damascus and then the Abbasids of Baghdad became the principal power in the Near East. It had not, however, a sufficiently coherent organization for permanence; parts of it became independent, others were annexed by the Turks. Arab rule in Spain, which once threatened to overwhelm Europe, lingered on till the 15th century. The collapse of the political power of Arabia was singularly complete. It is still one of the least known parts of the globe and has few links with the outside, for the Arabs of northern Africa form separate states. Nevertheless, Arabic religion and literature are a great power in western Asia, and northern Africa and were so until quite recently in eastern Europe.

Since the World War the Kingdom of Saudi Arabia has become the dominant state in Arabia and Turkish suzerainty has ceased.

The Malays.—This widely scattered race has no political union. It occupies the Malay peninsula, Java, Sumatra, the Philippines, and islands of the Malay archipelago as well as Formosa and Madagascar, while the natives of the South Sea islands speak languages which, if not Malay, have at least been influenced by it. This distribution suggests that the Malays are a sea-faring race with exceptional powers of dispersal who have spread from some island centre, perhaps Java. Philologists, however, hold that there is a great linguistic group called Austronesian, which comprises the Munda, Malay, Polynesian and Micronesian languages and that the movement which distributed them started from the extreme west. Three periods can be distinguished in the history of the Malays. In the first they were semibarbarous, as are the natives of Borneo at present. In the second Hindu civilization reached Java, Sumatra and the Malay peninsula. The Sumatran empire called Srivijaya was a considerable power from the 7th to the 14th century. In the third period Islam superseded Hinduism except in Bali.

Indo-China is an appropriate name for Burma, Siam, Cambodia, Annam, etc., for both in position and civilization they are intermediate between India and China. The population belongs to many races, of whom the first with any history were the speakers of the Mon-Khmer languages still used in Pegu and Cambodia. (1) Early in the Christian era one, or perhaps two, Hindu invasions established in Cambodia or the land of the Khmers a kingdom whose former importance is attested by a series of remarkable buildings dating from A.D. 800–1200. It still exists as a French protectorate. (2) In southern Annam a Hindu kingdom called Champa, which also has left considerable ruins, was founded about the end of the 2nd century A.D. It is not known how Hindu invaders reached these regions but possibly via Java. (3) The Annamites, a race apparently allied to the Chinese, absorbed Champa and founded a kingdom which was independent, though nominally tributary to China, from the 10th to the 19th century. (4) The Burmese are linguistically allied to the Tibetans and entered Burma from the north-west. Their early history consists largely of conflicts with the Talaings of Pegu. About 1750 Alompra united his countrymen, destroyed the power of the Talaings and founded a kingdom which was eventually annexed by Great Britain in 1885. (5) The Thai or Siamese, who speak a language of the Chinese type but use an Indian alphabet, are a late invasion from southern China whence they descended about the 13th century.

At present the eastern part of this region, consisting of French protectorates or colonies, is known as French Indo-China; Siam is an independent kingdom; the Malay peninsula and Burma are British, the latter having been annexed to British India in 1886.

In historic times Asia has attempted to assert her influence over Europe by a series of invasions, most of which were repulsed. Such were the Persian wars of Greece and perhaps one may add Hannibal's invasion of Italy, if the Carthaginians were Phoenicians transplanted to Africa. The Roman empire kept back the Persians and Parthians but could not prevent the incursions of the Avars, Huns, Bulgarians and later of the Mongols and Turks. The earlier Asiatic invasions had little result, for the invaders retired after a time (like Alexander from India) or more rarely (*e.g.*, Huns and Bulgarians) settled down without maintaining any connection with Asia. The Turks, and to some extent the Arabs, were more permanent, because they began by occupying the adjacent parts of Asia and Africa, so that the final invaders were in touch with Asiatic settlements. But though the Turks have affected all eastern Europe, the result of their conquests was not so much to plant Asiatic culture there as to arrest development.

The influence of Asia on Africa has been considerable and until the middle of the 19th century greater than that of Europe. Some authorities hold that Egyptian civilization came from Babylonia and that the so-called Hamitic languages are older and less specialized members of the Semitic group. The connection between Carthage and Phoenicia is more certain, and the ancient Abyssinian kingdom was founded by Semites from southern Arabia. The traditions of the Somalis represent them as coming from the same region, and there was a continuous stream of Arab migration to East Africa which founded a series of cities on the coast, including Zanzibar. There was also a fairly ancient connection between this region and India. The whole of northern Africa has become Mohammedan as far south as Timbuktu and Wadai.

The relation of the pre-European civilizations of America to Asia is a much debated question, and some facts support the theory that they were due to Asiatic immigrants.

European Influence.—European influence on Asia has been especially strong at two epochs, first after the conquests of Alexander the Great and secondly from the 16th century onwards. Alexander's conquests resulted in the foundation of Hellenistic kingdoms in Asia which produced some effect on India, and brought oriental ideas to Egypt, Greece and Rome. There followed a long period in which eastern Europe had to repel Asiatic invasions and had little opportunity of influencing the East beyond Asia Minor. Indian astronomy, however, appears to owe a debt to Greece. Though attempts have been made to prove that certain developments of Indian religion in the early centuries of our era were due to Christianity, the contention has not been established. Somewhat later the Crusades kept up communication with the Levant, but intercourse with farther Asia was limited to the voyages of a few travellers. Looking at eastern Europe and western Asia only one must say that up to the 20th century Asiatic influences prevailed, though the tide is turning, for Islam was paramount and European culture at a low ebb. But the case is different if one looks at the two continents as a whole, for better communication brought about strange vicissitudes, and western Europe asserted its power not in western but in middle and eastern Asia.

In the 16th century a new era began with the discovery of the route round the Cape, and the naval powers of Europe started on careers of oriental conquest. The movement was maritime and European (excluding Russian) power in Asia is based almost entirely on improved navigation. There was no attempt to overwhelm by land invasions, but commerce was combined with territorial acquisition and a continuity of European interest secured by the presence of merchants and settlers. The course of annexation followed the events of European politics and European possessions in the east often changed hands according to the fortunes of their masters at home. Portugal was first on the scene and in the 16th century established a considerable empire on the coasts of East Africa, India and China, fragments of which still remain such as Goa and Macao. Before the century was out the Dutch appeared as the successful rivals of the Portuguese and in 1565

the Spaniards acquired the Philippines, which they held till 1899, when they ceded them to the United States. But the severest struggle for supremacy took place between France and England about 1740–83. Both entered India as commercial companies, but the disorganized condition of the Mogul empire necessitated the use of military force to protect their interests and allured them to conquests. The companies gradually undertook the financial control of the districts where they traded and were recognized by the natives as political rulers. At the end of the Napoleonic wars, Holland had Java, Sumatra and other islands, France some odds and ends in Cochin China and India, while Great Britain emerged with the Straits Settlements, Ceylon and a free hand in India. The East India Company assumed more and more definitely the functions of government, and when, after the mutiny of 1857, it became desirable to define British authority, there seemed nothing unnatural in transferring the entire administration from the company to the Crown.

Other European possessions were acquired towards the end of the 19th century, such as Indo-China (France), Burma (Britain), and Tsing-tao (Germany). Whereas the earlier conquests were mostly the results of large half-conscious movements, these later ones were annexations deliberately planned by European cabinets. It seemed to be assumed that Asia was to be divided among the Powers and each was anxious to get as much as was conveniently possible.

The advance of Russia was different from that of the other powers, since it took place by land and not by sea. Though the extent of Russian territory in Asia is enormous, she has always moved along the line of least resistance. She was a moderately strong empire lying to the north of the great Muslim states and having for neighbours weak principalities and semi-civilized tribes. The conquest of Siberia and Central Asia presented no real difficulties. Persia and Constantinople were left on one side, and Russia mas defeated as soon as she was opposed by a vigorous adversary in the Far East. (C. EL.)

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ASIAGO, BATTLE OF, 1916. The Asiago plateau was the scene of various battles on the Italian front during World War I (*q.v.*); but the more distinctive name of the battle of Asiago was given to the fighting which took place on the Trentino front during the Austrian offensive of 1916.

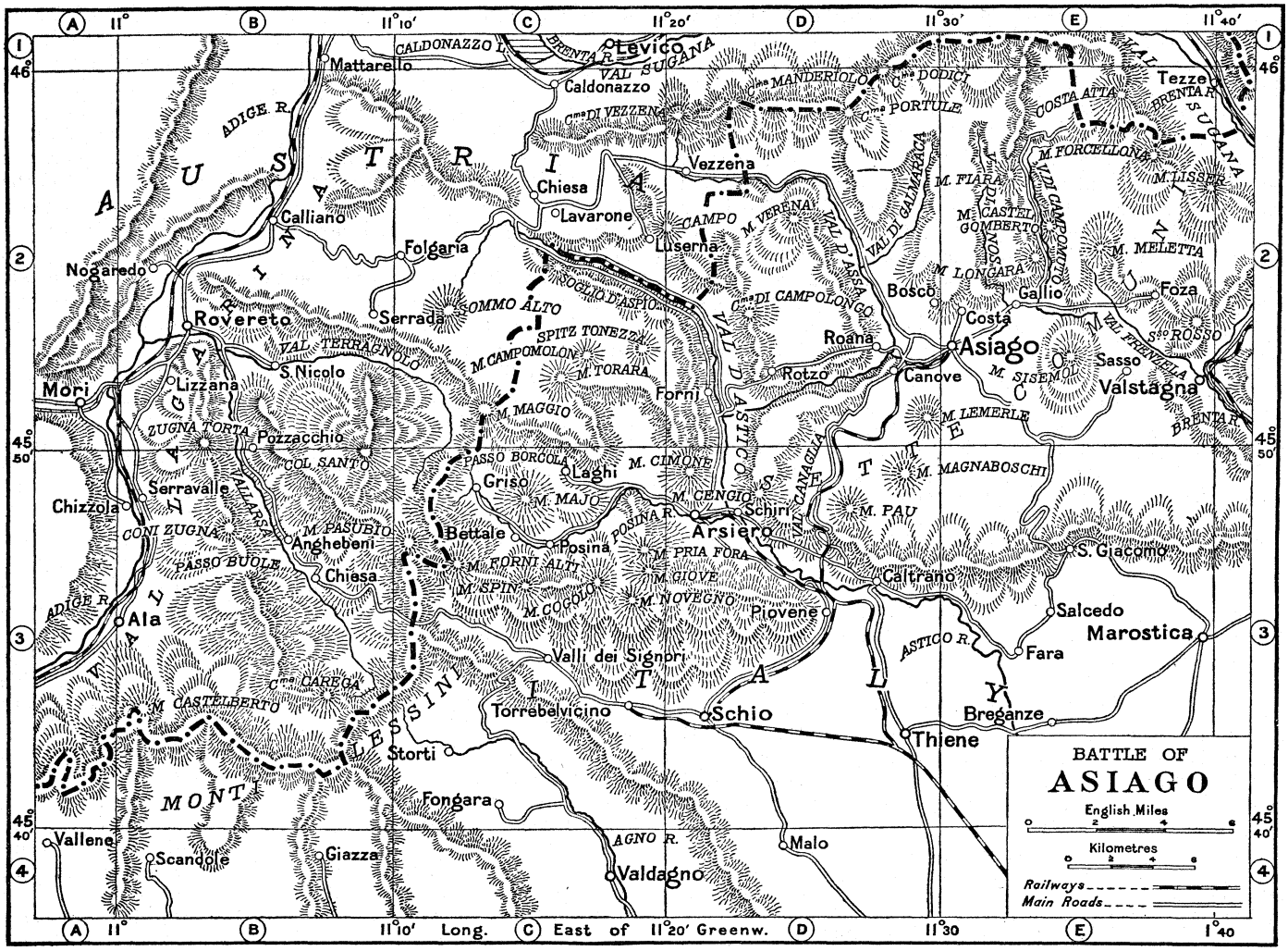
An attack from the Trentino with the object of cutting the Italian communications with the Julian front, and so bottling Cadorna's main force in what Krauss (in his book *Die Ursachen* unserer Niederlage) calls "the Venetian sack," was an operation which could not but commend itself to the Austrian general staff. Even Falkenhayn, who refused his co-operation to the proposal made by Conrad von Hotzendorf in Dec. 1915, admits that "it was very inviting." He did not, however, agree with Conrad and with Krauss, then chief of the staff to the archduke Eugene, that a completely successful attack would have a decisive effect. He doubted the possibility of collecting the force he considered necessary for the enterprise (25 divisions), and did not think that the railway communications were adequate to supply such a force. He was, moreover, anxious about the Russian front. Conrad's plan was to attack through the Asiago and Arsiero uplands, in the direction of Vicenza and Bassano, and when he failed to convince Falkenhayn that the effort should be a joint one, he determined to attack independently.

Cadorna's Plans.—Cadorna's line of argument, when rumours of attack began to arrive, resembled that of Falkenhayn. He did not think that Conrad could spare troops for an offensive on the grand scale, and he was of opinion that the railway communications in the Trentino were insufficient for such an offensive. He concluded that the reported movements in the Trentino signified a limited attack, to be undertaken with the object of hampering his own offensive action towards the east. He had continually urged upon Brusati, who commanded the 1st Army, that his rôle was strictly defensive, now that his first duty, that of reducing the length of the Trentino front and occupying strong defensive positions previously selected, had been successfully performed. On various occasions Cadorna had emphasized the necessity of strengthening the positions chosen by him for defence, but his instructions had been insufficiently regarded and the front was not prepared to resist an attack.

When Cadorna went to visit the lines in person, at the end of April, he found that while the front lines, in many cases unsuitable for prolonged resistance, had been elaborately fortified, in various sectors the reserve lines which he had indicated as the "battle positions" were almost untouched. Cadorna ordered the positions to be modified, and the work of preparation was hastened on; but the enemy attack seemed imminent, and it was impossible to set about a complete reorganization under the immediate threat. On May 8 Brusati was replaced by Gen. Pecori-Giraldi, the commander of the 7th Corps (3rd Army), and within a week the Austrian offensive was launched.

Disposition of Forces.—The Austrian attacking force was arranged in two armies, one behind the other, Dankl's 11th Army in front with nine divisions, Kövess's 3rd Army in support, with five divisions. The troops in the Val Lagarina and Val Sugana were not included in this force, which was to make its offensive between the two valleys, where only supporting attacks were to be carried out. Krauss, as chief of the staff to the archduke Eugene, was opposed to the disposition of the two armies and to the limitation of the attack to the hill country. He urged that the front of attack should from the outset be divided between Dankl and Kövess, and pressed for the concentration of attacking masses in the valleys, especially in the Val Sugana. But the original plan, prepared in all its details by Conrad and his staff, was not modified; it would seem that the archduke and his chief of the staff had little freedom of action. The tactical direction of the attack was entrusted to Dankl, who had at his disposal some 180 battalions.

To meet the attack, Pecori-Giraldi had in line and immediate reserve, between Lake Garda and the Val Cismon (north of the Val Sugana), 130 regular battalions, seven battalions of Customs Guards and 45 battalions of Territorial Militia, the latter at very low strength and of small fighting value. But his centre was weak, for 28 battalions of regular troops were in the Val Sugana sector, and on the actual front of attack he had only 90 regular battalions. Another division was concentrating at Desenzano, and five more were on the Tagliamento ready to be sent in support in case of need. The artillery strength consisted of 851 guns, of which 348 were of heavy or medium calibre and 259 were light guns of position. Dankl had, initially, a big superiority in infantry, but his great advantage lay in his preponderance of artillery strength. Between the Val Lagarina and the Val Sugana were concentrated some 2,000 guns, of which nearly half were of heavy or medium calibre, including 40 305-mm. howitzers, four 380's and two or three German 420's.



THE PLATEAU OF **ASIAGO** SHOWING THE MOUNTAINOUS NATURE OF THE REGION. THE **MAIN** BATTLE LASTED FROM MAY 14 TO 25. 1916. AND ENDED IN THE FAILURE OF THE AUSTRIANS TO BREAK THROUGH THE ITALIAN DEFENCES TO THE PLAINS

Austrians' Attack — The offensive opened on May 14 with a very heavy bombardment along the whole line from the Val Lagarina to the Val Sugana, but the concentration of fire was most intense between the Vallarsa and the Upper Astico, and against this sector, the following day, the main infantry attack was launched. The plan was to attack first with the right wing of the 11th Army, commanded by the archduke Charles, supported not only by its own artillery, but by flanking fire from the massed guns on the Lavarone plateau. When the right wing had made sufficient ground the left wing was to come into action against the Italian line north of the Upper Astico.

For a time everything went well with the attack. The Italians were driven back from their ill-chosen front lines, losing many prisoners and guns, and by May 19 'their position was very grave all along the line from the Vallarsa to the Astico. The retiring troops had failed to make a prolonged stand on the insufficiently prepared battle positions. On the left Monte Pasubio, the key position, was only lightly held by reserves, which had been hurried up in the nick of time, and in the centre the Austrians had driven the defenders off the main line of defence, which ran from Monte Maggio by Campomolon to Spitz Tonezza. The 37th Division, which had held this line, had been forced back beyond the Posina and the Astico, and there were gaps both to right and left of it. The Austrian right was pressing hard on the Italian main positions west of the Vallarsa (Coni Zugna and Passo Buole), and was collecting forces to attack Pasubio. There was breathing space for a moment in the centre, but the Austrian left now came into action, Krautwald von Annan's 3rd (Graz) Corps being launched against the Italian 34th Division. Ample Italian reserves were now on the move, but it was a race. Krauss blames the archduke Charles for waiting with his 20th Corps until the guns could be brought up to support a new attack, instead of driving through at once to Arsiero with all available troops. The risk was not taken, and the short respite gave time to close the door in the face of the invader.

The course of the battle, with the necessity of bringing up reserve divisions, led to a reorganization of the attacking forces, Kovess taking command of the left wing and Dankl of the right. In the Vallarsa and Pasubio sector the attack developed strongly, but without success. Farther north the archduke Charles was waiting for his guns and reserves, and between his left and the 3rd Corps, Kirchbach's 1st Corps was coming into action. The 3rd Corps was hammering against the Italian 34th Division, which was not to resist for long.

The situation in the centre was critical, and Cadorna considered that if the Austrians were able to concentrate on the weak spot and keep up the impetus of their attack they might succeed in breaking through to the plain. On May 20 he went to Udine, and after consultation with the duke of Aosta and Frugoni gave orders for the concentration of a reserve army in the Venetian plain. The first four corps of this reserve army (the 5th), which were made up of units drawn from the 2nd and 3rd Armies, were ready on June 2.

Meanwhile the Austrians were continuing their advance in the centre, but they could gain no ground against the Italian left. By May 22 Bertotti's 44th Division, sent up from Desenzano, was in solid possession of both sides of the Vallarsa road and of Pasubio, and in touch with Ricci-Armani's 37th Division on his left. It was in this sector that the Austrian offensive met its fate. Owing to the steadfast resistance of the troops under Ricci-Armani and Bertotti, Dankl could never secure a sufficient width of front for his ad-

vance. If the Zugna ridge had fallen, the effect upon the Pasubio position, already a salient, would have been more than serious, and upon the holding of the Pasubio lines depended the maintenance of the positions to the eastward. If Pasubio went, the line south of the Posina was turned, and the Austrians had a new route to the plain by the Valli dei Signori, as well as the opening they were now making for, by the Lower Astico. Till May 30 the attacks on the Zugna ridge were continuous, but no progress was made. The attempts upon Pasubio were as incessant, and lasted longer. The Austrian infantry advanced along the great ridge from Col Santo; they came up from Anghebeni and Chiesa in the Vallarsa and from the Val Terragnolo by the Borcola Pass. All efforts were in vain.

North-east of Pasubio, along all the rest of the mountain front to the rim of the Val Sugana, the Austrians gained notable successes. Kovess drove back the Italians across the Val d'Assa, and thence still farther east, across the parallel valleys of Nos and Campomolon. To the south-west Dankl's left crossed the Astico, and after heavy fighting pushed the Italians back across the Val Canaglia, while his centre gained ground across the Posina, south of Arsiero. At the end of May the Italian position still seemed critical, and Cadorna gave orders for the withdrawal of stores and heavy guns from the Isonzo front to beyond the Sile, south of Treviso. He believed he had the measure of the Austrians, but he omitted no precautions. His confidence, in fact, was justified. The impetus of the Austrian attack was dwindling. Losses had been very heavy; the attacking divisions were beginning to lose their offensive value, and the reserves were insufficient. Already on May 27 Conrad had been compelled to ask Falkenhayn to send a division of the Austrian 12th Corps, which belonged to Prince Leopold's Army Group. And Cadorna's 5th Army was practically ready in the plain.

On June 4 Brusilov broke through at Luck. The first news of the Russian attack did not perturb Austrian headquarters, for Conrad thought that his line in the east was firmly held. In a few days the situation was changed altogether. But even before the news of the disaster had reached Bozen it was clear that the offensive against Italy had failed. Kövess was to gain a little more ground. By June 8 the Austrians were only three miles from Valstagna, low down in the Brenta valley, but they had shot their bolt. South of Asiago and south of the Posina the attack was continued for ten more days. Here were the shortest routes to the plain and here the Austrians had been able to bring up their guns in sufficient numbers. Kirchbach made a great effort against the Monte Lemerle-Monte Magnaboschi line, while the archduke Charles strove hard to win room south of Arsiero by incessant attacks in the Novegno sector. No further ground was gained.

The Austrian Retreat. — By the middle of the month Cadorna had begun the first move of a counter-attack, but the Austrians were now getting ready to go out of the salient and back to a strong line which they had already selected. Attacking on May 25, all along the line, the Italians found the invaders in retreat. It was too late to develop the counter-offensive which was to have been directed against the two sides of the Austrian salient, and Cadorna relinquished the idea of a big attack as soon as he found a resistance which could only be overcome by long preparation and the use of artillery in mass.

Casualties on both sides were very heavy, and indicate the severity of the fighting. The Austrian losses were estimated at over 100,000; the Italian figures, up to the end of the counter-movement, were 35,000 killed and 75,000 wounded, with 45.000 prisoners, many of whom should be reckoned among the wounded. The Austrian attempt to break through ended in definite failure but the attack was well planned and conducted with skill and determination. Failure was due to the fact that Conrad met with a resistance which went beyond his calculation. Falkenhayn and Cadorna had summed up the situation rightly.

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ASIA **MINOR,** the general geographical name for the peninsula forming the bulk of the republic of Turkey, on the extreme west of the continent of Asia, bounded on the north by the Black Sea, on the west by the Aegean, and on the south by the Mediterranean, and at its north-west extremity parted from Europe only by the narrow straits of the Bosporus and Dardanelles. On the east no natural boundary separates it from the Armenian plateau. The term Asia Minor was not used by classical geographers (it is first found in Orosius in the 5th century A.D.) and is not in local or official use now. The name might have arisen as a vague distinction between the larger continent and the Roman province of "Asia" (*q.v.*), which at one time included most of the western section of the peninsula. Geographically, however, the name has a far deeper significance; the country is but "a small Asia" with its highland interior and its fringe of rich, less arid, well-peopled coastlands. The name Anatolia (*Anadol*) is used locally for the part of the peninsula west of the Halys, *i.e.*, with Cappadocia and Pontus. This name appears first in literature in the work of Constantine Porphyrogenitus (10th century).

A central core of ancient rocks with newer folds rucked round about it, it is comparable in size and structure to the Iberian peninsula, its counterpart in the western Mediterranean. The function of Asia Minor as a great "landbridge" between the continents has made its study important, and from its shorelands from early times Europe has received varied immigrations of men and culture. The interior has been through many changes of fortune which some students are inclined to associate with changes of climate and especially with variations of rainfall.

Structural Features and Mountain Ranges. — The central plateau of Asia Minor consists largely of nearly horizontal strata, while the edges are intensely folded and form mountain ranges allied to the systems of Tertiary date in both Europe and Asia. Tertiary deposits are found both on the coastal lowlands and among the mountains and there are late Tertiary fresh-water strata on the plateau. The southern system of folds forms the great arc of the Taurus with its north-eastward continuation the Anti-Taurus. The Taurus is composed mainly of Eocene and Cretaceous limestones, but Miocene strata also have been markedly uplifted, though they are not deeply involved in the folding. The average height is some 7,000ft. but there are summits above 10,000ft. in both Lycia and Cilicia (Bulghar Dagh). In the Anti-Taurus the folding has affected the Eocene, but not the Miocene, strata. The sharp north-south ridge of the Ala Dagh (11,000ft.) is a conspicuous feature. The name Anti-Taurus is variously used by different authors: (1) some give this name to the northern buttress of the plateau, parallel to the Taurus; (2) for some it means the whole line of heights separating streams running to the Black sea and Anatolian plateau from those running to the Mediterranean and the Persian gulf, *i.e.*, the line from the source of the Kizil Irmak through the Ala Dagh to the Taurus; (3) others use it for bare hills south of Sivas, traceable right along, in more forested heights, to the Taurus. The range of Amanus (Giaour Dagh in the north) is separated from the Taurus and Anti-Taurus line (3rd sense) by the deep valley of the Jihun and its continuation, the Gulf of Alexandretta. It forms the limit between Cilicia and Syria and is highest at Kaya Duldul (6,500ft.) above the Jihun. Groups of volcanic peaks rise above the plateau and extend for about 150m. from Kaisarieh to Karaman, with Argaeus or Erjish Dagh rising above Kaisarieh itself to a height of 13,100ft., the highest point in Asia Minor. The north side of the plateau is formed by the Pontic arcs. Along the eastern arc from Trebizond to Sinope a well defined system includes large amounts of Cretaceous limestones and serpentines, and Oligocene beds are involved in the folds. West of Sinope, Cretaceous beds form a long strip parallel to the shore line, and this system culminates in Ilkaz Dagh, south of Kastamuni.

On the west of the plateau the main direction of folds is east-to-west but, on the borders of Phrygia and Mysia, they meet the north-westward extension of the Taurus folds and bend around the ancient block of Lydia; there are zones of serpentine and of crystalline and schistose rocks, believed to be Palaeozoic, and it is known that portions of the old block are mingled with newer fold schemes on the western coasts. There are many evidences of volcanic activity in the district of Kula and in hot springs con-

nected with the Lycus, Maeander and other valleys. The valleys of the Maeander, Hermus and Caicus communicate between the plateau and the Aegean coast while those of the Kara Su and Sangarius lead to the sea of Marmora, the coast of which continues the Mesozoic band mentioned for the Black sea coasts west of Sinope (see above), but here the rocks are Jurassic and Triassic as well a; Cretaceous. Devonian fossils have been identified near the Bosporus. Marine Eocene beds occur near the Dardanelles but the Tertiary beds of western Asia Minor are mostly fresh-water and late Tertiary; it is interesting that in the west they are much disturbed, as this points to the recent date of important movements in the Aegean area. In this last area we meet with broken mountain arcs that link the Dinaric and Greek mountain lines with those of Asia Minor and partial submergence has brought into existence islands, the disposition of which in chains led them to play a very important part in the early development of maritime intercourse in the 3rd millennium B.C. Here again volcanic activity is conspicuous (Milo, Santorin, etc.), among the fold-lines.

Lakes and Rivers.—The salt lake Tuz Geul (anc. Tatta) on the central plain, said to be 60m. by 10–30m. in winter, becomes a mere marsh in the summer drought. Other salt lakes are Buldur Geul (2,900ft. above sea-level) and Aji-tuz Geul (2,600ft.). Beishehr Geul (anc. *Karalis*) at 3,770ft. is a fine freshwater lake with an outflow stream discharging into the lower Soghla Geul which in its turn loses itself on the arid south part of the plateau. Egirdir Geul (probably anc. *Limnae*) at 2,850ft. is fresh and noted for its fish. In north-west Asia Minor, in the lowlands between the ridges that run out westwards to the south-east coast of the Sea of Marmora, are Isnik Geul (Ascania), Abulliont Geul (*Apol*-Zonia) and Maniyas Geul (*Miletopolis* Lake).

The older drainage of Asia Minor seems to have been westwards towards the Aegean depression, but some phase of this depression was attended by uplift on the west of the peninsula converting the western ends of streams flowing to the Aegean into a plateau-edge drainage, and giving rise to a large lake on the plateau, the remnants of which include the plateau lakes above named and the salt incrustations between Tuz Geul and the stream from Soghla Geul. The subsidence of the Black sea allowed northward streams to cut back into the plateau and the Sakaria (*Sangarius*), the Kizil Irmak (Halys, 600m. long) and Yeshil Irmak (Iris) have captured portions of the old east-to-west drainage. The depression between the blocks of Arabia and Asia Minor has analogously helped the Euphrates to cut back and capture a part of the east-to-west drainage. Old names include *Tembris* (Pursak Su), a tributary of the Sangarius; *Cappadox* (Delije Irmak), a tributary of the Halys; and the Lycus (Kelkit-Irmak), a tributary of the Iris.

Of the western plateau-edge drainage one should mention Edrenos Chai (anc. *Rhyndacus*), and Susurlu Chai (*Macestus*), which unite 12m. before they flow into the sea of Marmora; Bigha Chai (*Granicus*), which flows into the west of the Sea of Marmora; and Menderes Su (*Scamander*), which reaches the Dardanelles. The last two rise in Kaz Dagh (Mt. Ida). Bakir Chai (Caicus), Gediz Chai (*Hermus*), Kuchuk Mencleres (*Caystrus*) and Menderes Chai (Maeander) flow to the Aegean and bring down so much silt from the plateau edge that, for example, the Caystrus silt has filled up the port of Ephesus; while the Hermus has changed its course more than once, for as recently as 1880 it reached the sea near Smyrna, but now follows a parallel valley farther north. The silt of the Maeander long ago filled up the harbour of Miletus and converted its islands into mounds standing out of a swamp. The chief tributary of the Hermus is Kun (*Phrygius*), which receives Gurduk (*Lycus*) and Kuzu (*Cogamus*); those of the Maeander include, on the right, the *Glaucus,* Banaz (*Senarus*), and *Hippurius,* and on the left, Churuk Su (*Lycus*), flowing by Colossae, Ak (*Harpasus*) and China (Marsyas).

The southward drainage to the Mediterranean works back along structural lines of the Taurus fold mountains and is thus varied in its directions, but it consists mainly of rather short streams which flood down quantities of water in winter and spring. They are probably helped also by subterranean drainage. In Lycia are the Gereniz Chai (*Indus*) and the Eshen (*Xanthus*); in Pamphylia the Ak Su (*Cestrus*), Keupri Su (*Eurymedon*) and Menavgat Chai (Melas). Farther east the two branches of the Geuk Su (*Calycadnus*) run south-east between lines of the Taurus. The Tersous Chai (Cydnus) has three streams, one of which flows through the Cilician Gates; in its lower course it deposits so much silt that Roman Tarsus is covered to a depth of 20 feet. The Sihun (*Sarus*) and its tributaries flow through precipitous ravines in the Taurus, and one of the tributaries (Kerkhun Su), cutting back westwards through the Bulghar Dagh, opens a way for the roads from the Cilician Gates to Konia. Apparently at one time the Sihun flowed south-eastwards to join the Jihun (*Pyramus*). This river is made up of a number of streams and in its lower course runs through the defile between the Taurus and the Giaour Dagh to reach the Cilician plain near Budrun, whence it flows west and south-west to the sea past Missis, being navigable up to this point. East of the Kezil Irmak and the Jihun basins we enter that of the Euphrates.

Passes.—Over the principal passes of the Taurus there went Roman or Byzantine roads:—(I) from Laodicea to Adalia (Attalia), by way of the Khonas pass and the valley of the Istanoz Chai; (2) from Apamea or from Pisidian Antioch to Adalia, by Isbarta and Sagalassus; (3) from Laranda by Coropissus and the upper valley of the southern Calycadnus to Germanicopolis and thence to Anemourium or Kelenderis; (4) from Laranda by the lower Calycadnus to Claudiopolis and thence to Kelenderis or Seleucia; (j) from Iconium or Caesarea Mazaca through the Cilician Gates (Gulek Boghaz, 3,300ft.) to Tarsus; (6) from Caesarea to the valley of the Sarus, and thence to Flaviopolis on the Cilician plain; Germanicia (Marash) is the name of this pass.

In the Anti-Taurus region (in the sense of the ranges from south of Sivas down to the Taurus), the chief passes are those followed by old roads: from Sivas (Sebasteia) to Divrik (*Tephrike*) and the upper valley of the western Euphrates; from Sivas to Malata (*Melitene*) by the pass of Delikli Tash and the basin of the Tokhma Su, and from Kaisarie to Marash (*Germanicia*) by the Kuru Chai and the valley of Geuksun (*Cocysus*). The Giaour Dagh (*Amanus* Range) is crossed by two famous passes:—Baghche (*Amanides* Pylae), with the road from the Cilician plain to *Apamea Zeugma* on the Euphrates, and Beilan (Pylae Syriae or Syrian Gates), with the Roman road from Tarsus to Syria.

The valleys of the Maeander, Hermus and Caicus give ways from the plateau to the Aegean and the descent to the Sea of Marmora along the Kara Su and Sangarius is easy. The best roads from the plateau to the Black sea are those due to the Romans, from *Tavium* and Sebasteia to *Sinope* and *Amisus* and those from *Sebasteia* to Cotyora and *Cerasus-Pharnacia.*

The subterranean drainage, added to the tectonic instability, accounts to some extent for the number of thermal and mineral springs. The most important are:—Yalova, in the Ismid sanjak; Brusa, Chitli, Terje and Eskishehr, in the Brusa vilayet; Tuzla, in the Karasi; Cheshme, Ilija, Hierapolis (with enormous alum deposits), and Alashehr, in the Aidin; Terzili Hammam and Iskelib in the Angora; Boli in the Kastamuni; and Khavsa, in the Sivas. Many of these were famous in antiquity and occur in a list given by Strabo. The Maeander valley is especially noted for its hot springs.

Climate, Vegetation and Animal Life.—The north coastal regions have a very heavy rainfall, especially during the autumn and winter. The rainfall here is lightest in the west but increases to over 100in. per annum in the more mountainous east. The high ground behind the patches of coastal lowland has forests of pine, fir, cedar, oak and beech, while the more sheltered valleyways have very luxuriant vegetation resembling the Mediterranean flora. West of the promontory of Sinope the vegetation tends to be poorer and the olive in particular is not found. East of Sinope, where the Caucasus shelters the coast from the cold north-east winds of the Russian steppe, the olive grows abundantly and the vegetation is more luxuriant. The apple, pear, cherry and plum are grown extensively in northern coastal Asia Minor. The wheat of the Sivas vilayet is well known.

The southern and western coasts have a Mediterranean climate, with a tendency towards greater extremes of temperature than is the case further west. The summers are warmer and drier, with less rain, and there is greater cold in winter than on the French or Italian Riviera. A great feature is the *inbat* or strong north wind which blows fiercely almost daily from noon to sunset off the sea in summer along the west coast. Cold winds from the Russian steppe are felt as far south as Smyrna in winter. The fig, olive and vine are grown everywhere, while on the west coast the ilex, plane, oak, valonia oak and pine predominate. The mountain slopes of the Taurus are clad with forests of oak and fir and there are numerous *"yailas"* or grassy "alps" with abundant water to which the villagers and nomads move with their flocks during the summer months. The sheltered southern valleys produce the orange, lemon, citron, sugar cane and date palm.

The interior plateau region is more allied to the Russian steppe in both climate and vegetation. The rainfall is slight, being less than 10in. per annum on an average, and what rain occurs falls in spring or early summer. The seasonal range of temperature is extreme, conditions becoming more continental towards the Armenian Highlands in the east, which experience a heavy snowfall in winter. Near streams willows, poplars and chestnut grow, but elsewhere the country is almost entirely steppe or scrubland.

The wild animals include the bear, boar, chamois, fallow, red and roe-deer, gazelle, hyena, ibex, jackal, leopard, lynx, moufflon, wild sheep and wolf. Amongst domestic animals are the buffalo, the Syrian camel, and a mule camel bred from a Bactrian sire and a Syrian mother. A large number of sheep and Angora goats are reared on the plateau, and fair horses are bred on the Uzan Yaila, while small hardy oxen are largely bred for ploughing and transport. The larger birds are the bittern, great and small bustard, eagle, francolin, goose, partridge, sand grouse, pelican, pheasant, stork and swan. The rivers and lakes are well supplied with fish. (X.)

ETHNOLOGY

Ethnologically Asia Minor forms a unit with Arabia, and the latter country will therefore be treated with the former in the present article.

Owing to the important ancient empires which flourished in the Near East this region has in places been thoroughly explored, and although much remains to be done, there are already abundant materials for reconstructing the racial history. Asia Minor remains at present the least known country.

Zumoffen found near Antioch skeletal remains which are alleged to be Neanderthaloid, although no complete report has yet been published. Turville-Petre found in a cave near the Sea of Galilee the remains of a skull which, though differing in certain respects from the Neanderthal clearly belongs to this type. The Mousterian culture associated with this type of man is widely spread throughout the region, and has been proved by Buxton to extend even into the desert regions between the Jordan and the Euphrates, although no remains of man have actually been found in the valley of the twin rivers; either they are covered by living on the high desert which to-day is only penetrated at certain seasons by Bedouin. Palaeolithic implements of a later date are also found in the same regions, but none have so far been found in the valley of the twin rivers; either they are covered by silt or else the region was at this early period too marshy for habitation. The earliest type of man known in this area comes from graves of about 3,000 B.C., a type which in form is almost identical with the people who were living in Europe in Aurignacian times and who survive to-day in remote places, Fleure having found them on the Plynlimmon moorland. This very long-headed, slender stock still forms to-day the main part of the Arab population of much of the Near East. Two other types appear in early times in northern Mesopotamia and over all the northern part of the Near East, one type identical with what is usually called "the Mediterranean race." They are long-headed but their skulls are much more round in contour than the Eurafrican type mentioned above. The third type is round-headed and has been called Armenoid owing to the prevalence of this type among the modern Armenians. They are especially associated with the bridgeland of mountains which stretches from the Pamir westwards into Asia Minor, and ultimately to the Alps. Von Luschan considered that they were the oldest inhabitants of Asia Minor, and though they may have been the first dwellers in the mountains they were certainly late comers into the plains. On the whole the racial history of the entire region has consisted of the gradual blending of these three stocks since the dawn of history, but the Armenoid types have probably increased in a larger proportion than the others.

The modern populations consist of different groupings of these main racial stocks and can be most conveniently divided partly on a geographical and partly on a political and linguistic basis. There are four main areas: first, Turkey, including Turkey proper, Armenia and Cyprus; secondly, Syria and Palestine; thirdly, Mesopotamia; and fourthly, Arabia. Within these larger areas the most important groups may be summarized as follows: in the first, Turks, Greeks, Kurds, Armenians and various religious communities, who are endogamous and often keep themselves apart from the rest of the population. In Syria and Palestine, although there are representatives of the groups already mentioned, the three most important groups are the Jews, Arabs and again certain important religious communities, the most noticeable being the Druses and Maronites of the Lebanon district. In Mesopotamia the bulk of the population are Arabs, although there are important racial differences.

Apart from aberrant groups there are several different forms of social organization, the dividing lines cutting across one another. On a basis of religion there is a profound cleavage between Muslim and Christian, though even here there are certain intermediate people, Linobambakoi, Linsey-woolsies, who to a certain extent show, at least on the surface, the characters of both. Environment and natural surroundings have been practically responsible for three types of social organization, urban, common to Jew, Christian and Muslim, agricultural also common to the three though to a lesser extent to the Jews, except in ancient and in very modern times, and pastoral nomadism, practised almost entirely by the desert and steppe dweller. The Muslim communities are, at least in theory, polygamous, though polygamy is becoming increasingly uncommon. The women were secluded and never saw any men except their husbands and their immediate relations, though naturally among the poorer classes this rule did not hold, for they had to work in the fields or go to market. As a general rule the towns are mixed, though different religions have different quarters, both mixed and pure Turk or Christian villages exist, and in Palestine there are Jewish communities. In the desert the group of tents is organized on a war footing in which the sheikh has an absolute position, unlike the position of the elected or appointed village elder. Among the more powerful tribes the groups are organized into a single unit, this unit being not infrequently at war with its neighbours. This region gave birth to three of the great religions of the world, Christianity, Judaism and Islam. It still is the home of innumerable heretical cults of all these three religions. They have all influenced one another, and some of the sects partake of the nature of more than one of these mutually intolerant religions. Of these heretical sects the most interesting are the various crypto Christians, outwardly Muslims, secretly Christians, the Druses and Maronites, the Dancing Dervishes, the Yezidis or Devil worshippers and the Babis.

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ARCHAEOLOGY

Continued study at Hissarlik, and at Yortan, 160km. to the S.E., has shown the long life of Hissarlik I and the continuation of its culture by the larger Hissarlik II. Alişar-höyuk, 160km. N.E. of Ankara (Angora), has early settlements with black pottery, later replaced by red ware mhich came in with Aegean figurines from Hissarlik. Alaça-höyuk, further north, has rich

early graves with internal wooden constructions like those of S. Russian kurgans; they yield black ware though red had come into use in the locality.

Kusura, south of Afion-Karahissar, gives analogous evidence. Mersin, in Cilicia, is the latest (1939) site to acquire importance, and here, beneath a layer of 3500–3000 B.C., is an enormous accumulation of settlement debris, suggesting a very high antiquity, and relationships with both western Anatolia and Mesopotamia.

THIRD MILLENNIUM B.C.

Anatolia.—Probably as early as the epoch of the Agade dynasty (28th century), Anatolia was invaded by Semites from Syria, who there founded a permanent colony, whose archives dating from the last centuries of the 3rd millennium have been discovered at Kül-Tepe, near Kaisaryieh. A text, half historical, half legendary, belonging to the days of Sargon the Old (c. 2800), describes a campaign of this king from the other side of the Taurus in order to help a colony engaged in commerce. which complained of oppression at the hands of the inhabitants of the country. These archives consist of cuneiform tablets, letters and contracts, relating to the commercial undertakings of the great merchants of the district. They are written in the ancient Assyrian language; the writing resembles that used at the time of the Ur dynasty (25–24th centuries). An impression of a cylinder seal bearing a dedication to King Ibi-Sin of this dynasty, gives the earliest date of these tablets for it seems probable that this ancient seal was in long use, and that most of the tablets only date from c. 2100. Side by side with the Semitic names of the members of this colony appear those of the inhabitants of the country. They are Asianics of the type called "protohittite," speaking the dialect in use in Anatolia before the supremacy of invaders of Indo-European stock, who established successfully the Hittite confederation of the 2nd millennium B.C. On these tablets the impression of Asianic seals appears along with that of seals of the Semites of Cappadocia. The Asianic seals are flat, usually circular, of slight dimensions, ornamented with the heraldic eagle, with ornamental designs based on animal motives, with concentric circles or with spirals. The Semitic seals are cylindrical, and, retaining the complexity of Sumerian art, by which they are inspired, represent the combat of the hero Gilgamesh with wild beasts, animals crossed in an X, a divinity seated on a chariot, and the adoration of an idol in the form of a bull. So single great monument can be attributed either to the Semites of Cappadocia or to the Asianic peoples who were their contemporaries.

Troy II.—The excavations on the hill which bears the famous city of Troy (Hissarlik) were begun by the German, Schliemann, assisted by Dorpfeld, in 1870, and were continued intermittently until 1894, on the site of nine successive cities, of which only two are of real importance: Troy II., discovered by Schliemann and wrongly regarded as the Troy of Homer, which belonged to about 2400–1900 B.C., and Troy VI., discovered by Dorpfeld, which is really the Troy of Homer (1500–1180). The second Troy, which was destroyed by fire, had foundations of stones joined by a mortar of clay, on which rose walls of rough bricks with wood supports. The town was surrounded by a rampart with towers. At Troy II. appeared vases with human figures, and pitchers with vertical and elongated lips. Rich jewels, discovered by Schliemann in a hiding place, and erroneously described as "the treasure of Priam," comprise golden diadems with many small chains finished off with the simplified image of an idol, earrings of the same metal and technique, libation vases, one of which is in gold and is shaped like a sauce tureen with two handles. There are also flat bronze axes with widened edges, bronze knives and daggers, together with stone weapons, sometimes sumptuously set in a metal mount. The antiquities of Troy II. show that it spread copper, red ware, etc., to the Aegean and acquired thence ideas of marble figurines, stone vessels, and various ornaments. Its relations with Cyprus, which became important for copper, are becoming clearer, but the links by land with south-east Europe and with Anatolia now stand out

SECOND MILLENNIUM B.C.

The Hittites.— The interior of Asia Minor was at this epoch under the influence of the Hittites, whose ancient capital Khattushash (Boghaz Keui), flourished in the second half of the 2nd millennium. Many monuments of Hittite origin are spread over the whole of the peninsula, and as a whole, with one or two exceptions, belong to a very homogeneous art, which is sober, if somewhat crude. with traces of oriental as well as of Aegean influence.

Troy VI.—The sixth city of Troy which, as Dorpfeld recognized, is the Troy of Homer, was destroyed about 1180. The ruins of Troy VI. amount to very little, for when the Romans built on the site, they razed the top of the hill to obtain a large oval base for their structures and destroyed all the buildings of the VI., VII., and VIII. cities; nothing remains of Troy VI. but a few foundation-elements on the slopes of the hill below the Roman levelling. A part of the rampart four or five metres thick is a strong fortification flanked by towers, with three gates of a more modern type than in the earlier buildings. At Troy, as at Tiryns and Mycenae, no enemy could reach the gates without exposure on a portion of the rampart, which made defence easier. What pillage and fire left unhurt was destroyed by the Romans, and of the Troy of Homer there remains little to-day save memory.

FIRST MILLENNIUM B.C.

The empire of Boghaz Keui had been destroyed by the Sea peoples, but its artistic traditions were carried by the Mushki people, perhaps akin to the Phrygians, occupying the territory of which Boghaz Keui was the centre, then by the Phrygians, whose kingdom corresponded to the country situated to the west of the area occupied by the Hittites of Boghaz Keui, by the Lydians, the Carians and the Lycians.

The **Mushki.**—At the beginning of this period Hittite influence is still dominant. Art, however, displayed a decadence, which showed itself in a grossness of shape and a general clumsiness, as in a certain number of the sculptures at Üyük, the basreliefs on rocks at Bor and Ivziz (north of the Taurus), representing a local king before his god. These sculptures typify the transition from those of Anatolia under the Hittite empire to those of Syria of the 1st millennium B.C.

Phrygia and Lydia.— The most important Phrygian monuments are funerary and fall into two principal groups. The first is in the neighbourhood of the town of Ayazinn, the second to the north of it. To the first group belongs the tomb, called the tomb of Midas, in which the facade hewn out of the rock itself is a great flat surface, divided in the form of a cross into equal parts, surrounded by regular scrolls in relief. The facade is surmounted by a triangular pediment slightly raised, crowned by a double scroll. In the lower part of the façade a false door is carved. This arrangement appears also in a monument in the valley of Thyndakos, called the Delikli-tash (the pierced stone). The real entrance to such tombs was in the upper part. They consisted, therefore, of shafts sunk in the rock itself, the external face of which was ornamented. Sometimes these monuments were purely commemorative and consisted of the single facade sculptured from the rock, in the style of the monument of Midas. The group of tombs situated near Ayazinn are not distinguished from the first group; they have the same facades with geometric ornamentation in relief, with or without a false door, and surmounted by a triangular pediment more or less raised. In certain cases the scheme of shafts has not been adopted, and the door, in that case a real one, gives access to the tomb. Resides the geometrical type of decoration, a naturalistic and very effective one exists. Thus in the necropolis of Ayazinn a rock-face shows half way up the door of a tomb. On either side gigantic lions, cut out of the living rock, stand erect, facing each other, their forepaws resting on the top of the door. This motive of lions guarding the tomb is found on other monuments of the necropolis. Quite a different type of tomb (at Ayazinn, at Yapuldak, at Gherdek-kaïa-si) shows Greek influence in its facades, columns and decorative ornaments;

these are the most recent of all the series, which belong, without doubt, to the period between the 8th and 4th centuries B.C.

In Sipyle, near Smyrna, another kind of tomb is to be found, a tumulus; the most celebrated is the so-called tomb of Tantalus, easily comparable to those in Lydia, where very few specimens remain except of funerary architecture. The type of tumulus tomb is due to Thracian influence. The finest monument of this kind is the tomb of Alyattes, the father of Croesus, near Sardis. It consists of a funerary chamber sunk into a circular base made of stones and earth, and surmounted by a cone of worked earth. A pillar with an expanded base should adorn the summit. This type of tumulus tomb occurs frequently in this area, most of them dating perhaps from the beginning of the 6th century B.C. The coins, however, and the jewels found in Lydia, at Tralles, for example, display also Eastern influences, chiefly Assyrian, with occasional use of Egyptian designs. Decorative Lydian art manifests individual taste, but situated like that of Phoenicia, was similarly subject to varied influences at that epoch.

Lycia.—In funerary architecture, Lycia draws its inspiration chiefly from Phrygia in the arrangement of the tomb; carved out of a rock wall itself. But the style is quite different; generally the artist reproduces the front of a wooden house with projecting beams, in which the jutting ends have been intentionally preserved. This scheme is found in the tombs of Kenibachi, Hoïran, A-Myra and Antiphellos; the façade is surmounted by a triangular pediment in the second case, arched in the first; a scheme which is found in the so-called Lycian sarcophagus in the royal necropolis of Saïda.

THE GRAECO-ROMAN EPOCH

During the last centuries of this millennium and the first centuries of the Christian era, Greek and Roman influence became predominant in the country. There are, therefore, changes in the character of the monuments. The art, which at first was purely oriental, then hellenized, gives place to Graeco-Roman art, and can be distinguished from that of the continent only by its oriental exuberance of detail, this being the case also at this time in Syria.

Assus.—Among the principal ruins of the Aegean coast and its neighbourhood, we must cite in going from north to south: Assus, facing the north-eastern point of the island of Mitylene, built on terraces cut into the side of a hill, where an agora, a theatre, a gymnasium and a street of tombs have been unearthed. The sculptures of Assus use the Dorian order, but in a hybrid form, a feature not found in Asia Minor except at Pergamus. The temple, of which nothing remains but the bare surface of the stylobate, dates probably from the middle of the 5th century.

Pergamus.—At the junction of the Selinus and the Caicus, is the ancient capital of a State, which became independent of the Macedonian empire of Alexander's successors, and which maintained its independence from 220 to 133 B.C. The German excavations at Pergamus have revealed baths, amphitheatre, theatre, an *asklépieion*, and on the Acropolis, the agora and gymnasia, remains of the sanctuary of Athene Polias and of the temple of Trajan and Hadrian.

Ephesus.—The Austrian and the British excavations have laid bare the great monuments of the city, the agora, baths, library, theatre, gymnasium and porticos. At the Odéon a long portico of 23 columns, the bases of the columns still occupying their original positions, and several of their capitals, decorated with bulls' heads have been found. The most celebrated monument of Ephesus is the Artemision, the temple of Artemis. The old temple was built in the 6th century B.C., on the site of three previous sanctuaries; it was burnt in 356, rebuilt and finished at the end of the 4th century.

Priène.—In the deep valley of the Maeander German excavations have revealed a hellenistic city with streets cut at right angles; the theatre, the sanctuary of Demeter and the temple of Athene Polias, built in 334 B.C., are still to be seen. These ruins show us what was the type of hellenistic city in Asia Minor.

Miletus, near Priène, explored by the Germans, the most luxurious town of Ionia, possessed four gates, which have been partly cleared by the excavations. Its theatre is one of the most beautiful buildings of its kind. On a hummock near the town have been found traces of an earlier Miletus, destroyed by the Persians in 494 B.C.

Didyma is situated near Miletus; the French, and then the Germans, have made excavations there, which have brought to light the remains of the oracular shrine of Apollo; begun at the end of the 4th century B.C., it was not finished at the beginning of the Christian era. It was a long building surrounded by columns (122 in all) which were more than 20 metres high, only three of which remain standing. The sculptures on the door leading from the naos to the cellar are an indication of the richness of the ornamentation of this temple. "The way of the Branchides," ornamented with the statues of priests of that name, leads from the temple to the sea.

Halicarnassus, to the south of Miletus, was the capital of a small State, which became independent under Mausolus, a Persian satrap. The British Museum possesses important fragments of the famous tomb (from which the word mausoleum is derived) which was raised by his widow.

SYRIA: THIRD AND SECOND MILLENNIUM B.C.

Byblos.—The excavations of M. P. Montet at Byblos (Djebail to-day, 30km. to the north of Beyrouth) have thrown some light on the archaeology of Phoenicia at the dawn of history. About 3000 B.C. the kings of Egypt maintained regular relations with Byblos; they held in peculiar veneration the local goddess of the place, the "Baalat Gebal," *i.e.*, the "Lady of Byblos," and sent her offerings. In 1926 a piece of an alabaster vase was found bearing the name of Khufa, the Pharaoh who built the Great Pyramid of Giza (c. 30th century B.C.).

During the 2nd millennium B.C. relations between Egypt and Phoenicia had not lessened in any way; Virolleaud and Montet have discovered at Byblos a hypogeum of the local kings, contemporary with the Pharaohs of the 12th dynasty. The king of Egypt was then overlord of the city; he sent presents, such as perfume vases made of obsidion set with gold, to the local petty kings, who, in imitation of Egypt, had made locally breast-plates in cloisonné, or in wrought gold. They wrote their names clumsily in Egyptian hieroglyphics on the arms, which were the insignia of their authority (that called the *harpé* is of Babylonian origin, and the ancestor of the oriental scimitar).

Kafer-ed-Djarra.—In the vicinity of Sidon, at Kafer-ed-Djarra, several burial areas have been excavated, first by Dr. Contenau and then by M. Guigues. The tombs, in the form of a baker's oven, contain a great deal of pottery. A 12th dynasty Egyptian faience balsam vase was discovered there, as well as scarabs of the Hyksos type, with an imitation of Egyptian wax in which designs derived from the spiral play a large part. Further, many types of pottery, some Egyptian, but more often copies of Aegean pottery, have been found there.

The Tomb of **Ahiram.**—Another hypogeum, also discovered at Byblos by M. P. Montet, dating from the end of the 2nd millennium B.C., contains a sarcophagus with the oldest Phoenician inscription known at present, in the name of Ahiram, a vassal of the Pharaoh. The tomb of Ahiram represents on its four sides funeral scenes in a border of lotus blossom; the bearers of offerings for the dead and the lamenting mourners. A certain number of objects found in the tomb, bearing the name of the Pharaoh, Rameses II., give the date of the tomb of Ahiram and its inscription as the 13th century B.C. This date has been disputed; but even if it should be ascribed to the extreme end of the millennium (and indeed it cannot be later), the inscription still remains the oldest in the Phoenician language known up to the present time.

Kadesh, **Mishrifeh.**—The explorations of Pézard on the site of Tell-Nebi-Mend, near Homs, the ancient Kadesh, a strong place of the Hittites against the Egyptians, came to a premature end owing to the death of the excavator, and nothing has been done at Homs itself, at Damascus or at Aleppo, which, history tells us, passed under Hittite dominion in the 1st century of the 2nd millennium B.C. The researches of Du Mesnil du Buisson at

Mishrifeh, in northern Syria, near Homs, show that Egyptian influence (a sphinx of the 12th dynasty has been discovered there) had reached there. Cuneiform tablets record the inventory of the treasures of the Mesopotamian goddess, Ninegal, who had a sanctuary there, and from them we learn that the old name of the site was Katna. Mesopotamian influence can be traced also in several monuments at Mishrifeh (heads of statues) and at Damascus and its neighbourhood (the lion of Cheik-Saad in the museum of Damascus, a bas-relief of Salihiyeh representing a warrior, in the British Museum). Eut it is by no means the only influence. The Anatolian art has had an effect, and for this reason the term Syro-Hittite must be given to this art. This corresponds to historic fact, for the Hittites in the 2nd millennium had settled in Palestine. This view is strengthened by the great number of cylinder seals of the period found in this region. Their general style is a development of the style of the Cappadocian cylinders; on profound examination they betray the distant influence of Sumerian art; but in detail—the types, attitudes, costumes of the people—they continue the tradition of Boghaz Keui.

FIRST MILLENNIUM B.C.

The Interior of Syria: Zendjirli, Carchemish, Tell-Halaf. —German excavations at Zendjirli (the old kingdom of Samal) to the north-west of Aleppo near the Amanus, and the British work at Carchemish on the Euphrates, which after the fall of Boghaz-Keui was the capital of the new Hittite confederation, have produced some important inscriptions and have reconstituted the art of the Arameans. Here Hittite and Mesopotamian influences contend. A type of city based on a circular plan, surrounded by one or several walls has been revealed. In these are found *bit-hilani* (Assyrian for these buildings), which are more wide than deep, with steps and a peristyle with columns and often flanked by two square towers. In conformity with technique found in Assyria, the courts and halls of the palace are decorated with plinths of carved stone, representing mythological scenes, lines of palace guards, or winding processions. Roaring lions guarded the doors. But this art is earlier than the glorious Assyrian period, for it starts with the beginning of the 1st millennium and is distinguished from the Assyrian by the use of basalt, and by a vigorous, bold, almost primitive, style, where massiveness is compensated by sincerity. This art, in comparison with the Assyria of the Sargonides, is provincial, but its date makes it independent of Assyria. It is related in a general way, though not directly, to the art of Boghaz Keui. Some of the oldest sculptures, those of Üyük for example, explain this art of upper Syria at the beginning of the 1st millennium, though there is missing the translation in relationship with the Hittite art of Anatolia of the 13th century. The German excavations of von Oppenheim at Tell-Halaf (on the Chabur) have revealed monuments of the same style, the most vigorous being the oldest; others, which are analogous to the most recent specimens from Zendjirli, exhibit in decadence the formula, of which they are the extreme branch in the direction of Assyria.

Phoenicia.—The majority of the Phoenician monuments which have come down to us date from the 1st millennium, and to a large extent from the middle of it, when Persian rule was established in the country. We learn from this epoch the funerary art of the Phoenicians, and as a result of Renan's mission we also possess several ruins of their temples. Interment is usually made in vaults, to which access is by an upright square shaft. The sarcophagi are plain stone cases, with a lid having a slightly shelving ridge. Certain Sidonian monarchs, Tabnit and his son, Eshmunazar, were interred in Egyptian sarcophagi, which shows how great the influence of Egypt (5th century B.C.) still was in Phoenicia, In imitation of these sarcophagi, of which the first is in the museum of Constantinople, and the second in the Louvre, the Phoenicians cut sarcophagi out of marble from the islands in the shape of a mummy case, with the head raised in high relief on the cover. These are known as the "anthropoid" sarcophagi (5th and 6th centuries). They were buried in the true subterranean dwellings, to which access is by shaft, or often, more conveniently, by stairs. Such necropoli are found all along the coast, notably at Sidon, at Tortose (Tartous) and Amrit. In this last necropolis there are still vestiges of the commemorative monuments which the Phoenicians placed in their tombs; they are cylindrical in shape with a rounded end.

To the same epoch date the foundations of temples, which prove the continuity of the Semitic worship in this area. At Amrit, in a great court a small *naos* (shrine) is cut out of the rock itself, showing that it was a place of worship. At Sidon, on the side of a hill on a terrace overlooking the river, are the ruins of a temple, dedicated to Eshmun, the Phoenician Aesculapius. The most important Phoenician inscriptions, found in Phoenicia itself, come from Sidon and from the dynasty to which Tabnit and Eshmunazar belonged. We may conclude that Phoenician art, in the course of its history, remained under the direct influence of the conquerors and of the countries with which Phoenicia had intercourse. Phoenician art is a compound of Egyptian, Aegean and Mesopotamian motives, which local artists have utilized and combined with real taste.

The Sarcophagi of **Sidon.**—As forming a link between the art of the East and that of the Graeco-Roman period the sarcophagi, discovered in the hypogeum, where Tabnit was buried, may be mentioned. Though of a more recent period, they belong entirely to Greek art. These sarcophagi, rightly famous, are in the museum of Constantinople. The most famous is termed the "Sarcophagus of Alexander," not because that monarch was buried there, but because his effigy is reproduced among the sculptures of the bottom part. It is made of Pentelian marble. The artist has depicted on the sides scenes of battle and the chase, in which the Macedonian conqueror is taking part. The sculptures have an admirable finish and style, and were originally enlivened with touches of colour. It dates from the end of the 4th century B.C. and has a lid in the form of a roof, ornamented at the four corners with small recumbent lions. Of the other sarcophagi of this series, which, though bearing no name, to judge by their richness must surely have sheltered the sovereigns of Sidon, the sarcophagus known as the "Lycian" is made of sculptured marble (c. 400 B.C.), while that called "the Satrape," which depicts some man of rank inspecting his horses, or taking a part in a banquet, or at a hunt, is dated to the middle of the jth century. A third, known as "The Weepers," represents a temple in outline, with columns between which are mourners in the funeral procession of the dead man (middle of the 4th century). Therefore, at least from the Persian epoch, oriental art in Phoenicia was in competition with Greek art, which little by little was to oust it.

The Graeco-Roman Period.—From the beginning of this era it is no longer necessary to draw distinctions in Syrian art between the region of the interior and that of the coast. The whole country was under Graeco-Roman influence, and art was permeated with it in varying degrees. The great Syrian ruins date from this age, such as the old temple of Boetocécé (called to-day Hosn Suleiman) on the road from Tripoli to Hamah, a vast enclosure of Semitic type, restored in the 1st century A.D. (The original enclosure was left open to the sky.)

Baalbek.—Here in the ancient Heliopolis, situated on the line from Rayak to Homs, are the remains of two great temples with their adjoining buildings, constructed within an enclosure of high walls, some of the stones being of gigantic size. The propylaea led to a hexagonal court 60 metres in diameter, at the end of which was the temple of the sun. Nothing remains of it but the foundations and six tall columns. In front of the temple was a sacrificial altar and basins for lustral water. Theodosius, at the end of the 4th century A.D. partly demolished the temple in order to build a church, itself ruined. At the side of the Temple of the Sun is a smaller sanctuary called the Temple of Bacchus, doubtless because one of the doors is decorated with vines. It was probably dedicated to Atargatis, the goddess spouse of the chief god of Heliopolis. It is in better preservation than the Temple of the Sun. The rich floral decoration used by the artists of Syria and Palestine in their profuse ornament of the buildings constructed at this epoch is very conspicuous here.

Palmyra, situated in an oasis, about 85m. east of Homs, was *an* important town at the time of the Assyrian empire (7th century B.c.), but its splendour dates from the and, and still more from the 3rd century A.D., when, under Queen Zenobia, it was the head of an immense empire. The temple of "the sun" presents many analogies with that of Baalbek, and is surrounded in the same way by walls. Other monuments of less importance, temples, a theatre, and in particular a colonnade, in which a number of the columns are still standing, are decorated as lavishly and richly as those at Baalbek. Most of the treasures from Palmyra, now in museums, come by reason of their funerary practices. The custom of placing in the tombs the bust of the dead in high relief, accompanied by an epitaph, produced an easy form of sculpture of beautiful decorative effect, which is a good source of information as to the dress and the customs of the people. (See PALMYRA.)

At the beginning the temple of Jupiter at Damascus (later the church of St. John and then the mosque of Ommeiádes) must have been a magnificent building. The court of the present mosque corresponds to the temple enclosure, which was formerly set in a still greater enclosure, which to-day is entirely covered by buildings, nothing remaining except the ruins of the gates.

Doura.—After the occupation of Mesopotamia by English troops, on the edge of Syria, at Salihiyeh on the Euphrates, to the north-west of Abou Kemal, in 1920, were discovered the remains of the old city of Doura-Europos (1st century A.D.), which Breasted and Cumont have partially explored. The excavations have uncovered a building ornamented with precious frescoes, representing a sacrifice offered by a dignitary of the town, surrounded by all his followers, and a sacrifice offered to the local goddess, Fortuna of Doura and Palmyra, by the Roman legion which was in garrison there (3rd century A.D.). These paintings exhibit the influence of Palmyra (perhaps the artist was a Palmyrian) and afford interesting evidence of the influence which oriental art, as known through the important works at Palmyra and Doura, had on Byzantine art. From the beginning of the 1st millennium A.D. a number of funerary monuments have been found, sarcophagi, statues in Graeco-Roman style, tombs painted with frescoes, especially near Sidon, and finally a marked preference for the use of mosaic. A good example is the mosaic of Kabr Hiram discovered by Renan near Tyre, and a funeral stele with portraits of the deceased found on the outskirts of Sidon in 1914 and now in the museum of Beirut.

The Christian Epoch *in* Syria has left an appreciable number of monuments. In the north the most celebrated is the monastery of Qala'at Semân on the road from Aleppo to Alexandretta, where St. Simon Stylites lived. The church was built, undoubtedly, at the beginning of the 6th century, a little time after the death of the saint. It is composed of a central octagon, 30 metres in diameter: an essentially Syrian arrangement, making the centre of a cross. Not far from Qala'at Semân are the ruins of Tourmanîn, a church of the 6th century, and a large two-storied building for the use of pilgrims.

At El-Barah, near the caravan route from Hamah to Aleppo, and at Serdjilla, an hour's distance away, many houses of the jth century are still in an admirable state of preservation. They were abandoned at the time of the Arab occupation. They owe their preservation to the fact that stone was used almost entirely in their construction. Beautiful specimens of Syrian silver work of this period, chalices, vials for holy oil, vases, sumptuous bookbindings of the Gospels, belonging, many of them, probably to the middle of the 6th century, are to be seen in the important museums.

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See also ASIANIC LANGUAGES. (G. Co.)

HISTORY

Asia Minor has been known from the earliest period as a battleground between the East and the West. The central plateau with no navigable rivers and few natural approaches, its monotonous scenery and severe climate, is a continuation of Central Asia. The west coast, with its fertile valleys and fine climate, is almost a part of Europe. These conditions are unfavourable to permanence, and the history of Asia Minor is that of the march of nomad tribes and colonists, and of the rise and fall of small states.

About 1950 B.C. western Asia Minor appears to have been held by the 1st dynasty of Hittites (*q.v.*), with their capital at Kushara (?). Two centuries later Aryan races seem to have invaded the country and imposed at least their language on the Hittites, who about 1500 B.C. emerged suddenly as a powerful empire at Hati (Boghaz-Keui of to-day, Greek Pteria), ruling over Asia Minor and fighting the Egyptian Pharaohs for the mastery of Syria, and Assyria for the mastery of Mittani (Jernblus).

The Hittite sculptures and inscriptions have been found in their own capital at Boghaz-Keui and at various places between Smyrna and the Euphrates.

This Hittite empire was overthrown by Indo-European races, possibly Greeks, who, crossing the Hellespont from Europe to Asia, with their iron weapons defeated the Hittites possessing only bronze weapons. These Indo-European races established many colonies all along the Aegean coast and in the hinterland, from which arose the Phrygian kingdom. Traces of this kingdom remain in various rock tombs, forts and towns, and in legends preserved by the Greeks. In the 8th century B.C. the Cimmerians coining from Armenia overran the Phrygian kingdom, and on its decline rose the kingdom of Lydia, with its centre at Sardis. A second Cimmerian invasion, followed later by Cyaxares, almost destroyed the rising kingdom, but the invaders were stopped by Alyattes (617–586 B.C.; see SCYTHIA). The last King Croesus (?560–546 B.C.) carried his boundaries to the Halys, and subdued the Greek colonies on the coast. These flourishing Greek colonies formed a chain of settlements extending from Trebizond to Rhodes. Too jealous of each other to combine, and too demoralized by luxury to resist, they fell an easy prey to Lydia. After the capture of Sardis by Cyrus, 546 B.C., these colonies passed to Persia without resistance. Under Persian rule Asia Minor was divided into four satrapies, but the Greek cities were governed by Greeks and the tribes in the interior retained their native princes and priest-dynasts. The conflicts between Persians and Greeks are told in the article GREECE: History. Beginning with Darius' attempt to conquer the European, as well as Asiatic, Greeks, they ended in **334** B.C. when Asia Minor was invaded by Alexander the Great. (See GREECE; PERSIA; IONIA.)

After the death of Alexander various *diadochoi* (succession rulers) established their rule over various parts of the peninsula.

Rhodes became a great maritime republic. The Ptolemies of Egypt ruled over the Mediterranean coast of Asia Minor. A small independent kingdom was founded at Pergamum 283 B.C., which lasted a century and a half. Bithynia became an independent monarchy, Cappadocia and Paphlagonia tributary provinces under native princes. In the south the Seleucids founded Antioch, Apamea, Attalia, the Laodiceas and other cities as centres of commerce, some of which afterwards played an important part in the Hellenization of the country and in the spread of Christianity. During the 3rd century B.C. certain Celtic tribes crossed the Bosporus and established their power in districts between the Sangarius and Halys, called Galatia. Its capital was at Ancyra—the modern Angora, the capital of republican Turkey.

The defeat of Antiochus the Great at Magnesia, 190 B.C., placed Asia Minor at the mercy of Rome, but it was only in 133 B.C. that the first Roman province, Asia, was formed to include the western Anatolia. Under Mithridates the Great (*q.v.*) Pontus rose into a formidable power; but he was driven from his country by Pompey and died in 63 B.C. The Romans organized the peninsula into various provinces, leagues and almost independent principalities, and under their dominion Asia Minor developed and became prosperous. At the end of the 3rd century A.D., in reorganizing the empire, Diocletian broke the great military commands and united the provinces into groups called dioceses. A great change followed the introduction of Christianity, which gradually spread over the region. The seven Christian Churches of Asia Minor were built up in this period.

When the Roman empire mas divided into two in 395, Asia Minor fell to the Eastern Roman empire with its capital at Constantinople; the native languages and old religions partly disappeared and the country was thoroughly Hellenized. At the close of the 6th century Asia Minor had become wealthy and prosperous, but centuries of peace and over-centralization produced a state of affairs which is embodied in the term Byzantine. The vigorous Persian monarch Chosroes II. (Khosrau) invaded Asia Minor from 616 to 626 and pitched his camp on the Bosporus. The emperor Heraclius, however, restored the Byzantine power by marching his army to Kurdistan; but soon after the Arabs entered Asia Minor, and in 668 A.D. laid siege to Constantinople. For the following three centuries Byzantium and the caliphs of Baghdad waged occasional warfare for the mastery of the bridgeheads of the Euphrates and the Cilician gates. But a more dangerous enemy was soon to appear from the East. In 1067 the Seljuk Turks ravaged Cilicia and Cappadocia; in 1071 they defeated and captured the emperor Romanus Diogenes; in 1080 they took Nicaea. One branch of the Seljuks founded the empire of Rum with its capital at Iconium. During the 12th century a number of Seljuk Atabeks ruled in different districts of Asia Minor; the Mamelukes of Egypt in Syria and farther East; Greeks in Pontus, Armenians in Cilicia, Danishmends (an Armenian family) at Sivas, Bayandurs (a Greek family) at Erzerum, etc. The Mongols swept the whole region and in 1243 subdued the Seljuk sultan of Rum. In the ensuing struggle for power among the Turkoman tribes, the Osmanli Turks eventually assumed supremacy and established their state at Brusa. In 1400 Sultan Bayazid I. held almost all Asia Minor west of the Euphrates. But he was defeated and imprisoned by Timur, who swept through the country to the shores of the Aegean. On the death of Timur, the Osmanli power was re-established after a prolonged struggle which ended with the annexation by Mohammed II. (1451–81) of Karamania and Pontus. The later history of Asia Minor is that of the Ottoman empire. The Turks have dominated Asia Minor since in the widest sense, until their supreme power was challenged in 1832 by an Egyptian army under Ibrahim Pasha, and their rule shattered in the World War.

The devastation of Asia Minor, initiated by the Seljuk hordes in the 11th century, was followed by a long succession of nomad Turkish tribes. The latter did not ill-treat the native people; but as they passed onwards they left the country bare and desolate. Whole provinces passed out of cultivation and the natives, taking to the mountains or to towns, abandoned their lands to these nomads, who replaced wheeled traffic by the pack horse and the camel. The native peasants were thus forced to be nomads themselves. The Mongols, as they advanced, sacked towns and historic monuments; they razed to the ground even mounds and "all that might serve as a place of armed resistance." Timur conducted his campaigns with a ruthless disregard of life and property. Entire Christian communities and almost all who attempted any self-defence were massacred; flourishing towns were completely destroyed and all Asia Minor was ravaged. From these disasters the country never recovered, and many traces of Hellenic civilization disappeared with the enforced use of the Turkish language and the wholesale conversions to Islam under the early Osmanli sultans.

In modern times, Asia Minor slowly recovered under western influences; but the construction of railways and the consequent growth of trade and local industries were seriously interrupted by the disaster of the World War. When the Turks signed the Armistice on Oct. 30, 1918, they were utterly beaten. The British armies had captured all the Arab-speaking lands of Asia Minor. In May 1919 a Greek army seized Smyrna and most of the Ionian coast and gradually extended its occupation to Eski-Shehir (the ancient Dorylaeum) and Afiun-Karahissar. At one moment it was thought that the Hellenic civilization was again rising in its historic centres.

The Treaty of Sèvres (*q.v.*), signed by the Turks in Aug. 1920, reduced Asia Minor to its geographical and ethnic boundaries as it had been established by five centuries of Turkish domination. Great Britain assumed the mandates of Palestine and 'Iraq, and France that of Syria. Meanwhile Great Britain, France and Italy had signed a tripartite agreement, by which they divided south and south-eastern Asia Minor into spheres of influence. The Turkish nationalist movement, however, led by Mustapha Kemal Pasha soon reasserted itself. The Turks drove the French from Cilicia and the Greeks from Smyrna. The Treaty of Sèvres was not ratified and was superseded by the Treaty of Lausanne (July 1923) which left Turkey absolutely sovereign in Asia Minor in the narrow sense. After the suppression of the sultanate in Nov. 1923, soon followed by that of the caliphate, Turkey declared itself a republic' with its capital at Angora.

Under the auspices of the Allied Powers and in conjunction with the Treaty of Lausanne a convention for the exchange of populations was signed between Turkey and Greece, by which about one million Greeks, the oldest civilized natives of western Asia Minor, were driven from their ancestral homes and lands and transferred to Greece and Macedonia, thus wiping out the last traces of Hellenism in Anatolia.

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ASIANIC **LANGUAGES.** The languages described as Asianic were spoken in Asia Minor by non-Hellenic peoples before the arrival of Greek, by which most of them have been slowly ousted or absorbed. The term is purely geographical and comprises a number of ancient languages, of different families and modes of writing whose only common feature is their obscurity. They are mainly (1) recorded in cuneiform, as Sumerian (*q.v.*), Hittite Cassite, Vannic and Elamite; or (2) languages whose name alone survives, as Pisidian, Lycaonian, Cappadocian, Paphlagonian, Phrygian (an Indo-European language); and (3) the speech of the peoples of the coast of Asia Minor, Mysian, Lydian (Maiones), Carian and Lycian (Termiles), recorded by alphabets akin to or derived from the Greek.

Mysian.—According to Herodotus the Mysians were related to the Carians and Lycians, and of their speech we have only three glosses surviving on which no conclusions can be based.

Lydian.—Excavations conducted by the American school, 1910–13, produced numerous inscriptions dating from the 5th and 4th centuries B.C. written in an alphabet closely resembling

the Greek, usually from right to left. Mostly funerary inscriptions, they contain with variations the common formula—"This is the tomb of X son of Y. May he who damages it be punished by the divinity, himself and his family." We have a few short bilingual (Greek and Lydian) inscriptions and one (Lydian-Aramaic) dating 45j or 394 or 349 B.C. which, despite many obscurities, is the basis of our decipherment and interpretation. We have a fairly accurate knowledge of Lydian, although the value of some signs is problematic and the greater part of the vocabulary remains unknown, while the longest texts available, metrical inscriptions from Sardis, are still a riddle.

Phonetics.—Lydian has the vowels, a, e, *i,* o and *u;* nasalized vowels *ã, ẽ;* an aspirate h, two *l*'s, one plain and one rolled, two series of occlusives, surd and sonor, with an absence of aspirated occlusives. There are accumulations of consonants due perhaps to habits in writing or perhaps indicating a modification of the short vowels, possibly the result of accent.

Grammar.—Nouns seemingly have two genders and three cases in the singular, less certainly in the plural. The nominative masculine and feminine in the singular is *-s* for roots in *-i* and *-ś* in others. The oblique case (dative and perhaps locative) is *-λ* and the accusative *-n* as also probably the oblique plural. Demonstratives and adjectives have the case forms as the nouns to which they belong. Thus the demonstrative es- is in the masculine-feminine nominative es-S which becomes *eśś;* in the neuter it is es-d becoming est; thus we have *eśś vãnaś,* this tomb, and *est mrud,* this monument. In all genders the form es λ is used in oblique cases. Possession is indicated by an adjective in *-l-* which can be associated with the oblique case form *-λ* and takes the same case forms as the noun. Thus *vãnaś* Atalis, the tomb of Atas. Verbal forms are less clear. Lydian seems to have had a third person singular form in *-d* and a third person plural form in *-ent.* The numerals are not known. The post-position *-k* means 'and' as *-c* in Etruscan. Negative forms are *nik . . . nik,* neither . . . nor, and a negative or indefinite element *nã-* combines with the pronoun pis, *pid* forming *napis, napid* somebody, something. The alternative *buk* means or, and the conditional form is ak in the protasis, sometimes. lengthened to akit or by adding *it-in* to *aktin,* while fak, then, introduces the leading element in the apodosis. The order of words is subject, verb, object. The exact meaning of individual words is not known save in a few cases such as the words for tomb, monument, court, house, water, fire, priest, divinity, destroy, with a certain number of words explained by glosses.

Carian.—Our knowledge of Carian rests on about 80 small inscriptions recorded in an alphabet containing several signs identical with Greek forms. The earliest date from the middle of the 7th century B.C., and three are bilingual, Egypto-Carian. Decipherment is still uncertain, and the meaning of a large number of the signs is conjectural despite the work of Sayce. Herodotus mentions the tradition that the Carians were once the inhabitants of the islands. Sundwall with some probability relates Carian to Lycian. The evidence is, however, based on place-names and on the glosses recorded mainly by Stephen of Byzantium. The material does not enable us to verify the association of Carian with Cretan or the relationship of Carians to Mysians and Lydians.

Lycian.—Discoveries made over the last century from 1811 onwards have brought to light about 150 inscriptions dating from the 5th and 4th centuries B.C. written in an alphabet of Greek origin, which come mainly from Limyra, Xanthos, Myra, Pinara and Tlos. Nearly all are funeral inscriptions and uniform in purport and language except the second part of the long stele of Xanthos and the inscription of Antiphellos which are metrical in an archaic, perhaps different, dialect and much more obscure. A few very short and varying bilingual (Greco-Lycian) inscriptions give some help towards interpretation.

Phonetics.—Lycian possessed as vowels, a, e, *i* (marked *ϵ*), *u* (marked *o*), nasalized vowels *ã, ẽ,* sonants *w* and y, a series of occlusives in frequent alternation, like *l* and *r,* sign *m̃* and *ñ* whose value is doubtful, two spirants, *x* and *θ,* two sibilants s and *z* and the aspirate *h.* An equivalence of e, a, or a is found but not explained. A few signs have not been surely identified.

Grammar.—Two genders seem to have existed with a declension with a nominative, an oblique case in *-i* (plural *-e*) and an accusative with nasalization. The possessive of the 1st person is emi or mine. The relative is ti. In the verb the singular third person was, it seems, *t* or d, and the third person plural was *nt* and there was a vowel conjugation, the timbre of the vowel varying with the variations of time. The usual negative form is ne, *ni.* A certain number of words have been elucidated by the bilingual inscriptions so that the meaning of certain phrases can be established with some accuracy, although it is as yet impossible to deal satisfactorily with the larger inscriptions.

Affinities of the Asianic Languages.—As to the relationship of these languages to one another, all that can be said is that they have certain identical tendencies in pronunciation, in nasalized vowels, which prove nothing, some grammatical coincidences (accusative in -n; verb forms for the third person in *-t* and *-nt*) which are of little aid. Neither Lydian nor Lycian display any certain marks of relationship. Their vocabularies are very different, a fact which does not prevent their having a common origin. Too little is known of Carian, which must be omitted, and as regards Lydian and Lycian such facts as we have do not as yet indicate a close affinity. Fundamental resemblances have been found between Lydian and Indo-European, such as case forms, the adjectival concord, the system of relative and demonstrative pronouns, the verbal forms for the third person, singular and plural, the negative forms. On the other hand, not one Lydian word has a clear Indo-European origin and the oblique case in X- is definitely alien to Indo-European declension though known in Etruscan and the southern Caucasus. Lycian has similar but less numerous points of likeness and many features in it are common in Etruscan (*q.v.*), such as a large number of proper names, some words and elements of common derivation. If these languages are really to be regarded as related and if we may apply to them the term "Asianic family," which is probable, though not proved, their position with regard to Indo-European languages may be that they have retained some features of their common origin but have from early times diverged independently; similarly as regards the relationship with Etruscan and the southern Caucasus, unless the features shared with these languages are accidental. But before this or any other hypothesis can be taken as beyond doubt, more investigations are necessary.

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(E. BEN.)

ASIENTO or **ASSIENTO,** a Spanish word meaning a farm of the taxes, or contract. The word acquired notoriety on account of the "Asiento Treaty" of 1713. After the establishment of the Spanish Bourbon dynasty in 1700, a French company was formed which received the exclusive privilege of the Spanish-American slave trade. At the peace of Utrecht the British Government claimed the monopoly. The Asiento Treaty (March 16, 1713) accordingly authorized British subjects to introduce 144,000 slaves in the course of 30 years, at the rate of 4,800 per annum and to send one ship of 500 tons per annum, laden with manufactured goods, to the fairs of Porto Bello and La Vera Cruz. This privilege was conveyed by the British Government to the South Sea Company, and formed the solid basis of the fit of speculative fever called the South Sea Bubble (*q.v.*). Until 1739 the trade in blacks went on without interruption, but amid increasingly angry disputes between the Spanish and the British Governments. The right to send a single trading ship to the fairs of Porto Bello or La Vera Cruz was abused. Under pretence of renewing her provisions the ship was followed by tenders loaded with goods, and thus arose what was in fact a vast contraband trade. The smugglers were guilty of many piratical excesses, and the Spanish revenue officers acted often with violence on mere suspicion, After many disputes,

war was declared in 1739. When peace was made at Aix-la-Chapelle (*q.v.*), in 1748, Spain undertook to allow the asiento to be renewed for the four years which were to run when war broke out in 1739. But the renewal for so short a period was not considered advantageous, and by the Treaty of El Retiro of 1750, the British Government agreed to the recession of the Asiento Treaty altogether on the payment by Spain of £100,000.

"AS IF," THE PHILOSOPHY OF. The expression was coined by Hans Vaihinger and applied to his own system of philosophy, according to which all human knowledge, all explanations in the realm of science, philosophy, law, religion, etc. are merely so many fictions or assumptions which tell us that the things or events, etc., referred to are or behave "as if" they had such or such a character, or "as if" they had been produced in such and such a way. Thus, for instance, in physics the conceptions of ether, electric fluid, etc., are merely fictions which facilitate our grasp of the transmission of certain forms of energy "as if" there were such a medium as ether, or an electric fluid, etc. In law a company is treated "as if" it were a person. In morals and religion certain imperatives of conduct are conceived "as if" there were a God, a hereafter, and rewards and punishments, etc. Vaihinger does not regard these fictions as deliberate fictions or mere make-beliefs. His contention rather is that human knowledge, be it pursued never so earnestly, is at best only a series of fictions, or "as ifs," by which man with his finite capacities endeavours to make the world intelligible to himself so as to feel at home in it.

The philosophy of "as if" traces its descent from Kant, through Lange (the historian of materialism) and Nietzsche. Kant, by limiting human knowledge to phenomena, that is, to things as they appear to man, not as they are in themselves, and by regarding human knowledge as moulded by certain a *priori* forms innate in the human mind, obviously, if unintentionally, gave an impulse to the philosophy of "as if." Nietzsche promptly pointed out that other beings than man may have other a priori forms of apprehending reality, and that the human forms of apprehension instead of revealing the true nature of reality may only conceal it in order to make human existence tolerable. The whole philosophy of "as if" may be regarded as one expression of the sceptical and agnostic tendencies of the age, of which pragmatism and hominism are other expressions.

See H. Vaihinger, *The Philosophy* of *"As if"* (English trans., 1926).

ASIOLI, BONIFACIO (1769–1832), Italian composer. A child prodigy, he had already written three masses and much other music by the time he was eight. In 1808 he was made censor of the Milan conservatory, and in 1810 he entered the service of the Empress Marie Louise of France, remaining until the fall of the empire. Besides his music, he wrote *Principi elementari di musica* (1809), which was reprinted six times and translated into four languages.

'ASIR, a district of West Arabia between 17° 31′ and 21° N. and 40° 30′ and 45° E.; bounded north by Hejaz, east by Nejd, south by Yemen and west by the Red Sea. Apart from Rub' Al Khali no district of Arabia is less known to Europeans who have only visited As Sabya and a few places near the coast. It consists of a maritime plain with an average width of 25 mi. rising gradually to the foot of a mountain range, whose eastern flank falls to a highland plateau merging gradually with the steppes of Nejd. It is about 230 mi. long and 180 mi. broad. Its mountains contain a number of fertile valleys and coffee is cultivated on its mountain slopes as in Yemen. Kunfuda, Jizan and Maidi are the most important of many petty ports on the Red sea, and As Sabya is the lowland capital (and residence of the Idrisi ruler), as Abha (or Ibha) is that of the highlands. Wadis Bisha, Ranya and Turaba, each with a considerable population, are the principal valleys of the eastern plateau, while Khamis Mushait and Wadi Shahran are among the most notable in the highlands. The population is a hardy race of mountaineers with a tendency towards Wahhabi fanaticism, while the principal element in the east is the Qahtan tribe centring on Ranya. The Turkish occupation of 'Asir was never very effective beyond the coast, though Turkish expeditions penetrated the country frequently between 1814 and 1837 and garrisons have been maintained in a desultory fashion at Abha and Rhamis Mushait. The Idrisi dynasty of Sabia and Abu Arish is of comparatively recent advent to the country, its founder, Said Ahmad, having established himself in the latter part of the 19th century with a doctrine akin to that of the Sanusis of North Africa. Under Said Mohammed 'Asir first acquired political importance, his rebellion in 1911 against the Turks having with Italian assistance achieved a measure of success. From 1915 he was in treaty relations with Great Britain and in 1920 occupied Hudaida after the departure of the temporary British garrison. In 1920 the Wahhabis occupied Ibha and all upland 'Asir, while Imam Yahya recovered Hudaida in 1921. The following year Said Mohammed died and his son, 'Ali, proving incapable of maintaining his position, fled the country in 1925. His uncle, Hasan, in 1926 placed his remaining territory under a Wahhabi protectorate by formal treaty, under which he was appointed governor of the province for life. The Farisan islands off the coast belong to 'Asir and came into prominence owing to the grant by the Idrisi in 1926 of an oil-prospecting concession to a member of the Shell group. There has been much unrest on the southern boundary of 'Asir, in dispute with the Imam, but the steady extension of Ibn Sa'ud's effective administration of the province exercised a calming effect on the tribes of the border.

ASISIUM: *see* ASSISI.

ASKALON, now a desolate site on the sea-coast 12m. N. of Gaza and about 3m. from El-Majdal on the Kantara-Jerusalem railway. It occupies a rocky amphitheatre embracing about ¾m. of shore with traces of an old harbour in the south-west corner. Protruding from this sand-swept terrain shattered columns and the remnants of ruined buildings and broken walls bear ample testimony to a past magnificence. The site is studded with wells (*θαυμαστὰ φρέατα* Origen c. Cels. IV. 44), and the ruins are interspersed with gardens which belong to the inhabitants of the neighbouring village of El-Jōrah. The country around is fertile. Vines, olives, and a variety of fruit trees flourish. Its most characteristic product, however, is the onion Ascalonia *coepa* whence Ital. scalogno, Fr. *échalotte,* Eng. *shalot.* Its wine and its henna were renowned of old.

History.— In the Amarna letters (c. 1400 B.C.) Askalon is one of the cities which write to the Pharaoh for help against the Habiru. Also it would appear that Askalon was leagued with Gezer and Lachish against Abd-Khipa the pro-Egyptian ruler of Jerusalem. In 1285 B.C. Rameses II. took Askalon by storm. The scene is depicted on a wall of the Ramesseum at Thebes. In 1223 B.C. certain Palestinian cities, amongst them Askalon, revolted against their overlord, Merneptah, to their own undoing. "Carried off is Askalon" sings the Egyptian poet laureate of the period. Askalon is not mentioned amongst the cities of Judah in Joshua XV. and it appears as Philistine from the days of Samson to the Hellenic age. In 701 B.C. it fell to Sennacherib. About 630 B.C. the Scythian invasion engulfed Palestine and Herodotus tells us of their sack of the temple at Askalon. With the conquest of Alexander the city became Hellenized and following his time its fate as a tributary was determined alternately by Egypt and Syria. Although a stronghold of Hellenism it prudently opened its gates to Jonathan the Maccabee (147 B.C.) and later to Alexander Jannaeus. It was the birthplace of Herod the Great who adorned it with fine buildings. During the Roman period it was a noted centre of Hellenic scholarship. It became also the seat of a bishopric. From 104 B.C., for four and a half centuries it was an *oppidum liberum* of the Roman empire. In A.D. 636 it passed into the hands of the Arabs. During the Crusades Askalon was the key to south-west Palestine. In 1099 its gates were shut against the defeated Egyptian host and the panic-stricken refugees from fallen Jerusalem. Over 30,000 are said to have perished at that time beneath its walls. When eventually Askalon was taken after a six months' siege by Baldwin III., its capture completed the Frankish conquest of the country (1153). In 1187 it was retaken by Saladin after but feeble resistance. The approach of Richard Coeur de Lion, fresh from his triumph at Acre, caused Saladin to burn the city and demolish the defences (1191). The English king promptly set about their restoration with zeal, but under the terms of the truce arranged with Saladin the following year the

walls were once more destroyed and the city abandoned. In 1240 Richard of Cornwall began the task of rebuilding, but the city was captured in 1247 by Fakhr ed-Din. Finally Sultan Beibars, in accord with his scheme of defence, destroyed the fortifications in 1270 and blocked the harbour with stones.

Excavations.— In 1815 Lady Hester Stanhope employed from 100 to 150 men for several weeks excavating, but with no scientific method, a part of the site. After a preliminary survey in 1913, the Palestine Exploration Fund commenced their post-war campaign here (1920–23) under the supervision of Garstang and Phythian–Adams. Herod's cloisters—the "court surrounded by columns" of Josephus—have been exposed and a number of statues, amongst them one of Isis-Tyche, recovered. The remains of a Byzantine theatre, which has proved to be an earlier senate house converted to this purpose, have been revealed. A statue of Peace was discovered close to the mouth of a well, probably the "Well of Peace" familiar from the description of Antoninus Martyr (A.D. 560–570). The stratification of the site has been determined and a date of about 1800 B.C. for the earliest traceable habitation established. Sufficient supplies of pottery, etc., have been unearthed in the appropriate stratum to enable experts to recognize a distinctive Philistine handiwork. The Palestine Department of Antiquities has established here a local museum.

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ASKAULES, probably the Greek word for bag-piper, although there is no documentary authority for its use. Neither it nor ἄσκαυλος (which would naturally mean the bag-pipe) has been found in Greek classical authors, though J. J. Reiske—in a note on Dio Chrysostom, *Orat.* lxxi. ad *fin.,* where an unmistakable description of the bag-pipe occurs ("and they say that he is skilled to write, to work as an artist, and to play the pipe with his mouth, on the bag placed under his arm-pits") —says that ἀσκαύλης was so used.

ASKE, ROBERT (d. 1537), English rebel, was a country gentleman who belonged to an ancient family long settled in Yorkshire. In 1536 Aske led the insurrection called the "Pilgrimage of Grace." Marching with the banner of St. Cuthbert and with the badge of the "five wounds," he occupied York on Oct. 16, and on the 20th captured Pontefract Castle, with Lord Darcy and the archbishop of York, who took the oath of the rebels. He caused the monks and nuns to be reinstated, and refused to allow the King's herald to read the royal proclamation, announcing his intention of marching to London to declare the grievances of the commons to the sovereign himself, secure the expulsion of counsellors of low birth, and obtain restitution for the church. Aske, followed by 30,000 or 40,000 men, marched on Doncaster, where lay the Duke of Norfolk with the royal forces, which, inferior in numbers, would probably have been overwhelmed had not Aske persuaded his followers to accept the King's pardon and the promise of a Parliament at York, and to disband.

Aske then went to London under the guarantee of a safe-conduct and was well received by Henry. He put in writing a full account of the rising and of his own share in it; and fully persuaded of the King's good intentions returned home Jan. 8 1537, bringing with him promises of a visit from the King to Yorkshire, of the holding of a parliament at York, and of free elections. Shortly afterwards he wrote to the King warning him of the still unquiet state not only of the north but of the midlands, and stating his fear that more bloodshed was impending. The same month he received the King's thanks for his action in pacifying Sir Francis Bigod's rising.

But the new rising had given the court an excuse for breaking off the treaty and sending another army under Norfolk into Yorkshire. Possibly in these fresh circumstances Aske may have given cause for further suspicions of his loyalty, and in his last confession he acknowledged that communications to obtain aid had been opened with the imperial ambassador and were contemplated with Flanders. In any case Aske was persuaded to go to London on false assurances of security. He was arrested in April, tried before a commission at Westminster, and sentenced to death for high treason on May 17; on June 28 he was taken back to Yorkshire, being paraded in the towns and country through which he passed. He was hanged at York in July, expressing repentance for breaking the King's laws, but declaring that he had promise of pardon both from Cromwell and from Henry. Aske was a real leader, who gained the affection and confidence of his followers.

See *Henry VIII. and the English Monasteries,* by F. A. Gasquet (1906); *Letters and Papers of the Reign of Henry VIII.,* vol. xi. and xii.; *English Hist. Rev.,* v. 330, 550 (account of the rebellion, examination and answers to interrogations); *Chronicle of Henry VIII.,* tr. by *M.* A. S. Hume (1889); Whitaker's *Richmondshire,* i. 116 (pedigree of the Askes).

ASKED PRICE, the price which the owner of any property places upon it for the purpose of sale. A prospective buyer will usually make an offering price or "bid" at a lower figure. When the bid and asked price coincide, either through the purchaser's raising his offer to meet the asked price, or through the seller's reducing his asked price to meet the bid, or by a compromise price somewhere between the two, a sale may be consummated. On the stock and produce exchanges bid and asked prices are regularly quoted on all items, and such quotations are carried in the financial reports of the daily papers, on the ticker systems, and in other financial information media.

ASKEW or **ASCUE, ANNE** (1521?–1546), English Protestant, born at Stallingborough about 1521, second daughter of Sir William Askew (d. 1540) of South Kelsey, Lincoln. She came to London and made friends with Joan Bocher, who was already known for heterodoxy, and other Protestants. Anne was examined for heresy by the lord mayor (March 1545), then by Bishop Bonner, and then (June 13 1545) brought up as a sacramentarian at the Guildhall. These efforts having failed, she was brought on June 18 1546 before a special commission without jury and without witnesses, and was condemned, on her confession, to be burnt. On the following day she was racked, and after four weeks in prison was burnt at Smithfield (July 16).

It is probable that the pertinacity displayed against Anne was due to the desire of the reactionary party to intimidate Hertford and Catherine Parr who were suspected of sympathy with her.

BIBLIOGRAPHY.—Bale's two tracts, printed at Marburg in Nov. 1546 and Jan. 1547, are the basis of Foxe's account. *See* also *Acts of the Privy Council* (1542–47), pp. 424, 462; Wriothesley's *Chron.* i. 155, 167–9; *Narratives of the Reformation,* passim; Gough's *Index to Parker Soc. Publications;* Burnet's *Hist. of the Reformation;* Dixon's *Hist. of the Church of England; Dict. Nat. Biog.*

Her torture, disputed by Jardine, Lingard and others, is substantiated not only by her own narrative, but by two contemporary chronicles, and by a contemporary letter; *ibid., Narratives of the Reformation,* p. 305; Ellis, *Original Letters,* 2nd ser. ii. 177.

ASMA'Ī, Abd al-Malik ibn Kuraib (c. 739–831), Arabian scholar, was born of pure Arab stock in Basra and died in Baghdad. He became tutor to the son of Harūn-al-Rashīd, and acquired property in Basra, where he again settled for a time. Asma'i was one of the greatest scholars of his age. While Abū 'Ubaida followed (or led) the Shu'ūbite movement and declared for the excellence of all things not Arabian, Asma'i was the avowed supporter of the superiority of the Arabs over all people, and of the freedom of their language and literature from all foreign influence. Of Asma'ī's many works mentioned in the catalogue known as the *Fihrist,* only about half a dozen are extant. Of these the *Book of Distinction* has been edited by D. H. Miiller (1876); the *Book of the Wild Animals* by *R.* Géyer (1887); the *Book of the Horse,* by A. Haffner (1895); the *Book of the Sheep,* by A. Haffner (1896).

For life of Asma'i, *see* Ibn Khallikān, *Biographical Dictionary,* translated from the Arabic by M'G. de Slane (1842), vol. ii. pp. 123–127. For his work as a grammarian, *see* G. Flügel, *Die grammatischen Schulen der Araber* (1862).

ASMARA, the capital of the Italian colony of Eritrea, north-east Africa. It is built on the Hamasen plateau, near its eastern edge, at an elevation of 7,765ft. It is some 40m. W.S.W. in a direct line from the seaport of Massawa but 75m. by railway. (The line from Massawa, which had reached Ghinda, at the foot of the plateau, in 1904, was completed to Asmara in 1912.) Pop.

(1939) 85,000, of whom 50,000 were Italian. The natives are Abyssinian. The European quarter contains several fine public buildings. Fort Baldissera is built on a hill to the south-west of the town and is considered impregnable.

Asmara (Amharic, "good pasture place") is an old town. It was in the maritime province of northern Abyssinia, governed by the Bahar-nagash (ruler of the sea). By the Abyssinians the Hamasen plateau was known as the plain of the thousand villages, of which Asmara was one of the most prosperous, and it grew through being on the high road from Axum to Massawa. The Franco-German War (1870) killed a project of W. Munzinger French consul at Massawa, to annex the Hamasen to France (cf. A. B. Wylde, *Modern* Abyssinia, 1901). In 1872 Munzinger, now in Egyptian service, annexed Asmara to the khedivial dominions, but in 1884, owing to the rise of the Mahdi, Egypt evacuated her Abyssinian provinces and Asmara was chosen by Ras Alula, the representative of the negus Johannes (King John), as his headquarters. Shortly afterwards the Italians occupied Massawa, and in 1889 Asmara. In 1900 the seat of government was transferred from Massawa to Asmara, which is surrounded by rich lands, cultivated in part by Italian immigrants, and is a busy trading centre.

ASMODEUS or **ASHMEDAI,** an evil demon who appears in later Jewish tradition as "king of demons." He is sometimes identified with Beelzebub or Apollyon (Rev. ix. 11). In the Talmud he plays a great part in the legends concerning Solomon. In the apocryphal book of Tobit (iii. 8) occurs the well-known story of his love for Sara, the beautiful daughter of Raguel, whose seven husbands were slain in succession by him on their respective bridal nights. At last Tobias, by burning the heart and liver of a fish, drove off the demon, who fled to Egypt. From the part played by Asmodeus in this story, he has been often familiarly called the genius of matrimonial unhappiness or jealousy, and as such may be compared with Lilith. Le Sage makes him the principal character in his novel Le Diable boiteux. Both the word and the conception seem to have been derived originally from the Persian. The name has been taken to mean "covetous"; it is in any case no doubt identical with the demon Aēshma of the Zend-Avesta and the Pahlavi texts, but the meaning is not certain. It is generally agreed that the second part of the name Asmodeus is the same as the Zend *daēwa, dēw,* "demon." The first part may be equivalent to Aēshma, the impersonation of anger. But W. Baudissin (Herzog-Hauck, *Realencyklopädie*) prefers to derive it from *ish,* to drive, set in motion; whence *ish-mīn,* driving, impetuous.

See *Jewish Encyclopaedia* (*s.v.*). *See* also the articles in the *Encyclopaedia Biblica,* Hastings' *Dictionary of the Bible,* and Herzog-Hauck, *Realencyklopadie.*

ASMONEUS or **ASAMONAEUS** (so Josephus), great-grandfather of Mattathias, the father of Judas Maccabaeus. Nothing more is known of him, and the name is only given by Josephus (not in 1 Macc. ii. 1). But the dynasty was known to Josephus and the Mishna (once) as "the sons (race) of the Asamonaeans (of A.)"; and the Targum of 1 Sam. ii. 4 has "the house of the Hashmoneans who were weak, signs were wrought for them and strength." If not the founder, Asmoneus was probably the home of the family (cf. Heshmon, Jos. xv. 27).

See Schurer, *Geschichte des jüdischen Volkes,* i. 248 *N*; art. "Maccabees" §2 in *Ency. Biblica.* (J. H. A. H.)

ASNIÈRES, a town, department of Seine, France, on the left bank of the Seine, practically an extension of Paris and 1½m. N N.W. of its fortifications. Pop. (1936) 71,831, compared with 35,883 in 1906. It is a boating centre for Parisians. Industries include boat-building and the manufacture of perfumery, colours, etc.

ASOKA, a famous Buddhist emperor of India who reigned from 264 to 228 or 227 B.C. Thirty-five of his inscriptions on rocks or pillars or in caves still exist (see LUMBINĪ), and they are among the most remarkable and interesting of Buddhist monuments (see BUDDHA AND BUDDHISM). Asoka was the grandson of Chandragupta, the founder of the Maurya (Peacock) dynasty, who had wrested the Indian provinces of Alexander the Great from the hands of Seleucus, and he was the son of Bindusāra, who succeeded his father Chandragupta, by a lady from Champā. The Greeks do not mention him and the Brahman books ignore him, but the Buddhist chronicles and legends tell us much about Asoka.

The inscriptions, which contain altogether about 5,000 words, are entirely of religious import, and their references to worldly affairs are incidental. They begin in the 13th year of his reign, and tell us that in the 9th year he had invaded Kalinga, and had been so deeply impressed by the horrors involved in warfare that he had then given up the desire for conquest, and devoted himself to conquest by "religion." What the religion was is explained in the edicts. It is purely ethical, independent alike of theology and ritual, and is the code of morals as laid down in the Buddhist sacred books for laymen. He further tells us that in the 9th year of his reign he formally joined the Buddhist community as a layman, in the 11th year he became a member of the order, and in the 13th he "set out for the Great Wisdom" (the *Sambodhi*), which is the Buddhist technical term for entering upon the well-known, eightfold path to Nirvana.

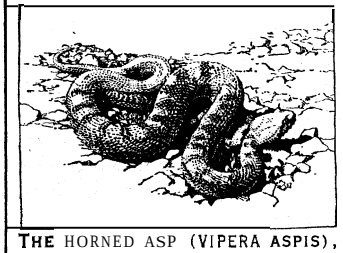
The extent of Asoka's dominion included all India from the 13th degree of latitude up to the Himalayas, Nepal, Kashmir, the Swat valley, Afghanistan as far as the Hindu Kush, Sind and Baluchistan. It was thus as large as, or perhaps somewhat larger than, British India before the conquest of Burma. He was undoubtedly the most powerful sovereign of his time and the most remarkable and imposing of the native rulers of India.

"If a man's fame," says Roppen, "can be measured by the number of hearts who revere his memory, by the number of lips who have mentioned, and still mention him with honour, Asoka is more famous than Charlemagne or Caesar." At the same time it is probable that, like Constantine's patronage of Christianity, his patronage of Buddhism, then the most rising and influential faith in India, was not unalloyed with political motives, and it is certain that his vast benefactions to the Buddhist cause were at least one of the factors that led to its decline.

See also Vincent Smith, *Asoka* (1901), revised edition (1920); E. Senart, *Inscriptions de Pzyadasi* (1891); chapters on Asoka in T. W. Rhys David's *Buddhism* (20th ed. 1903), and *Buddhist India* (1903); *V.* A. Smith, *Edicts of Asoka* (1909). (T. W. R. D.)

ASOLO (anc. Acelum), Venetia, Italy, province of Treviso, about 19m. N.W. direct from Treviso, some 10m. E. of Bassano by road and 10 mi. W N W. of Montebelluna by tram. Pop. (1936) town, 760; commune, 10,042. It is on a hill. 690 ft. above sea-leve! Remains of Roman baths and of a theatre have been discovered in the course of excavation. It became an episcopal see in the 6th century. Catherine Cornaro, queen of Cyprus, retired here on abdication and was visited by Pietro Bembo, who conceived here his *Dialoghi degli Asolani,* and by Andrea Navagero (Naugerius). Paulus Manutius was born here.

ASOR, an instrument "of ten strings" mentioned in the Bible, about which authors are not agreed. The word occurs only three times in the Bible, and has not been traced elsewhere.



THE HORNED ASP (VIPERA ASPIS), A POISONOUS SNAKE OF EUROPE CLOSELY ALLIED TO THE ADDER

ASP (Vipera *aspis*), a species of venomous snake, closely allied to the common adder of Great Britain, which it represents throughout the southern parts of Europe, being specially abundant in the region of the Alps. It differs from the adder in having the head entirely covered with scales, shields being absent, and in having the snout somewhat turned up. The term "Asp" as it is used in literature is applied to several species of poisonous snake, that by which Cleopatra is said to have ended her life is generally supposed to have been the cerastes, or horned viper (Cerastes *cornutus*), of northern Africa and Arabia, a snake about 15in. long, exceedingly venomous, and provided with curious horn-like protuberances over each eye. The snake, however, to which the word "asp" has been most commonly applied is the haje of Egypt, the spy-slange or spitting-snake of the Boers (Naja haje), one

of the very poisonous Elapidae, from 3 to 4 ft. long, with the skin of its neck loose, so as to render it dilatable at the will of the animal, as in the cobra of India, a species from which it differs only in the absence of the spectacle-like mark on the back of the neck. Like the cobra, the haje has its fangs extracted by jugglers, who afterwards train it to perform various tricks.

ASPARAGINE, a naturally occurring base found in plants belonging to the families Leguminosae and Cruciferae, and noticeably in asparagus. It has the structure

$$CO_2H.CH[NH_2].CH_2.CO.NH_2,$$

and belongs to the important group of amino-acids, being both an acid, by virtue of the carboxyl (CO_2H) group, and a base, by virtue of the two amino (NH_2) groups. Owing to the presence of an "asymmetric carbonation" (C above), it should exist in two optically active forms and one inactive form (see STEREOCHEMISTRY).

A. Piutti (1887) synthesized the asparagines from the monomethyl ester of inactive aspartic acid by heating it with alcoholic ammonia. In this way both asparagines were obtained and were separated by picking out the hemihedral crystals. Laevo asparagine, which was isolated by L. N. Vauquelin in 1805, is slightly soluble in cold water and readily soluble in hot water and crystallizes in prisms, containing one molecule of water of crystallization, the anhydrous form melting at 234–235° C. Nitrous acid converts it into malic acid, $HOOC.CHOH.CH_2.COOH$. It is laevo-rotatory in aqueous or in alkaline solution, and dextro-rotatory in acid solution (L. Pasteur, 1851). Dextro-asparagine was first found in 1886 in the shoots of the vetch (Piutti). It forms rhombic crystals possessing a sweet taste. It is dextro-rotatory in aqueous or alkaline solution, and laevo-rotatory in acid solution.

Hydrolysis by means of acids or alkalis converts the asparagines into aspartic acid; while on heating with water in a sealed tube they are converted into ammonium aspartate.

ASPARAGUS, a genus of the lily family (Liliaceue), comprising upwards of 120 species, widely distributed in the temperate and warmer parts of the old world. They are erect or climbing, extensively branching and sometimes more or less woody plants, rising from cord-like, thickened or tuberous rootstocks (Rhizomes). The leaves are reduced to minute scales bearing in their axils tufts of green, needle-like or flattened branches (cladodes or *cladophyls*), which perform the function of leaves. Some species climb or scramble, in which they are aided by the development of the scale-leaves into spines. Asparagus is dioecious; the flowers are small, whitish and pendulous; the fruit is a berry. Several climbing species are grown as house plants and in greenhouses for their ornamental foliage. The so-called asparagus-fern (A. *plumosus*), native to South Africa, with numerous horticultural varieties, is an especially elegant species, highly prized for its delicate, feathery branches. The vine-like smilax of the florists (A. asparagoides), with stiffish, shining, many-veined "leaves" (*cladodes*), is likewise a native of South Africa.

Garden Asparagus.—Economically the most valuable species is the common perennial vegetable (A. *officinalis*). The plant is a native of the north temperate zone of the old world, grows wild on coasts and sandy areas in the south of England and on the steppes of Russia. It has escaped from cultivation and become extensively naturalized in North America, especially around salt marshes from New Brunswick to Virginia, sparingly along roadsides and in fields in the interior, and also on the Pacific coast. Since Greek and Roman times the young shoots have been in high repute as a culinary vegetable.

In the United States about 125,000 ac. of asparagus were grown annually in 15 states that had an average commercial production from 1930 to 1939 of about 120,000 tons. In 1941 about 100,000 tons were grown for market and 39,000 tons for canning and freezing. It is also grown in home gardens. Asparagus will not thrive long in regions of hot summers and very mild winters where freezing rarely occurs. However, in a favorable climate, well-prepared and properly managed plantings on good soil may remain productive 12 to 15 years or more. Asparagus does best on a loose, medium to light, deep, rich sandy loam soil or a muck soil. In growing the crop, seeds are sown in early spring about 3 in. apart in rows about 3 ft. apart. The plants grow for one season in these nursery rows, then the year-old roots or "crowns" are dug for transplanting into the permanent fields about 2 ft. apart in rows 4 to 5 ft. apart. The soil should be well manured and fertilized before planting and annually thereafter. The roots may be transplanted in the fall where the winters are not severe, or in the spring. In transplanting, the crowns are placed in a furrow 6 to 8 in. wide and 8 in. deep in soil that has been thoroughly worked to the depth of a foot or more. The roots are well spread out and the crowns covered about 4 in. deep. As the tops grow, the remaining soil is filled into the furrow. If it is desired to harvest green asparagus shoots the field is cultivated nearly flat, with no more soil over the crowns than is needed to protect them from the cultivating tools. For producing white or blanched shoots the soil is ridged up deeply over the rows each spring before harvest begins so that the developing shoot reaches a length of about 10 inches before it emerges. The ridges are worked down after the cutting season. Asparagus should be harvested daily during the cutting season of usually 8 to 10 weeks in the spring.

ASPARAGUS-PEA, the name of a group of cultivated leguminous plants mostly derived from *Psophocarpus tetragonolobus*, native to India. All varieties are rapidly-growing vines, 10 ft. to 50 ft. long, producing quadrangular, green-winged pods, 3 in. to 9 in. long. The tender young pods are eaten like string beans and have a distinct flavour resembling that of asparagus. The seeds, which are about the size of peas, are very rich in proteins. Because of their extreme hardness when ripe, they are difficult to cook, hence usually only the immature seeds are eaten. The plant is a quasi-perennial, bearing almost continuously for one or two years. Its cultivation is increasing in most tropical countries and it is also grown as a cover-crop.

ASPASIA, born at Miletus, was the most famous of the Ionian courtesans who settled at Athens. She became Pericles' mistress, for by his own law of 451 she could not, as a foreigner, be his legal wife, and her charm and talents seem to have won her an important place in the intellectual society of the time. The comic poets represent her as the political adviser of Pericles, and as the cause of the Samian and Peloponnesian wars (Plutarch, and Aristoph. Ack. 497), but this is probably mere caricature. Shortly before the Peloponnesian war she was accused of impiety, and only the tears and entreaties of Pericles secured her acquittal (see Cambridge Ancient History, vol. v., note 8). After the death of his two legitimate sons, he procured the passing of an enactment legitimizing his son by Aspasia.

See Plutarch, *Pericles;* Plato, Menexenus; Xenophon, *Oecon.* 52, 14; Natorp, Philologus, 51, p. 489 (attempted reconstruction of the dialogue *"Aspasia"* by Aeschines the Socratic); Le Conte de Bièvre, Les Deux *Aspasies* (1736); J. B. Capefigue, Aspasie et *le Siècle* de *Périclès* (1862); L. Bec de Fouquières, Aspasie de *Milet* (1872); H. Houssaye, Aspasie, *Cléopâtre, Théodora* (1899); E. Meyer, Forschungen, vol. ii, pp. 55–56, in opposition to Wilamowitz-Mollendorf, in Hermes, xxxv. (1900); A. E. Zimmern, Greek *Commonwealth,* part iii., chap. 12, pp. 334–342. See also PERICLES.

ASPASIUS, a Greek peripatetic philosopher, and a prolific commentator on Aristotle. He flourished probably towards the close of the 1st century A.D., or perhaps during the reign of Antoninus Pius. Commentaries on books 1–4, 7 (in part), and 8 of the *Nicomachean* Ethics are preserved; that on book 8 was printed with those of Eustratius and others by Aldus Manutius at Venice in 1536. They were partly (2–4) translated into Latin by Felicianus in 1541, and have frequently been republished, but their authenticity has been disputed. The most recent edition is by G. Heylbut in *Commentaria* in *Aristotelem* Graeca, xix. i. (1889).

Another ASPASIUS, in the 3rd century A.D., was a Roman sophist and rhetorician, son or pupil of the rhetorician Demetrianus. He was secretary to the Emperor Maximin.

ASPECT RATIO, of an aeroplane wing, the ratio of the span to the chord, the latter being the length of the straight line drawn from the leading to the trailing edge, at right angles to the length of the wing. (See AEROPLANE.)

ASPEN, a section of the poplar genus (*Populus*) of which the common aspen of Europe, P. *tremula,* may be taken as the type. This is a tall, fast-growing tree with a slender trunk, and gray bark that becomes rugged when old. The roundish leaves, toothed on the margin, are slightly downy when young, but afterwards smooth, dark green on the upper and grayish green below; the long slender petioles, flattened towards the outer end, allow of free lateral motion by the lightest breeze, giving the foliage its well-known tremulous character. By their friction on each other the leaves give rise to a rustling sound. The flowers, which appear in March and April, are borne on pendulous hairy catkins, 2 or 3 in. long; male and female catkins are, as in the

other species of the genus, borne on separate trees (dioecious).

The aspen is found in moist places, sometimes at more than 1,600 ft. above sea-level in Scotland. It is an abundant tree in northern Britain, and is found occasionally in the coppices of the southern counties; it abounds in the forests of northern Europe, while in Siberia its range extends to the Arctic circle.

The wood is light and soft, though tough; it is employed for pails, herring-casks, butchers' trays, pack-saddles, and various articles for which its lightness recommends it; in mediaeval days it was valued for arrows; the bark is used for tanning; cattle and deer browse on the young shoots and suckers. Charcoal prepared from it is light and friable, and has been employed in gunpowder manufacture. The powdered bark is given to horses as a vermifuge; it possesses tonic and febrifugal properties, containing salicin. The aspen is propagated by cuttings or suckers.

The American aspen (P. *tremuloides*). called trembling aspen, closely allied to the European species, is the most widely distributed tree in North America. It ranges from Labrador to the mouth of the Mackenzie river and the valley of the Yukon and southward to Pennsylvania, Missouri and Nebraska, and in the Rocky mountains and the Sierra Nevada to Chihuahua and Lower California, often ascending to 10,000 ft. altitude. It attains a maximum height of 100 ft. and a trunk diameter of 3 ft., but is usually much smaller. The bigtooth aspen (P. *grandidentata*), has ovate or roundish leaves deeply and irregularly serrated on the margin. The wood of both these species is manufactured into wood-pulp. (E. S. HR.)

ASPENDUS, an ancient city of Asia Minor, mod. *Balkis Kale',* or, more anciently in the native language, *Estvedys* (whence the adjective *Estvedijys* on coins), very strongly situated on an isolated hill on the right bank of the Eurymedon at the point where the river issues from the Taurus. The sea is now about 7m. distant, and the river is navigable only for about 2m. from the mouth; but in the time of Thucydides ships could anchor off Aspendus. Really of pre-Hellenic date, the place claimed to be an Argive colony. It derived wealth from great *salines* and from a trade in oil and wool, to which the wide range of its admirable coinage bears witness from the jth century B.C. onwards. There Alcibiades met the satrap Tissaphernes in 411 B.C., and thence succeeded in getting the Phoenician fleet, intended to co-operate with Sparta, sent back home. The Athenian, Thrasybulus, after obtaining contributions from Aspendus in 389, was murdered by the inhabitants. The city bought off Alexander in 333, but, not keeping faith, was forcibly occupied by the conqueror. In due course it passed from Pergamene to Roman dominion, and, according to Cicero, was plundered of many artistic treasures by Verres. It was ranked by Philostratus the third city of Pamphylia, and in Byzantine times seems to have been known as Primopolis, under which name its bishop signed at Ephesus in A.D. 431. In mediaeval times it was evidently still a strong place but is now a wretched hamlet.

With the Roman theatre, the finest in the world, the ruins have earned for the place a connection with Solomon's Sheban queen. On the summit of the hillock, surrounded by a wall with three gates, lie the remains of the city. The public buildings round the forum can all be traced, and parts of them are standing to a considerable height. They consist of a fine nympheum on the north with a covered theatre behind it, covered market halls on the west, and a peristyle hall and a basilica on the east. In the plain below are large thermae, and ruins of a splendid aqueduct. But all else seems insignificant beside the huge theatre, half hollowed out of the north-east flank of the hill. This was completely planned and described by Count Lanckoronski's expedition in 1884. It is built of local conglomerate and is in marvellous preservation. Erected to the honour of the emperors Marcus Aurelius and L. Verus by the architect Zeno for the heirs of a local Roman citizen (as an inscription repeated over both portals attests), its auditorium has a circuit of 313ft. There are 40 tiers of seating, divided by one *diazoma,* and crowned by an arched gallery of rather later date, repaired in places with brick. This auditorium held 7.500 spectators. The seats are not perfect, but so nearly so as to appear practically intact. The wooden stage has, of course, perished, but all its supporting structures are in place, and the great scena wall stands to its full height and produces a magnificent impression whether from within or from without. Inwardly it was decorated with two orders of columns, one above the other, with rich entablatures, much of which survive. In the *tympanum* is a relief of Bacchus (wrongly supposed to be of a female, and called the Bal-Kys, *i.e.* "Honey Girl"). The position of the sounding board above the stage is apparent. Under the forepart of the auditorium, built out from the hill, are immense vaults. The whole structure was enclosed within one great wall, pierced with numerous windows. This structure was probably put to some ecclesiastical Byzantine use, as certain mutilated heads of saints appear upon it; and later it became a fortress.

ASPER, AEMILIUS, Latin grammarian, possibly lived in the 2nd century A.D. He wrote commentaries on Terence, Sallust and Virgil.

Editions in Keil, *Probi in Vergilii Bucolica Commentarius (1848);* *see* also Suringar, *Historia Critica Scholiastarum Latinorum (1834);* Grafenhan, *Geschichte der klassischen Philologie im Alterthum,* iv. (1843–50).

ASPERGES, the ceremony of sprinkling the people with holy water before High Mass in the Roman Catholic Church, so called from the opening words *Asperges me, Domine, hyssopo* (Ps. li. 7). The brush for sprinkling is an *aspergillum,* and a vessel for holy water an *aspersorium.*

ASPERN-ESSLING, BATTLE OF (1809), was fought on May 21 and 22, 1809, between the French and their allies under Napoleon and the Austrians commanded by the Archduke Charles (*see* NAPOLEONIC CAMPAIGNS). When Austria, with her army reorganized, reopened hostilities in 1809, the swift opening move of Napoleon split her army asunder and enabled him to push down the south bank of the Danube and occupy Vienna, left exposed by the Austrian retreat across the river. Napoleon then aimed to complete the overthrow of the Austrian forces, but the bridges over the Danube had been broken, and the archduke's army had reassembled on and about the Bisamberg.[1] The first task of the French was the crossing of the Danube. Lobau, one of the numerous islands which divide the river into minor channels, was selected as the point of crossing, but rough weather caused 24 hours' delay in the bridging of the channels from the right bank to Lobau and it was not until midday on May 20 that the troops, other than the advanced detachments, crossed to the island. By the evening of the 20th a large force had been collected there and the last arm of the Danube, between Lobau and the left bank, bridged. Masséna's corps at once began to cross to the left bank and dislodged the Austrian outposts. Undeterred by the news of heavy attacks on his rear from Tirol and from Bohemia, Napoleon hurried all available troops to the bridges, and by midday on the 21st 25,000 men were collected on the edge of the Marchfeld, the broad open plain of the left bank, which was also to be the scene of the battle of Wagram. The archduke did not seriously resist the passage; it was his original intention to await developments, but a misleading, if happily misleading, report led him to seize the opportunity for a blow before the bulk of the French army had crossed. Napoleon seems to have taken the risk too lightly, both underestimating his opponents and the need for preparatory measures, but he sought to minimize it by concentrating close to the river before pushing forward—and thus also to avoid attention. His forces on the Marchfeld were drawn up in front of the bridges facing north, with their left in the village of Aspern (Gross-Aspern) and their right in Essling (or Esslingen). Both places lay close to the Danube and could not therefore be turned. But the French had to fill the gap between the villages, and also to move forward to give room for the main body to form up. Whilst they were thus engaged the archduke moved to the attack with his whole army of 98,000 men in five columns. Three under Hiller, Bellegarde and Hohenzollern were to converge upon Aspern, the other two, under Rosenberg, to attack Essling. The Austrian cavalry was in the centre, ready to move out against any French cavalry which should attack the heads of the columns During the 21st the bridges became more and more unsafe, owing

[1] *See* sketch map in the article WAGRAM.

to the violence of the current, and the passage of the French reinforcements was frequently delayed.

The battle began at Aspern; Hiller carried the village at the first rush about 4 P M, but Masséna recaptured it, and held his ground with the same tenacity he had shown at Genoa in 1800. The French infantry, indeed, fought on this day with the old stubborn bravery which it had failed to show in the earlier battles of the year. The three Austrian columns, hindering each other by their convergence on a single point, were unable to do more than drive the French out to the far edge of the village before night fell. In the meanwhile nearly all the French infantry posted between the two villages and in front of the bridges had been drawn into the fight on either flank. Napoleon therefore, to create a diversion, sent forward his centre, now consisting only of cavalry, to charge the enemy's artillery, which was deployed in a long line and firing into Aspern. The first charge of the French was repulsed, but the second attempt, made by heavy masses of cuirassiers overrode the guns, but failed to break Hohenzollern's infantry squares, and in the end retired to their old position. Even so, they effectively discouraged any further attack on the French centre In the meanwhile Essling had been the scene of fighting almost as desperate as that of Aspern. The French cuirassiers made repeated charges on the flank of Rosenberg's force, and for long delayed the assault, and in the village Lannes with a single division made a heroic and successful resistance, till night ended the battle. The two armies bivouacked on their ground, and in Aspern the French and Austrians lay within pistol shot of each other.

All through the night more and more French troops were put across, and at the earliest dawn of the zznd the battle was resumed. Masséna by degrees cleared Aspern of Austrians, but at the same time Rosenberg stormed Essling at last Lannes, however, resisted desperately, and reinforced by St Hilaire's division, drove Rosenberg out. By 7 AM. Napoleon had 77,000 troops across and he launched a great attack on the Austrian centre Beginning with Lannes on the right, the whole French centre, with the cavalry in reserve, moved forward. The Austrian line mas broken through, between Rosenberg's right and Hohenzollern's left, and the French squadrons poured into the gap. Victory seemed within reach when the archduke brought up his last reserve, himself leading on his soldiers with a colour in his hand. Lannes was checked, and with his repulse the impetus of the attack died out all along the line. Meantime Aspern had been lost to a counter-attack by Hiller and Bellegarde, and graver news reached Napoleon at the critical moment. The Danube bridges had at last been cut by heavy barges, which had been set adrift down stream for the purpose by the Austrians. Napoleon thereupon (11 A M) suspended the attack and decided to retire to Lobau. About 3 P M. Essling fell to another assault of Rosenberg, and though again the French, this time part of the Guard, drove him out, the Austrian general then directed his efforts on the flank of the French centre, slowly retiring on the bridges. The retirement was costly, and the French must have been driven into the Danube but for the steadiness of Lannes, the exhaustion of the assailants, and the archduke's inexplicable action in drawing back part of his force about 4 P M. Although he turned them about again on hearing that the French were retiring across to Lobau, he did not seek a renewal of the struggle. The French lost 20,000 and amongst the killed were Lannes and St. Hilaire. The Austrians lost 23 360. Even this, the first serious defeat of Napoleon did not shake his resolution. The beaten forces were at last withdrawn safely into the island. On the night of the 22nd the great bridge was repaired, and the army awaited the arrival of reinforcements, not in Vienna, but in Lobau But it had been a narrow escape from disaster, and its special historical significance is an illustration of the over-confidence which was fastening more and more strongly on Napoleon's mind. (B. H. L. H.)

ASPHALT. According to the standard definition of the American society for testing materials, asphalts are "black to dark brown solid or semi-solid cementitious materials which gradually liquefy uhen heated, in which the predominating constituents are bitumens all of which occur in the solid or semi-solid form in nature or are obtained by refining petroleum, or which are combinations of the bitumens mentioned with each other or with petroleum derivatives thereof " In more popular terms asphalt may be defined as a semi-solid sticky residue formed by the partial evaporation or distillation of certain petroleums. This is as true of native asphalts as of those obtained by refining petroleum

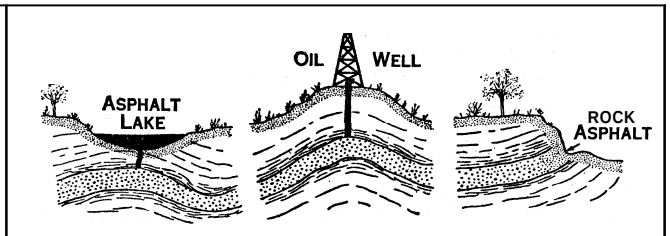


DIAGRAM SHOWING HOW ASPHALT IS FOUND IN NATURE

The solid or semi-solid native bitumens were termed ἄσφαλτος by the Greeks Only native asphalts were known, but late in the 19th century it was found that asphalt was a constituent of certain petroleums and could be recovered by distilling off the volatile oils which held it in solution In 1928 over 80% of the world's supply of asphalt was produced at petroleum refineries

Sandstones and limestones naturally impregnated with asphalt —commonly known as rock asphalt or bituminous rock—are found in various parts of the world, the most widely known deposits being at Val de Travers in Switzerland; Seyssel in France and Mons in Belgium; San Valentino and Cesi in Italy; Ragusa in Sicily; Limmer, Lobsann and Vorwohle in Alsace; and in Texas, Oklahoma, Alabama and Kentucky in the United States. The largest and best known deposit of relatively pure asphalt occurs as an asphalt or pitch lake on the Island of Trinidad, British West Indies, and covers an area of about roo acres. A sample of crude contains approximately 39% of pure asphalt or bitumen, the balance being gas, water, light oils and organic and mineral matter. The surface of the lake forms a crust which may be removed by means of picks. The plastic material from beneath flows into the excavations and rapidly hardens into a new crust. A more extensive but shallower deposit is found at Bermudez lake in Venezuela. This asphalt is softer than that found at Trinidad and contains less mineral matter. An exceptionally pure asphalt of very brittle nature known as Gilsonite, is obtained in Colorado and Utah. Other varieties are known as manjak, glance pitch, wurtzelite, etc.

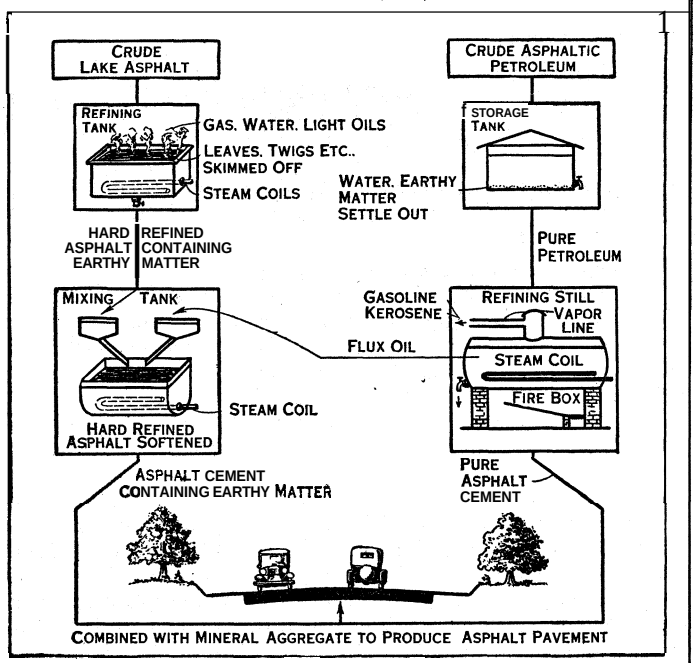
Practically all native asphalt is too hard for direct use and must be heated until water, gas and other volatile materials are driven off and then fluxed or softened to the desired consistency by mixing with it the proper amount of residual petroleum. On the other hand asphalt recovered directly from petroleum (*q.v.*) by distillation does not require fluxing, as the process is stopped when the product reaches the desired consistency. When a high melting-point is desired, the asphalt is heated to fluidity and air is blown through it, producing what is known as "blown" or oxidized asphalt.

Asphalt Cements.—The hardness of asphalt is determined by measuring the distance that a standard needle, under a load of 100g. applied for five seconds, will penetrate the asphalt at 77°. This "penetration" test classifies asphalts into grades, and when a consistency suitable for some commercial use is reached, the products are known as "asphalt cements." These are used primarily as nater and weather resisting binders Their value for these purposes was utilized in ancient times for preserving mummies and in some cases for coating and binding masonry.

Asphalt is extensively used in paving, roofing and water-proofing Over 75% of the total production is employed in the construction of highways in which it is used to bind together the stone, sand and mineral dust which constitute the bulk of the wearing surface Approximately 140,000,000sq yd. of asphalt pavements are constructed annually in the United States alone. Relatively fluid asphalt products known as "cut-backs" and "road oils," are used for the surface treatment of macadam and gravel roads.

Asphalt is also employed in the manufacture of mats for underwater revetment, wall boards, flooring, floor coverings, sheathing, moisture-proof wrapping paper, paints, varnishes, enamels, japans, acid-proof coatings. pipe dips, sealing compounds, insulating products, emulsions and moulding composition. The roofing industry consumes about 15% of the total production in the manufacture of asphalt-impregnated roofing and shingles.

The total annual production and importation of asphalt into the United States amounts to over 6,000,000 tons of which some



HOW LAKE AND PETROLEUM ASPHALTS ARE REFINED

5,500,000 tons are recovered directly from domestic petroleum and petroleum imported to the American refineries from South American countries.

(See BITUMEN)

BIBLIOGRAPHY.—*See* Forbes, *Bitumen* and *Petroleum in* Antiquity; Abraham, Asphalts and *Allied Substances;* Richardson, Asphalt Construction for *Pavements and* Highways; Hubbard, Laboratory *Manual* of *Bituminous* Materials; O. G. Strieter, The Mechanism of Asphalt *Formation* (192j). (P. HU.)

ASPHODEL, a much misunderstood term. The asphodel of the poets is often a narcissus; of the ancients it is either of the genus *Asphodeline* or belongs to Asphodelus, a genus of the lily family (Liliaceae), containing seven species in the Mediterranean region. These are hardy herbaceous perennials with narrow tufted radical leaves and an elongated stem bearing a handsome spike of white or yellow flowers. *Asphodelus albus* and A. *fistulosus* have white flowers and grow from 1½ to 2 ft. high; A. *ramosus* is a larger plant, the large white floners of which have a reddish-brown line in the middle of each segment. Bog-asphodel (*Narthecium ossifragum*), a member of the same family, is a small herb in boggy places in Britain, with rigid narrow radical leaves and a stem bearing a raceme of small golden yellow flowers. In the United States, the American bog-asphodel (N. americatzum) of the pine-barrens of New Jersey and Delaware, and the western bog-asphodel (N. *californicum*), of the coast ranges of California and Oregon, are both rare plants.

In Greek legend the asphodel is the most famous of the plants connected with the dead and the underworld. Homer describes it as covering the great meadow (ἀσφόδελος λειμών), the haunt of the dead (*Od.*xi 539,573; xxiv.13). It was planted on graves, and is often connected with Persephone, who appears crowned with a garland of asphodels. Its general connection with death is due no doubt to the greyish colour of its leaves and its yellowish flowers, which suggest the gloom of the underworld and the pallor of death. The roots were eaten by the poorer Greeks; hence such food was thought good enough for the shades (*cf.* Hesiod, Works and Days, 41; Pliny, *Nat. Hist* xxi. 17 [68]; Lucian, De *luctu,* 19). The asphodel was also supposed to be a remedy for poisonous snakebites and a specific against sorcery; it was fatal to mice, but preserved pigs from disease.

See Pauly-Wissowa, Realencyklopadie, *s.v.;* H. O. **Lenz,** Botanik *der alten* Griechen und *Römer* (1859); J. Murr, **Die** *Pflanzenwelt* in *der griechischen* Mythologie (1890).

ASPHYXIA, a term in medicine signifying arrest of respiration from some hindrance to the entrance of air into the lungs. (*See* RESPIRATORY SYSTEM, DISEASES OF.)

ASPIC, a poisonous African snake popularly supposed to give a quick and easy death. "The worm's an odd worm," said the clown to Cleopatra, "those that do die of it do rarely recover," and the aspic was welcomed by the queen as the means of swift dispatch. The French have a proverb *froid* comme *un* aspic, and it is to be supposed that French cooks, when they invented as a dainty savoury a bit of meat, game or fish imbedded in calf's-foot jelly, called it an aspic because it was cold to the touch like a snake. Aspic is also the botanical name of the Lavandula spica, or spikenard, from which a white aromatic and highly inflammable oil is distilled, called *huile d'aspic.*

ASPIDISTRA, a small genus of the lily family (Liliaceae), native of the Himalayas, China and Japan. Aspidistra *elatior* is a favourite pot-plant, bearing large green, or white-striped leaves (var. variegata) on an underground stem, and small dark purplish, cup-shaped flowers close to the ground. It is very resistant to unfavourable conditions and will live in the low light intensity of an ordinary dwelling room.

ASPIRIN is the trade-name of acetyl salicylic acid. Its dose is 0·3 to 1·0g. (5 to 15 grains). Like other salicylates it is of great use in acute rheumatic fever, in which it seems to have almost a specific action, as it causes the temperature to drop and the pain and swelling of the joints to decrease. Recent studies seem to point to a beneficial action on the heart itself in this disease. Aspirin also relieves headaches and neuralgia but does not cure the cause of these pains. It is much safer to use than the so-called antipyretics. The symptoms of an overdose are ringing in the ears, some dimness of vision at times, nausea and vomiting. With the lowering of temperature in fever there may be great sweating. Exposure to cold after its administration is therefore unwise.

ASPROMONTE, mountain, Calabria, Italy, behind Reggio di Calabria, the western extremity of the Sila range. It is 6,420ft. high and has forest-clad slopes. Here Garibaldi was wounded and taken by Italian troops under Pallavicini (1862).

ASQUITH, HERBERT HENRY: see OXFORD AND ASQUITH. HERBERT HENRY ASQUITH, 1ST EARL OF.

ASS, a common name for varieties of the subgenus *Asinus,* belonging to the horse tribe, and especially for the domestic ass; it differs from the horse in its smaller size, long ears, the character of its tail, fur and markings, and its proverbial dullness and obstinacy. The fifth proposition of Book i. of Euclid is known as the Pons *Asinorum,* "bridge of asses."

ASS, FEAST OF THE, a festival formerly held on Jan. 14 in Northern France, in commemoration of the biblical flight into Egypt. A girl with a baby at her breast and seated on an ass splendidly caparisoned was led through the town to the church where mass was said. The ceremony degenerated into a burlesque in which the ass of the flight became confused with Balaam's ass. So scandalous became the popular revels associated with it, that the celebration was prohibited by the church in the 11th century. (*See* FOOLS, FEAST OF.)

ASSAB, a bay and port on the African shore of the Red sea, 60m. N. of the strait of Bab-el-Mandeb. Assab bay was the first territory acquired by Italy in Africa. Bought from the sultan of Raheita in 1870, it was not occupied until 1880. (See ERITREA: History.)

ASSAI (Ital.), though meaning originally "enough" (cf. Fr. assez) has acquired also the secondary meaning of "very," in which sense alone it is employed in musical terminology, as in Presto *assai,* meaning "very fast."

ASSAM, a province of British India. Area (including the State of Manipur) 67,334 sq.mi. Pop. (1941) 10,204,733.

The Brahmaputra emerges from Himalayan gorges into a valley, 50m. wide, with steep mountain sides, and flows west and west-south-west till it turns south around the bastion of the Garo Hills. This broad valley is the main region of Assam but the province also includes the hills that bound this valley on the south. They are named from their peoples — the Garo, Khasi, Jaintia and North Cachar hills and the highest point in them is Shillong peak (6,450 ft.). South of these hills are the districts of Sylhet and South Cachar, essentially the Surma valley, flat below the very abrupt slope of the Khasi and Jaintia hills. To the east and south-east, Assam is bordered by hill ranges which make a barrier between it and Burma; these are a part of the mountain curve that stretches down the west side of Burma. The hills of the Assam-Burma border are named from their peoples the Naga hills and rise to nearly 10,000 feet at Japro peak. Within the general limits of the province are petty feudatory states in the Khasi hills, while south of the Naga hills and east of Cachar lies the feudatory state of Manipur (area 8,620sq.m.; pop. [1931] 445,606).

BY COURTESY OF THE NORTHERN BAPTIST CONVENTION

THE BATTLE ARRAY OF A WARRIOR OF THE NAGAS, THE LARGEST HILL TRIBE IN ASSAM

Rivers. — The Brahmaputra may be said to be formed by the union of a number of streams at the head of the valley of Assam. The Dihang, called Tsang-po in Tibet, has its source far to the west on the north side of the Himalaya and flows parallel to that range for hundreds of miles until it breaks through Himalayan gorges in a series of waterfalls and rapids and emerges into the Assam valley. The Sesiri, Dibang and Luhit rivers from the north-east unite with it to form the Brahmaputra which receives further tributaries from the Himalayas on the north and from the other hills named on the south-east. The former include the Subansiri, Bhareli, North Dhansiri, Barnadi, Manas and Sankosh rivers, mostly glacier-fed. Among the latter are the two Dihings (Noa and Buri), the Disang, Dhansiri and Kalang, streams which dwindle as the dry season progresses. The valleys of the Dhansiri and Kalang isolate the Mikir and Rengma hills from the southern hill framework. The Brahmaputra becomes a sheet of water several miles broad in the rainy season.

Soils and Geology. — Geographically the Assam hills (Garo, Khasi and Jaintia, North Cachar, etc., hills), lie in the angle between the Himalayas and the Burmese ranges, but geologically they belong to neither. The greater part of the mass consists of gneiss and schists overlain unconformably by cretaceous beds, consisting chiefly of sandstones with seams of coal, the whole series thinning out northwards as though towards a shore line; they are covered by tertiary rocks, including nummulitic beds and valuable seams of coal. These rocks show neither Himalayan nor Burmese folding but, while nearly horizontal towards the north, they are bent sharply downwards to the south in a simple monoclinal fold. The hill sides are generally forested. A good deal of the valley is raised well above flood-level and is rich agricultural land, partly under rice, partly in tea and other plantations. The alluvial deposits of the Brahmaputra and its tributaries show much variation of fertility and elevation; there are vast *chars* of pure sand inundated every year but easily and rapidly transformed into pastures in many places, and there are also terraces and islands of firm soil raised well above the floods. Many of the wetter lands are occupied by great reeds and grasses. The Himalayan and Burmese mountain frame includes great masses of tertiary rocks, with coal seams in the Burmese ranges.

Climate. — In January the high pressure over the land gives rise to frequent winds down the valley of the Brahmaputra, though there may be some rain and fogs are common; the temperature at this season averages 61° F. But the wind from the sea soon begins to penetrate along this corridor and Assam thus contrasts strongly with many parts of North India which have a dry hot season whilst the rains have been watering Assam from early March onwards, merging finally into the great monsoonal rainfall. The Khasi hills are said to have the heaviest rainfall in the world, with an average of 424 inches at Cherrapunji overlooking the low-lying land of the Surma, which, in monsoon time, becoines a lake of almost warm water. Sylhet on the southern lowland has an annual rainfall of 159 inches, and Gauhati on the floor of the Brahmaputra valley, that is north of the hills, only 67in. The heavy and long continued rains keep the temperature relatively moderate, the mean temperature of the warm season not reaching above 84° F.

Earthquakes. — Assam is liable to earthquakes. By far the severest shock known is that of 1897, the focus of which was in the Khasi and Garo hills. In the station of Shillong every masonry building was levelled to the ground. Throughout the country bridges were shattered, roads were broken up like ploughed fields and the beds of rivers were dislocated. In the hills there were terrible landslips which wrecked the little Cherrapunji railway and caused 600 deaths. The total mortality recorded was 1,542. In 1918 another severe earthquake, which had its centre in the Balisera hills in Sylhet, caused considerable damage to property but very little loss of life.

Fauna.—Wild elephants are numerous on the lower slopes of the Assam range and in the Brahmaputra valley. The Government *keddah* establishment captures large numbers, and the right of hunting is also sold by auction to private bidders. The rhinoceros is found in swampy places along the Brahmaputra. Tigers, leopards and bears are numerous. Another formidable animal is the wild buffalo or *gaur* which is of great size, strength and fierceness. Wild game is plentiful; pheasants, partridges, snipe and waterfowl of many descriptions make the country a tempting field for the sportsman.

Forests. — An area of 6,645 square miles is occupied by Government reserved forests. The most valuable are those bearing *Sal (Shorea robusta)* in the districts of Goalpara, Kamrup and the Garo hills.

Agriculture. — The principal and almost the only food-grain grown is rice. In 1936 there were 4.8 million acres under rice, amounting to 72% of the total cultivated area. Mustard and jute are grown in important quantities, and cotton and tobacco are cultivated on the lower slopes. The production of fruit and vegetables has increased and, in addition to meeting local needs, a considerable proportion is now exported to Bengal; potatoes being raised in the Khasi hills, which are also the centre of orange cultivation supplying most of Bengal and Assam.

Tea Plantations. — The most important article of commerce produced in Assam is tea, and tea growing has been the basic factor in the development of the province. At the end of 1936 there were 1,103 tea gardens, covering 439,000 acres, and over half a million persons were employed. The production of rice is sufficient for local consumption only, and so additional quantities have to be imported in order to feed workers in the tea-gardens. The tea plantations are the great source of wealth to the province, and the necessities of tea cultivation are the chief stimulants to the development of Assam.

The gardens, which are mainly European-owned, are situated in the Brahmaputra and Surma valleys. The Assamese themselves are too prosperous to work in the tea gardens, and coolie labour is therefore brought in from outside, the number averaging 15,000 per annum. Elaborate legislation has been designed to protect the labourer and, at the same time, to ensure fulfilment of contract. The first of these enactments dates back to 1863, but the now general *sardari* system, by which selected men or women are sent to their native districts to induce relations, friends, etc., to emigrate, came into operation in 1915, in which year an act was passed abolishing recruitment by contractors.

Industries. — Difficulties of transport and lack of capital have impeded development of the natural resources. Apart from the manufacture of tea, the industries are not of great importance. Coal mining is carried on at Makum and Nazira, but the output has tended to decline (annual average 1931–36, 250,000 tons). The production of petroleum has greatly increased within recent years,

the principal wells being at Lakhimpur (1936, 55 million gal.). The limestone and iron-ore of the Khasi hills formerly provided the materials for important metallurgical industries, but the lime trade has declined, and iron smelting has disappeared. The manufacture of tea chests from the timber of the forests is a minor industry.

Trade. — The greater proportion of the external trade of Assam is still mainly carried by its water ays, although railway traffic is steadily increasing year by year. Calcutta handles about 70% of the total trade, since it is the focus of both rail and water communications. The Eastern Bengal State railway runs from Dhubri north of the Brahmaputra to Gauhati, whence it follows the Kalang valley eastwards to Lumding. Here it meets the Assam-Bengal railway which has come north from Chittagong via Karimganj and across the hills. From Lumding the railway goes along the Dhansiri valley to the towns of north-east Assam. The Assam-Bengal railway has branches to Sylhet and Silchar. All these lines are of metre gauge.

Inhabitants. — The total population of Assam, according to the census of 1931, was 9,247,857, of whom 56% were Hindus, 30% Mohammedans and 11% Animists. The number of Christians was almost doubled in the decade and in 1931 was 249,246: the increase was specially remarkable in the Lushai hills, where mass conversion brought up the number from 2,000 to 59,000, nearly half the entire population. The total density is only 137 persons per square mile and there are extraordinary variations. As explained in the Government review of the census of 1921. some of the sources of these variations are physical and climatic, but some at least are to be sought in history, and the devastation caused in the Brahmaputra valley by the Moamaria insurrection and the Burmese invasion left a scanty population at the time of the British annexation. Until recent years an unhealthy climate and the absence of communications, in spite of the opening up of the country by tea gardens, prevented speedy development. In the Surma valley also, Cachar and the east and south portions of the Sylhet districts suffered too much from the raids of the neighbouring hill tribes to be inviting places of residence. In the hills it is not so long since head-hunting was considered to be the only proper occupation of a man, while the primitive conditions of agriculture militate against a large population. Assam has moreover in the past suffered from the ravages of "black fever" or Kala *Azar* to an extent of which there is no record elsewhere. An intensive campaign undertaken by the Government and the discovery of effective methods of treatment have done much to counteract this terrible disease.

BY COURTESY OF THE NORTHERN BAPTIST CONVENTION

A WOMAN OF ASSAM

Assamese women are considered among the most beautiful in India

About one-sixth of the population is foreign born and consists of immigrants such as those who have come to cultivate waste land or to work in the tea gardens, the majority from Bengal and Behar and Orissa. The population is consequently somewhat heterogeneous; there are, for instance, 88,000 Nebans. Of the total population 4,723,000 (in round figures) are inhabitants of the Brahmaputra valley, 2,724,342 of the Surma valley, and 1,262,535 of the hill districts. No less than 120 distinct languages, of which 60 are native to Assam, were returned at the census—figures significant of a heterogeneous population of which immigrants form a large constituent. Altogether 43% of the people speak Bengali, 22% Assamese and 18% various Tibeto-Burman languages. Bengali is the mother-tongue of the great majority of the people of the Surma valley. Assamese is written in nearly the same alphabet as Bengali, and the vernacular Assamese possesses a close affinity to that language. Indeed, so close was the resemblance that for a time Bengali was used as the court and official language; but with the development of the country the Assamese tongue asserted its claim to be treated as a distinct vernacular, and the Government in 1873 re-established it as the language of official life and public business.

Hill Tribes. — The Singphos, Daphlas, Miris, Khamtis, Mishmis, Abors, etc., are found near the frontiers of Lakhimpur district. The Nagas inhabit the hills and forests along the eastern and south-eastern frontier of Assam, residing partly in the British district of the Naga hills and partly in independent territory under the political control of the deputy-commissioner of the adjoining districts. Under regulation V. of 1873, an inner line has been laid down in certain districts, up to which the protection of British authority is guaranteed, and beyond which, except by special permission, it is not lawful for British subjects to go. This inner line has been laid down in the Balipara Frontier tract towards the Bhotias, Akas and Daphlas; in the Sadiya Frontier tract and Lakhimpur towards the Daphlas, Miris, Abors, Mishmis, Khamtis. Singphos and Nagas, and in Sibsagar towards the Nagas. The line is marked at intervals by frontier posts held by military police and commanding the roads of access to the tract beyond, and any person from the plains who has received permission to cross the line has to present his pass at these posts. The inner line formerly maintained along the Lushai border has since 1895 been allowed to fall into desuetude. (For the ethnology of Assam *see* ASIA: *Anthropology* and Ethnology, § Farther Asia.)

Administration. — Assam was constituted a provin'ce under a chief commissioner in 1874, but in 1905 it was merged in the nemly created province of Eastern Bengal and Assam. Five years later it was restored to its former status, and in 1921 it was constituted a province under a governor with an executive council (of two members) and two ministers. Under the provisions of the Government of India Act, Assam became an autonomous province in 1937, with a legislature composed of two chambers—the Legislative Council consisting of 21 members, three of whom are nominated and the rest elected, and the Legislative Assembly, consisting of 118 elected members. The North-East Frontier (Sadiya, Balipara and Lakhimpur regions) together with the Naga Hills, Lushai Hills and North Cachar Hills districts are excluded areas, and the Garo Hills, Mirkir Hills. and British portions of the Khasi and Jaintia Hills district (excluding Shillong) comprise a partially excluded area. The capital of the province is Shillong.

HISTORY

Assam was the province of Bengal which remained most stubbornly outside the limits of the Mogul empire and of the Mohammedan polity in India. Indeed, although frequently overrun by Mussulman armies, and its western districts annexed to the Mohammedan vice-royalty of Bengal, the province maintained an uncertain independence till its invasion by the Burmese towards the end of the 18th century, and its final cession to the British in 1826. It seems to have been originally included, along with the greater part of north-eastern Bengal, in the old Hindu territory of Kamrup. Its early legends point to great religious revolutions between the rival rites of Krishna and Siva as a source of dynastic changes. Its roll of kings extends deep into pre-historic times, but the first rajah capable of identification flourished about the year A.D. 76.

When Hsüan Tsang visited the country in A.D. 640, a prince named Kumar Bhaskara Barman was on the throne. The people are described as being of small stature with dark yellow complexions; fierce in appearance, but upright and studious. Hinduism was the state religion, and the number of Buddhists was very small. The soil was deep and fertile, and the towns were surrounded by moats with water brought from rivers or banked-up lakes. Subsequently we read of Pal rulers in Assam. It is supposed that these kings were Buddhist and belonged to the Pal dynasty of Bengal. Although the whole of Kamrup appears from time to time to have been united into one kingdom under some unusually powerful monarch, it was more often split up into numerous petty states; and for several centuries the Koch, the Ahom and the Chutia powers contested for the Assam valley. In the early part of the 13th century the Ahoms or Ahams, from northern Burma and the Chinese frontiers, poured into the eastern districts of Assam, founded a kingdom and held it firmly for

several centuries. The Ahoms were Shans from the ancient Shan kingdom of Pong. Their manners, customs, religion and language were and for a long time continued to be, different from those of the Hindus; but they found themselves compelled to respect the superior civilization of this race, and slowly adopted its customs and language. The conversion of their king Chuchengpha to Hinduism took place in the year A.D. 1655, and all the Ahoms of Assam gradually followed his example. From this time dates the deterioration of the Assamese and their decline as a power. In mediaeval history, the Assamese were known to the Mussulman population as a warlike predatory race, who sailed down the Brahmaputra in fleets of canoes, plundered the rich districts of the delta, and retired in safety to their forests and swamps. As the Mohammedan power consolidated itself in Bengal, repeated expeditions were sent out against these river pirates. The physical difficulties which an invading force had to contend with in Assam, however, prevented anything like a regular subjugation of the country; and after repeated efforts, the Mussulmans contented themselves with occupying the western districts at the mouth of the Assam valley. In 1638, during the reign of the emperor Shah Jahan, the Assamese descended the Brahmaputra, and pillaged the country round the city of Dacca; they were expelled by the governor of Bengal, who retaliated upon the plunderers by ravaging Assam. During the civil wars between the sons of Shah Jahan, the king of Assam renewed his predatory incursions into Bengal; upon the termination of the contest, Aurangzeb determined to avenge these repeated insults, and despatched a considerable force for the regular invasion of Assamese territory (1660–62). His general, Mir Jumla, defeated the rajah, who fled to the mountains, and most of the chiefs made their submission to the conqueror. But the rains set in with unusual violence, and Mir Jumla's army was almost annihilated by famine and sickness. Thus terminated the last expedition against Assam by the Mohammedans. A writer of the Mohammedan faith says:—"Whenever an invading army has entered their territories, the Assamese have sheltered themselves in strong posts, and have distressed the enemy by stratagems, surprises and alarms, and by cutting off their provisions. If these means failed, they have declined a battle in the field, but have carried the peasants into the mountains, burned the grain and left the country desert. But when the rainy season has set in upon the advancing enemy, they have watched their opportunity to make excursions and vent their rage; the famished invaders have either become their prisoners or been put to death. In this manner powerful and numerous armies have been sunk in that whirlpool of destruction, and not a soul has escaped." The same writer states that the country nas spacious and populous; that the paths and roads were beset with difficulties; and that the obstacles to conquest were more than could be expressed. The inhabitants, he says, were always prepartd for battle, and the approach to their forts was opposed by dangerous jungles, and broad and boisterous rivers. From the middle of the 17th century internal dissensions, invasion and disturbances of every kind convulsed the province, and neither prince nor people enjoyed security. Late in the 18th century some interference took place on the part of the British government, then conducted by Lord Cornwallis; but his successor, Sir John Shore, adopting the non-intervention policy, withdrew the British force, and abandoned the country to its fate. Its condition encouraged the Burmese to depose the rajah, and to make Assam a dependency of Ava. The extension of their encroachments on a portion of the territory of the East India company compelled the British government to take decisive steps for its own protection. Hence arose the series of hostilities with Ava known in Indian history as the First Eurmese War, on the termination of which by treaty in Feb. 1826, Assam remained a British possession. In 1832 that portion of the province denominated Cpper Assam was formed into an independent native state, and conferred upon Purandhar Singh, the ex-rajah of the country; but the administration of this chief proved unsatisfactory, and in 1838 his principality was reunited with the British dominions. After a period of successful administration and internal development, under the lieutenant-governor of Bengal, it was erected into a separate chief commissionership in 1874.

In 1886 the eastern Dwars were annexed from Bhutan; and in 1874 the district of Goalpara, the eastern Dwars and the Garo hills were incorporated in Assam. In 1898 the southern Lushai hills were transferred from Bengal to Assam, and the north and south Lushai hills were amalgamated as a district of Assam, and placed under the superintendent of the Lushai hills. Frontier troubles occasionally occur with the Akas, Daphlas, Abors and Mishmis along the northern border, arising out of raids from the independent territory into British districts. In Oct. 1905, the whole province of Assam was incorporated in the new province of Eastern Bengal and Assam.

See E. A. Gait, *The History of Assam* (1906); *L.* W. Shakespear, *History of Upper Assam (1914).*

ASSAMESE LANGUAGE, the Indo-Aryan tongue spoken in the Assam valley. In its grammar it closely resembles Bengali (*q.v.*), since both are derived from a common source. Its vocabulary is mainly tadbhava. It has been affected by its proximity to Tibeto-Burman dialects both in vocabulary and in structure, as in the use of pronominal suffixes, and in phonetics, though following Bengali generally in its accentuation. The chief glory of Assamese literature is in history. The *buranjis* or historical works are voluminous and have been carefully preserved.

Tadbhava means "of the same character as" Sanskrit, contrasted with tatsama, "identical with" the Sanskrit word. The French word ange is tadbhava, while angelus is tatsama, identical with the Latin.

See *Linguistic Survey of India,* vol. v. pt. 2 p. 393, for grammar and list of authorities.

ASSARY or **ASSARION,** a Roman copper coin, the "farthing" of Matthew x. 29.

ASSASSIN, a general term for a secret murderer (properly *Ḥashīshīn,* from *Hashish,* the opiate made from the juice of hemp leaves), originally the name of the Ismā'īlī branch of the Shiite sect founded by Ḥasan-i-Sabbāḥ at the end of the 11th century, and from that time active in Syria and Persia until crushed in the 13th century by the Mongols under Hūlāgū in Persia, and by the Mamluk Baybars in Syria. Ḥasan, a native of Ḵhurasan and a Shiite, after many adventures settled near Kuhistan and gradually spread his peculiar modification of Ismā'īlī doctrine. Having collected a considerable number of followers he formed them into a secret society. In 1090 he obtained, by stratagem, the strong mountain fortress of Alamūt in Persia, and, removing there with his followers, settled as chief of the famous Assassins.

The speculative principles of this body were identical with those of the Ismā'īlīs, but their external policy was marked by one peculiar and distinctive feature—the employment of secret "assassination" against all enemies. This practice was introduced by Ḥasan, and formed the essential characteristic of the sect. At their head was the supreme ruler, the *Shaykh-al-labal, i.e.,* Chief, or, as it is commonly translated, Old Man of the Mountains. Under him were three *Dā'ī-al-Kirbāl,* or, grand priors, who ruled the three provinces over which the shaykh's power extended. Next came the body of *Dā'īs* or priors, who were fully initiated into all the secret doctrines, and were the emissaries of the faith. Fourth were the *Rafiqs,* who were in process of initiation, and ultimately advanced to the dignity of *da'is.* Fifth came the most distinctive class, the *Fidā'īs* (*i.e.,* the devoted ones), who were the guards or assassins proper—young men who were kept uninitiated, and the blindest obedience was exacted from and yielded by them. Finally, the sixth and seventh orders were the *Lāsiqs,* or novices, and the common people.

The Assassins soon began to make their power felt. One of their first victims was Ḥasan's former friend, Nizām-al-Mulk (*see* SELJUKS), whose son also died under the dagger of a secret murderer. After a long and prosperous rule Ḥasan died at an advanced age in 1124, and was succeeded by his chief *dā'ī,* Kiyā Buzurg-Ummēd.

During the 14 years' reign of this second leader, the Assassins were frequently unfortunate in the open field, and their castles were taken and plundered; but they acquired a stronghold in Syria, while their numerous murders (*e.g.,* of the caliphs Mustar-

shid and Rāshid) made them an object of dread to the neighbouring princes, and spread abroad their evil renown. Buzurg-Ummēd was succeeded by his son Muhammad I. (1138–62) in whose reign the fortress of Masyāḍ became the chief seat of the Syrian branch of the society. His son Ḥasan (1162–66) declared himself to be the promised Imam, the caliph of God upon earth, and a lineal descendant of Ismāil. His son and successor Muhammad II. (1166–1210) had to contend with many powerful enemies, especially with the great Atabeg sultan Nūr ad-Din, and his more celebrated successor, Saladin, who had gained possession of Egypt after the death of the last Fatimid caliph, and against whom even secret assassination seemed powerless. During his reign, also, the Syrian branch of the society, under their *dā'ī,* Sinān, made themselves independent, and remained so ever afterwards. It was with this Syrian branch that the Crusaders made acquaintance; and it appears to have been their emissaries who slew Count Raymund of Tripoli and Conrad of Montferrat.

During the reign of his son, Ḥasan III. (1210–1220), no assassinations occurred, and he obtained a high reputation among the neighbouring princes. Like his father, he was removed by poison, and his son, 'All ad-Din Muhammad III. abandoned the mild principles of his father and a fresh course of assassination was entered on. In 1255, after a reign of 35 years, 'Alā ad-Din was slain, with the connivance of his son, Rukn ad-Din, the last ruler of the Assassins. In the following year Hūlāgū, brother of the Tatar, Mangū Khān, invaded the hill country of Persia, took Alamiit and many other castles, and captured Rukn ad-Din. (See MONGOLS.) He treated him kindly, and, at his own request, sent him under escort to Mangū, who ordered Rukn ad-Din to be put to death, and sent a messenger to Hūlāgū commanding him to slay all his captives. 'About 12,000 of the Assassins were massacred, and their power in Persia was completely broken. The Syrian branch flourished for some years longer, till Baybars, the Mamlūk sultan of Egypt. ravaged their country and nearly extirpated them. Small bodies of them lingered about the mountains of Syria, and are believed still to exist there. Doctrines somewhat similar to theirs are still to be met with in north Syria, Persia and India.

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ASSAULT, in English law, "an attempt or offer with force or violence to do corporal hurt to another, as by striking at another with a stick or other weapon, or without a weapon, though the party misses his aim." Mere words, be they ever so provoking, will not constitute an assault. Coupled with the attempt or threat to inflict corporal injury, there must in all cases be the possibility of carrying the threat into effect, and so if the person threatened is out of range there can be no assault. A battery is more than a threat or attempt to injure the person of another; the injury must have been inflicted, but it makes no difference however small it may be, as the law does not "draw the line between degrees of violence," but "totally prohibits the first and lowest stage of it." Every battery includes an assault. A common assault is a misdemeanour, and is punishable by imprisonment with or without hard labour to the extent of one year, or by fine, and if it occasions bodily harm, with penal servitude for five years, or imprisonment to the extent of two years, with or without hard labour. There are various different kinds of assaults of a more serious description which are provided against by particular enactments of parliament, such as the Offences against the Person Act 1861; and there are also certain aggravated assaults for which the punishment is more severe than for common assault, as an assault with intent to murder, with intent to commit a rape, etc. An assault may be both a tort and a crime, giving a civil action for damages to the person injured, as well as being the subject of a criminal prosecution.

United States.—In the United States assault and battery, although sometimes defined by statute, usually follow the common law definitions. The statutes usually define an assault as an unlawful attempt to commit immediate bodily injury upon another, and battery as an unlawfui touching of another by an assailant in a rude and insolent manner, with or without a weapon. Intent is a constituent part of civil assault, thus an accident cannot constitute an assault since it lacks negligence and intention. The apparent intention must be to inflict physical injury on the person assaulted. However, if an action is for assault and battery the intention is not a material element, for, if the act was wrongful, the intent is presumed from the act. If the act was lawful the element of malice or recklessness enters and this is a necessary part of the action in such case, and must be stated under United States practice. A criminal assault and battery may be committed although the person injured does not know of, realize or fear the existence of the assault and battery. It may be stated as a general rule in assault and battery that the intention of the aggressor and the fear or apprehension of the person assaulted are not in any way controlling, thus if a person throws a stone at A and strikes B, he is guilty of assault and battery upon B upon the principle of constructive intent; *i.e.,* that a man is presumed to intend the natural and probable consequences of his acts. For when one puts into motion an injurious or deadly agency he assumes responsibility for all the natural and probable consequences of his conduct. There is an irreconcilable difference of opinion in the United States as to what constitutes a criminal assault in a case where A points a gun at B, within shooting distance, knowing that the gun is not loaded, and threatens to "blow his head off." Some courts hold that this is not a criminal assault because A has no actual intention and lacks the ability to injure B in the manner threatened. Other courts hold that it is a criminal assault because there is an apparent present intention and ability to injure B, and the outward demonstration of A may lead to defensive measures on B's part which might produce, at least, a breach of the peace. The weight of authority is in favour of the latter position. A battery may be committed by the administration of a drug to another who is innocent as to its nature and content. So, in battery, deception may be the equivalent of force, since the deceit practised is a fraud on the will of the innocent consumer of the drug equivalent to force. An officer of the law, or one who aids him, in the enforcement of his lawful duties is privileged in the use of such force as is reasonably necessary to uphold the law and preserve order.

In military language, the word is used of the culminating phase of an attack, when the advancing troops come to close quarters with the enemy, surging into and overrunning his positions.

ASSAYE, a village of Hyderabad or the Nizam's Dominions, in southern India, just beyond the Berar frontier. The place is celebrated as the site of a battle fought on Sept. 23, 1803, between the combined Mahratta forces under Sindhia and the rajah of Berar and the British under Maj.-Gen. Wellesley, afterwards the duke of Wellington. The Mahratta force consisted of 50,000 men, supported by 100 pieces of cannon served by French artillerymen, and entrenched in a strong position. Against this the English had but a force of 4,500 men, which, however, after a severe struggle, gained the most complete victory that ever crowned British valour in India. Of the enemy 12,000 were killed and wounded; and Gen. Wellesley lost 1,657—one-third of his little force—killed and wounded. Assaye is 26 1m. N. W. of Hyderabad.

ASSAYING, a term originally applied to the trying or testing of ores and alloys for their contents of gold or silver. Later it has received a wider significance; from meaning to test any ore or metallurgical product, in order to find its proportion of valuable constituents, it has even been extended to cover the determination of alkaloids (*q.v.*) in plants. It will, however, be used in this article in a metallurgical sense only. It is essentially a commercial process, hence the difference between assaying and chemical analysis. Analysis is an end in itself: the greater the accuracy, the more satisfactory is the result. In assaying it is desired to determine the value of a material, and a degree of accuracy which exceeds that required to obtain this value is uneconomical for it requires excessive time and care which might be more valuably employed. This does not mean that great accuracy is never required, as the value of the substance to be determined must be taken into account. For example, in the

assay of ores, iron is usually reported to 0·1%, whereas platinum may be carried beyond an accuracy of 0·0001%.

The origin of the art is lost in antiquity. The trial by "Touchstone" and by "Fire" are mentioned by Theophrastus (371–288 B.C.), and the early alchemists were well acquainted with such processes as precipitation, cupellation, etc., which are still in everyday use. The earliest known books on assaying were published in Germany at the beginning of the 16th century. The most interesting of these is Agricola's De Re *Metallica,* which devotes considerable space to the subject.

Assaying is closely allied to the metallurgical industry. In early times it was merely a small-scale smelting operation, and followed the large-scale processes in detail. Hence the "Dry" or "Fire" assays originated, in which the assay sample was smelted in a small crucible with suitable reagents, using a wood or charcoal furnace. The simultaneous development of chemistry led to the introduction of analytical or "Wet" methods, which are now used for the majority of metals. The old smelting, or "Fire" assay, has survived for some materials, and is still the only method available for the determination of gold and silver in ores.

The trial by "Touchstone," or "Lydian stone," to estimate the gold proportion of alloys, probably dates from the time of the Lydians (500 B.C.). The colour of the streak made on a black stone by the metal under examination, was compared with similar streaks made by "needles" of metal of known composition, called "Touchneedles." These needles were used in sets, one of golden-silver alloys, another of gold-copper alloys, and a third of "Triple" alloys, containing gold, silver, and copper. Touch needles were introduced later for testing silver-copper alloys.

DRY OR FIRE ASSAYING

Gold and Silver Ores.—Gold and silver are bought by the ounce (Troy), and, for convenience in the evaluation of ores, the contents of precious metals are not reported in percentages, but in oz., or decimals of an oz. (Troy), per ton of ore. The ton (Avoirdupois) contains 32,666.6 oz. (Troy), and, to save calculation, the weight of ore taken for assay is 32.67 grammes, or some multiple of this. This weight is known as the Long Assay Ton (A.T.). and has the advantage that every 0·001 gramme of metal found represents 1 oz. (Troy) per ton of ore. In some countries it is more usual to employ the Short Ton of 2,000 lb., and the Short Assay Ton of 29·17 grammes is used in assaying. In many of the Latin countries the Metric Ton of 1,000 kilos is the standard, and the values are reported in grammes per ton, no Assay Ton being required. Sometimes the gold or silver present is reported in its money value (*e.g.,* $42.50 per ton).

The assay consists of three operations: (1) fusion, (2) cupellation, and (3) parting.

(1) Fusion.—This may be carried out by two methods.

(a) In the "Pot Fusion" method, one A.T. or more of the crushed ore is mixed and fused in a clay crucible, or pot, with lead oxide (about 30 grammes), a reducing agent such as charcoal, argol, or flour (up to about 5 grammes), and a suitable quantity of reagents called "fluxes" which combine with the "gangue," or waste matter in the ore, forming a "flowing," or fusible slag. The fluxes used depend upon the nature of the ore. If the gangue contains silica, tin or zinc, soda is required; for iron, lime, or other basic materials, borax, crushed quartz, or similar fluxes are introduced. The quantity of these fluxes is varied to suit the requirements of the ore under examination, and will be nearly twice the weight of the ore. The crucible is placed in a coke, oil, or gas furnace at a fairly low temperature, and kept at a dull-red heat for about ten minutes, to allow the chemical reactions to be completed. By the action of the reducing agent, metallic lead is formed, which sinks through the charge to the bottom of the pot, alloying with, and so collecting the gold and silver. The temperature is then raised until the whole charge is molten and thoroughly fluid, and the contents of the pot are poured into a dry, iron mould. When cold, the brittle slag is broken away with a hammer, leaving a "button" of lead which contains the precious metals.

Certain types of ore require special treatment. Sulphide ores may be given a preliminary roasting at a red heat to burn off the sulphur, or the ore is desulphurised during fusion by adding suitable reagents to the charge. Cupriferous ores are treated with acid before fusion, to dissolve away the copper. Arsenical ores are roasted before fusion, and antimonial ores are oxidised by adding nitre to the charge.

(b) In the "Scorification" method, about 10 grammes or ½ A.T. of ore is mixed with 30–35 grammes of granulated lead in a "Scorifier," which is a shallow fireclay dish. Another 30–40 grammes of granulated lead are placed on top of the charge, and about 1 gramme of borax is added as a thin cover. The scorifier is placed in a muffle furnace at a very high temperature, when simultaneous oxidation of the lead and of the ore takes place. Some impurities volatilise, and the remainder combines with the oxidised lead and the borax, forming a slag. A ring of this slag soon forms round the surface of the molten lead, and, as oxidation proceeds, the ring extends towards the centre and finally covers the whole surface. At this point the oxidation ceases, and the charge is poured as before. The quantities of granulated lead and borax required will depend upon the nature of the ore, and are variable. It will be seen that, as a smaller quantity of ore is used, the method is only suitable for rich materials, and hence is practically confined to the assay of rich silver ores, very high grade gold ores being rarely found.

(2) *Cupellation.*—By this process the gold and silver are isolated from the lead obtained in the first operation. A cupel is a shallow cup made of bone-ash or some other absorbent matter, which, when hot, is capable of absorbing any molten material which wets its surface. The lead button is fused upon a red-hot cupel in a muffle furnace. The lead melts and oxidises, forming molten litharge, which is absorbed, together with any oxidised impurities, into the cupel. The gold and silver do not oxidise, but remain on the cupel, forming a small bead of "Bullion," which is weighed.

(3) Partifig.—The bullion bead is attacked with nitric acid which dissolves, or "parts," the silver from the gold. Before commencing this operation, it is necessary to ensure that the alloy is of such a composition that the whole of the silver will be dissolved away from the gold. The proportion, by weight, of silver to gold should be at least 4:1 if the gold present exceeds 0·01 gramme, and this ratio is increased for smaller amounts of gold. If there is insufficient silver present, more must be added by the process of "Inquartation." This consists of adding a sufficient weight of silver to the bead, either by melting the metals together with a blow-pipe flame, or by recupelling them in a small piece of pure lead. The name "Inquartation" was introduced in early times, when it was believed that the proportion of silver to gold should always be 3:1. The inquarted alloy is flattened under a hammer and dropped into boiling nitric acid. The silver dissolves, leaving a brown residue of gold. This is washed with distilled water, dried, and annealed by heating it to redness, when it takes on the familiar yellow colour of pure gold. The weight of this residue gives, by calculation, the gold content of the ore, and the silver is determined by difference from the weight of the bullion.

Gold Bullion.—This is assayed by cupellation. A representative sample of 0·5 gramme of the alloy is wrapped in 2–6 grammes of pure, silver-free lead foil, the exact weight of the lead depending on the purity of the alloy. The lead packet is cupelled in the usual manner, and the resulting bead of gold and silver is weighed. The bead is again wrapped in lead foil, together with sufficient silver to form a parting alloy, the proportion of silver to gold in this case being 2¼:1. The bead obtained after cupellation, is cleaned and rolled into a thin strip, or "fillet," which is curled into a small "cornet" or coil. The comet is treated twice with boiling nitric acid, and is then washed, dried, annealed, and weighed. Errors introduced during cupellation and parting are corrected by carrying out simultaneous "check" assays on test pieces made up to the same composition as the alloy. The gold present is reported as so many parts of gold in 1,000 parts of alloy. This is called "Fineness," and British gold coinage is said

to be "916·6 Fine."

Lead Ores.—The assay consists of fusion with suitable fluxes and a reducing agent, in a clay or iron crucible. The charge is varied to suit the ore. A typical example being about one part of ore, $2\frac{1}{2}$ parts of soda, one half part of borax and one half part of argol. When a clay crucible is used, a piece of hoop iron, in length about twice the height of the crucible, is pushed down into the mixture to act as a desulphurising agent. When an iron crucible is used, the pot itself acts in this way. The crucible is heated in a wind furnace, and it is important to work the charge at the lowest temperature which will give a fluid slag, in order to prevent undue loss of lead, and to minimise the amount of metallic impurities which will pass into the button. On completion of the fusion, the charge is poured into a mould, and the lead button is separated from the slag and weighed.

Tin Ores.—The smelting assay is unsuitable for crude tin ores, but satisfactory results may be obtained with high-grade concentrates, provided the charge is run at a low temperature and is not left in the fire longer than necessary. The sample of ore is mixed with four times its weight of crude potassium cyanide, and is placed in a clay crucible. The pot is put in a furnace, and the temperature is raised to dull redness, and kept there until the charge is thoroughly fused. The temperature is further raised for a few minutes to render the slag quite fluid, and the charge is poured as usual. Many metallic impurities in the ore are reduced and pass into the tin button; consequently the method is unreliable except for fairly clean concentrates.

WET ASSAYING

This employs the volumetric, gravimetric, and electrolytic methods. Volumetric methods are in particular favour; as less manipulation is required, and the sample may often be titrated without lengthy chemical separations. The weight of ore taken for assay is much smaller than in Fire Assaying, 0·25–2·0 grammes generally being sufficient. It is essential that the sample shall be finely crushed, especially if it is to be dissolved in acids, as particles of the mineral may be encased in the insoluble gangue. Minerals which are not decomposed by acids are fused with a flux which will render them soluble in water or acids.

Silver Bullion.—The cupellation assay was used formerly, for the determination of silver in many of its alloys. This method has been replaced in the majority of mints and assay offices by volumetric methods. The chief of these is the "Gay Lussac" assay, which was introduced into the Paris mint in 1830, and has since been adopted in most offices. An exact weight of the bullion is dissolved in nitric acid, and very nearly all the silver is precipitated at once by the addition of a known volume of a standard solution of salt. When the precipitate has settled, the remaining silver is precipitated by the further addition of a small quantity of a more dilute solution of salt, the precipitate forming a white cloud in the supernatant liquid. The quantity of this silver is judged by the appearance of the white cloud.

Copper.—The material is attacked with suitable acids, and the copper is carried into solution. There are three methods of assay available. (1) In the cyanide assay, the solution is rendered ammoniacal, which results in the formation of a deep blue liquid. This colour is discharged by titration with a standard solution of potassium cyanide, the volume of the latter being a measure of the copper present. (2) In the iodide assay, the copper is first separated from the other metals present, and is then redissolved in Nitric acid. The mineral acid is destroyed by adding an excess of zinc acetate. Potassium iodide is then added, which results in the reduction of the copper and the liberation of a quantity of iodine which is proportional to the amount of copper present. This iodine is measured by titration with a standard solution of sodium thiosulphate, using starch solution as an inside indicator (*q.v.*), towards the end of the titration. **(3)** In the electrolytic assay, any hydrochloric acid is expelled from the solution, and the acidity is carefully adjusted to the correct strength. The solution is then subjected to electrolysis, the copper being deposited on the cathode. The increase in weight of the latter gives the amount of copper present.

Iron.—The ore is brought into solution by acid attack, the iron is reduced by one of the usual chemical processes, and the ferrous solution is oxidised by titration with a standard solution of potassium dichromate, or of potassium permanganate. In the former case a weak solution of potassium ferricyanide is used as an outside indicator (*q.v.*).

Lead.—Minerals of this metal are dissolved in hydrochloric acid, sometimes assisted by nitric acid. The lead is separated by evaporation with sulphuric acid, and the solution is cooled, diluted, and filtered. The precipitated lead sulphate is redissolved in hot ammonium acetate solution, and titrated, just below the boiling point, with a standard solution of ammonium molybdate. A solution of tannic acid is used as an outside indicator. An alternative method is to reprecipitate the lead as chromate, filter, and dissolve the precipitate in a hydrochloric acid solution of salt. Potassium iodide is added, which results in the liberation of iodine. This is titrated with thiosuplhate as in the copper assay.

Tin.—The ores of tin are decomposed by fusion with sodium peroxide in an iron or nickel crucible, or by ignition with zinc oxide and metallic zinc. In either case the residue is leached out with water and dissolved in hydrochloric acid. The tin is reduced by suspending a nickel coil in the solution and boiling vigorously for 40–60 minutes. The solution is cooled in an atmosphere of carbon dioxide, and the tin is oxidised by titration with a standard solution of iodine, using starch as an inside indicator.

Zinc.—These ores are attacked with acids, and the solution is subjected to a process of separation which follows, in principle, the system adopted in Qualitative Analysis. (See CHEMISTRY: Analytical.) The clear zinc solution is rendered slightly acid, and is titrated, just below the boiling point, with a standard solution of potassium ferrocyanide. A solution of uranium nitrate is used as an outside indicator.

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ASSAY OFFICE, a department operating under the United States mint as a laboratory for the purpose of assaying, *i.e.*, chemically and otherwise testing for purity, content and value, metals submitted to it for this purpose. The metals brought for assay are usually gold and silver, and may be in the forms of bullion, jewellery, ornaments, metal-ware and others. The Assay Office is authorized to buy gold, although no longer allowed to coin it, and to pay for it with an order on the U. S. Treasury for an equal amount in currency or Federal Reserve notes. It will also, for a reasonable charge, assay metals for others than prospective sellers to the Government or analyse sample ores brought in, the latter activity forming a considerable part of the work in the western branch. The U.S. Assay Office is in New York city and has very heavy duties owing to the vast movements of gold passing through the city. All foreign gold received is here submitted to test. In recent years special facilities for the assaying of platinum have been installed in the New York office. There are branches of the Assay Office at New Orleans, Louisiana and Seattle, Washington.

The Assay Commission, established by the United States government, meets annually to examine and test, in the presence of the Director of the Mint, the fineness and weight of certain coin indiscriminately withheld at the various mints for that purpose. The number of coins reserved for such examination must be not less than one piece for each two thousand of silver coins and they must be taken out at every delivery of coins made by the coiner. Gold is no longer coined. The commission is composed of the judge of the district court for the Eastern district of Pennsylvania, the Comptroller of the Currency, the assayer of the assay office at New York, and such other persons as the President shall from time to time designate, the entire Commission usually numbering from ten to fifteen persons.

ASSAY OFFICE BAR, a bar of fine, meaning pure, gold which has been made from metal assayed by the U.S. Assay Office. Such a bar bears the Government stamp certifying to its

weight and fineness. Bars of precious metals turned out by private assayers cannot carry the Government stamp, and are known as "commercial bars."

ASSEGAI or **ASSAGAI** (from Berber-Arab as-zalzayah, through Portuguese azagaia), a weapon for throwing or hurling, a light spear or javelin made of wood and pointed with iron, particularly the spear used by the Zulu and other Kaffir tribes of south Africa. In addition to the long-handled assegai there is a shorter weapon for use at close quarters.

ASSEMANI, the name of a Syrian Maronite family of oriental scholars.

JOSEPH SIMON (1687–1768), a Maronite of Mount Lebanon. He was sent to the Maronite college in Rome, and entered the Vatican library. In 1717 he was sent to Egypt and Syria to search for valuable mss., and returned with about 150 very choice ones. The pope again sent him to the East in 1735, and he returned with a still more valuable collection. On his return he was made titular archbishop of Tyre and librarian of the Vatican library.

His two great works are the Bibliotheca Orientalis *Clementino-Vaticana* rec. *manuscr.* codd. Syr., Arab., Pers., Turc., Hebr., Samarit., *Armen., Aethiop.,* Graec., Aegypt., Iber., et *Malab., jussu* et *munif.* Clem. XI. (1719–28), and *Ephraemi* Syri opera omnia quae extant, Gr. Syr., et Lat. (1737–46). Of the *Bibliotheca* the first three vols. only were completed. The work was to have been in four parts but only the first—Syrian and allied mss., Orthodox, Nestorian and Jacobite—was completed. There is a German abridgment by A. F. Pfeiffer.

His brother, JOSEPH ALOYSIUS (*c.* 1710–82), was professor of oriental languages at Rome, and a nephew, STEPHEN EVODIUS (1707–82), was assistant to his uncle at the Vatican library, and held various ecclesiastical preferments. His most important work is Bibliotlzecae *mediceo-Laurentianae* et Palatinae codd. *manuscr. Orientalium Catalogus* (Flor. 1742). Another member of the family, SIMON (1752–1821) was professor of oriental languages at Padua.

ASSEMBLE, a term of great significance in modern productive methods. It explains the difference between the older practice of fitting parts to one another, and the modern way of finishing components so that they can be brought together or "assembled" without the need for any cutting or alteration; if spares and replacements are needed, they may then be supplied in tens of thousands, all certain to fit without alteration.

There is often a modified procedure in manufacturing parts of large and elaborate structures, the primary assembling being done at the works, with a moderate amount of hand fitting, and then all the joints are marked with paint or stencilling for the final assembly *in situ.* Perfection of assembling occurs in the smaller all-metal products and parts such as screws and bolts, brass fittings, steam and water valves, ball bearings, clocks, typewriters, sewing-machines, magnetos, small arms, machine-guns, cartridges, shells, small engines, pumps and motor cars. The practice originated in the United States because of the great demand for sewing-machines and small arms, and later for typewriters.

An elaborate equipment and routine system becomes necessary to make parts ready to assemble. All the cutting tools on the machine-tools must keep their size for a certain period without wear, and to test the results therefrom numerous gauges have to be employed, the germ of the system being the "limit-gauge." This has two measuring portions, called and marked the "go" and "not go." No machine tool can cut or grind a piece of metal to exact size (commercially), but if a definite limitation of error each may is ensured, then the piece will assemble with its other component. Hence the limit-gauge is made oversize one end, say 4 in. plus one 2,000th of an inch, and undersize at the other, one 2,000th of an inch less than 4 inches. A shaft must, therefore, be made of such diameter that it will neither be too large to pass into the + opening of the gauge, nor so small that it will pass into the − opening. Thus the limits of size are guaranteed.

The assembling department of a factory may contain merely benches, with bins full of the parts within reach, the assemblers putting the details together without any special holding arrangements, the product being taken away by hand or trucks. This is not a suitable system for the larger articles, and conveyor outfits have to be installed, such as plain rails on which the objects arc moved away, travelling chains or plates, turntables, etc. Motor cars are assembled while running on dummy flanged wheels rolling on rail tracks, each assembler adding some portion as the chassis reaches his standpoint.

Motion-study becomes essential in these highly organized systems, and special tools greatly assist, such as ratchet screwdrivers and spanners, screwdriver braces, and pneumatic and electric wrenches for rapid rotation without labour.

(See CONVEYORS IN MASS PRODUCTION; MASS PRODUCTION.)

ASSEMBLY, UNLAWFUL, the term used in common law for an assembly of three or more persons with intent to commit a crime by force, or to carry out a common purpose (whether lawful or unlawful), in such a manner or in such circumstances as would in the opinion of firm and rational men endanger the public peace or create fear of immediate danger to the tranquillity of the neighbourhood. In the Year Book of the third year of Henry VII.'s reign assemblies were referred to as not punishable unless in *terrorem populi domini regis.* An assembly, otherwise lawful, is not made unlawful if those who take part in it know beforehand that there will probably be organized opposition to it, and that it may cause a breach of the peace (Beatty v. Gillbanks, 1882, 9 Q. B. D. 308), but if words are said or acts done indirectly inducing others to commit a breach of the peace, the meeting becomes unlawful (Wise v. Dunning, 1902, 1 K. B. 167). All persons may, and must if called upon to do so, assist in dispersing an unlawful assembly (*Redford* v. Birley, 1822, 1 St. Tr. n.s. 1215; R. v. Pinney, 1831, 3 St. Tr. n.s. 11). This is merely one aspect of the common law duty of every man to assist in keeping the peace and it is an indictable misdemeanour to refuse so to assist (R. v. Sherlock, 1 C. C. R. 20). An assembly which is lawful cannot be rendered unlawful by proclamation unless the proclamation is one authorized by statute (R. v. Fursey, 1833, 3 St. Tr. n.s. 543, 567; R. v. *O'Connell,* 1831, 2 St. Tr. n.s. 629, 656; see also the Prevention of Crimes [Ireland] Act 1887). Meetings for training or drilling, or military movements, are unlawful assemblies unless held under lawful authority from the Crown, the lord-lieutenant, or two justices of the peace (Unlawful Drilling Act 1820, s. 11).

An unlawful assembly which has made a motion towards its common purpose is termed a *rout,* and if the unlawful assembly should proceed to carry out its purpose, *e.g.,* begin to demolish a particular enclosure, it becomes a riot (*q.v.*). All three offences are misdemeanours in English law, punishable by fine and imprisonment. The common law as to unlawful assembly extends to Ireland, subject to the special legislation referred to under the title RIOT. The law of Scotland includes unlawful assembly under the same head as rioting.

ASSEMBLYMAN, the official who is elected to serve as a member of the more numerous branch of the State legislature in New Jersey and New Tork, where he is elected for a term of one year. In most of the other States such official is called a "representative" and serves for a term of either one or two years, generally the latter. There is no constitutional prohibition against the re-election of such official and the office is frequently used as a stepping-stone in a man's political career to some higher position, such as State senator, district or circuit judge or representative in Congress.

ASSEN, capital of the province of Drente, the Netherlands, 16 mi. by rail S. of Groningen, at the junction of two canals running north and south to Groningen and Meppel respectively. Pop. (1940) 20,235. Many remains of early man from this region are in the Leyden museum. Assen was the site of a small convent in the middle ages around which the present town gathered. Bishop Otto II (of Utrecht) was murdered here in 1237. There is a museum of antiquities, and it is an important market town. It was occupied by Germany in 1940.

ASSER or **ASSERIUS MENEVENSIS** (died c. 910), English bishop, author of a life of Alfred the Great, was born in Wales. He became a monk at St. David's, and having acquired some reputation for learning, he was invited by King Alfred to

his court. He agreed to spend six months of each year with the King and six months in his own land; but his first stay at the royal court extended to eight months, and it is probable that the annual visit to Wales was curtailed, if not altogether discontinued. It is difficult to fix the date of Asser's arrival in England, but it was probably about 885. He was bishop of Exeter, and before 900 became bishop of Sherborne. His death is recorded in the Anglo-Saxon *Chronicle* under the date 910, although it is possible that it occurred a year or two earlier.

Asser's work, *Annales rerum gestarum Alfredi magni,* written about 893, contains a chronicle of English history from 849 to 887, and an account of Alfred's life, largely drawn from personal knowledge, down to 887. The only manuscript of which there is any record dates from about 1000, and that was destroyed by fire in 1731. From that manuscript an edition was printed in 1574 under the direction of Matthew Parker, Archbishop of Canterbury; but this contained many interpolations and alterations which were copied by subsequent editors. The text has since been the subject of careful study, and the edition edited by W. H. Stevenson (Oxford, 1904) distinguishes between the original work of Asser and the later additions. Some doubt has been cast upon the authenticity of the work, especially by T. Wright in the *Biographia* Britannica literaria (London, 1842), who ascribes the life to a monk of St. Neots; but the latest scholarship regards it as the work of Asser, although all the difficulties which surround the authorship have not been removed. The life was largely used by subsequent chroniclers, among others by Florence of Worcester, Simeon of Durham, Roger of Hoveden, and William of Malmesbury.

BIBLIOGRAPHY.—see W. H. Stevenson, introduction to Asser's Life of *King Alfred* (1904); *R.* Pauli, introduction to Koenig *Aeljred* (1851).

ASSESSED VALUATION, the value placed upon real or personal property by governmental authority for purposes of taxation. It may or may not be an indication of the market value of the property, but in any case, provided the assessments are equitable, it supplies a guide to the relative values of similar kinds of property in the same assessment district. Methods of assessing the valuation of real estate for tax purposes differ in various places. Sometimes valuations are based upon full market value and at other times upon some fraction of the market value. Of the two general methods of raising taxes, a high assessment value with a low tax rate, and a low assessment value with a correspondingly higher tax rate, the latter is much more generally used.

A study of real estate assessment and assessed valuation is of great importance to the dealer and investor in municipal bonds. The debt of a municipality is usually limited by law to a certain percentage of the assessed valuation of the property and the holder of municipal bonds should know the assessed value to be sure that the limit of debt has not been exceeded. Where the assessment is for practically full market value of property the debt limit should be considerably below the assessed valuation to make the bonds sound; but where the assessment represents only one-half or one-third of the market value, as is the case in many communities, the bonded debt may safely approach much more closely to the assessed valuation. Investment bankers who offer municipal bonds frequently state in their circulars not only the assessed valuation of the municipality in question and the ratio of total debt to it, but also the method of assessment and the total estimated market value of all property.

ASSESSMENT, a demand or call made by a corporation upon stockholders for a specified sum of money per share of stock in addition to that already paid in. Such assessments are generally made when the company is financially embarrassed and it is a question of the stockholders meeting the assessment or the company becoming insolvent. Reorganizations of corporations frequently involve the placing of an assessment on the stockholders and sometimes even upon bondholders.

For English law see DAMAGES; TAXATION; VALUATION AND VALUERS.

ASSESSMENT INSURANCE: see FRIENDLY SOCIETIES; BENEFIT SOCIETIES and APPROVED SOCIETIES.

ASSESSOR, a Roman term originally applied to a trained lawyer who sat beside a governor of a province or other magistrate, to instruct him in the administration of the laws (see Roll, De *assessoribus magistratuum Romanorum,* Leipzig, 1872). The system is still exemplified in Scotland, where it is usual in the larger towns for municipal magistrates, in the administration of their civil jurisdiction, to have the aid of professional assessors. In England, by the Judicature Act 1873, the court of appeal and the High Court may in any cause or matter call in the aid of assessors. The Patents Act 1907 makes special provision for assessors in patent and trade-mark cases. By the Supreme Court of Judicature Act 1891 the House of Lords may, in appeals in admiralty actions, call in the aid of assessors, while in the admiralty division of the High Court it is usual for the Elder Brethren of Trinity House to assist as nautical assessors. In admiralty cases in the county courts, too, the judge is frequently assisted by assessors of "nautical skill and experience" (County Court Admiralty Jurisdiction Act 1868). In the same courts assessors may be appointed by the rules made under the Employers' Liability Act 1880; while a medical referee may be summoned as an assessor in cases under the Workmen's Compensation Acts. In the ecclesiastical courts assessors assist the bishop in proceedings under the Church Discipline Act 1840, s. 11, while under the Clergy Discipline Act 1892, s. 2, they assist the chancellor in determining questions of fact. By the Appellate Jurisdiction Act 1876, s. 14, the king in council may make rules for the attendance of archbishops and bishops as assessors in the hearing of ecclesiastical cases by the judicial committee of the privy council.

In France and in all European countries where the civil law system prevails, the term assesseur is applied to those assistant judges who, with a president, compose a judicial court.

In Germany an Assessor, or *Beisitzer,* is a member of the legal profession who has passed four years in actual practice and become qualified for the position of a judge. (X.)

United States.—An assessor in the United States is an official who evaluates property for purposes of taxation. An assessor exists as a county officer in virtually all of the States, and is elected by the voters for a term of two, three or four years. Originally, in the early colonial days, the work of the assessor was done by justices of the peace, transferred in later colonial days to county boards of commissioners or supervisors. The duties of the assessor are generally to list all property and persons subject to taxation. Appeals are provided by statutes to county boards of commissioners or supervisors or courts where the person taxed may protest against the amount assessed as being unfair. Some States have provided for township assessors, elected by the voters of the township, to work under the supervision of the assessor, and in others the assessor is permitted a sufficient number of deputies to aid him in the completion of his work, the assessments generally being made annually. Most of the States have State boards of taxation which supervise, to some extent, the work of the assessors. In most of the States this board is named by the governor, but in a few, such as Illinois where it is called the board of equalization, it is elected.

In Roman law, used throughout Europe, wherever the civil law system obtains, an assessor is one who is called by the courts to give legal advice and assistance. In the United States Federal district courts experienced shipmasters serve as assessors in this sense of the word in admiralty matters. In the State probate and surrogate courts in the United States, "appraisers" are frequently appointed to ascertain the value of deceased persons' estates.

See H. G. James, *Local* Government in *the United* States (1921).

(S. LE.)

ASSETS: see CURRENT ASSETS, DEFERRED ASSETS, FIXED ASSETS.

ASSIDEANS: see MACCABEES.

ASSIGNATS, a form of paper money issued in France from 1789 to 1796. Assignats were so termed as representing land assigned to the holders. The term is from Lat. assignatus, assigned.

The financial strait of the French Government in 1789 was extreme. Coin was scarce, loans were not taken up, taxes **had**

ceased to be productive, and the country was threatened with imminent bankruptcy. In this emergency assignats were issued to provide a substitute for a metallic currency. They were originally of the nature of mortgage bonds on the national lands. Those lands consisted of the church property confiscated, on the motion of Mirabeau, by the Constituent Assembly on Nov. 2 1789, and the crown lands, which were taken over by the nation on Oct. 7 (*see* FRENCH REVOLUTION).

The assignats were first to be paid to the creditors of the State. With these the creditors could purchase national land, the assignats having, for this purpose, the preference over other forms of money. If the creditor did not care to purchase land, it was supposed that he could obtain the face-value for them from those who desired land. Those assignats which were returned to the State as purchase-money were to be cancelled, and the whole issue, it was argued, would consequently disappear as the national lands were distributed.

A first issue was made of 400,000,000 francs' worth of assignats, each note being of 100 francs' value and bearing interest at the rate of 5%. They were to be redeemed by the product of the sales, and from certain other sources, at the rate of 120,000,000 francs in 1791, 100,000,000 francs in 1792, 80,000,000 francs in 1793 and 1794, and the surplus in 1795. The success of the issue was undoubted, and, possibly, if the assignats had been restricted, as Mirabeau at first desired, to the extent of one-half the value of the lands sold, they would not have shared the usual fate of inconvertible paper money. Mirabeau was a strenuous advocate of the assignats. "They represent," he said, "real property, the most secure of all possessions, the soil on which we tread." "There cannot be a greater error than the fear so generally prevalent as to the over-issue of assignats . . . reabsorbed progressively in the purchase of the national domains, this paper mopey can never become redundant."

EIGHT THOUSAND MILLION ASSIGNATS

In 1790 the interest on the assignats holdings was reduced to 3%, and as the Treasury had again become exhausted a further issue was decided upon; it was also decreed that the assignats were to be accepted as legal tender, all public departments being instructed to receive them as the equivalent of metallic money. This second issue amounted to 800,000,000 francs and carried no interest. It was solemnly declared in the decree authorizing the issue that the maximum issue was never to exceed 1,200,000,000 francs. This pledge, however, was soon broken, and further issues brought the total up to 3,750,000,000 francs. The consequence of these further issues was instant depreciation, and the note of 100 francs' nominal value sank to less than 20 francs' coin. Recourse was then had to protective legislation. The first step was to decree the penalty of six years' imprisonment against any person who should sell specie for a more considerable quantity of assignats, or who should stipulate a different price for commodities according as the payment was to be made in specie or in assignats. For the second offence the penalty was to be 20 years' imprisonment (Aug. 1 1793), for which the death penalty was ultimately substituted (May 10 1794). This severe provision was, however, repealed after the fall of Robespierre. Notwithstanding these precautions the value of assignats still declined, till the proportion to specie had become that of six to one. Then came the passing by the convention, May 3 1793, of the absurd "maximum." The decree required all farmers and corn-dealers to declare the quantity of corn in their possession and to sell it only in recognized markets. No person was to be allowed to lay in more than one month's supply. A maximum price was fixed, above which, under severe penalties, no one was to buy or sell. These measures were soon stultified by further issues, and by June 1794 the total number of assignats aggregated nearly 8,000,000,000, of which only 2,464,000,000 had returned to the Treasury and been destroyed. The extension of the "maximum" to all commodities only increased the confusion. Trade was paralysed and all manufacturing establishments were closed down. Attempts by the convention to increase the value of the assignats were of no avail. Too many causes operated in favour of their depreciation: the enormous issue, the uncertainty as to their value if the Revolution should fail, the relation they bore to both specie and commodities, which retained their value and refused to be exchanged for a money of constantly diminishing purchasing power. Even between the assignats there were differences. The royal assignats, which had been issued under Louis XVI., had depreciated less than the republican ones. They were worth from 8 to 15% more, because of the hope that in case of a counter-revolution they would be less likely to be discredited.

The Directory was guilty of even greater abuses in dealing with the assignats. By 1796 the issues had reached the enormous figure of 45,500,000,000 francs, and even this gigantic total was swollen still more by the numerous counterfeits introduced into France from the neighbouring countries. The assignats had now become totally valueless—the abolition of the "maximum" the previous year (1795) had produced no effect, and though, by various payments into the Treasury, the total number had been reduced to about 24,000,000,000 francs, their face-value was about 30 to 1 of coin. At that value they were converted into 800,000,000 francs of land-warrants or *mandats territoriaux,* which were to constitute a mortgage on all the lands of the republic. These *mandats* were no more successful than the assignats, and even on the day of their issue were at a discount of 82%. They had an existence of six months, and were finally received back by the State at about the 70th part of their face value in coin. (*See* also PAPER MONEY; MONEY.)

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ASSIGNEE, one to whom property is assigned. (See ASSIGNMENT.)

ASSIGNMENT. An assignment is the term for that kind of total alienation by deed or writing (other than testamentary) of a chattel interest in real property, or of chattels personal, or of an equitable interest in real estate, which is not essentially destructive of such interest. Assignments are either voluntary or for valuable consideration. The former are specifically termed "gifts" (see GIFT). The document evidencing the latter is called a "bill of sale." The technical operative words of an assignment are "assign, transfer and set over"; but any other words showing an intention to make a complete transfer will amount to an assignment. In Scotland the usual term for this contract is assignation. The parties thereto in England and Scotland respectively are called assign and assignee, assignor and cedent. In the United States they are known as assignor and assignee.

In the United States.—An assignment of the property of a debtor is often made to a trustee for the benefit of creditors, the trustee being authorized to administer and to liquidate as far as necessary the assets, and to apply them to the satisfaction of the creditors, the surplus, if any, being returned to the assignor. Such assignment may be partial or general. **A** partial assignment may stipulate what is to be assigned, but a general assignment for the benefit of creditors embraces the entire property of the assignor except such part as may be exempt by statute, and constitutes an act of bankruptcy (*q.v.*). Exemptions vary in different jurisdictions and local laws must be consulted in any given case. A permanent assignment, such as is made in the transference of the title to stock and bonds, is known as an irrevocable assignment.

Assignment in Blank.—This is a formal assignment of a bond or of a certificate of stock in which the name of the party to whom the assignment is made is omitted; it is often called "endorsement in blank." Instruments so assigned are convenient and easy for a broker to handle with promptness, as he merely has to fill in the name of a purchaser to make the instrument transferable on the books of the issuing company. Great care must be exercised to guard against forgery in such stock assignments, and for that reason most corporations will not transfer stock on their books unless the signature of the assignee on the old certificate is guaranteed by a bank or by a stock exchange house or is acknowledged by a notary.

ASSIGNOR, one who assigns property to another. *(See* ASSIGNMENT.)

ASSIMILATION, a term used in psychology to denote the mechanism by which two or more mental processes are drawn into a single unitary whole. What takes place in psychological assimilation can be understood by considering the way in which lines slightly different in length are taken to be equal, or musical intervals slightly out of tune (as in equal-tempered musical instruments) assume the character of the pure intervals. In more complex mental formations, such as perceptions, recognitions, memories and emotions, the parts lose their individual independence and form a single unit of experience.

ASSINIBOIA, a name formerly applied to two districts of Canada, but not now held by any. (1) A district formed in 1835 by the Hudson's Bay Company, having in it Fort Garry at the junction of the Red and Assiniboine rivers in Rupert's Land, Korth America. It extended over a circular area, with a radius of 50m. from Fort Garry. It was governed by a local council nominated by the Hudson's Bay Company. It ceased to exist when Rupert's Land was transferred to Canada in 1870. (2) A district of the North-West Territories, which was given definite existence by an act of the Dominion parliament in 1875. Assiniboia extended from the western boundary of Manitoba (99° W. in 1875, and 101° 25′ W. in 1881) to 111° W., and from 49° N. to 52° N. The name was a misnomer, as it barely touched the Assiniboine river. To the north of the district lay the district of Saskatchewan, with which Assiniboia was united in 1905.

ASSINIBOIN, an American Indian tribe in the northern Plains, of Siouan affiliation, closely related in dialect to the Yankton Dakota, but separately mentioned as early as 1640. Their habitat in the 17th century was about Lake Winnipeg, and in the 18th century on the upper Saskatchewan, where they ultimately gave its name to the province of Assiniboia. Culturally they belong with the Dakota and Plains Cree. *See* R. H. Lowie, *Am. Mus. Nat. Hist. Anthr. Pap.*, vol. iv. (1909).

ASSISI (anc. *Asisium*), episcopal see, Umbria, Italy, province of Perugia, 15 mi. E.S.E. by rail from Perugia. Pop. (1936) town, 4,686; commune, 22,514. The town occupies a fine position on a spur of the Monte Subasio (1,345 ft. above sea-level) with a view over the Tiber and Topino. St. Francis was born here in 1182, and returned here to die in 1226. The Franciscan monastery and the lower and upper church of St. Francis, begun immediately after his canonization in 1228, and completed in 1253, are fine Gothic. The neo-classical crypt was added in 1818, when his sarcophagus was found. The lower church contains frescoes by Cimabue, and famous ones over the high altar by Giotto, illustrating the vows of the Franciscan order; while the upper church has frescoes representing scenes from the life of St. Francis (by Giotto and his pupils) on the lower nave walls, and scenes from the Old and New Testament history by Pietro Cavallini and his pupils on the upper. The church of Santa Chiara (St. Clare), the foundress of the Poor Clares, with its massive lateral buttresses, fine rose-window, and simple Gothic interior, was begun in 1257, four years after her death. It contains the tomb of the saint. Santa Maria Maggiore is also good Gothic. The cathedral (San Rufino) has a fine façade with three rose-windows of 1140. The mediaeval castle (1,655 ft.) was built by Cardinal Albornoz (1367) and added to by Popes Pius II. and Paul III. Two miles to the east in a ravine below Monte Subasio is the hermitage *delle Carceri* (of the prisons) (2,300 ft.), partly built, partly cut out of rock, given to St. Francis by Benedictine monks as a place of retirement. Close to the station is the large pilgrimage church of Santa Maria degli Angeli, begun in 1569 by Pope Pius V., with Vignola as architect, but not completed until 1679, partly destroyed by an earthquake in 1832, and afterwards rebuilt. It contains the original oratory of St. Francis (the Porziuncola) and the cell in which he died.

Discoveries from the ancient city of Asisium include traces of city walls, the so-called temple of Minerva (with six Corinthian travertine columns of the Augustan era), part of the pavement of the forum. and remains of the amphitheatre in the northeast corner. Asisium was the birthplace of the Roman poet Propertius.

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ASSIZE or **ASSISE,** a legal term, meaning literally a "session," but in fact sometimes a jury, or the sittings of a court, and sometimes the ordinances of a court or assembly.

It originally signified the form of trial by a jury of 16 persons, which eventually superseded the barbarous judicial combat; this jury was named the grand assize and was sworn to determine the right of seisin of land (*see* EVIDENCE). The grand assize was abolished in 1833; but the term assize is still applicable to the jury in criminal causes in Scotland.

In the only sense in which the word is not now almost obsolete, assize means the periodical session of the judges of the High Court of Justice held in the various counties of England, chiefly for the purposes of gaol delivery and trying causes at *nisi prius.* Previous to Magna Carta (1215) writs of assize had all to be tried at Westminster, or to await trial in the locality in which they had originated at the septennial circuit of the justices in eyre; but, by way of remedy for the great consequent delay and inconvenience, it was provided by this celebrated act that the assizes of *mort d'ancestor* and *novel disseisin* should be tried annually by the judges in every county. By successive enactments, the civil jurisdiction of the justices of assize was extended, and the number of their sittings increased, till at last the necessity of repairing to Westminster for judgment in civil actions was almost obviated to country litigants by an Act, passed in the reign of Edward I., which provided that the writ summoning the jury to Westminster should also appoint a time and place for hearing such causes within the county of their origin. The date of the alternative summons to Westminster was always subsequent to the former date, and so timed as to fall in the vacation preceding the Westminster term, and thus *"Unless before,"* or *nisi prius,* issues came to be dealt with by the judges of assize before the summons to Westminster could take effect. The *nisi prius* clause, however, was not then introduced for the first time. It occurs occasionally in writs of the reign of Henry III. The royal commissions to hold the assizes are (1) general, (2) special. The general commission is issued twice a year to the judges of the High Court of Justice, and two judges are generally sent on each circuit. It covers commissions—(1) of oyer and terminer, by which they are empowered to deal with treasons, murders, felonies, etc. This is their largest commission; (2) of *nisi prius* (*q.v.*); (3) of gaol delivery, which requires them to try every prisoner in gaol, for whatsoever offence committed; (4) of the peace, by which all justices must be present at their county assizes, or else suffer a fine. Special commissions are granted for inquest in certain causes and crimes (*see* CIRCUITS; PRACTICE AND PROCEDURE).

Assizes, in the sense of ordinances or enactments of a court or council of state, as the "assize of bread and ale," the "assize of Clarendon," the "assize of arms," are important in early economic history. As early as the reign of John the observance of the *Assisae venalium* was enforced, and for a period of 500 years thereafter it was considered no unimportant part of the duties of the legislature to regulate by fixed prices the sale of bread, ale, fuel, etc. (*see* ADULTERATION). The word assize is used in a wider legislative connection by early chroniclers and historians—the "assisae of the realme," *e.g.*, occasionally meaning the organic laws of the country. For the "assizes of Jerusalem" *see* CRUSADES.

The term assize, originally applying to an assembly or court, became transferred to actions before the court of the writs by which they were instituted. The following are the more important

Assize of darrein presentment, or last presentation, was a writ directed to the sheriff to summon an assize or jury to enquire who was the last patron that presented to a church then vacant, of which the plaintiff complained that he was deforced or unlawfully deprived by the defendant. It was abolished in 1833 and the action of *quare impedit* (*q.v.*) substituted. But by the Common Law Procedure Act 1860, no *quare impedit* can be brought, so that an action in thr king's bench of the High Court was substituted for it.

Assize of *mort d'ancestor* was a writ which lay where a plaintiff complained of an "abatement" or entry upon his freehold, effected by a stranger on the death of the plaintiff's father, mother, brother, sister, uncle, aunt, etc. It was abolished in 1833.

Assize of *novel disseisin* was an action to recover lands of which the plaintiff had been "disseised" or dispossessed. It was abolished in 1833. *See* Pollock and Maitland, *History of English Law.*

Assize, clerk of, an officer "who writes all things judicially done by the justices of assizes in their circuits." He has charge of the commission, and takes recognizances, records, judgments and sentences, grants certificates of conviction, draws up orders, etc. By the Clerks of Assize Act 1869 he must either have been for three years a barrister or solicitor in actual practice, or have acted for three years in the capacity of subordinate officer of a clerk of assize on circuit.

ASSIZE OF JERUSALEM: *see* CRUSADES.

ASSMANNSHAUSEN, a village of Germany, near Wiesbaden, on the right bank of the Rhine and the railway from Frankfort-on-Main to Niederlahnstein. Pop. 1,344. It has a lithium spring, baths and a *Kurhaus,* and is famed for its red wine *(Assmannshauser).*

ASSOCIABILITY is a term used by Herbert Spencer *(Principles of Psychology,* sec. 160 ff.) to denote the capacity of an experience (state of consciousness or feeling) of one kind for association or integration with others so as to lead subsequently to mutual revival or recall. He pointed out that emotions are less associable with one another than are other mental experiences. He explained this by saying that associability or integration varies directly with the relational character of experiences, and emotions are least relational, whereas visual experiences, *e g,* are among the most relational. *See* ASSOCIATION OF IDEAS; PSYCHOLOGY.

ASSOCIATED BANKS, banks that make daily clearings through the same clearing house, *i.e.,* a group of banks which are members of the same clearing house association. *(See* CLEARING HOUSE.)

ASSOCIATED PORTLAND CEMENT MANUFACTURERS, LTD. This company, formed in 1900, was one of the earliest of British industrial combinations. It amalgamated some 24 businesses, and the 32 works acquired, producing over 1,000,000 tons of cement a year, were nearly all situated on the Thames and Medway, the cradle of the Portland cement industry.

While the company possessed brands of repute, it suffered at the outset from over-capitalization and lack of working capital; these disadvantages were intensified by depression in the building industry. Also at this juncture a revolution was taking place in the method of production. The rotary kiln, an English invention, had been made a practical success in the United States. This method of calcination not only improved the quality of the cement but saved much fuel and labour as compared with the system of hand-operated chamber-kilns. J. Bazley White and Brothers, one of the constituent firms, had already secured a licence to install rotary kilns under American patents, and the company paid a large sum in cancellation of royalties, but the patent rights purchased afforded no exclusive advantages, as the rotary kiln system came to be generally adopted by cement manufacturers.

No dividend was paid on the ordinary share capital down to 1912, which marked a turning-point in the firm's affairs. With the aid of additional finance furnished by a debenture issue, the British Portland Cement Manufacturers, Ltd., was formed. This company absorbed 32 firms and also controlled a number of subsidiary companies. Much competitive tonnage was thus eliminated; the total tonnage controlled came to represent some 80% of the productive capacity of Great Britain. By 1926 the British Portland Cement Manufacturers, Ltd., had absorbed the assets of its subsidiary companies.

In recent years considerable sums have been expended in modernizing the plants. The new Bevan works, with an output of 10,000 tons weekly and shipping facilities enabling vessels up to 10,000 tons to be loaded expeditiously at any state of the tide, is probably the largest and most efficient cement plant in Europe. With the completion of other re-construction work, the annual group productive capacity will be 3,000,000 tons of rotary kiln Portland cement excluding all shaft kiln plant. The products of both companies are sold by the Cement Market Company, Limited. Foreign works are successfully operated in Mexico, British Columbia, South Africa and India. It should be added that the company gives close attention to research and welfare work.

The Associated Portland Cement Manufacturers, Ltd., had an issued share capital, at Dec. 31, 1927, of £4,785,000, and outstanding debentures of £4,139,000. The company owns, amongst other important cement properties, about 75% of the ordinary shares of British Portland Cement Manufacturers, Ltd., and at Dec. 31, 1927, the latter company had an issued share capital of £3,080,000 and outstanding debentures of £1,698,000.

ASSOCIATED PRESS. The Associated Press was founded in 1848 by six New York city newspapers which combined to divide the cost of gathering news by telegraph, then in its infancy. This group supplied its news to loosely formed regional associations such as the Western Associated Press, the New England Associated Press, and other imitative organizations. In 1862 the Western Associated Press began a fight for a voice in the management of the parent association. The conflict continued sporadically for 30 years. Finally, in 1892, Victor F. Lawson, of *The Chicago Daily News,* led a final uprising against the proprietary evils which threatened to disrupt systematic news gathering. Out of this struggle, known in journalism as the "Revolution of 1893," emerged the modern Associated Press, first and only world-wide. non-profit, co-operative news-gathering association. Operating on principles entirely different from those of any of its precursors, this organization absorbed the others. In 1940 the AP, as the organization is familiarly known, collected news and news pictures for its 1,437 member newspapers, and distributed this news over 285,000 miles of leased wires The pictures are delivered by Wirephoto over a 20,000-mile network linking major cities in the United States and Canada. The association maintains its own staff of 7,200 in key cities in the United States and foreign lands. The news report compiled by these employees is augmented by the work of the editorial forces on all member papers, which are obligated to supply the association with the news of their localities. In all, approximately 100,000 newspapermen and women contribute, directly or indirectly, to a report which totals upwards of 1,000,000 words of news daily. Originally an Illinois corporation, the co-operative transferred to New York in 1900 and obtained a charter under the membership corporation laws of that State. This charter provided for an organization which has no capital stock, makes no profits, declares no dividends. The association is owned and controlled by the member publishers who annually elect a board of directors which in turn chooses a president and a general manager. The cost of operation in 1939 was $11,081,321.05. Headquarters are in New York city.

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ASSOCIATE JUSTICE, a judicial official in the Federal and many of the State courts in the United States. In the United States judiciary there are eight associate justices of the Supreme Court, who have concurrent authority with the chief justice, except that he presides and assigns cases for opinions. Likewise there are eight associate justices of the United States court of customs, with headquarters in New York. Such associate justices have the same authority as the chief justice, except that he assigns the cases for hearings. In the District of Columbia there are five associate justices of the Supreme Court, which is the court of original general jurisdiction. They are assigned to the civil, equity or criminal divisions by their chief justices, who also sit as trial judges. The members of the supreme courts of the Territories who do not preside over the courts are associate justices. In the various States the courts of highest jurisdiction are either the supreme court or the court of appeals, composed of judges or

justices. Where justices sit on the bench, the associate justices are all the members of the body except the chief justice, and their relationship is similar to that of the chief justice and associate justices of the United States Supreme Court. In other States the presiding official is the chief judge or presiding judge, and his associates are known as judges or associate judges. In a few States, such as New York, the courts of general original jurisdiction are presided over by justices rather than by judges.

See C. N. Callender, American Courts, Their Organization and Procedure (1927). (S. LE.)

ASSOCIATION is a term used in a specialized sense in chemistry to denote the union of like atoms of an element or molecules of a compound to give a more complex molecule having the same chemical properties. The term polymerization is not quite synonymous, for it has a wider application (see later). Thus the molecule of white phosphorus is produced by the association of four atoms of the element to give P_4, and the molecules of water are said to be associated because they are complex molecules, each consisting of two or three simple H_2O molecules. The reverse process of complex molecules breaking down to simple ones is known as dissociation, but this term is not necessarily the converse of the term association, since it includes also the breaking down of a molecule into simpler unlike species (ions, atoms, or molecules).

The phenomenon of association is found in solids, liquids, and gases, but its extent can only be determined with certainty in the case of gases; its existence can be detected in the case of liquids, but its extent cannot be determined definitely; whilst in solids, its existence is inferred both because a solid is probably at least as complex as the corresponding liquid or vapour, and because, in many cases, X-ray examination shows that several molecules unite to form a crystal unit.

The existence of association in gases was inferred from vapour-point density determinations by E. Mitscherlich and J. B. A. Dumas, but its extent was only clearly demonstrated when S. Cannizzaro showed how to apply Avogadro's law to such cases. Chiefly owing to the work of Victor Meyer, a mass of data was then accumulated on the molecular complexity of vapours at temperatures up to 2,000°C. Thus, the vapour densities showed that the molecules of most metals were monatomic at temperatures slightly above their boiling points, that phosphorus was P_4 in the vapour state, arsenic As_2 at 1,700°C., and sulphur S_8 under reduced pressure at 2o0°C., decreasing by stages to S_2 at about 1,700°C. This decreasing complexity with increasing temperature is quite general, and even stable molecules like Cl_2 and Br, begin to break up to Cl and Br above 1,000°C.; so also at very high temperatures H,, N_2, and O, show a very slight dissociation to simple atoms. Among compounds, cuprous chloride was shown to be Cu, Cl_2 in a state of vapour, and ferric chloride to be Fe_2Cl_6 at about 500°C., whereas many metallic chlorides and bromides were unassociated; acetic acid was $(C_2H_4O_2)_2$ just above its boiling point, but $C_2H_4O_2$ at about 200°C.; phosphorous, arsenious, and antimonious oxides were P_4O_6, As_4O_6, and Sb_4O_6 at low temperatures, the second being As_2O_3 at 1,800°C. and the last remaining complex even at this high temperature. Phosphoric oxide seems to persist as P_4O_{10} at very high temperatures. In many cases the equilibrium between the higher and lower type of molecule has been shown to conform to the law of mass action (see CHEMICAL ACTION) at each of a number of temperatures. Moreover, according to this law, increase of pressure should decrease dissociation, *i.e.*, favour association, and this also has been verified. The association of nitrogen peroxide can be followed visually by the loss of colour as the deep brown NO, is cooled and assumes the form of the colourless N_2O_4 in increasing proportions.

In a few cases, vapour-density results have led to erroneous conclusions; thus, mercurous chloride was thought to be HgCl until it was shown that the molecule was really Hg_2Cl_2, but that it dissociated into unlike molecules ($Hg_2Cl_2 \longrightarrow Hg + HgCl_2$) and not into like molecules (2HgCl). According to H. B Baker, however, perfectly dry mercurous chloride does not dissociate hut remains as Hg_2Cl_2 in the vapour state (*see* DRYNESS, CHEMICAL)

The association of liquids can be deduced from a variety of phenomena. J. D. van der Waals showed that a certain relation should hold between the critical temperature and pressure and the vapour pressure at any given temperature, and the fact that marked deviations were fbund by S. Young in the case of certain liquids containing hydroxyl groups (*e.g.*, water, alcohols, and acetic acid) was ascribed to association in the case of these liquids. Similarly, the abnormally high boiling point of water (100°C.), when compared with that of hydrogen sulphide (−60°C.), for instance, leads to the same conclusion. Further, F. Trouton showed that for "normal" liquids the equation $ML/T = 20{\cdot}7$ held with fair accuracy at the boiling point (M=molecular weight; L=latent heat of vaporization; T=absolute temperature); marked deviation from this relation is shown by the above hydroxylic liquids and is regarded as evidence of association.

The precise extent of association in the liquid state was first studied by Sir W. Ramsay and J. Shields, using a modification of a formula proposed by R. Eotvos. If γ is the surface tension, M the molecular weight, and v the specific volume at any given temperature T, then they found that the "molecular surface energy" $\gamma(Mv)^{\frac{2}{3}}$ changes at a definite rate with change of temperature: $d\gamma(Mv)^{\frac{2}{3}}/dT = k$, the constant k being approximately 2.121 for all non-associated liquids. In many cases, k was less than this value, and a factor x was introduced, such that the use of Mx instead of M gave the correct value for k. The necessary value of x decreased with rise of temperature and was held to denote the degree of association, and the results were in agreement with the foregoing qualitative methods. Quantitatively, however, the method is open to many objections; P. Walden showed that k was not a constant, even for normal liquids, and was dependent upon the molecular weight, varying from 2 up to about 6, this high value obtaining for tristearin. G. M. Bennett and A. D. Mitchell showed that the "total molecular surface energy," $K = (\gamma - T.d\gamma/dT)\ (Mv)^{\frac{2}{3}}$, was constant over a wide range of temperature for any one unassociated liquid, and that K was an additive function of certain atomic and structural constants even for substances which gave high values for Ramsay and Shields's k; K was not constant for associated liquids, but although the method could be applied to the evaluation of the degree of association of some liquids, it failed in the case of hydroxylic liquids. Walden used the specific cohesion $a^2 = 2\gamma v$ and found that $Ma^2/T = 1{\cdot}162$ for normal liquids, and this constant did not suffer from the same disadvantages as that of Ramsay and Shields. By a modification of this he deduced degrees of association for many substances, but some (e g., benzene, 1·85) seemed improbable as judged by other methods.'

Longuinescu found that for normal liquids $T/d\sqrt{n} = 100$, where d is density at boiling point, T (in absolute degrees), and n is the number of atoms in the molecule. His results for n led to values for the degree of association which were similar to those deduced from other methods. E. C. Bingham, from viscosity data, and J. Traube, from considerations of atomic and molecular volumes, deduced similar results. The general trend of the foregoing methods seems to indicate that water is chiefly $(H_2O)_2$ and $(H_2O)_3$, but this is doubtless a statistical average for all sorts of molecules from H_2O to, possibly, $(H_2O)_6$ (see WATER).

Still more modern views, based on dielectric constants, internal pressure, and other physical properties, tend to supplant all the foregoing results in attributing a considerable but *constant* degree of association to many of the liquids hitherto regarded as "normal," and a similar but variable degree to other liquids.

Although it is not possible to give any very definite information as to solids, yet many cases are on record in which they give complex molecules in solution. Thus, benzoic acid exists as double molecules in benzene solution; trimethylammonium chloride and bromide undergo four- or five-fold association in fairly concentrated bromobenzene solution; phosphorus and sulphur are respectively P_4 and S_8 in carbon disulphide solution; but most metals are monatomic when dissolved in mercury or molten tin.

'In dealing with surface-tension measurements, it must always be remembered that the molecules in the surface layer may differ from those in the bulk of the liquid.

In dealing with solutions, however, so many new factors are involved that the results should not be accepted as conclusive without careful consideration—the solvent plays an important and imperfectly understood part in such cases. For this reason, it is doubtful how to interpret G. Oddo's results that water has an association factor of 1·2—2·0 when dissolved in several organic solvents.

It is important to note that association in the solid state is a fundamental concept of A. Smits's theory of allotropy (*q.v.*), and that the results of both this author and H. B. Baker seem to show that association in the solid and liquid states depends on the degree of dryness (*q.v.*), just as it does in the gaseous state.

As implied at the outset, the terms association and polymerization are not always interchangeable, for the latter was applied by J. J. Berzelius (1833) to cases where the percentage composition remained the same, but the properties (and molecular weight) were different, whereas in association there is no well-marked change in the chemical properties, as far as we are able to tell. In the article POLYMERIZATION, instances are given of organic substances which differ greatly from their "polymerides"; on the other hand, in the cases dealt with here, such differences are not sufficiently pronounced to be detectable as a rule, although the different forms of phosphorus and sulphur may possibly have to be classed as polymerides on account of their altered solubility properties (see ALLOTROPY). It may be that, in the future, improved experimental technique will be able to assign different properties to each of the different stages of complexity in the molecules of all the substances discussed here.

BIBLIOGRAPHY.—W. E. S. Turner, *Molecular* Association (1915).

(A. D. M.)

ASSOCIATION ADVERTISING is the co-operative advertising of competitors to promote the sale or use of the product of an industry, *e.g.*, the campaign to increase the buying of cut flowers. While this is really co-operative advertising by competitors, it is usually conducted and paid for by the trade association of the industry; hence is commonly called Association Advertising. It developed early in the 20th century and reached its peak in 1925 when there were 31 associations expending from $30,000 to $1,500,000 annually in co-operative sales promotion. This form of advertising has arisen out of a new conception of competition which recognized that trade rivalry is not merely that of one concern with another in the same kind of business, but rather that of one industry with another; *e.g.*, aggressive advertising for composition roofings curtailed the sale of cedar shingles. The proprietors of the shingle mills, through their association, raised an advertising fund and began vigorously to promote the sale of their product. Behind many other association campaigns there has been a similar development. It may be noted that the result is not merely an advertising battle in which each industry struggles to hold what it already has, for if the advertising is successful even competing industries may prosper more with advertising than without. This is illustrated by the experiences of manufacturers of flat wall-paints and wall-papers. Before makers of the latter started advertising, their products suffered a diminution of sales because of the aggressive advertising of the former. An association advertising campaign for wall-paper resulted in greatly increased sales without reducing the consumption of flat paints. The explanation is that people became "wall conscious," in the language of the marketing man. Whereas walls had frequently gone for years without refreshening or redecorating, under the stimulus of the two advertising campaigns, new wall-paper or new paint was often applied annually or biennially.

See Hugh E. **Agnew,** Co-operative Advertising by Conzpetitors (1926); Neil Borden, Co-operative Advertising (1932) (H. E. A.)

ASSOCIATION OF IDEAS. The chief problem that is involved in a discussion of the Association of Ideas and the Laws of Association is the problem of recollection and the conditions under which it takes place. Although the expression "association of ideas" was introduced by Locke, the problem under consideration was already dealt with by Plato incidentally, and by Aristotle fairly fully. According to Plato. reminiscence takes place in one of the three ways illustrated by the following examples: (1) A lyre or garment belonging to the beloved one puts the lover in mind of him. (2) From beholding a picture of Simmias you may remember him. (3) The sight of a weedy youth may put one in mind of a robust athlete. These examples illustrate what are usually known as association *by* contiguity, similarity and contrast respectively. Aristotle was much more explicit than Plato in formulating these types or laws of association as principles governing the reinstatement of ideas previously experienced. These three laws of association were accepted and taught by various philosophers (Epicureans, Stoics and Scholastics) during the centuries that intervened between Aristotle and Hobbes. But no great importance was attached to these principles. Even Locke, who, as already remarked, coined the phrase "association of ideas," laid no particular stress on the laws of association. Hobbes attached considerable importance to association of ideas in mental life, but did not advance the subject of association to any appreciable extent. It was Hume who marked the next considerable advance beyond Aristotle in this matter. He recognized association by *contiguity*, and by similarity; but instead of association of contrast Hume put forward association by cause and effect—the observation of clouds, for instance, puts one in mind of rain. Strictly speaking this was really tantamount to reducing the laws of association to two, namely, those of contiguity and resemblance, since Hume regarded the idea of causal connection as merely a case of habitual association by contiguity (or contiguous sequence) between an antecedent and a consequent. Hume, however, was interested in the epistemological bearing of the subject of association of ideas rather than in its psychological importance.

The so-called Associationist Psychologists (Hartley, James Mill, etc.) attached exaggerated importance to the association of ideas, which they regarded as occupying in the realm of psychology a place analogous to the Law of Gravitation in the realm of Physics (see ASSOCIATIONISM), as Hume had already vaguely suggested.

Criticism and Restatement. — (a) Thomas Brown, although he may be described as a member of the school of Associationists or Associationist Psychologists, objected to the term Association, for which he substituted the term suggestion. He pointed out that the term association appears to imply some previous association between the idea suggested and the idea which suggested it. Yet in many cases, and especially in cases of so-called association by similarity, there is no previous association—any object seen for the first time may suggest the idea of something resembling it, but which has never been associated with it in the past. Even if the term association be suitable in cases of association by contiguity (even this Brown questioned), it was clearly inappropriate for cases of suggestion by similarity.

(b) F. H. Bradley went far beyond Brown in his criticism of the laws of association, although he did not repudiate association in principle, when properly formulated and kept within its proper bounds. The laws of association most widely accepted in the 19th century were those of contiguity and of similarity—the only ones really acknowledged by Hume. The main points in Bradley's criticism come out most clearly if attention is paid to the way in which the laws were formulated by the best known British psychologist of the 19th century, A. Bain. (1) The Law of Contiguity: "Actions, sensations and states of feeling, occurring together or in close connection, tend to grow together, or cohere, in such a way that, when any one of them is afterwards presented to the mind, the others are apt to be brought up in idea" (Senses *and* Intellect, p. 327). To this Bradley said that sensations, etc., are particular experiences or events that do not recur at all. Consequently the sensations that are contiguous are not really associated in the manner stated by the law of contiguity, whereas the associated ideas were never contiguous before, so that their association could not be due to their contiguity. (2) The Law of Similarity: "Present actions, sensations, thoughts or emotions tend to revive their like among previous impressions or states" (ibid. p. 457). Bradley's criticism based on the non-recurrence of the same sensation, etc., applies here also. And he adds two further criticisms. Two ideas, etc., can only be recognized as

similar if they are both present in the mind; but what the law seeks to explain is how an idea present in the mind calls up another that is absent. Moreover, ideas alleged to be associated by similarity are usually more unlike than like one another; so that the recall cannot be due to mere similarity. Bradley then formulated his own law of association to which he gave the name (borrowed from Hamilton) of the *Law* of Redintegration: "Any part of a single state of mind tends, if reproduced, to reinstate the remainder," or "any element tends to reproduce those elements with which it has formed one state of mind." At first sight this law appears to be exposed to Bradley's own criticism about the non-recurrence of states of mind. But the most characteristic feature in Bradley's account (though it can really be traced to Aristotle) is his view that association only marries universals, that is, it associates not particular experiences as such, but the elements that are identical in the individual of the same type. In this way Bradley's Law of Redintegration is really a law of identity and contiguity.

(c) Physiological Basis of Association.—Of the older psychologists, Aristotle and Hartley were almost the only ones to attempt some sort of explanation of association, namely, by reference to its physiological or neural basis. But until quite recently the subject received very little further attention—most psychologists being content apparently to subscribe to Hume's remark that the causes of association "are mostly unknown, and must be resolved into original qualities of human nature, which I pretend not to explain" (Inquiry Concerning *Human* Understanding, Part I. § v.). But with the increasing vogue of Physiological Psychology, the attempt to find a physiological explanation of association or suggestion has naturally been renewed. So far as association by contiguity is concerned, a physiological account seems to suggest itself readily. W. James pointed to the "laws of habit in the nervous system" as its physiological cause or basis. The idea more or less generally accepted is that if two nerve-centres in the brain are excited simultaneously or in immediate succession, then some connection is established between them, to the extent at least that the resistance at their synapse (the point of contact between two neurones or nerve-centres) is reduced; and the more frequently this simultaneous or successive activity of two neurones occurs, the more does the path between them tend to become a path of least resistance, so that if one of them is afterwards excited, the excitation spreads to the other. If Bradley's Law of Redintegration be accepted as a true account of association, then the foregoing physiological account of association by contiguity may be made to account for all association—similarity being explained by identity and contiguity. And this is so much in favour of Bradley's views on the matter. But the physiological account involves, of course, the larger problem of the relation between body and mind.

(d) J. Ward and G. F. Stout.—Excessive stress on Association, as may be seen most clearly in the case of so-called associationist psychology, has had a tendency to betray psychologists in two ways. It has often misled them to overlook the initial unity of consciousness, to treat experiences as if they were ultimately mere atoms put together and held together by the quasi-gravitation of association. And in the second place, but largely perhaps in consequence of this soulless treatment of psychology, the whole character of association was conceived in a too impersonal and non-conational manner—as if human experiences were the chance result of the play of impersonal tendencies and in no way influenced by the desires and strivings of the individual subject of the experiences. These defects curiously enough are not to be found in Aristotle, who indeed laid emphasis on the activity and purposiveness involved in recollection and association—"we hunt," he says, "for the next in the series, starting our train of thought from what is now present or from something else, and from something similar or contrary or contiguous to it" (Memory *and* Recollection, 452a, p. 111, ed. G. R. T. Ross). The faults in question were mainly the consequence of a tendency to fall into line with the mechanistic ideas of modern science. Ward and Stout have done much to stem this current of thought in psychology, and to remedy the faults under consideration. Association, according to Ward, is largely a matter of selective attention, and attention largely depends on interest. Hence to a considerable extent association is a form of integration or a way of constructing a continuum expressing and subserving some interest of the experiencing mind. Stout likewise emphasizes the importance of interest in the formation of associations. Association and recall are determined by continuity of interest.

BIBLIOGRAPHY.—G. Croom Robertson, *Philosophical Remains* (contains *a* brief history); *G.* R. T. Ross's edition and translation of Aristotle's *De Sensu* and *De Memoria;* works on Psychology by Bain, Sully, Ward, Stout, James, etc.; the works of the other writers mentioned in the text. (A. Wo.)

ASSOCIATIONISM or **ASSOCIATIONIST PSYCHOLOGY.** This is the name of a theory that mental experiences consist in the last resort of certain ultimate elements of consciousness which are variously combined into complex wholes under the laws of association. (See ASSOCIATION OF IDEAS.) In its extreme form this theory treats the whole development of the mind as little more than an increase in the combinations of pre-existing elements. The theory was probably modelled more or less on the atomic theory in physics—the simple elements of experience corresponding to physical atoms, and association to gravitation.

Associationism may be traced to some extent to the ancient Epicureans and Stoics. But it is mainly modern, and, indeed, British, though not without some adherents in France and Germany.

In the modern period, Hobbes is the first thinker of permanent note to whom this doctrine may be traced. Though, in point of fact, he took anything but an exhaustive view of the phenomena of mental succession, yet after dealing with trains of imagination, or what he called mental discourse, he sought in the higher departments of intellect to explain reasoning as a discourse in words dependent upon an arbitrary system of marks, each associated with, or standing for, a variety of imaginations; and, save for a general assertion that reasoning is a reckoning—otherwise a compounding and resolving—he had no other account of knowledge to give. The whole emotional side of mind, or, in his language, the passions, he, in like manner, resolved into an expectation of consequences based on past experience of pleasures and pains of sense. Thus, though he made no serious attempt to justify his analysis in detail, he is undoubtedly to be classed with the associationists of the next century. They however, were wont to trace their psychological theory no further back than to Locke's Essay. Bishop Berkeley was driven to posit expressly a principle of suggestion or association in these terms:—"That one idea may suggest another to the mind, it will suffice that they have been observed to go together without any demonstration of the necessity of their co-existence, or so much as knowing what it is that makes them so to co-exist." (*New* Theory *of* Vision, §25); and to support the obvious application of the principle to the case of the sensations of sight and touch before him, he constantly urged that association of sound and sense of language which the later school has always put in the foreground, whether as illustrating the principle in general or in explanation of the supreme importance of language for knowledge. It was natural, then, that Hume, coming after Berkeley, and assuming Berkeley's results, though he reverted to the larger inquiry of Locke, should be more explicit in his reference to association; but he was original also, when he spoke of it as a "kind of attraction which in the mental world will be found to have as extraordinary effects as in the natural, and to show itself in as many and as various forms." (Human Nature, i. 1, §4). Other inquirers about the same time conceived of association with this breadth of view, and set themselves to track, as psychologists, its effects in detail.

David Hartley, in his *Observations* on Man, published in 1749 (11 years after the *Human Nature,* and one year after the better-known Inquiry of Hume), opened the path for all the investigations of like nature that have been so characteristic of English psychology. A physician by profession, he sought to combine with an elaborate theory of mental association a minutely detailed hypothesis as to the corresponding action of the nervous system, based upon the suggestion of a vibratory motion within

the nerves thrown out by Newton in the last paragraph of the *Principia*. So far. however, from promoting the acceptance of the psychological theory, this physical hypothesis proved to have rather the opposite effect, and it began to be dropped by Hartley's followers (as F. Priestly, in his abridged edition of the Observations, 1775) before it was seriously impugned from without. When it is studied in the original, and not taken upon the report of hostile critics, who would not, or could not, understand it, no little importance must still be accorded to the first attempt, not seldom a curiously felicitous one, to carry through that parallelism of the physical and psychical, which since then has come to count for more and more in the science of mind. Nor should it be forgotten that Hartley himself, for all his paternal interest in the doctrine of vibrations was careful to keep separate from its fortunes the cause of his other doctrine of mental association. Of this the point lay in no mere restatement, with new precision, of a principle of coherence among "ideas," but in being taken as a clue by which to follow the progressive development of the mind's powers. Holding that mental states could be scientifically understood only as they were analysed, Hartley sought for a principle of synthesis to explain the complexity exhibited not only in trains of representative images, but alike in the most involved combinations of reasonings and (as Berkeley had seen) in the apparently simple phenomena of objective perception as well as in the varied play of the emotions, or again in the manifold conscious adjustments of the motor system. One principle appeared to him sufficient for all, running, as enunciated for the simplest case, thus: "Any sensations A,B,C, etc., by being associated with one another a sufficient number of times, get such a power over the corresponding ideas (called by Hartley also vestiges, types, images), *a,b,c,* etc., that any of the sensations A, when impressed alone, shall be able to excite in the mind, *b,c,* etc., the ideas of the rest." To render the principle applicable in the cases where the associated elements are neither sensations nor simple ideas of sensations, Hartley's first care was to determine the conditions under which states other than these simplest ones have their rise in the mind, becoming the matter of ever higher and higher combinations. The principle itself supplied the key to the difficulty when coupled with the notion, already implied in Berkeley's investigations, of a coalescence of simple ideas of sensation into one complex idea, which may cease to bear any obvious relation to its constituents. So far from being content, like Hobbes, to make a rough generalization to all mind from the phenomena of developed memory, as if these might be straightway assumed, Hartley made a point of referring them, in a subordinate place of their own, to his universal principle of mental synthesis. He expressly put forward the law of association, endued with such scope, as supplying what was wanting to Locke's doctrine in its more strictly psychological aspect, and thus marks by his work a distinct advance on the line of development of the experimental philosophy.

The new doctrine received warm support from some, as Law and Priestley, who both, like Hume and Hartley himself, took the principle of association as having the like import for the science of mind that gravitation had acquired for the science of matter. The principle began also, if not always with direct reference to Hartley, yet, doubtless, owing to his impressive advocacy of it. to be applied systematically in special directions, as by Abraham Tucker (1768) to morals, and by Archibald Alison (1790) to aesthetics. Thomas Brown (d. 1820) subjected anew to discussion the question of theory. Hardly less unjust to Hartley than Reid or Stewart had been, and forward to proclaim all that was different in his own position, Brown must yet be ranked with the associationists before and after him for the prominence he assigned to the associative principle in sense-perception (what he called external affections of mind) and for his reference of all other mental states (internal affections) to the two generic capacities or susceptibilities of simple and relative suggestion. He preferred the word suggestion to association, which seemed to him to imply some prior connecting process, whereof there was no evidence in many of the most important cases of suggestion, nor even, strictly speaking, in the case of contiguity in time where the term seemed least inapplicable. According to him, all that could be assumed was a general constitutional tendency of the mind to exist successively in states that have certain relations to each other, of itself only, and without any external cause or any influence previous to that operating at the moment of the suggestion. Brown's chief contribution to the general doctrine of mental association, besides what he did for the theory of perception was, perhaps, his analysis of voluntary reminiscence and constructive imagination — faculties that appear at first sight to lie altogether beyond the explanatory range of the principle. In James Mill's Analysis of the Phenomena of *the Human Mind* (1829) the principle, much as Hartley had conceived it, was carried out, with characteristic consequence over the psychological field. With a much enlarged and more varied conception of association, Alexander Bain re-executed the general psychological task, while Herbert Spencer revised the doctrine from the new point of view of the evolution-hypothesis. John Stuart Mill made only occasional excursions into the region of psychology proper, but sought, in his System of Logic (1843), to determine the conditions of objective truth from the point of view of the associationist theory, and, thus or otherwise being drawn into general philosophical discussion, spread wider than any one before him its repute.

The associationist school has been composed chiefly of British thinkers, but in France also, it has had distinguished representatives. Of these it will suffice to mention Condillac, who professed to explain all knowledge from the single principle of association (liaison) of ideas, operating through a previous association with signs, verbal or other. In Germany, before the time of Kant, mental association was generally treated in the traditional manner as by Wolff. Kant's inquiry into the foundations of knowledge, agreeing in its general purport with Locke's however it differed in its critical procedure, brought him face to face with newer doctrine that had been grafted on to Locke's philosophy; and to account for the fact of synthesis in cognition, in express opposition to associationism, as represented by Hume, was, in truth, his prime object, starting as he did, from the assumption that there was that in knowledge which no mere association of experience could explain. To the extent, therefore, that his influence prevailed, all inquiries made by the English associationists were discounted in Germany. Notwithstanding, under the very shadow of his authority a corresponding, if not related, movement was initiated by J. F. Herbart. Peculiar and widely different from anything conceived by the associationists, as Herbart's metaphysical opinions were, he was at one with them and at variance with Kant, in assigning fundamental importance to the psychological investigation of the development of consciousness, nor was his conception of the laws determining the interaction and flow of mental presentations and representations, when taken in its bare psychological import, essentially different from theirs. In F. E. Beneke's psychology also, and in more recent inquiries conducted mainly by physiologists, mental association has been understood in its wider scope, as a general principle of explanation.

The associationists differ not a little among themselves in the statement of their principle, or when they adduce several principles, in their conception of the relative importance of these. Hartley took account only of contiguity, or the repetition of impressions synchronous or immediately successive; the like is true of James Mill, though incidentally, he made an express attempt to resolve the received principle of similarity, and through this, the other principle of Contrast, into his fundamental law — law of Frequency, as he sometimes called it, because upon frequency, in conjunction with vividness of impressions, the strength of association, in his view, depended. In a sense of his own, Brown also, while accepting the common Aristotelian enumeration of principles, inclined to the opinion that "all suggestion may be found to depend on prior co-existence, or at least on such proximity as is itself very probably a modification of co-existence," provided account be taken of "the influence of emotions and other feelings that are very different from ideas, as when an analogous object suggests an analogous object by the influence of an emotion which

each separately may have produced before, and which is, therefore, common to both." To the contrary effect, Spencer maintained that the fundamental law of all mental association is that presentations aggregate or cohere with their like in past experience, and that, besides this law, there is in strictness no other, all further phenomena of association being incidental. Thus in particular, he would have explained association by contiguity as due to the circumstances of imperfect assimilation of the present to the past in consciousness. A. Bain regarded contiguity and similarity logically, as perfectly distinct principles, though in actual psychological occurrence blending intimately with each other, contiguous trains being started by a first (it may be implicit) representation through similarity, while the express assimilation of present to past in consciousness is always, or tends to be, followed by the revival of what was presented in contiguity with that past.

The highest philosophical interest, as distinguished from that which is more strictly psychological, attaches to the mode of mental association called inseparable. The coalescence of mental states noted by Hartley, as it had been assumed by Berkeley, was further formulated by James Mill in these terms:—"Some ideas are by frequency and strength of association so closely combined that they cannot be separated; if one exists, the other exists along with it in spite of whatever effort we make to disjoin them." (Analysis of the *Human* Mind, 2nd ed. vol. i., p. 93.)

J. S. Mill's statement is more guarded and particular:—"When two phenomena have been very often experienced in conjunction, and have not, in any single instance, occurred separately either in experience or thought, there is produced between them what has been called inseparable, or, less correctly, indissoluble, association; by which is not meant that the association must inevitably last to the end of life—that no subsequent experience or process of thought can possibly avail to dissolve it; but only that as long as no such experience or process of thought has taken place, the association is irresistible; it is impossible for us to think the one thing disjoined from the other."—(Examination of Hamilton's Philosophy, 2nd ed., p. 191.)

It is chiefly by J. S. Mill that the philosophical application of the principle has been made. The first and most obvious application is to so-called necessary truths—such, namely, as are not merely analytic judgments but involve a synthesis of distinct notions. Again, the same thinker sought to prove inseparable association the ground of belief in an external objective world. The former application, especially, is facilitated, when the experience through which the association is supposed to be constituted is understood as cumulative in the race, and transmissible as original endowment to individuals—endowment that may be expressed either, subjectively, as latent intelligence, or, objectively, as fixed nervous connections. Spencer, as before suggested, is the author of this extended view of mental association.

BIBLIOGRAPHY.—(*See* ASSOCIATION OF IDEAS.) (A. Wo.)

ASSOCIATIONS, INDUSTRIAL. Associations whose membership consists of firms engaged in a particular branch of industry or trade are of three kinds:

(1) those which exist for purposes of collective bargaining with their workpeople or their representatives;

(2) those which are concerned with the regulation of prices, output, sales, etc.; and

(3) those which devote themselves to the technical, scientific and informational aspects of the business in which the firms are engaged.

These three types of function are not mutually exclusive, but in Great Britain most industrial associations devote themselves wholly or mainly to one or other kind of activity. In the United States employers' associations for dealing with workpeople are rare, trade unionism being neither so developed nor so recognized as in other countries; price and output associations, being illegal, are not openly existent; therefore all industrial associations fall ostensibly within the third type. Such American employers as have occasion to negotiate collectively with workpeople are tending to do so through the medium of the informational trade association.

Employers' Associations.—There are in Great Britain some 2,500 associations of employers concerned with matters relating to the employment of labour. They may be regarded as the counterpart on the employers' side of the Trade Union on the workpeople's side. They exist for the purpose of establishing a unified policy among the employers in the industry in regard to wages, hours and working conditions generally, and their principal activities culminate in negotiating agreements on these matters with the responsible Trade Unions (see TRADE UNIONS), and in giving effect generally to the collective views of employers in the industry upon labour questions. In some countries there is a central organization whose membership consists not of individual concerns but of the Employers' Associations for the various industries. In Great Britain there is the National Confederation of Employers' Organizations, which exists for the purpose of co-ordinating the industrial and political activities of the many employers' associations or federations which constitute its membership. This body may be regarded as the employers' counterpart of the General Council of the Trades Union Congress.

Associations for the Regulation of Trade.—Associations of business concerns for the regulation of prices, output, tendering, selling areas, etc., exist in very many branches of British trade and industry. They are properly constituted bodies having rules, constitution, officers, subscription, entrance fees, etc. The object of these associations is to control the competition in which firms in the same line of business ordinarily engage, in such a way as to make for remunerative prices, steady trade, and reduction of overlapping and waste. They represent one phase of the persistent tendency towards the replacement of competition in industry by combination (see COMBINES, also COMPETITION IN INDUSTRY), but trade associations must be distinguished from some other forms of industrial combination in that they are terminable alliances and not permanent fusions (see AMALGAMATION; also TRUSTS). The Trade Association is an association, for particular purposes, of otherwise independent and self-governing business concerns. So long as it exists, members must conform to its rules or incur penalties; but if for any reason—stress of external circumstance or internal jealousy or disloyalty—it should break up, the constituent firms revert to their original unfettered independence, competing against each other, it may be, as keenly as before. These internal disruptive forces are on occasion very strong and the history of British associations for the regulation of trade exhibits many instances of dissolution followed after a time by re-formation.

Under English law contracts or agreements in restraint of trade, such as those between members of the associations described above, are not actually illegal unless they involve an illegal act, but they are in principle unenforceable, since the Courts will not in general entertain any legal proceeding instituted with the object of enforcing or recovering damages for the breach of such agreements. In the United States agreements for the limitation of competition are illegal under the Sherman Law (1890). In Canada associations regulating price or output are liable to investigation under the Combines Act of 1923 with punishment under the Criminal Code in case of proved offence. In Australia and New Zealand there is little legal interference with such associations.

Informational Associations.—Associations existing solely for the supply of statistical or credit information to their members or for scientific and technical research and standardization. and concerning themselves not at all with the regulation of trade, are not numerous in Great Britain, though some outstanding examples occur in the iron and steel, electrical, motor, chemical, silk, glass, leather, paint, flint glass, and paper industries. The interchange of information in regard to credit terms, railway rates, shipping freights, forms of contract, methods, and processes, the standardization and interchange of costings, and the collection and dissemination of trade statistics is more frequently carried out as an adjunct to the control of prices or output. The Federation of British Industries may be regarded as the central organization concerned with the co-ordination of the informational activities of trade associations and as the counterpart, in the sphere of

trade, of the National Confederation of Employers' Organizations in that of wages, hours, and working conditions.

In the United States, however, concerted action in fixing prices or regulating output is questionable under the common law and definitely illegal under the various anti-trust statutes. The years onward from the passage of the Sherman act in 1890 have been years of uncertainty as to what a trade association might or might not legally do, but there has, notwithstanding, been a vast increase in the members of such associations. About 1910 the idea of "co-operative competition" through the medium of "Open Price Associations" took shape. Under this plan members were to furnish to the association day by day particulars of enquiries, quotations and orders and, less frequently, of output and stocks. These were to be collated, and a summary statement based on the returns despatched to all members. Since the information so furnished related to past, not future, prices and output, and was in the nature of an ascertainment, not an agreement, it was expected that these activities would be found not to be in contravention of the law, but to be a salutary and legal means of turning blind competition into informed competition. The courts, however, found against these activities where it could be shown that they resulted in fact in approximations to a unified policy in regard to production or price, but the decision of the Supreme Court, in the Maple Flooring and Cement cases in 1925, established the legality of a much wider range of informational activity than had previously been known to be definitely within the law. The trade association on the informational basis is one of the most momentous features of modern industrial developments in the United States. According to an estimate made by the National Industrial Conference Board in 1925 "it is fairly safe to assume the existence of between 800 and 1,000 trade associations of a national or interstate character." (J. H.)

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ASSOCIATION TESTS are used in psychology to discover the mental connections which underlie such cognitive functions as perception, learning, memory, language ability, reasoning and judgment, and also in psychopathology to discover the way in which emotional experiences upset normal mental connections. In the usual association test an individual is given a word and is told to respond with the first word which comes into his mind. The exact procedure varies for different purposes. The kind of words with which the individual responds and the length of time it takes him to make his replies are factors which throw important light on the nature of mental constitution, variation and abnormality.

ASSOCIATIVE LAWS, two laws relating to numbers, one with respect to addition and the other with respect to multiplication. These laws may respectively be defined symbolically as follows: $a + (b + c) = (a + b) + c$, and $a(bc) = (ab)c$; that is, the terms or the factors may be associated in any way we choose. (See also COMMUTATIVE LAWS.) The numbers may be either positive or negative, integral or fractional, rational or irrational, and real or imaginary. The laws do not hold throughout the entire range of mathematics, however. For example, the associative law of addition does not hold for certain divergent series. (See SERIES.)

ASSONANCE, a term defined, in its prosodical sense, as "the corresponding or riming of one word with another in the accented vowel and those which follow it, but not in the consonants" (New English Dictionary). Much rustic or popular verse in England is satisfied with assonance, as in such cases as

> And pray who gave thee that jolly red nose?
> Cinnamon, Ginger, Nutmeg and **Cloves,**

where the agreement between the two *o's* permits the ear to neglect the discord between *s* and v. Assonance appears to have preceded rhyme in several of the European languages, and to have led the way towards it. It is particularly observable in the French poetry which was composed before the 12th century, and it reached its highest point in the "Chanson de Roland," where the sections are distinguished by the fact that all the lines in a *laisse* or stanza close with the same vowel-sound. When the ear of the French became more delicate, and pure rhyme was introduced, about the year 1120, assonance almost immediately retired before it and was employed no more, until recent years, when several French poets have re-introduced assonance in order to widen the scope of their effects of sound. It held its place longer in Provençal and some other Romance literatures, while in Spanish it has retained its absolute authority over rhyme to the present day. It has been observed that in the Romance languages the ear prefers the correspondence of vowels, while in the Teutonic languages the preference is given to consonants. Various German poets of considerable merit, and in particular Tieck and Heine, have endeavoured, as English rhymers have done, to mix pure rhyme with assonance, but the result of this in almost all cases is that the assonances are drowned in the stress of pure rhymes. Assonance as a conscious art, in fact, is scarcely recognized as legitimate in English literature. In Irish (Gaelic) poetry, on the other hand, assonance triumphed over pure rhyme, and the Irish poets writing in English who rhymed "Blarney" with "charming" were merely following a national tradition.

ASSUMED BONDS, bonds of a corporation which has been absorbed by another by means of merger, consolidation, purchase or other methods. In a merger, the corporation which retains its identity; in a consolidation, the newly formed corporation; and in a sale, the purchasing company, assumes all the indebtedness of the merged, consolidated or purchased organization, and hence becomes entirely responsible and liable for the payment of the bonds, which then take the name of assumed bonds. Bonds of one existing corporation which are guaranteed as to either interest or principal by the endorsement of another corporation are sometimes loosely called assumed bonds, but for such instruments it is better to reserve the name "guaranteed bonds."

ASSUMPSIT, the Latin word meaning "he has undertaken." It is applied in English law to an obsolete form of action for the recovery of damages by reason of the breach or non-performance of a simple contract, either express or implied, and whether made orally or in writing. Assumpsit was the word always used in pleadings by the plaintiff to set forth the defendant's undertaking or promise, hence the name of the action. See **PRACTICE** AND PROCEDURE.

ASSUMPTION, FEAST OF, the feast of the Assumption of the blessed Virgin Mary (Lat. *assumptio, dormitio depositio, pausatio B.V.M.* (Gr. κοίμησις or ἀνάληψις τῆς θεοτόκου), celebrated by the Christian Church on Aug. 15, commemorating her death and miraculous ascent into heaven. The belief in the latter has its origin in apocryphal sources, such as the εἰς τὴν κοίμησιν τῆς ὑπεραγίας δεσποίνης ascribed to the Apostle John, and the *De transitu Mariae,* assigned to Melito, bishop of Sardis, but actually written about A.D. 400. They were accepted as authentic by Gregory of Tours (d. 593 or 594), who in his De gloria *martyrum* (1.4) gives the following account of the miracle: As all the Apostles were watching round the dying Mary, Jesus appeared with His angels and committed the soul of His Mother to the Archangel Michael. Next day, as they were carrying the body to the grave, Christ again appeared and carried it with Him in a cloud to heaven, where it was reunited with the soul. According to St. John of Damascus, the patriarchs and Adam and Eve also appear at the death-bed; a Jew who touches the body loses both his hands, which are restored to him by the Apostles; and the body lies three days in the grave without corruption before it is taken up into heaven.

The festival is first mentioned by St. Andrew of Crete (b. *c.* 650), and is said to have been fixed on Aug. 15 by the emperor Maurice (d. 602). From the East it was borrowed by Rome, where there is evidence of its existence so early as the 7th century. The belief in the bodily assumption of the Virgin has never

been defined as a dogma and remains a "pious opinion" which the faithful are not bound to accept, though its denial would involve "insolent temerity" as being contrary to the common agreement of the Church. By the reformed Churches, including the Church of England, the festival is not observed, having been rejected at the Reformation as being neither primitive nor founded upon any "certain warrant of Holy Scripture."

ASSUR (country), the land of Assyria, not to be confused with the city of Ashur (modern Shergat) from which it took its name. The country is situated on the Tigris, at the southern extremity of Assyria proper, which was bounded on the north by the foothills of Kurdistan, and lay between the Tigris and its tributary the lesser Zab (Zab al Asfal) in a fertile triangle of land. The early history of Assyria probably consisted in the gradual occupation of this fertile region, from the city of Assur, which retained its position as a holy city long after the political power had been transferred to the more conveniently placed Nineveh. (See MESOPOTAMIA: *Ancient* Geography.)

ASSUR, ASHUR, ASUR, name of the ancient capital of Assyria, the modern ruins, Kalat Sherghat, built on a rocky headland on the west bank of the Tigris, 40 miles above the mouth of the Lower Zab. It is first mentioned in the 46th year of Dungi of Ur, 2376 B.C., where the name is written with the Sumerian ideogram A-USAR, of unknown meaning. At this time the governor of the city was Zariku, who bears a Semitic name. The city then belonged to the kingdom of Ur, and the same Zariku governed the city for Bur-Sin, Dungi's successor. In his own inscription Zariku writes the name of the city A-Shir, and this is the usual writing of the name of the city god in the early inscriptions of the city. It is certain, however, that the Sumerian goddess Innini, *i.e.*, Accadian Ishtar. was the oldest important deity of Assur, and that the site was occupied by the Sumerians many centuries before the rise of this city-state to a place of great political importance in the time of the first Babylonian dynasty (2169–1870). There can be little doubt concerning the racial character of the people of Assur from the period of Zariku onward. They were Semites and possibly from Amurrû, who, like the Semitic colony in Cappadocia of the same period, obtained their culture from Babylonia. Inscriptions of later Assyrian kings mention two early rulers, Ushpia, who built the temple of the god Ashur, in the-north-east corner of the city and Kikia, who built the city walls. There is also an Accadian inscription of a certain Ititi, son of Yakulaba. All of these local rulers bear non-Semitic and non-Sumerian names, and they indicate a period of Gutean or Mitanni occupation of the city, in the interval between the decline of the old Sumerian period and the occupation by Semites in the time of Dungi. It is, therefore, probable that the city-god Xshir, Ashur, is of Sumerian origin.

The old city was bounded on the east by quay walls, extending for 700 metres, along the west bank of the Tigris. An ancient branch of the Tigris flowed past the north side of the city, which was protected by a buttressed wall and a huge building known as the Mushlalu, just north of the great stage tower of the temple of the god Ashur. The north side measured about 800 metres, and on this side of the city stood the temple and stage tower of Ashur (north-east corner), the ancient palace, the double temple of the gods Adad and Anu, and a vast new palace of Tukul-Ninurta (13th century B.C.). The western and southern sides were originally defended by a double wall, whose line sweeps in a return curve to the Tigris, over 1,500 metres long. In the early part of the second millennium the outer wall on the south was extended southward and eastward to enclose a large new precinct of the city. Outside the city, 150 metres from the north-west corner, stood the house of the New Year's festival on the bank of the ancient rivulet, which ran past the northern side of the city. The temple of Ishtar, where excavations revealed the oldest (Sumerian) culture at Assur, lay in the west central part of the city, and a later temple to the god Nebo stood just east of it. The city was occupied continuously down to Parthian times, and a great palace of that period was built over the ruins of the inner southern wall.

The most important city gates are on the western side, the most famous being the Tabara or "gate of the metal workers," on the extreme western curve of the wall. A second great gate pierced the double wall of this side 400 metres south of Tabara. Two more gates pierced the west wall between Tabara and the north-west corner of the city, and there was another gate on the south side near the Tigris.

The antiquities recovered in the excavation of the temple of Ishtar indicate a very advanced Sumerian civilization at Assur, whose origins appear to be almost as ancient as any yet found in Sumer of the south. They prove that the Sumerians were settled here before 3500 B.C., but the city clearly had no independent line of kings either in the Suinerian period down to *c.* 2600 B.C., or in the long period of Semitic governors, when this city-state was a dependency first of Ur and then of Babylon. It is clear that an interval of Gutean domination intervened between the Sumerian period and the Semitic occupation. Assur remained a dependency of Babylon until the end of the first Babylonian dynasty, and Nineveh did not become the capital of Assyria until the end of the reign of Ashurnasirpal II. (883–859). In a triangular space enclosed between the southern inner city wall and the southern extension outer wall, stood the inscribed stelas of the kings of Assyria from Adadnirari I. to Ashurbanipal, including one of Semiramis, and a parallel row of stelas of many provincial governors. It formed a kind of memorial ground for the great rulers and officials of Assyria from the 14th century to the end of the Assyrian kingdom, and proves that Assur remained the holy city of that mighty empire long after it ceased to be the capital. As seat of the cult of Adad, the thunder god, the ideogram IM-(ki) is also employed to write the name of the city.

The **God Ashur.**—It was noted above that this local deity of the city was probably of Sumerian origin, although the meaning of the ideogram, by which his name mas first written, is obscure. He was never admitted into the official Sumerian–Babylonian pantheon, nor is his, or any other Assyrian temple, named in the canonical Sumero-Babylonian liturgies, which were sung in Assyrian temples also. The local deities of the two cities which became capitals of Babylonia and Assyria were at first minor gods, and they owe their importance to political influence. The priests of Assur identified their city-god with the mighty earth-god Enlil of Nippur, and his consort bears the same name as that of the ancient Enlil; viz., Ninlil, the Assyrian; and the name of Ashur's temple Ekhursagkurkurra, "House of the mountain of the lands," also suggests an earth-god. The stage tower of this temple is called E-aratta-kisharra, "House of Aratta of the Universe," and explained by "House of Enlil." Aratta is an ancient title of Enlil at Shuruppak. Ashur replaces Marduk in the Epic of Creation (*q.v.*), and is consequently represented in art with the winged sun disc and assumed many aspects of the sun-god.

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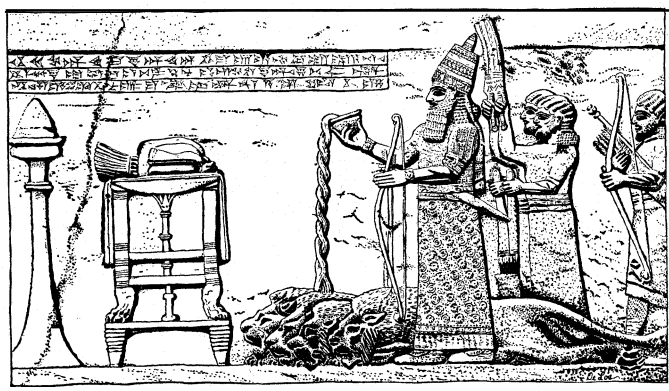
ASSURANCE: see INSURANCE.

ASSUR-BANI-PAL ("Assur creates a son"), the grand monarque of Assyria, was the prototype of the Greek Sardanapalus, and appears probably in the corrupted form of Asnapper in Ezra iv. 10. He had been publicly nominated king of Assyria (on the 12th of Iyyar) by his father Esar-haddon, some time before the latter's death, Babylonia being assigned to his twin-brother Samas-sum-yukin, in the hope of gratifying the national feeling of the Babylonians.

After Esar-haddon's death in 668 B.C. the first task of Assur-bani-pal was to finish the Egyptian campaign. Tirhakah, who had reoccupied Egypt, fled to Ethiopia, and the Assyrian army spent 40 days in ascending the Nile from Memphis to Thebes. Soon afterwards Necho, the satrap of Sais, and two others were detected intriguing with Tirhakah; Kecho and one of his companions were sent in chains to Nineveh, but were there pardoned and restored to their principalities Tirhakah died 667 B.C., and his successor. Tandaman (Tanuat-Amon), entered Upper Egypt,

where a general revolt against Assyria took place, headed by Thebes. Memphis was taken by assault and the Assyrian troops driven out of the country. Tyre seems to have revolted at the same time. Assur-bani-pal, however, lost no time in pouring fresh forces into the revolted province. Once more the Assyrian army made its way up the Nile, Thebes was plundered, its temples were destroyed, and two obelisks were carried to Nineveh as trophies



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A FRAGMENT OF A SCULPTURED RELIEF SHOWING ASSUR-BANI-PAL, THE GREAT KING OF ASSYRIA IN THE 6TH CENTURY B.C., ENGAGED IN A RELIGIOUS CEREMONY OF POURING LIBATION OVER LIONS

(see Nahum iii. 8). Meanwhile, the siege of insular Tyre was closely pressed, its water-supply was cut off, and it was compelled to surrender.

Assur-bani-pal was now at the height of his power. The land of the Mannā (Minni), south-east of Ararat, had been wasted, its capital captured by the Assyrians, and its king reduced to vassalage. A war with Teumman of Elam had resulted in the overthrow of the Elamite army; the head of Teumman was sent to Nineveh, and another king, Umman-igas, was appointed by the Assyrians. The kings of Cilicia and the Tabal offered their daughters to the harem of Assur-bani-pal; embassies came from Ararat, and even Gyges of Lydia dispatched envoys to "the great king" in the hope of obtaining help against the Cimmerians. Suddenly the mighty empire began to totter. The Lydian king, finding that Nineveh was helpless to assist him, turned instead to Egypt and furnished the mercenaries with whose help Psammetichus drove the Assyrians out of the country and suppressed his brother satraps. Egypt was thus lost to Assyria forever (660 B.C.). In Babylonia, moreover, discontent was arising, and finally Samas-sum-yukin put himself at the head of the national party and declared war upon his brother. Elamite aid was readily forthcoming, especially when stimulated by bribes, and the Arab tribes joined in the revolt. The resources of the Assyrian empire were strained to their utmost. But as a result in some measure of the internecine troubles of Elam, the Babylonian army and its allies were defeated and driven into Babylon, Sippara, Borsippa and Cutha. One by one the cities fell, and Babylon finally was starved into surrender (648 B.C.) after Samas-sum-yukin had burned himself in his palace to avoid falling into the conqueror's hands.

It was now the turn of the Arabs, some of whom had been in Babylon during the siege, while others had occupied themselves in plundering Edom, Moab and the Hauran. Northern Arabia was traversed by the Assyrian forces, the Nabataeans were almost exterminated, and the desert tribes terrorized into order. Elam was alone left to be dealt with, and the last resources of the empire were therefore expended in preventing it from ever being again a thorn in the Assyrian side.

But the effort had exhausted Assyria. Drained of men and resources, it was no longer able to make head against the Cimmerian and Scythian hordes who now poured over western Asia. The Cimmerian Dugdammē (Lygdamis in Strabo i. 3, 16), whom Assur-bani-pal called "a limb of Satan," after having sacked Sardis, had been slain in Cilicia, but other Scythian invaders came to take his place. When Assur-bani-pal died in 626 (?) B.C., his empire was already in decay, and within a few years the end came. (*See* SARDANAPALUS.)

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ASSUS (mod. BEHRAM), an ancient Greek city of the Troad, on the Adramyttian gulf. The situation is magnificent. The natural cleavage of the trachyte into joint planes had already scarped out shelves which it was comparatively easy for human labour to shape; and so, high up this cone of trachyte, the Greek town of Assus was built, tier above tier, the summit of the crag being crowned with a Doric temple of Athena. The view from the summit is very beautiful and of great historical interest. In front is Lesbos, one of whose towns, Methymna, is said to have sent forth the founders of Assus, as early, perhaps, as 1000 or 900 B.C. The whole south coast-line of the Troad is seen, and in the south-east the ancient territory of Pergamum, from whose masters the possession of Assus passed to Rome by the bequest of Attalus III. (133 B.C.). The great heights of Ida rise in the east. Northward, the Tuzla is seen winding through a rich vallev. This valley was traversed by the road which St. Paul must have followed when he came overland from Alexandria Troas to Assus, leaving his fellow travellers to proceed by sea. The north-west gateway, to which this road led, is flanked by two massive towers, of Hellenic work. On the shore below, the ancient mole can be traced by large blocks under the clear water. Assus affords the only harbour on the 50m. of coast between Cape Lectum and the east end of the Adramyttian gulf; hence it must always have been the chief shipping-place for the exports of the southern Troad. The great natural strength of the site protected it against petty assailants, but, like other towns in that region, it has known many masters—Lydians, Persians, the kings of Pergamum. Romans and Ottoman Turks. From the Persian wars to about 350 B.C. Assus enjoyed at least partial independence. It was about 348–345 B.C. that Aristotle spent three years at Assus with Hermeas, an ex-slave who had succeeded his former master Eubulus as despot of Assus and Atarneus. Under its Turkish name of Behram, Assus is still the commercial port of the southern Troad, being the place to which loads of valonia are conveyed by camels from all parts of the country. Explorations were conducted at Assus in 1881–83 by Mr. J. T. Clarke for the Archaeological Institute of America.

See J. T. Clarke, *Assos*, 2 vols. *1882* and *1898 (Papers of Arch. Inst. of America, i.–ii.)*; and authorities under TROAD.

ASSYRIA. The two great empires, Assyria and Babylon, which grew up on the banks of the Tigris and Euphrates, can be separated as little historically as geographically. From the beginning their history is closely intertwined; and the power of the one is a measure of the weakness of the other. (See BABYLONIA AND ASSYRIA.)

ASSYRIAN LANGUAGE. The Babylonians, though Semites, learnt the cuneiform (*q.v.*) script from the non-Semitic Sumerians, whom they found in southern Mesopotamia in the 3rd millennium B.C.; and 1,000 years afterwards the northern Assyrians adopted it. Sumerian had 600 signs, constituting thousands of ideograms (signs depicting ideas). Some signs had only word-values, others both these and syllable-values. The Babylonians primarily used only the syllable-values of these signs. But they freely borrowed their word-values, as a kind of short-hand, using in reading (as variants show) the Babylonian equivalent.

The use of Sumerian, when no longer spoken, in the temple-services led the Babylonians and Assyrians to compile lists of signs and vocabularies, sometimes of more than 300 ideograms, giving the sign together with its name, Sumerian pronunciation and Semitic meaning, which they often glossed with synonyms. They also drew up lists of Sumerian paradigms and dialectical forms with Semitic renderings in parallel columns. Some lists contain foreign (*e.g.*, Cossaean or Hittite) words. These and liturgical texts with interlinear translations have proved indispensable in the decipherment of cuneiform documents.

Assyro-Babylonian (Xccadian), the oldest known member of the eastern group of the Semitic languages (see SEMITIC LANGUAGES), had affinities with all the other groups, yet not enough to be called a mixed language. Thus with the central (Amorite-Aramaic) it prefers a to *u* or o (cf. Bab.-Ass. *ṭābu*=Aram. *ṭābh* with Hebr. *ṭôbh* "good"); with the western (Canaanite-Hebrew-Phoenician) group it shared much of its vocabulary (cf. Ass.-Bab. *anâku*=Can. *anuki*=Hebr. *'ānōkhî*=Phoen. anech with Aram. *'ănâ* "I"); and with the southern group it retained the case-endings (as in Arabic) and employed *-k* instead of *-t* for the first person singular in the permansive or perfect tense (as in Ethiopic). Babylonian and Assyrian differed only dialectically; *e.g.*, Bab. *gâtu*=Ass. *qâtu* "hand" and Bab. *ashṭur*=Ass. *alṭur* "I wrote." During more than 2,000 years changes crept in; *e.g.*, Bab. *lawû* or *lamû*=Ass. *lamû, labû* or *lapû* "to surround." Each also exhibited variations within itself: thus s was sometimes preferred to sh in early Babylonian (as in *sû* for *shû* "he") and late (vulgar) Assyrian (as in *Asdudu*=Hebr. *'ashdôdh* "Ashdod"). Cappadocian, an Assyrian offshoot, also substituted *s* for *sh* before *i* and showed other peculiarities, such as the change of k to *g* before a and of *t* to d before *u* and the loss of the more strongly articulated consonants.

Assyro-Babylonian stood out from the Semitic languages in several ways. Its script showed the primitive vocalization and, partially, the accentuation. Its connection with Sumerian brought in foreign words under a Semitized form. The gutturals ' (*'āleph*), *h*, h and ' ('ayin) were mostly weakened into vowels: *e.g.*, Bab.-Ass. *alâku* "to go" (cf. Hebr. *hālakh* "went") and Bab.-Ass. *bêlu* (=Hebr. *ba'al* "lord"), although *ḫ* always and ' and h sometimes were preserved, as in Bab.-Ass. *ma'âdu* "to be much" (cf. Hebr. *mĕ'ōdh* "very"); so w and y generally disappeared, as in Bab.-Ass. *idû* "to know" (cf. Hebr. *yādha'* "knew"). Assimilation of vowels (as in *unikkir* for *unakkir* "changed") was common and of consonants (as in *nidittu* for *nidintu* "gift") regular; final vowels were sometimes dropped, as in *kashdâk* for *kashdâku* "I am seized." Many uncontracted forms, lost in the cognate languages, were preserved in the older, though contracted in the later, speech; *e.g.*, Capp. *idu(w)ar*=Bab.-Ass. *ituar* and *itâr* "returns." It sometimes had sh where the other languages have h or ' (*'āleph*); namely, in certain pronouns, as in *shû* (cf. Hebr. *hû*) "he" and so on, and in the causative prefix, as in *shuzkur* (cf. Hebr. *hizkîr* and Aram. *'adhkar*) "mentioned." The pronominal suffixes with verbs alone expressed the direct, but with an affixed *-m* the indirect, object.

Certain nouns took the feminine ending in Assyro-Babylonian but not in the cognate languages, like Ass.-Bab. *irṣitu*=Hebr. *'ereṣ* "earth," or, though elsewhere masculine, were feminine in it, like Ass.-Bab. *kabittu*=Hebr. *kābhēdh* "liver." Special vowels distinguished the cases (sing. nom. *-u*, acc. -a, gen. -i; du. nom. *-â*, acc.-gen. -8; plur. nom. 0, acc.-gen. *-î*), to which various affixes might be added, though with little change in significance. These endings, however, soon sporadically and later generally, were used indiscriminately, and various transcriptions (*cf.* Gr. *μιτερθ*=Bab.-Ass. *miṭertu* "rain") show that they were usually disregarded in speaking. The dual, too, tended to fall into desuetude.

The verbs employed the usual Semitic inflections and derived themes, with modifications. There were three instead of two tenses: a "permansive" which expressed state, corresponding with the Semitic perfect (Bab.-Ass. sakir "was remembered"=Hebr. *zākhar* "remembered"); a preterite corresponding with the imperfect (Bab.-Ass. izkur "remembered"=Hebr. *yizkōr* "was remembering," "remembers," "will remember"); and a present corresponding with the Ethiopic imperfect (Bab.-Ass. *izákar* "remembers"=Eth. *yezâker* "is remembering," "remembers," "will remember"). Subordinate verbs were marked by the termination *-u* or sometimes -a, which often in independent clauses had also the sense of the German *her*. The derived themes are nearly as numerous as those of Ethiopic, and one of these, or the permansive, was used in place of a passive formed by modification of the vowels.

Syntactically, it showed no definite affinities. It shared several idioms with Hebrew and used the enclitic -mu for *u* "and," like the Hebrew "*wāw*-consecutive" but without its effect on the following tense, to connect each fresh verb in the narration of a series of events; unlike Hebrew, it often employed asyndeton and was rich in adverbs, co-orclinate and subordinate conjunctions, and other particles. Like Aramaic and Syriac, it often substituted a periphrasis with *shâ* "of" for the "construct state," and it tended under Sumerian influence to throw the verb to the end of the sentence, as Syriac and Ethiopic frequently did. In prohibitions it used *lâ* "not" with the present or *ê* "not" with a tense resembling but hardly identical with the preterite: for example, *lâ tazákar* or *ê tazkur* "do not remember."

In prose the style was heavy and unadorned, often almost barbarous. In poetry there was little attempt at grace or charm, but the order of the words was more varied and the vocabulary somewhat fuller; the lines, which a caesura sometimes broke, were of roughly the same length, and there were occasional attempts at parallelism and rhythmic beat. (G. R. D.)

ASSYRIAN LAW: see BABYLONIAN LAW.

AST, GEORG ANTON FRIEDRICH (1778–1841), German classical scholar, was born at Gotha and died at Munich, where he was professor of classical literature for 1j years. His works are *Platons* Leben und *Schriften* (1816), an edition of Plato's works (1819–32), with Latin translation and commentary, and Lexicon *Platonicum* (1834–39). Ast denounced as spurious many of the Platonic dialogues which had hitherto been accepted as genuine. He also wrote many books on philosophy.

ASTARA, a small port in the Azerbaijan S.S.R. on the Caspian sea at the mouth of Astara river. Lat. 38° 25′ N. Long. 48° 52′ E. The river is the boundary between Persia and Russia and trade from Tabriz in rice, timber, rushes and piece goods is carried on, though the lack of railway transport hampers the town.

ASTARABAD, a province of Persia, bounded north by the Caspian sea and the Atrak river, south by the Elburz mountains, west by Mazandaran and east by Khurasan. Area about 5,630 sq.m. with a sparse population. The land is thickly wooded but marshy in parts, and the soil is exceedingly productive, even with little culture. Among the products rice must have first mention, then wheat, sesame-oil and walnut wood. In the middle ages there was considerable rearing of silk-worms. The province is malarial owing to the extensive swamps. Affluence and industry nowhere exist, and apart from the capital and its port, Bandar Jaz, trade and commerce are insignificant. The district formerly suffered from frequent excursions of the Turkomans, but these have ceased in recent years. In many villages of Astarabad and Mazandaran reside Gudars, an energetic tribe, though despised by the Persians, which is engaged in agriculture, cattle-rearing and the drying of fruit. The revenue of the province was 1,206,700 krans in 1926–27.

ASTARABAD, chief town of Astarabad province, Persia; on the Astar, a tributary of the Kara Su, in 36° 40' N. lat. and 54° 30′ E. long., 23m. from the Caspian sea, at the foot of a thickly wooded spur of the Elburz. Occupying a commercially and strategically important position the town dates back to a remote antiquity. During the recurring disorders in Persia in the 18th century, Astarabad was frequently ravaged; it attained its present compass of 3½m. under Nadir Shah. Jonas Hanway, pioneer trader, visited the town in 1744 and endeavoured to open up a direct commerce through it between Europe and Asia. The town, built four square, is surrounded by a high wall flanked by bastions now much dilapidated. The frequent rains compel the inhabitants to build their houses of stone. The population, which must have been more numerous in earlier centuries, is estimated at 10,000–12,000. The chief articles of trade are cotton, rice, sugar-cane, salt, sesame-oil, soap and carpets; but the trade has suffered heavily by the opening of the Trans-Caspian line. The climate is unhealthy especially during the hot weather.

ASTARTE, a Semitic goddess whose name appears in the Bible as Ashtoreth. She is everywhere the great female principle, answering to the Baal of the Canaanites and Phoenicians and to the Dagon of the Philistines. She had temples at Sidon and at Tyre (whence her worship was transplanted to Carthage), and the

Philistines probably venerated her at Ascalon (I. Sam. xxxi. 10). Solomon built a high-place for her at Jerusalem which lasted until the days of King Josiah (I. Kings xi. 5; II. Kings xxiii. 13), and the extent of her cult among the Israelites is proved as much by the numerous biblical references as by the frequent representations of the deity turned up on Palestinian soil. The Moabites formed a compound deity, Ashtar-Chemosh (see MOAB), and the absence of the feminine termination occurs similarly in the Babylonian and Assyrian prototype Ishtar. The old South Arabian phonetic equivalent 'Athtar is, however, a male deity. Another compound, properly of mixed sex, appears in the Aramaean Atargatis ('At[t]ar-'athe), worn down to Derketo, who is specifically associated with sacred pools and fish (Ascalon, Hierapolis-Mabog). (See ATARGATIS.)

As the great nature-goddess, the attributes of fertility and reproduction are characteristically hers, as also the accompanying immorality which originally, perhaps, was often nothing more than primitive magic. As patroness of the hunt, later identification with Artemis was inevitable. Hence the consequent fusion with Aphrodite, Artemis, Diana, Juno and Venus, and the action and reaction of one upon the other in myth and legend. Her star was the planet Venus, and classical writers give her the epithet Caelestis and Urania. Robertson Smith argues that Astarte was originally a sheep-goddess, and points to the interesting use of "Astartes of the flocks" (Deut. vii. 13) to denote the offspring. To nomads, Astarte may well have been a sheep-goddess, but this, if her earliest, was not her only type, as is clear from the sacred fish of Atargatis, the doves of Ascalon (and of the Phoenician sanctuary of Eryx), and the gazelle or antelope of the goddess of love (associated also with the Arabian Athtar).

ASTATIC COILS, when passing an electric current, produce no external magnetic field. Conversely, a varying external magnetic field does not induce in them an electromotive force. (See ELECTRICITY.)

ASTELL, MARY (1668–1731), English author, was born at Newcastle-upon-Tyne. She published, in 1697, a work entitled A Serious Proposal to the Ladies, *wherein* a Method is offered for the *Improvement* of their Minds. A scheme of hers for an Anglican sisterhood which was favourably entertained by Queen Anne, was frustrated by Bishop Burnet. Mary Astell was attacked in the Tatler (No. 52) under the name of Madonella.

ASTER, a large genus of plants of the family Compositae, so named from the radiate or star-like appearance of the flowers, and known as asters or star-worts (Gr. ἀστήρ, a star). There are some 400 species, found chiefly in North America but scattered sparsely in Asia, Europe and South America. They are usually perennial, leafy-stemmed herbs, sometimes somewhat woody at the base, and bearing in late summer and autumn a profusion of flowering heads, mostly in clusters, but sometimes solitary. In each head numerous showy blue, red, purple or white rays surround a central disc of minute yellow tubular flowers. Many are strikingly handsome, and cultivated as ornamental fall-flowering plants. The Michaelmas daisy is the finest of the cultivated sorts, its scores of varieties having been developed by hybridizing chiefly American asters. The only species (*A. Tripolium*) native to Great Britain grows abundantly in saline marshes near the sea.

In North America there are upwards of 250 species, most numerous in the northeastern United States and adjacent Canada. They are generously represented in the Rocky Mountain region, some 50 species being found in Utah and Nevada, and about 20 occur in California. In the region east of Manitoba and Kansas and north of Tennessee, the asters, together with the goldenrods, dominate the floral landscape in autumn, filling fields, woodlands and roadsides with masses of brilliant colour. Among the many conspicuous kinds the New England aster (*A. novae-angliae*), found abundantly from Quebec to Alberta and south to South Carolina and New Mexico, is the best known. It grows 3 ft. to 5 ft. high with handsome purple heads 1½ in. to 2 in. across. Other noteworthy species are the New York aster (*A. novi-belgii*) and the smooth blue aster (A. *laevis*), both of which, like the foregoing, are widely cultivated.

In California the common aster is A. chilensis; other noteworthy species are the somewhat woody desert aster (A. *tortifolius*) and the reed-like spiny aster (A. *spinosus*), which grows 9 ft. high in the southwestern deserts and is popularly called Mexican devil-weed. The China aster (Callistephus chinensis) is also a member of the family Compositae. It is a hardy annual. a native of eastern Asia, and has yielded a great variety of forms. They are commonly known as garden asters in spite of not belonging to the genus Aster.

ASTER or **ASTROSPHERE,** the term used in biology for the star-shaped structure produced by the centrosome immediately prior to cell-division. Two asters arise in the cell and these unite to form the spindle. (See CYTOLOGY.)

ASTERIA or **STAR-STONE,** a name applied to varieties of ruby and sapphire which exhibit a six-rayed star. Cymophane, or chatoyant chrysoberyl, may also be asteriated. The asterism is due to the reflection of light from twin-lamellae or from fine tubular cavities or thin enclosures definitely arranged in the stone. The astrion of Pliny is believed to have been the modern moonstone.

ASTERISK, the sign * used in typography (from the Gr. ἀστερίσκος, a little star). The word is also used in its literal meaning, a small star, and as a description of an ornamental form in one of the utensils in the Greek Church.

ASTERIUS, bishop of Amasia, in Pontus, *c.* 400. His fame rests chiefly on his Homilies, which were much esteemed in the Eastern Church. Twenty-one of these are given in full by Migne (Patrol. Ser. Gr. xl. 164–477), and there are fragments of others in Photius (Cod. 271).

ASTERIUS, of Cappadocia, sophist and teacher of rhetoric in Galatia, was converted to Christianity about the year 300, and became the disciple of Lucian, the founder of the school of Antioch. He is best known as an able defender of the semi-Arian position, and was styled by Athanasius the "advocate" of the Arians. He is last heard of at the synod of Antioch in 341.

ASTEROIDS, the minor planets, over 1,000 in number, which describe orbits round the sun, lying between those of Mars and Jupiter (q v.), and having various eccentricities. (See MINOR PLANET.)

In zoology, a group of Echinoderma (q v.). the starfish as opposed to the brittle-stars or Ophiuroids (see STAR-FISH).

ASTHENIA, lack or loss of strength, a condition in which the body lacks or has lost strength either as a whole or in any of its parts. General asthenia is found in certain individuals with a characteristic physical build. They are thin, have small bones, underdeveloped musculature and are subject to neurotic affections. General asthenia occurs in many chronic wasting diseases such as anaemia and cancer. It is probably most marked in diseases of the adrenal gland, where it dominates the whole picture. Asthenia may be limited to certain organs or systems of organs. Thus there is asthenopia, which is characterized by ready fatiguability of vision, and myasthenia gravis, in which there is progressive increase in the fatiguability of the muscular system until death results from inability of the heart muscle to continue its work. In neurasthenia and psychasthenia there is a strong subjective sense of fatigue in the absence of real weakness.

ASTHENOPIA, a condition in which the eyes are weak and tire too easily. It may be brought on by disorders in any of the various complicated functions involved in the visual act. Thus imbalance between the muscles that keep the eyes parallel leads to fatigue in the constant effort to prevent double vision. Errors in refraction lead to fatigue of the muscles of accommodation in the continued compensation demanded of them. Clouding of the lens or of the media which transmit the light may bring it about, and finally disorders of the retina, where the impressions are received, will lead to fatigue. The symptoms are pain in the eyeball, frontal headache, blurring of vision and smarting and watering of the eye. These are usually worse toward evening and are aggravated by close work such as reading and sewing.

ASTHMA, a disorder of respiration characterized by severe paroxysms of difficult breathing (*dyspnoea*), usually followed by a period of complete relief, with recurrence of the attacks at

more or less frequent intervals. The term is often loosely employed in reference to states of embarrassed respiration, which are plainly due to permanent organic disease of the respiratory organs (see RESPIRATORY SYSTEM, DISEASES OF).

The attacks occur quite suddenly; in some patients at regular, in others at irregular, intervals. They are characterized by extreme difficulty both in inspiration and expiration, but especially in the latter, the chest becoming distended and the diaphragm immobile. In the case of "pure," "idiopathic" or "nervous" asthma there is no fever or other sign of inflammation. But where the asthma is secondary to disease of some organ of the body, the symptoms will depend largely on that organ and the disease present. Such secondary forms may be bronchitic, cardiac, renal, peptic or thymic.

The mode of onset differs greatly in different cases. In some the attack begins suddenly and without warning, but in others various sensations well known to the patient announce that an attack is imminent. The commonest warning is that of an intense desire for sleep, so overpowering that though the patient knows his only chance of warding off the attack is to keep awake he is utterly unable to fight against his drowsiness. Among other patients a condition of unwonted mental excitement presages the attack. The secondary forms of the disease may be ushered in by flatulence, constipation and loss of appetite, and a common symptom is a profuse diuresis, the urine being watery and nearly colourless. In the majority of instances the attack begins during the night, sometimes abruptly but often by degrees. A few hours after midnight he is aroused from sleep by a sense of difficult breathing. In some cases this is a slowly increasing condition, not becoming acute for an hour or more. But in others the attack is so sudden, so severe, that the patient springs from his bed and makes his way at once to an open window, struggling for breath. The face is pale, anxious, and it may be livid. The veins of the forehead stand out, the eyes bulge and perspiration bedews the face. The head is fixed in position, and likewise the powerful muscles of the back to aid the attempt at respiration. The breath is whistling and wheezing, and if it becomes necessary for the patient to speak, the words are uttered with great difficulty. The chest is almost motionless, and the respirations may become extraordinarily slowed. Inspiration is difficult as the chest is already over-distended, but expiration is an even greater struggle. The attack may last from an hour to several days, and between the attacks the patient is usually quite at ease. But notwithstanding the intensely distressing character of the attacks, asthma is not one of the diseases that shorten life, except by way of secondary changes it induces in the heart.

Though the causes of asthma are known to be diverse, recent investigation has shown that it depends essentially upon swelling of the mucous lining of the bronchioles and local outpouring of a mucous secretion. It is possible, too, that the muscular coats of the air-tubes are in a state of spastic contraction during an attack. Asthma is a special example of *anaphylaxis* (*q.v.*); the patient being hypersensitive to some protein or derived substance, exposure thereto by way of inspired air leads to anaphylactic phenomena predominating in the lungs. On subcutaneous inoculation with minute quantities of infusions of various substances the occurrence with one of them of a local oedema will indicate the substance to which the asthmatic patient is hypersensitive and should avoid in order to be free from attacks.

See F. M. Rackemann, "Clin. Study of 150 cases of bronchial Asthma," Arch. Int. *Med.* (1918), xxii., p. 517; F. Coke, Asthma (1923); W. M. Duke, Allergy, Asthma, Hay Fever, etc. (1925); J. Adam, Asthma and its *radical* treatment (1926).

ASTI (anc. Hasta), episcopal see, Piedmont, Italy, province of Alessandria, on the Tanaro, 22m. W. by rail from Alessandria. Pop. (1936) town, 26,476; commune, 48,898. Remains include 8th-century baptistery (S. Giovanni), 11th-century octagonal baptistery (S. Pietro), mediaeval towers, and a fine 14th-century Gothic cathedral. It was the birthplace of the poet Vittorio Alfieri. It is now famous for its sparkling wine (*Asti spumante*).

ASTIGMATISM, a form of aberration in optical systems, including the eye, resulting in rays proceeding from a point source forming an area instead of a point and thus causing blurred vision. (*See* OPTICS and VISION.)

ASTLEY, JACOB ASTLEY, BARON (1579–1652), royalist commander in the English Civil War, came of a Norfolk family. In 1598 he joined Counts Maurice and Henry of Orange in the Netherlands, and afterwards fought under the elector palatine Frederick V. and Gustavus Adolphus in the Thirty Years' War. Returning to England with a well-deserved reputation, he was employed by Charles I. in various military capacities. At the outbreak of the Great Rebellion (1632) he was made major-general of the foot. His characteristic battle-prayer at Edgehill has become famous: "O Lord, Thou knowest how busy I must be this day. If I forget Thee, do not forget me. March on, boys!" At Gloucester he commanded a division, and at the first battle of Newbury he led the infantry of the Royal Army. With Hopton, in 1644, he served at Arundel and Cheriton. At the second battle of Newbury he made a gallant and memorable defence of Shaw House, and at Naseby he once more commanded the main body of the foot. He afterwards served in the west, and with 1,500 men fought stubbornly but vainly the last battle for the King at Stow-on-the-Wold (March 1646). His remark to his captors has become as famous as his words at Edgehill, "You have now done your work and may go and play, unless you will fall out amongst yourselves." His scrupulous honour forbade him to take any part in the Second Civil War, as he had given his parole at Stow-on-the-Wold. He died in Feb. 1652.

ASTLEY, SIR JOHN DUGDALE, BART. (1828–1894), English soldier and sportsman, was in the army from 1848 to 1859. He married an heiress in 1858 and thenceforth devoted himself to horse-racing and sport. He lost large sums of money on the turf, where he was known as "the mate." He was Conservative M.P. for North Lincolnshire 1874–1880 and died on Oct. 10, 1894.

ASTON, FRANCIS WILLIAM (1877–), British scientist, was born at Harborne, Birmingham, Sept. 1 18; *j*, and educated at Malvern College and the universities of Birmingham and Cambridge. In 1909 he became assistant lecturer in physics at Birmingham University; and in 1920 was elected fellow of Trinity College, Cambridge. In 1920 he received the Mackenzie Davidson Medal of the Rontgen Society, and in 1922 the Hughes Medal of the Royal Society. He received the Nobel Prize for chemistry in 1922 for his work in connection with isotopes and also the John Scott Medal, Philadelphia, and the Paterno Medal, Rome, both in 1923. He has written Isotopes (1922) and numerous papers in scientific periodicals on electric discharge in gases, mass-spectra, isotopes, etc.

ASTON, HUGH (early 16th century), an old English musician, of considerable historical importance. He mas one of the first composers of purely instrumental works, and is further regarded by some authorities as the actual inventor of the instrumental variation form. He composed also a number of choral works (masses, motets, and so forth) some of which have been preserved.

ASTON MANOR, a district in the N.E. of Birmingham, Warwicks., England. It was originally a municipal borough of its own but was amalgamated with Birmingham (*q.v.*) in 1911. Aston Manor is an industrial district with large motor works. It is a parliamentary division of Birmingham, returning one member.

ASTOR, JOHN JACOB (1886–), younger son of the 1st Viscount Astor, was born May 20, 1886. Educated at Eton and New College, Oxford, in 1906 he joined the 1st Life Guards. and, from 1911 to 1914, was aide-de-camp to the viceroy of India. In 1916 Major Astor married Lady Violet Mary, daughter of the 4th Earl of Minto and widow of Lord Charles Mercer-Nairne. At the outbreak of World War I he went to France with the Household Cavalry, and served there four years. He was wounded at the first battle of Ypres and again severely in Sept. 1918. In 1922, Major Astor purchased the holding of the late Viscount Northcliffe in The Times Publishing Company, and became its chairman and the chief proprietor of *The* Tintes. Shortly afterwards he caused to be established a body of trustees consisting of the holders of certain important non-political offices, whose consent he made necessary to any future transfer of the

control of that journal. He was Conservative member for the Dover division of Kent in Nov. 1922 and again in 1923 and 1924. In 1925, as treasurer of the Empire Press Union, he attended the press conference in Australia.

ASTOR, JOHN JACOB (1763–1848), American merchant, was born at the village of Walldorf, near Heidelberg, Germany, on July 17, 1763. For four years he was employed in the piano and flute factory of an uncle, of the firm Astor and Broadwood, London. In 1783 he emigrated to America, and settled in New York. On the voyage he became acquainted with a fur-trader, by whose advice he devoted himself to the same business. He was also the agent in New York of the firm of Astor and Broadwood. By his energy, industry, and business judgment he amassed an enormous fortune—the largest up to that time made by any American. He devoted many years to organizing the fur trade from the Great Lakes to the Pacific ocean, and thence by way of the Hawaiian islands to China and India. In 1811 he founded a central depot, Astoria, at the mouth of the Columbia river, but two years later the settlement was seized by the English. The incidents of this undertaking are the theme of Washington Irving's *Astoria*. A series of disasters frustrated the gigantic scheme. Astor made vast additions to his wealth by investments in real estate in New York city. He died in New York city on March 29, 1848, his fortune then being estimated at about $30,000,000. He made various charitable bequests by his will, his chief benefaction being a bequest for the foundation and endowment of a public library in New York city, now a part of the New York public library.

See Parton's ***Life of*** *John Jacob Astor* (1865).

His eldest son, WILLIAM BACKHOUSE ASTOR (1792–1875) was sometimes known as the "Landlord of New York." Under his direction the building for the Astor library was erected. His son, JOHN JACOB ASTOR (1822–1890) was also well known as a capitalist and philanthropist.

The son of the last named, WILLIAM WALDORF ASTOR (1848–1919) served in the New York legislature from 1877 to 1881. He was United States minister to Italy from 1882 to 1885. He published two romances, *Valentine* (1885) and *Sforza* (1889). In 1890 he removed to England, and in 1899 was naturalized. In 1893 he became proprietor of the *Pall Mall Gazette*, and afterwards started the *Pall Mall Magazine*, and in 1916 was created a peer, assuming the title of Baron Astor of Hever Castle. He was made a viscount in 1917, and died in England Oct. 18, 1919.

ASTOR, NANCY WITCHER, VISCOUNTESS (1879–), daughter of Chiswell Dabney Langhorne, was born on May 19, 1879, at Mirador, Virginia. In 1897 she married Robert Gould Shaw of Boston, from whom she obtained a divorce in 1903, and in 1906 married Waldorf Astor. When her husband succeeded to the viscountcy, Lady Astor, who had been his constant comrade-in-arms in his constituency at Plymouth, was adopted as Unionist candidate in his place, and after a stirring campaign was elected by a substantial majority on Nov. 28, 1919. She was the first woman to sit in the House of Commons, though Countess Markieviecz, who did not take her seat, had been elected by an Irish constituency in the Sinn Fein interest at a slightly earlier date. Lady Astor was continuously returned for Plymouth at subsequent general elections. She took a lively interest in the questions before the house, but the fact that she was for two years the only woman member made it inevitable that the various women's organizations should look to her especially to represent the interests of women and children. Her sympathy and power of work helped her in this rôle. As soon as she entered parliament she arranged a deputation from the women's organizations to interview the prime minister on the subject of widows' pensions. She advocated the amendment of the legitimacy laws, and the equal guardianship of children; and in 1924 supported the Guardianship of Infants bill, which became law in that year. Lady Astor served on the joint select committee of both houses of parliament for the consideration of criminal law amendment, in and on the Home Office committee on the employment of women in police duties in Feb. 1920. Lady Astor inaugurated a movement for co-operation between the different women's organizations, and was chairman from the outset of the consultative committee of women's organizations established (1921) to secure that co-operation.

Outside questions relating exclusively to women, her chief work has been done for a progressive educational policy, for temperance, and for the extension of the Trade Boards Acts; in the advocacy of these causes she has shown a courage which compelled admiration even from those who were indifferent or opposed to them. She constantly advocated the raising of the school age, in 1923 she carried through the Intoxicating Liquor (Sale to Persons under 18) bill, and she maintained a continuous interrogation of the ministers of labour as to the low rates of wages existing in certain branches of the distributive and catering trades. Throughout her parliamentary career, as a representative of a dockyard constituency, she took an active interest in the naval and dockyard services. It may be said that Lady Astor's vitality and trenchancy, her energy and the variety of her interests, her fearlessness and gaiety combined to render her a noteworthy member of parliament, and emphasized the significance of a great departure—the election of women as members of the British House of Commons. She was created C.H. in 1937.

ASTOR, WALDORF ASTOR, 2ND VISCOUNT (1879–), British politician, born in New York May 19, 1879, and educated at Eton and New College, Oxford. He married in 1906, the daughter of Chiswell Dabney Langhorne *(see* ASTOR, NANCY WITCHER). He represented Plymouth as a Unionist 1910–18, and the Sutton division of Plymouth 1918–19, when he vacated his seat on succeeding to his father's peerage. He was chairman of the Government committee on tuberculosis and of the State medical research committee. During World War I he was inspector of quartermaster-genera1 services, and in 1918 became private secretary to the prime minister, Lloyd George. He acted as Parliamentary secretary to the ministry of food, 1918–19, and to the local government board in 1919, retaining the same position on the formation of the ministry of health up to 1921. Since 1915 he has been the proprietor of *The Observer* and active on behalf of many causes of social progress, especially temperance reform. At the same time he was one of the leading British owners and breeders of race horses.

ASTORGA, EMANUELE GIOACCHINO CESARE RINCON, BARON D' (1680–*c.* 1755), Italian musical composer, was born at Naples, and had a romantic career which has lost nothing at the hands of his biographers; he is said, on doubtful evidence, to have been the son of a baron of Sicily who was executed for his activities in the attempts to throw off the Spanish yoke, and to have been a pupil, at Palermo, of Francesco Scarlatti. The established facts concerning him are indeed few enough. They are: that the opera *Dafne* was written and conducted by the composer in Barcelona in 1709; that he visited London in 1714; that his *Stabat Mater* had its first public performance at Oxford many years later; and that he retired eventually to Bohemia, where he died in a castle which had been given to him in the domains of Prince Lobkowitz, in Raudnitz. Astorga deserves remembrance for his dignified and pathetic *Stabat Mater,* and for his numerous chamber-cantatas for one or two voices. He was one of the last composers to carry on the traditions of this form of chamber-music as perfected by Alessandro Scarlatti.

See Hans Volkmann, ***Emanuele*** *d'Astorga* (1911 **and** 1919).

ASTORGA, a city of N.W. Spain, province of León; on the right bank of the river Tuerto. Pop. (1930) 8,743. Astorga was the Roman Asturica Augusta, the administrative centre of one Asturian district and the point of convergence of the great military roads connecting the north-west with the Pyrenean passes and with Baetica. The route followed by this last road, which used the valley of the river Alagón to cross the Central Sierras, is in essence the route of the modern railway lines connecting the south-west with the north-west via Mérida, Plasencia and Astorga, the junction with the main line from Madrid to Corunna. Astorga has been the see of a bishop since the 3rd century, but the city was left in partial or total abandonment in the Muslim period from the time of the expulsion of the Berbers (c. 750) until the repopulation under Ordoño I of León (*c.* 860). Its Gothic cathedral dates from the 15th century.

ASTORIA, a city and a port of entry, the county seat of Clatsop county, Oregon, U.S.A., on the south bank of the Columbia river, which is about 6 mi. wide there, 10 mi. from the open ocean, and about 75 mi. in a direct line N W. of Portland. Astoria is at the junction of federal highways 30 and 101; it is served by the Spokane, Portland and Seattle railway. by intercity bus lines, and by river and coastwise steamers, and is a port of call for vessels operating between north Pacific ports. The population was 14,027 in 1920, of whom 4,509 were foreign born, and was 10,389 in 1940 by federal census.

Federal engineering deepened the channel at the entrance to the Columbia river to a minimum of 46 ft. at mean low tide. The port of Astoria, a municipal corporation embracing all Clatsop county, has constructed and operates modern deepwater terminals, with warehouses and facilities for handling grain, flour, lumber, coal and other bulk freight. The total water-borne foreign commerce in 1937 amounted to 46,550 tons—all exports. The principal industrial establishments are salmon canneries, creameries, lumber mills and flour mills. In 1937 there were 31 manufacturing establishments in Astoria with 598 wage earners who were paid $747,977. The value of products manufactured was $10,061,619. On Coxcomb hill stands a column 125 ft. high, on which a spiral frieze, 535 ft. in length, depicts the early history of Oregon.

Astoria is the oldest white settlement in the northwest. It was founded by John Jacob Astor in 1811 as a fur-trading post. From 1813 to 1818 the settlement was in the hands of the British. The first saw-mill was erected in 1851, and the salmon-packing industry dates from 1866. The city was chartered in 1876. On Jan. 1 1923 a city-manager form of government was adopted.

ASTRAEA, in ancient Greek mythology, the "star maiden," daughter of Zeus and Themis, or of Astraeus the Titan and Eos ("the dawn"), in which case she is identified with Dikē. During the golden age she remained among men distributing blessings, but when the iron age began, she left the earth in disgust and was placed amongst the stars as the constellation Virgo. She is represented with a pair of scales and a crown of stars.

ASTRAGAL, in architecture, a small torus. The term is sometimes restricted to the combination of a small torus and a fillet used between the shaft and capital of a classic order (see ORDER). It is frequently carved with a "bead and reel" ornament.

ASTRAGALUS, a very large genus of the pea family (Leguminosae or Fabaceae), widely distributed throughout the world, except in Australia, but most numerous in the steppe region of northern Asia, the high plains of western North America and the tropical Andes. The common species of Great Britain and of the eastern United States and Canada are called milk-vetch. They are mostly low herbs though some are shrubby, with leaves usually divided into many narrow leaflets. Astragalus contains upwards of 1,600 species. More than 275 of these are found in North America, 95% of which occur west of the Mississippi river. Although in number of species *Astragalus* ranks among the largest of plant genera, only a few are of economic importance. Gum tragacanth is derived from A. *gummifer* and other related low spiny shrubs native to Asia Minor. In Persia a sort of manna is obtained from A. *florulentus*. In northern Europe *A.* boeticus is cultivated for its seeds, which are used as a substitute for coffee, sometimes called Swedish coffee.

The long roots of A. *aboriginum*, which occurs from Saskatchewan to Alaska and southward to British Columbia, Nevada and Colorado, are used for food by the Crees and other North American Indians; in the plains region of the United States, extending from Nebraska and Wyoming southward to Texas and New Mexico A. *mollissimus* and other related species called loco-weed are poisonous to grazing animals. Many highly ornamental old-world species of Astragalus are in cultivation and several native to North America are now sparingly planted.

For North American species, *see* P. *A.* Rydberg, *Flora* of *the Rocky* Mountains *and Adjacent Plains* (1917); *M.* E. Jones, ***Revision*** of *North-American Species of Astragalus* (1923); Ivar Tidestrom, *Flora* of *Utah and Nevada* (1925); and *W.* L. Jepson, *Manual of the Flowering Plants* of *California* (1925); "Locoweed Disease," *U.S.* D. *Ag, Farmer's* Bull. 1054 (1936); "Timber Milk Vetch," *Colo. Ag. Exp. B.* 425 (1936).

ASTRAKHAN. (1) A former province in the U S S.R. consisting of a narrow strip on either side of the Volga river from about lat. 48° 2′ N. to the Caspian sea; later incorporated into the Stalingrad region of the Russian S.F.S R. The Akhtuba river runs parallel with the Volga river and the area lying along their courses consists of chains of lagoons, with darkish, alluvial, damp soil, in places impregnated with salt, and in the south-east are shifting sand hills and sand dunes. In the ravines and adjoining the lagoons are belts suitable for plough culture and in some years considerable crops are raised, but the rainfall is unreliable and the province is one of frequent famine, the 1921 famine being of unprecedented severity. Near the Volga is a flowery oasis, with melon and other vegetables, but the rest of the area is steppe-desert in type, blossoming in spring, but a monotonous yellow gray waste in summer. At Astrakhan the average rainfall is only 5·9in. per annum; average temperatures, January 19·0°F, July 77·9°F. The population consists of Russians, Tatars, Kalmucks and Kirghiz and the chief occupation is fishing (herring, sturgeon, perch, carp, salmon), which employed 250,000 men before 1914–18. There are indications of a conflict of interests between the need of the agriculturists for irrigation and of the fisheries for a quiet breeding place for fish. Home industries are leather, furriery, linen and cotton hosiery. Salt is obtained from the lakes in the north and in some places the vine is cultivated.

(2) A town which is situated on the left bank of the Volga river at the head of the delta. Lat. 46° 22′ N. Long. 48° 6′ E. Alt. soft. below sea-level, frozen 3–4 months. Its Caspian trade is hampered by the need for dredging the Volga delta and by the unsatisfactory state of the dry cargo fleet. though oil transport is adequate.

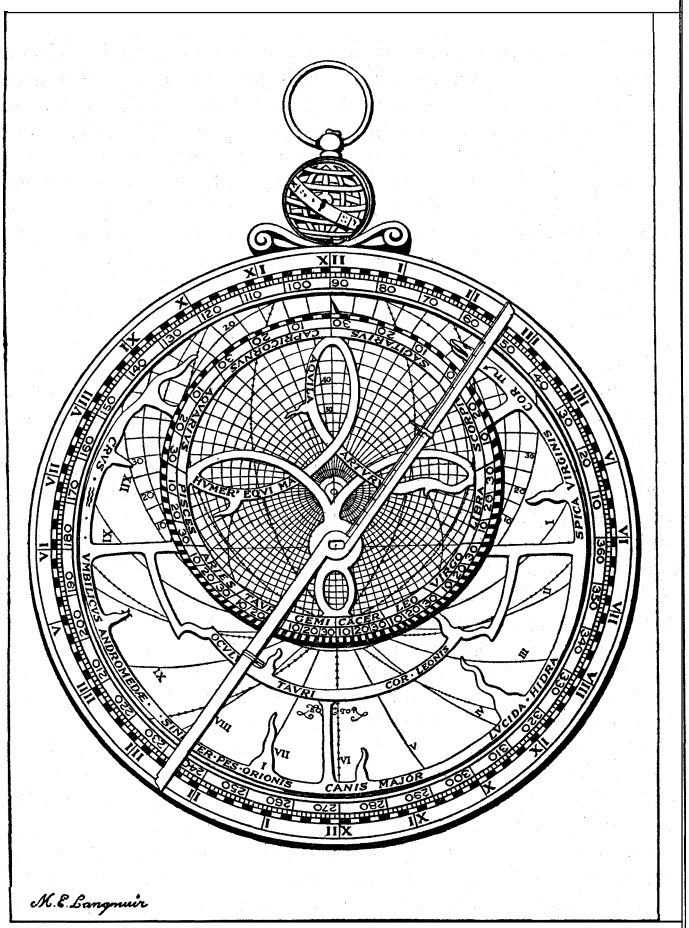
Astrakhan's chief exports are fish, caviare, watermelons and wine from its own area, grain, salt, metal, cotton and woollen goods from the interior, along with timber floated down the river from the north in spring. It is an entrepôt for naphtha and kerosene from Baku, cotton and dried fruits from Turkestan, rice, fruit and carpets from Persia and timber from the Caucasus. The skin of the new-born Persian lamb "astrakhan" is named from the city. Tanning, shipbuilding, brewing and small manufactures, *e.g.*, soap and tar products are carried on. The city is divided into three parts. (1) the Kreml or fortress (1 j50) on a hill, with a brick cathedral, an archbishop's palace and a monastery, (2) the White Town, with administrative offices and bazaars, (3) suburbs with wooden houses and irregular unpaved streets. The Greek Catholics, the Armenian Church and the Lamaists all had centres here. In 1919 a university was founded and there are technical schools, museums, wide squares and public gardens.

Formerly the city was the capital of a Tatar State and stood gm. to the north but it was destroyed by Timur in 1395 and the present city built. Ivan IV. expelled the Tatars in 1556, the Turks besieged it in 1 j69 and Stenka Razin captured it in 1670. Peter the Great made it the centre for his campaign against Persia and Catherine II. gave it special trading privileges. In the 18th century it was plundered by the Persians. It has been several times almost destroyed by fire, and was decimated by cholera (1830) and by famine (1921).

ASTRINGENT, a term comprising a group of agents that tend to shrink mucous membranes and raw surfaces and to dry up secretions. They are usually classed according to their mode of action into (1) those that decrease the blood supply by narrowing the small blood-vessels (adrenalin and cocaine are in this group); (2) those that abstract water from the part as glycerine and alcohol; and (3) those that coagulate the superficial layers and form a crust, as the metallic astringents. They are used in medicine to reduce swollen mucous membranes in inflammations of the nasal, alimentary and urinary passages. They are frequently employed in attempts to dry up excessive secretions and to stop the oozing of blood.

ASTROLABE, an instrument used for the taking of altitudes of heavenly bodies, from which time and latitude are deducible.

The planispheric astrolabe, to which the name is now commonly restricted, is believed to have been a Greek instrument invented by Hipparchus (150 B.C.), or even by Apollonius of Perga (c. 240 B.C.). It has recently been revived by Prof. Jenkin, of Oxford, as a useful educational instrument, so with a history of 2,000 years it may claim to be the oldest scientific instrument in the world, and has played a correspondingly important part in the history of civilization.



FROM "ARCHAEOLOGIA," BY COURTESY OF THE SOCIETY OF ANTIQUARIES, LONDON

THE FACE VIEW OF HUMPHREY COLE'S ASTROLABE, 1574, SHOWING THE ALIDADE, OR SIGHT RULE, THE RETE OR STAR MAP, REMOVABLE PLATE WITH LINES OF ALTITUDE, AND HOURS WITHIN THE GRADUATED RIM. PROPER USE OF THIS INSTRUMENT AT SEA WILL FIND THE SHIP'S LATITUDE AND GIVE THE TIME OF DAY

In its most usual form it consists of an evenly-balanced circle or disc of metal or wood, hung by a ring and provided with a rotatable alidade or diametral rule with sights, turning within a circle of degrees for measuring the altitudes of sun or stars. Seamen from the time of Martin Behaim (c. 1480) to the middle of the 18th century, when the astrolabe and cross staff were superseded as navigational instruments by Hadley's quadrant (see SEXTANT), relied largely upon such instruments and tables of the sun's declination for finding their latitude.

On the back is a circular map of the stars, the rete, beautifully designed in fretwork cut from a sheet of metal, with named pointers to show the positions of the brighter stars relatively to one another and to a zodiac circle showing the sun's position for every day of the year. Lying below the rete are one or more interchangeable plates engraved with circles of altitude or almucantars.

To obtain the time, first measure the altitude of the sun, then, having noted the sun's position for the day in the zodiac circle, rotate the rete until the sun's position coincides with a circle on the plate corresponding to the observed altitude. A line drawn through this point of coincidence and the centre of the instrument to a marginal circle of hours shows the time,

Among the accessories often introduced in the earlier astrolabes were "shadow scales," for simple surveying, measuring heights and distances; calendar scales showing the sun's place in the zodiac for every day of the year; magnetic compasses, usual in instruments of the 16th and 17th centuries, which thereby became useful to surveyors as circumferentors; and lastly, various lines and tables of use to astrologers. The principal varieties of astrolabes in use in the different countries of Europe and of the nearer East may be studied in the Lewis Evans collection in Oxford. The finest English examples, a great zft. astrolabe by Cole, of 1575, and a seaman's astrolabe by Elias Allen (1616) belong to St. Andrews university.

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ASTROLOGY, the ancient art or science of divining the fate and future of human beings from indications given by the positions of the stars and other heavenly bodies. The study of astrology and the belief in it, as part of astronomy, is found in a developed form among the ancient Babylonians, and, directly or indirectly through the Babylonians, it spread to Greece about the middle of the 4th century B.C., and reached Rome before the opening of the Christian era. In India and China astronomy and astrology largely reflect Greek theories and speculations; and similarly, with the introduction of Greek culture into Egypt, both astronomy and astrology were actively cultivated in the region of the Nile during the Hellenistic and Roman periods. Astrology was further developed by the Arabs from the 7th to the 13th century, and in the Europe of the 14th and 15th centuries astrologers were dominating influences at court.

Babylonian Astrology.— In Babylonia, as well as in Assyria, astrology takes its place officially as one of the two chief means at the disposal of the priests for ascertaining the will and intention of the gods, the other being through the inspection of the liver of the sacrificial animal (see OMEN; HEPATOSCOPY). Astrology is based on a theory of divine government of the world, which assumes a scientific or pseudo-scientific aspect. Starting with the indisputable fact that man's life and happiness are largely dependent upon phenomena in the heavens, that the fertility of the soil is dependent upon the sun shining in the heavens as well as upon the rains that come from heaven, that on the other hand the mischief and damage done by storms and inundations, to both of which the Euphratean Valley was almost regularly subject, were to be traced likewise to the heavens, the conclusion was drawn that all the great gods had their seats in the heavens. With the moon and sun cults thus furnished by the "popular" faith it was a natural step for the priests to perfect a theory of a complete accord between phenomena observed in the heavens and occurrences on earth.

If moon and sun, whose regular movements produced the conception of the reign of law and order in the universe as against the more popular notion of chance and caprice, were divine powers, the same held good of the planets, of which five were recognized—Jupiter, Venus, Saturn, Mercury and Mars—to name them in the order in which they appear in the older cuneiform literature; in later texts, Mercury and Saturn change places. These five planets were identified with the great gods of the pantheon as follows:—Jupiter with Marduk (*q.v.*), Venus with the goddess Ishtar (*q.v.*), Saturn with the god Ninib, Mercury with Nebo (*q.v.*), and Mars with Nergal (*q.v.*). The movements of the sun, moon and five planets were regarded as representing the activity of the five gods in question, together with the moon-god Sin (*q.v.*) and the sun-god Shamash (*q.v.*), in preparing the occurrences on the earth. The priests of Babylonia accordingly applied themselves to the task of perfecting a system of interpretation of the phenomena to be observed in the heavens, and it was natural that the system was extended from the moon, sun

and five planets to the more prominent and recognizable fixed stars. That system involved not merely the movements of the moon, sun and planets, but the observation of their relative position to one another and to all kinds of peculiarities noted at any point in the course of their movements. To all these phenomena some significance was attached, and this significance was naturally intensified in the case of such a striking phenomenon as an eclipse of the moon. By the same method of careful observation of the sun and planets, and later of some of the constellations and of many of the fixed stars, the body of observations and the interpretations assigned to the nearly endless variations in the phenomena thus observed grew to enormous proportions. The interpretations themselves were based chiefly (1) on the recollection or on written records of what in the past had taken place when the phenomenon or phenomena in question had been observed, and (2) on association of ideas, involving sometimes merely a play upon words in connection with the phenomenon or phenomena observed. Thus if on a certain occasion the rise of the new moon in a cloudy sky was followed by victory over an enemy or by abundant rain, the sign in question was thus proved to be a favourable one and its recurrence would be regarded as a good omen. On the other hand the appearance of the new moon earlier than was expected was regarded as an unfavourable omen prognosticating in one case defeat, in another death among cattle, not necessarily because these events actually took place after such a phenomenon, but on a general principle resting upon association of ideas, whereby anything premature would suggest an unfavourable occurrence.

Astrology in this its earliest stage is marked by two characteristic limitations. In the first place, the movements and position of the heavenly bodies point to such occurrences as are of public import and affect the general welfare; individual interests are not in any way involved. In Babylonia and Assyria the cult centred almost exclusively in the public welfare and the person of the king, because upon his well-being and favour with the gods the fortunes of the country were dependent in accordance with the ancient conception of kingship *(see* J. G. Frazer, *The Early History of Kingship).* In the second place, the astronomical knowledge presupposed and accompanying early Babylonian astrology is essentially of an empirical character. In a general way the reign of law and order in the movements of the heavenly bodies was recognized, and indeed must have led to the rise of a methodical divination. We have, probably, as early as the days of Khammurabi, the combinations of prominent groups of stars with outlines of pictures fantastically put together. The theory of the ecliptic as representing the course of the sun through the year, divided among twelve constellations with a measurement of 30° to each division, is also of Babylonian origin, perfected after the fall of the Babylonian empire in 539 B.C. The golden age of Babylonian astronomy belongs to the Seleucid period, *i.e.,* after the advent of the Greeks in the Euphrates Valley. The beginnings at least of the calculation of sun and moon eclipses belong to the earlier period. Recent investigations have shown that the precession of the equinoxes was known to Babylonian astronomers.

The Influence of Greece.—To the Greek astronomer Hipparchus was given the credit of the discovery (*c.* 130 B.C.) of the theory of the precession of the equinoxes, but such a signal advance in pure science did not prevent the Greeks from endeavouring to trace the horoscope of the individual from the position of the planets and stars at the time of birth, or, as was attempted by other astrologers, at the time of conception. The system was taken up almost bodily by the Arab astronomers, it was embodied in the Kabbalistic lore of Jews and Christians, and through these and other channels came to be the substance of the astrology of the middle ages, forming, under the designation of "judicial astrology," a pseudo-science which was placed on a perfect footing of equality with "natural astrology" or the more genuine science of the study of the motions and phenomena of the heavenly bodies.

Chiefly under Greek influences, the scope of astrology was enlarged until it was brought into connection with practically all of the known sciences: botany, chemistry, zoology, mineralogy, anatomy and medicine. Colours, metals, stones, plants, drugs and animal life of all kinds were associated with the planets and placed under their tutelage. In the system that passes under the name of Ptolemy, Saturn is associated with grey, Jupiter-with white, Mars with red, Venus with yellow, while Mercury, occupying a peculiar place in Greek as it did in Babylonian astrology (where it was at one time designated as *the* planet par *excellence*), was supposed to vary its colour according to changing circumstances. The sun was associated with gold, the moon with silver, Jupiter with electrum, Saturn with lead, Venus with copper, and so on, while the continued influence of astrological motives is to be seen in the association of quicksilver, upon its discovery at a comparatively late period, with Mercury, because of its changeable character as a solid and a liquid. In the same way, stones were connected with both the planets and the months; plants, by diverse association of ideas, were connected with the planets, and animals likewise were placed under the guidance and protection of one or other of the heavenly bodies. By this curious process of combination the entire realm of the natural sciences was translated into the language of astrology with the single avowed purpose of seeing in all phenomena signs indicative of what the future had in store. The fate of the individual, as that feature of the future which had a supreme interest, led to the association of the planets with parts of the body. Here, too, we find various systems devised, in part representing the views of different schools, in part reflecting the advancing conceptions regarding the functions of the organs in man and animals. From the planets the same association of ideas was applied to the constellations of the zodiac, which in later phases of astrology are placed on a par with the planets themselves, so far as their importance for the individual horoscope is concerned. The fate of the individual in this combination of planets with the zodiac was made dependent, not merely upon the planet which happened to be rising at the time of birth or of conception, but also upon its local relationship to a special sign or to certain signs of the zodiac. The zodiac was regarded as the prototype of the human body, the different parts of which all had their corresponding sections in the zodiac itself. The late Egyptian astrologers set up a correspondence between the 36 *decani* recognized by them and the human body, which is thus divided into 36 parts; to each part a god was assigned as a controlling force. Many diseases and disturbances of the ordinary functions of the organs were attributed to the influence of planets or explained as due to conditions observed in a constellation or in the position of a star; while, on the other hand, the influence of planetary lore appears in the assignment of the days of the week to the planets, beginning with Sunday, assigned to the sun, and ending with Saturday, the day of Saturn. In later periods, Saturn's day was associated with the Jewish Sabbath; Sunday with the Lord's Day; Tuesday with Tiw, the god of war, corresponding to Mars of the Romans and to the Nergal of the Babylonians. Wednesday was assigned to the planet Mercury, the equivalent of the Germanic god R'oden; Thursday to Jupiter, the equivalent of Thor; and Friday to Friga, the goddess of love, who is represented by Venus among the Romans and among the Babylonians by Ishtar. Astrological considerations regulated in ancient Babylonia the distinction of lucky and unlucky days, which passing down to the Greeks and Romans *(dies fasti* and *nefasti)* found expression in Hesiod's *Works and Days.*

Judicial Astrology.—In the science of judicial astrology a horoscope or "nativity" is a map of the heavens at the hour of birth, showing, according to the Ephemeris, the position of the heavenly bodies, from which their influence may be deduced. Each of the twelve signs of the zodiac (*q.v.*) is credited with its own characteristics and influence, and is the controlling sign of its "house of life." The sign exactly rising at the moment of birth is called the ascendant. The benevolent or malignant influence of each planet, together with the sun and moon, is modified by the sign it inhabits at the nativity; thus Jupiter in one house may indicate riches, fame in another, beauty in another, and Saturn similarly poverty, obscurity or deformity.

Judicial astrology, as a form of divination, is a concomitant of natural astrology, in its purer astronomical aspect, but mingled with what is now considered an unscientific and superstitious view of world-forces. Francis Bacon abuses the astrologers of his day no less than the alchemists because he has visions of a reformed astrology and a reformed alchemy. Sir Thomas Browne, too, while he denies the capacity of the astrologers of his day, does not dispute the reality of astrological science. But Aristarchus of Samos, Martianus Capella (the precursor of Copernicus), Cicero, Favorinus, Sextus Empiricus, Juvenal, and in a later age Savonarola and Pico della Mirandola, and La Fontaine, a contemporary of the neutral La Bruyère, were all pronounced opponents of astrology. In England Swift may fairly claim the credit of having given the death-blow to astrology by his famous *Prediction for the Year 1708, by Isaac Bickerstaff, Esq.* Many passages in the older English poets are unintelligible without some knowledge of astrology. Chaucer wrote a treatise on the astrolabe; Milton constantly refers to planetary influences; in Shakespeare's *King Lear,* Gloucester and Edmund represent respectively the old and the new faith. In modern languages words with astrological associations are still in use, such as *lunatic, saturnine, malheureux* and *ill-starred.*

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ASTRONOMICAL ARTICLES. Besides the article ASTRONOMY, this subject is dealt with under the following heads:

SOLAR SYSTEM.—1, *Sun; Eclipse; Chromosphere; Corona;* 2, *Planet; Mercury; Venus; Earth; Moon;* Mars; *Jupiter; Saturn; Uranus; Neptune;* 3, *Minor Planet; Eros; Trojan Planets;* 4, *Comets; Meteor.*

STELLAR UNIVERSE.—1, *Star; Nova; Sirius; Algol;* 2, *Star Cluster; Nebula; Cosmogony; Stellar Evolution.*

METHODS AND INSTRUMENTS.—1, METHODS—*Parallax; Time Measurement; Photometry; Plzotography, Celestial;* 2, INSTRUMENTS—*Observatory; Telescope; Transit Circle; Spectroheliograph; Micrometer; Altazimuth; Zenith Telescope; Blink Microscope; Coelostat; Heliostat; Photography;* 3, COMPUTATION—*Ephemeris HISTORICAL.— 1, History of Astronomy* (forming part of the article *Astrononty); Constellation; Ancient Eclipses* (in article *Eclipse);* 2, *Astrolabe; Armillary Sphere; Dial.*

Thirty-two short articles on individual constellations are given *(see* table at the end of the article *Constellation).* These contain, besides a reference to the mythology of the constellation, notes on the principal objects of astronomical interest.

Further articles deal with various phenomena of fundamental importance either cosmically or from their effect on questions of practical life:—*Precession of the Equinoxes, Aberration of Light, Equation of Tinte.*

ASTRONOMICAL SOCIETIES. The *Royal Astronomical Society* was founded in 1820 as the *Astronomical Society of London* and was incorporated March 7, 1831. Its headquarters are at Burlington House, London, and *Memoirs* (1882, etc.) and *Monthly Notices* (1831, etc.) are published. The first *International Astronomical Congress* met at Heidelberg in 1863 and in 1887 the first international conference for celestial photography assembled in Paris. The *International Astronomical Union,* organized at Brussels in 1919, held meetings at Rome in 1922, Cambridge, Eng., in 1925 and at Leiden, Holland, in 1928. Other astronomical societies: *British Astronomical Association* (London) and societies at Bristol (1869), publishing *Reports;* Leeds (1859), Manchester and Liverpool (1881); the *Roy. Astr. Soc. of Canada,* Toronto (1890), *Transactions* (1890), *Proceedings* (1902), *Journal* (1907, etc.); *Soc. Astr.,* Paris (1887), *Bull.; Kgl. Astr. Rechneninstitut,* Berlin (1897); *Astronomische Ges.,* Leipzig (1863), *Publ.* (1865, etc.) and *Vierteljahrschrift* (1866, etc.); *Soc. Astr. Ital.,* Milan (1920), *Revista; Soc. Belge. d'Astr. de Météorol. et de Physique du Globe,* Brussels (1893), *Bull. mens.; Soc. d'Astr.,* Antwerp (1905), *Gazette; Soc. Astr.,* Mexico (1902), *Boletin* (1902, etc.). The *American Astronomical Society* was originally founded in 1899 as the *Astronomical and Astrophysical Society of America.* The *Astronomical Society of the Pacific* was founded in 1889. The *American Association of Variable Star Observers* was organized in 1911.

ASTRONOMY. The earth on which we live is the fifth largest planet belonging to one of the lesser stars. Perhaps it is less necessary now than it used to be to insist on the smallness of our planet. Scientific inventions and ease of travel seem to have brought different parts of the earth near together, and we no longer hold an exaggerated idea of its immensity. But it is when we look up into the vault of the heavens that we realize the insignificance of the earth in the scheme of the material universe. Our sight penetrates space beyond space revealing world beyond world of unimaginable grandeur; and the greatest of these orbs is but as a speck in the vast intervening void. All this world beyond the earth is the field of the science of astronomy.

Of the objects of the sky the sun and moon stand out from the rest in prominence. Both appear to us of much the same size. In fact the phenomenon of eclipses gives a delicate test showing that the apparent angular sizes are almost identical; for when the moon passes between us and the sun, sometimes it is just able to cover it completely, sometimes it just fails to cover it and leaves a narrow ring of the sun showing all round it. But this apparent agreement is only a coincidence; the sun and moon are bodies of altogether different size and cosmical importance.

The moon is a smaller globe than the earth, of no particular importance except to the earth which it attends as satellite; it is probable that in the remote past its material formed part of the earth, that it broke away in a great convulsion, and has gradually receded to its present distance of 240,000 miles. Thus the first halting point in our journey through space tends rather to enhance our idea of the dignity of the earth by showing that a subordinate globe attends it; but that is unique, and when we pass beyond this comparatively small distance over which the earth's domain extends, the "proud father" is seen to be a very humble member of a great community.

The other luminary, the sun, stands to our earth in much the same relation as the earth does to the moon. The sun is the ruler and the earth a subordinate globe travelling round nearly in a circle (but strictly an ellipse) under the controlling force of the sun's gravitational attraction. The sun is of a size that befits the dignity of a ruler. The amount of matter constituting it is equivalent to 300,000 earths rolled into one. This great mass is maintained, by means which are still very largely a mystery, at enormously high temperature so that it pours forth the unceasing stream of heat and light of so much importance to terrestrial life. Our average distance from the sun is 92,870,000 miles; but since the earth's orbit is not exactiy circular its distance varies over a range of about 3,000,000 miles according to the time of year.

When we pass beyond the moon all astronomical distances become inconceivably great, and the reader may be inclined to group them together without distinction as virtually infinite. But it has to be realized that we have passed to a new scale of extension where we must make a distinction of comparatively smaller and greater distances. Great as may be the distance from the earth to the sun it is traversed by light in about eight minutes; or a radio-telegram would take the same time to travel. We see the sun not as it is now but as it was eight minutes ago. This gives a convenient way of realizing how much further our journey through space must extend. There is little doubt that the most remote object in the heavens which can be seen without telescopic aid is

a small fuzzy patch of light in the constellation Andromeda. At first glance this would be taken for one of the fainter stars, but the diffuseness of the light is distinctive, and telescopes show it to be a great spiral nebula. The light which we see to-day left that nebula 900,000 years ago. This is more or less the limit of our exploration; the telescope shows other spiral nebulae, smaller and presumably in many cases more remote, but their distances are at present a matter of conjecture.

The Solar System.—Just as the earth's supremacy comes to an end beyond the moon, so there are limits to the sun's supremacy. The solar system, as it is called, may be regarded roughly as limited by the orbit of the outermost planet, Neptune; though many of the comets obeying the sun's attraction have elongated paths which take them some way out into the space beyond this limit for part of their course. Neptune's distance from the sun is 30 times as great as that of the earth; and as seen from Neptune the brightness and heat would be diminished to about a thousandth; but even so the sun would appear far more brilliant than any of the stars. The isolation of this system from other astronomical bodies or systems can be best realized from the fact that the sun's light takes 4 hours to reach the limits of its domain (Neptune), but 4 years to reach its nearest neighbour among the stars.

For this reason the study of the heavenly bodies falls naturally into two divisions: the solar system and the stellar universe, the latter comprising all that is beyond the solar system.

To the solar system belong, besides the sun and the earth with its moon, the planets or "wandering stars." Such of the planets as are visible to the naked eye are ordinarily mistaken for true or "fixed" stars; they can usually be distinguished by the fact that their light does not twinkle, but that is by no means an infallible test since it depends a great deal on atmospheric conditions. Their special characteristic is that they move from place to place in the sky—not like the stars which form fixed constellations. For this reason it is impossible to give simple directions as to where they are to be found, or to insert positions for them in a map of the heavens. A planet of unusual brilliancy seen towards the west after sunset or the east before sunrise may fairly safely be identified as Venus; after the sun and moon it is much the brightest object of the heavens. Jupiter is also much brighter than any of the stars; its position in the sky is not so circumscribed as that of Venus and it may be visible at any time of the night. Mars is easily distinguished from other planets by its red colour, and when near the earth is conspicuous by its brilliancy; at other times it may easily be mistaken for one of the reddish fixed stars. Saturn can scarcely be distinguished from the bright (first magnitude) stars except by those who have enough familiarity with the normal appearance of the heavens to spot "a bright star in the wrong place." Mercury is rarely seen except in tropical latitudes; at favourable times it is visible as a brilliant point of light in the glow of sunset or sunrise. The other planets, Uranus and Neptune, are telescopic objects. These planets are bodies revolving round the sun and having the same status as the earth. Telescopes show that some of them are attended by satellites as the earth is attended by the moon. A planet more remote than Neptune was discovered at the Lowell observatory in Feb. 1930 in a position agreeing closely with a prediction made by the late Percival Lowell as the result of calculation from the perturbations of Uranus. Its present distance from the sun is between 3,700 and 4,000 million miles. The period is unknown at present but is expected to be about 300 years.

To complete the enumeration of the bodies of the solar system we must mention: (1) The minor planets, of which more than a thousand have been discovered, which in some way seem to represent what ought to have been an ordinary planet between Mars and Jupiter where there is a hiatus in the regular spacing of the successive orbits; (2) the comets, bodies of no great mass, which suffer extremes of heat and cold owing to their very elongated orbits and display "fireworks" at each return to proximity to the sun's heat; (3) swarms of meteors which the earth ploughs through on its way round the sun; these bodies (mostly of very small mass) become incandescent on striking the earth's atmosphere and show themselves as "falling stars"; (4) diffuse gaseous or meteoric matter seen in the zodiacal light and evidenced in other more indirect ways.

The Stellar Universe.—As already stated we have to adapt our minds to a transcendently large scale of size and distance in studying the solar system; but this is only a prelude to another million-fold leap in studying the scale of the stellar universe. Passing outside its own particular domain, the sun is just one of some thousands of millions of stars. It is not a particularly large star. In fact, most of the stars which we see in the night sky are in reality much more brilliant; but this is not quite a fair comparison to make, because naturally it is the more brilliant members of the community that have the best chance of being noticed. Whilst we must recognize that there are numerous stars which outshine the sun, we must also recognize that feebler stars are still more numerous. This part of astronomy includes the study of individual stars and their associations, star clusters, and nebulae. The last term includes three distinct types of objects.

The two main divisions of astronomical knowledge—the solar system and the stellar universe—cannot be kept entirely dissociated. Thus our study of the sun as the leading member of the solar system must be supplemented by a comparative study of him in relation to his compeers in the stellar universe. Moreover, much of astronomical research is directed not so much towards knowledge of individual objects as to the discovery of physical laws and truths of uni ersal application; the problem of the laws of motion of the planets round the sun repeats itself in the motion of the components of a double star; the configuration which in our own system gives rise to the awe-inspiring spectacle of an eclipse is also the secret of the winking of the "demon" star Algol.

Some Practical Uses of Astronomy.—What is the use of astronomy? It is not necessary here to defend the pursui! of pure science whether or not it leads to results which can be used (or, as commonly, misused) for modifying the conditions of human existence. Therefore it is not in any spirit of apology or defence that reference may be made to some of the practical reasons why a study of astronomy is necessary. To begin with, it provides the explanation of certain phenomena of immediate importance to us such as the seasons and the tides. The exact time circulated several times a day by radio is derived from continued astronomical observations. It is of fundamental importance in navigation. Greenwich observatory was founded in 1675 to meet urgent needs of navigation; and in particular its long series of observations of the moon from 1750 onwards has been the basis by which longitudes were determined up to recent times. The radio time-signals have now rendered the moon obsolete for this purpose; but even after 1900 the ownership of many hundreds of square miles of territory hung in the balance until the boundary commissioners were furnished with the latest observations of the moon's position.

All this, it will be said, belongs to the old fashioned type of astronomy, and is no justification of the usefulness of much of the present domain of research which seems to be inspired with the idea of getting as far away as possible from the earth and all terrestrial things. The answer is that scientific knowledge forms a single whole, and if astronomy lags behind, the sister science of physics will suffer. Present-day astronomy has a very definite part to play in the general advance. The stars and diffuse nebulae are physical laboratories where we can watch experiments performed on matter under the most extreme conditions of temperature and density. They supply the gaps in knowledge which the experimental physicist is unable to cover in the limited conditions of a terrestrial laboratory. The element helium, of great practical use to-day, was first discovered on the sun. The theory of relativity has revolutionized the conceptions of physics and is fundamental in our modern knowledge of the atom; but it largely owes its general acceptance to the astronomical tests which were applied. Numerous technical illustrations could be given of the way in which the stars have been invoked to supplement the terrestrial laboratory. At the time of writing (1928) comes the news that the most prominent lines in the spectra of the nebulae are now identified as "forbidden lines" of the spectrum of the oxygen atom in a certain state—forbidden, that is to say, in anything approaching terrestrial conditions but possible at the extremely

low density of a nebula. We cannot foresee what will be the next practical application of the rapidly advancing physical knowledge wrung by joint effort from the laboratory and the stars; but that there will be applications the whole history of science and invention assures us. One thing may be pointed out. The sun and stars hold the secret of releasing from matter vast quantities of energy compared with which all our commercial sources of energy are insignificant. Few scientific men would venture to hold out any expectation that by quest of this secret we may be able to provide the world with a source that will supersede all present fuel; but it would certainly be remiss not to make every effort to learn what we can of the conditions of release of this transcendent power.

Observatories and Their Work.—Numerous observatories have been set up in most countries to carry out astronomical observations. It may be well first to remove the rather amusing popular misconceptions as to the kind of work that goes on in these. The astronomer does not spend his nights with his eye "glued to the telescope." He is not bound to keep a continuous watch over the sky lest something should turn up when he happened to be asleep. Very little of his time is spent in gazing at the show objects of the heavens—the moon, planets, nebulae, etc.—which for the most part can show him nothing more to-night than they have shown him for many years past. He does not relapse into inactivity in those intervals when there is nothing particularly new or striking going on in the sky. Whilst we are on the subject of popular misconceptions, it may be added that the chief preoccupation of astronomers is not the question whether there is intelligent life on Mars or elsewhere in the universe; although an occasional crumb of information that might possibly bear on this subject may happen to be picked up, astronomy can take no responsibility for the speculations that may ensue. Also astronomers do not predict the weather; and, their work being at the mercy of the clouds, they have more cause than most people to rail against failure to foretell the state of the sky a few hours in advance.

What, then, is the work of an observatory? The question is rather like asking what is the work of a factory; no summary can cover all the different kinds of investigation that the different institutions may take up. A few years ago a central feature of every observatory was an accurate astronomical clock, which had to be kept corrected by frequent observations of stars. But now lines of work have developed in which accurate knowledge of time is inessential; and there is at least one famous observatory where no one worries about the time to a minute or so. But it would be nearly true to say that all astronomical work consists of exact measurement. If the eye of the observer is gazing fixedly into the telescope for a few minutes, his fingers are all the time twiddling screws to move cross-wires or other devices; and in the course of the night he has to look as much at terrestrial micrometer-readings as at celestial phenomena. Part, but by no means all, of the work consists of photography, the exposures ranging from less than a minute to many hours according to the nature of the investigation. These photographs are afterwards measured up under the microscope. Many measures are made photographically and visually of the brightness of different stars. Or the light may be split up by a spectroscope before photographing, and the spectra subsequently measured. What is learnt from all these measures forms the subject matter of many separate articles on celestial objects included in this encyclopaedia. The reader will there find evidence that the work is often fruitful; but he may not easily be convinced that there is need for such an enormous amount of measurement. There are several lines of explanation which may help us to understand this.

The Demand for Data.—Few people realize how big the vault of the sky is. If the moon is photographed with an ordinary astrographic telescope its image seems disappointingly small. The usual size of plate is $6\frac{1}{4}$x$6\frac{1}{4}$in.; and the beginner perhaps expects that this will cover only a limited area of the moon. Instead of that the full moon is only a circle just over an inch in diameter. Yet even on this unambitious scale it takes 10,000 plates to cover the whole sky. With more powerful telescopes giving a larger scale the task is correspondingly increased. The number of stars that might be studied is overwhelming, and indeed it is necessary to impose some systematic limitation on the survey; but proper motions determined by the ten thousand, parallaxes and radial velocities by the thousand, fail to satisfy the demands of the theorist for more and more data. Much of our knowledge of the stars has come from statistical studies, and work of that kind swallows up data by the thousand before it can assert results with confidence and accuracy.

It is by spreading our net wide that we catch the objects which will repay an intensive study. The minor planets give a good example of this. After the first few were discovered there seemed little object in continuing to find hundreds more, calculating their orbits, and generally keeping track of them. There was some chance that statistics of their distribution in distance, eccentricity, inclination, etc., might prove interesting; but otherwise they were an unmitigated nuisance in astronomy. But after Ceres, Pallas, Juno, Vesta, the work went on, each new planet being as uninteresting as its predecessor. Then in 1898, No. 433, Eros, was discovered, a body of the greatest astronomical importance which was the subject of thousands of observations at its close approach to the earth in 1901, and which will no doubt be watched with equal zeal at the still closer approach in 1931. Another dull accumulation of these planets followed until No. 588, Achilles, started the interesting Trojan group, which if it has done nothing else has set a new and difficult problem to the dynamical astronomers.

Another illustration may be given. One of the greatest needs in stellar astronomy is a knowledge of the masses of the stars; many important conclusions turn on evidence as to the mass. The only chance of making a direct determination of the mass is when the star is a binary system; but it is rare to find all conditions favourable. Burnham's General Catalogue lists 13,600 visual double stars and to these may be added more than 1,000 spectroscopic binaries. From these we are able to scrape together just about 30 reasonably well-determined masses. It seems a meagre amount of grain to extract from so much chaff; yet the advance that this knowledge of stellar mass makes possible is so great that we should have no reason to feel dissatisfied even if this were the only result of double star observation. When in these astronomical articles a star is mentioned as having given occasion for some new extension of knowledge, it should be recalled that in most cases the observer had no initial reason to suspect that it would prove more fruitful than a hundred other stars on his programme.

Astronomical Telescopes.—A telescope of some kind is employed in nearly all observations. There are two entirely distinct functions which it may fulfil—(1) to collect enough light from extremely faint objects to make them visible or capable of measurement; (2) to resolve and magnify brighter objects. These functions are independent, and any particular telescope is usually specialized for one purpose or the other. Having, for example, employed a wide aperture and long exposure to collect enough light from a faint extension of a nebula or the end of a comet's tail we do not want to squander it over a large area on the photographic plate. A wide dumpy instrument gathering much light on to a small scale picture is best for detecting the faintest objects. On the other hand, when the amount of light permits, we profit by employing a long telescope with high magnification; the accuracy of measurements is enhanced by the increased scale. For these and other reasons there is a tendency to specialization of telescopes for different kinds of work. Owing to conditions of achromatism a refracting telescope cannot ordinarily be used both for visual and photographic work; attempts to combine both functions in one instrument involve extra lenses and considerable sacrifice of light. In some applications of the largest telescopes the perfect figuring of the mirror would seem to be rather wasted. For measurement of the heat of the stars the rays have to be concentrated on a disc enormously greater than the ordinary size of a star-image; and in photo-electric work they merely have to enter the wide mouth of a photo-electric cell. In the spectroscopy of nebulae the perfection of the focus is unimportant. There would seem to be room in an observatory nowadays for a very big, very "bad" telescope.

Besides the largest telescopes mounted equatorially, *i.e.*, so as to keep the same stars in view notwithstanding the apparent diurnal

rotation of the sky, there are instruments (useless for prolonged scrutiny of objects) with which observations of position of the stars and planets are snapped as they traverse the field of view. The transit circle (or meridian circle), the altazimuth and the zenith telescope are the most important of these. They are used for measuring the positions, and hence ultimately the motions of heavenly bodies. With the equatorial telescopes positions can only be measured relative to the stars in the same field. This suffices for some kinds of work: but, for example, in following the motion of the moon and planets round the sky the whole system of reference stars will need to be connected together. This liaison is provided mainly by the transit-circle and forms a very important branch of practical work known as "Fundamental Astronomy."

Finally reference may be made to kinds of work which may perhaps give some colour to the popular misconceptions mentioned at the beginning of this section. There are two things which come on an astronomer without warning—the outbreak of a Nova or temporary star, and the arrival of a comet. The arrival of comets can be predicted sometimes, but the biggest comets come unannounced; outbreaks of Novae are never predicted. The discovery of either is likely to fall to someone who makes a practice of searching the sky night after night, whether with deliberate intention or from delight in its wonders. It is not likely to fall to those who are occupied with the intensive measurements abovementioned. After a comet has been observed on three nights its orbit is worked out, and it is possible to judge whether it is likely, by close approach to the sun or the earth, to give favourable opportunity for studying outstanding questions of cometary structure. The result is generally disappointing and it passes out of notice so far as the majority of astronomers are concerned, though the comet specialists will continue to keep an eye on its behaviour. The announcement of a Nova most decidedly disturbs the even life of an observatory; for these stars present some of the most perplexing problems of present day astronomy and there is great need for observation especially in the earliest stages of the outbreak. At least for spectroscopic workers it is well worth while to suspend other problems and make concentrated efforts to explore the mysterious phenomena.

SPHERICAL ASTRONOMY

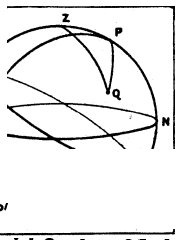
The Celestial Sphere.—In surveying the universe from a fixed point we can define the position of any object by specifying (1) its direction and (2) its distance. Owing to the property of propagation of light in straight lines we can immediately observe the direction of any visible object, but we cannot tell how far away it is. Our knowledge of astronomical distances is derived by more indirect methods, and it never attains the precision of our knowledge of directions. Hence our study of position begins with a study of direction only; or, we may put it, we study the location of heavenly bodies, not in space, but on the celestial sphere.

The celestial sphere, then, is a sphere with the observer as centre, of radius which is arbitrary though it is perhaps convenient to choose it very great; and an observation of direction fixes the object (or projects it) on some point of this sphere. For the present we can regard the fixed stars as fixed points of this sphere (ignoring their very slow proper motions). They play the part of the figures on a clock face, and we observe the sun, moon and planets moving across them like the hands of the clock. Primarily the actual observer himself is the centre of this sphere; but for combining with observations at other times and places we often apply corrections so as to give the positions which would have been observed from the centre of the earth or of the sun—geocentric or *heliocentric* positions. The correction necessary to reduce the original position to geocentric or heliocentric position is called parallax. The closer the object the greater is the parallax; for example, the moon has so large a parallax that if we point a moderately powerful telescope to its geocentric position (the position given in the Nautical Almanac) it will probably be out of the field of view; we, so to speak, look over the top of it.

The first thing we notice is that the celestial sphere carrying the stars is rotating; the stars rise in the east and set in the west. (Of course we know that it is really our earth that is rotating, but this is not the appropriate moment to air our superior knowledge.) R e can determine the axis of rotation because the end of the axis will remain still. One well known star remains nearly still; we always find it in practically the same direction and altitude in the sky. This must accordingly be very near the end of the axis, and the star is called Polaris or the Pole Star. By careful observation we fix the unchanging point or Pole more accurately among the stars, and find that Polaris is about $1°2'$ away from it. There is an opposite pole in the other hemisphere not marked by any bright star but equally locatable; and midway between them runs a great circle called the Equator of the celestial sphere.

The observer can also mark on the celestial sphere the zenith or point which (momentarily) is vertically overhead. This is given by the direction of gravity (including centrifugal force); it is perpendicular to any undisturbed liquid surface, and in practice is generally determined by a method employing reflection from a trough of mercury. Opposite to the zenith is the nadir, and the great circle midway between them is the horizon. This celestial horizon does not quite agree with the observed terrestrial horizon; because if we are on a hill we see rather more than half the celestial sphere. At fixed observatories we usually measure angles from the zenith; but at sea the sailor measures altitudes above the sea-horizon, and he has to subtract a correction called the "dip of the horizon" to give the altitude above the celestial horizon (corrected altitude=$90°$— zenith distance).

Sidereal Time.—The diagram shows our two named points, the pole P and the zenith Z, our two great circles, the equator and horizon, and the south pole P' and nadir Z' in the opposite hemisphere. The equator meets the horizon in the east and west points. The great circle joining PZ is called the meridian, and meets the horizon in the north and south points N, S. Finally the angular distance PN, *i.e.*, the altitude of the pole above the horizon, is called the latitude of the observer. The reason for this last identification is easily seen. If the observer were at the north pole, where the axis of the earth's rotation is the line going straight down to the earth's centre, *i.e.*, to the nadir, it is clear that Z and P would coincide. As we travel towards the earth's equator the angle between Z and P diverges; and at the equator our zenith direction Z is $90°$ away from its original direction P. In fact for stations on the equator P must be on the horizon. Conversely, travelling steadily through $90°$ of terrestrial latitude from the terrestrial equator to the pole, P rises steadily from the horizon through $90°$ to the zenith, and its height at any stage measures the latitude. It may be asked, How does the spheroidal figure of the earth affect the accuracy of this statement? The statement is still exact, because the latitude shown on maps is defined by this astronomical defihition; but the spheroidal shape has the effect of making a degree of latitude greater (in miles) near the pole than near the equator.



THE DIAGRAM OF A CELESTIAL SPHERE

Consider now a star or planet Q. We can specify its position either by giving its zenith distance ZQ and the azimuth from the south point, *i.e.*, the angle QZS; or by giving the north polar distance PQ and the angle QPZ which is called the hour angle. Formulae of spherical trigonometry connect these two methods of defining position. The hour angle introduces us to the problem of time.

The earth rotates once in $23^h.56^m.4.091^s.$ of ordinary time (mean solar time). But although the astronomer supplies mean solar time for the convenience of the general public, he has for his own use another reckoning of time called sidereal time and the foregoing period is equal to 24 sidereal hours. Thus in 24 hours by the sidereal clock the celestial sphere makes one revolution and comes into the same position again. The convenience of such a clock will be evident when we realize that if we have once seen a star in a certain direction at 5 o'clock (sid.), we always find it there at 5 o'clock (sid.). The hour angle (or indeed any angle)

can be expressed in the usual way in degrees, minutes, seconds, but it can also be expressed in time units by converting at the rate of 360° to 24^{h} of time.

When converted into time units in this way the hour angle tells us how long by the sidereal clock the celestial sphere will take to turn through the angle QPZ and so bring Q on to the meridian If it is now 5 o'clock (sid.) and the easterly hour angle of Q is 8 hours, Q will cross the meridian at 13 o'clock (sid.).

We have explained how to regulate the rate of the sidereal clock but we have not yet explained how to set it. At $0^{h}\,0^{m}\,0^{s}$ sidereal time a certain fixed mark of the equator (fixed relative to the stars) must be crossing the meridian NZS. We call this mark "the first point of Aries" and denote it by ♈. Evidently at any moment the sidereal time will be equal to the hour angle of ♈ measured towards the west. Every other star has its fixed time of passing the meridian by the sidereal clock and this time is called the right ascension of the star. This gives the third, and most usual, way of specifying positions on the celestial sphere, viz., Right Ascension, the time by the sidereal clock at which the point passes the meridian, or the angle ♈PQ measured towards the east; *Declination,* the complement of the north polar distance, or 90°-PQ.

In this system it is no longer necessary to refer to the time of observation, since if the point is in a constant position with respect to the stars the right ascension and declination remain constant (subject to corrections mentioned later).

Sun, Moon and Planets. — Turning from the fixed stars to moving bodies, the simplest motion is that of the sun. If we observed the earth from the sun we should see it describe a complete circle round the sphere of the stars once a year, as it went round its orbit. The direction from the earth to the sun is just the opposite, and therefore it sweeps out a great circle round the celestial sphere once a year. This great circle is called the ecliptic; it is the intersection of the plane of the earth's orbit with the celestial sphere. We can, of course, trace this great circle among the stars by observing the sun's right ascension and declination from day to day. The point ♈ (hitherto treated as arbitrary) is defined as the intersection of the equator and ecliptic; the sun in its course round the ecliptic passes through this point at the vernal equinox, about March 21. The ecliptic and equator are inclined at an angle of about $23\frac{1}{2}°$ called the obliquity.

The sun goes round the ecliptic towards the east increasing in declination after passing ♈ and therefore giving us (in the northern hemisphere) the long summer days. After reaching a maximum declination of $23\frac{1}{2}°$ it descends, passes through the point opposite ♈ about Sept. 21, and continues to a minimum declination of $23\frac{1}{2}°$. It has to make a complete circuit in $365\frac{1}{4}$ days and therefore has to do an average of nearly 1" a day. Thus when the celestial sphere has made one complete turn it has still 1° more to go before the sun is brought back to the meridian; that takes 4 minutes more, or, to give the accurate figures, the average sidereal time between two successive passages of the sun over the meridian is $24^{h}\,3^{m}.56{\cdot}55^{s}$. Since our daily affairs are more or less regulated by the sun we set this equal to 24^{h} of ordinary (mean solar) time. Clocks regulated by this time keep pace with the sun on the average throughout the year, but not exactly from day to day (see EQUATION OF TIME). The sidereal clock gives one extra, "day" in the year compared with the mean clock; hence there is only one instant in the year when the two clocks agree. About March 21 the sun coincides with ♈, so that it is on the meridian (noon) when ♈ is on the meridian, *i.e.*, at 0^{h} sidereal time; midnight which is the beginning of the civil day (0^{h}) accordingly coincides with 12^{h} sidereal time about March 21. Thus the time when the two clocks agree is at the autumnal equinox about Sept. 21. These statements, however, need a slight correction because of the equation of time, true midnight on Sept. 21 being at about 11.53 p.m. local mean time.

The orbit of the moon is inclined at a small angle 5°9′ so that the moon's position in the sky is always within this distance of the ecliptic. The principal planets also have small inclinations, so that it is possible to define a zone not much more than 10° wide within which the sun, moon and planets are always to be found This zone is called the zodiac, and its course amongst the stars is marked by the 12 well known constellations of the zodiac. Angular distance from the ecliptic is called *latitude,* and distance round the ecliptic measured from ♈ is called longitude. Positions of objects are often given in longitude and latitude instead of in right ascension and declination. It should be noted, however, that the names are rather misleading, because right ascensions and declinations are the proper analogues on the celestial sphere to longitudes and latitudes on the earth.

Perturbing Factors. — After measurements have been made of the apparent position of a body in the sky a host of corrections must be applied before the results can be reduced to a useful form. Besides the purely instrumental corrections, the chief corrections are: (1) Refraction. The bending of the rays of light in passing through our atmosphere displaces the apparent position of a star by 57″ when the altitude is 45°, and by a rapidly increasing amount at lower altitudes; the correction, moreover, varies according to the thermometer and barometer readings. Considering the magnitude and variability of this correction it is really rather surprising that it should be possible to measure absolute positions with an accuracy approaching 0·1″.

(2) Aberration of light (*q.v.*). This may be anything up to 20·5″, but the correction can be calculated without any uncertainty. It arises because, owing to the fact that the earth's velocity in its orbit is not insignificant compared with the velocity of light, the apparent direction of the light-ray is not the true direction of the object.

(3) Parallax. For bodies belonging to the solar system a sensible correction is required to reduce observations made from the observer's particular station on the earth's surface to a common standard, viz., an imaginary station at the centre of the earth. For a few stars an analogous correction is required to reduce observations from a particular point on the earth's orbit to a standard station coinciding with the sun; but for the most part stellar parallax is a matter of specific observation rather than a serious correction required for other investigations.

(4) Precession. We have hitherto treated the equator and ♈ as fixed marks in the sphere of the stars but actually they are continually moving — a fact which causes the practical astronomer no end of trouble. When positions observed at different times have to be compared or combined together, corrections must be applied for the difference between the equators and equinoxes with respect to which they have been measured. The steady part of this change is called Precession (See PRECESSION OF THE EQUINOXES).

(5) *Nutation.* This is part of the same phenomenon as precession; it comprises the periodic or oscillating part of the motion.

A modern branch of spherical astronomy is concerned with the projection of the celestial sphere on a plane photographic plate. The problem is equivalent to a central projection of the sphere on a plane which is tangent to it; and formulae have been developed for converting position measured on the plate (in plane rectangular co-ordinates) into right ascension and declination on the celestial sphere. Photographic determinations of position are necessarily differential, that is to say, the photograph must include a number of "reference stars" whose right ascensions and declinations are already known; from these the "plate-constants" for the particular plate under discussion are determined; and the plate constants are in turn used for deducing right ascensions and declinations of other objects in the photograph.

BIBLIOGRAPHY.—*Astronomy* by Russell, Dugan and Stewart (1926–27) is a comprehensive manual without any difficult mathematics. A smaller general work is General *Astronomy* by H. S. Jones (1922). Modern *Astrophysics* by H. Dingle (1924) and *Astronomical Physics* by F. J. M. Stratton (1925) deal with the side of astronomy most prominent at the present time, the former being intended for the general public and the latter for the working astronomer primarily. Other references are given under STAR, SUN, etc. Popular astronomical books are very numerous; mention may be made of Hutchinson's *Splendour* of the Heavens (1923), a composite work very fully illustrated.

(A. S. E.)

HISTORY OF ASTRONOMY

A practical acquaintance with the elements of astronomy is indispensable to the conduct of human life. Hence it is most

widely diffused among uncivilized peoples, whose existence depends upon immediate and unvarying submission to the dictates of external nature. Having no clocks, they regard instead the face of the sky; the stars serve them for almanacs; they hunt and fish, they sow and reap in correspondence with the recurrent order of celestial appearances. But these, to the untutored imagination, present a mystical, as well as a mechanical aspect; and barbaric familiarity with the heavens developed at an early age, through the promptings of superstition, into a fixed system of observation. In China, Egypt and Babylonia strength and continuity were lent to this native tendency by the influence of a centralized authority; considerable proficiency was attained in the arts of observation; and from millennia1 stores of accumulated data, empirical rules were deduced by which the scope of prediction was widened and its accuracy enhanced. But no genuine science of astronomy was founded until the Greeks sublimed experience into theory.

ASTRONOMY OF THE ANCIENTS

China.— Already, in the third millennium B.C., equinoxes and solstices were determined in China by means of culminating stars. This is known from the orders promulgated by the emperor Yao about 2300 B.C., as recorded in the the *Shû King*, a collection of documents antique in the time of Confucius (550–478 B.C.). And Yao was merely the renovator of a system long previously established. The *Shû King* further relates the tragic fate of the official astronomers, Hsi and Ho, put to death for neglecting to perform the rites customary during an eclipse of the sun, identified by Professor S. E. Russell with a partial obscuration visible in northern China 2136 B.C. The date cannot be far wrong, and it is by far the earliest assignable to an event of the kind. There is, however, no certainty that the Chinese were then capable of predicting eclipses. They were, on the other hand, probably acquainted, a couple of millenniums before Meton gave it his name, with the nineteen-year cycle, by which solar and lunar years were harmonized; they immemorially made observations in the meridian; regulated time by water-clocks, and used measuring instruments of the nature of armillary spheres and quadrants. In or near 1100 B.C., Chou Kung, an able mathematician, determined with surprising accuracy the obliquity of the ecliptic; but his attempts to estimate the sun's distance failed hopelessly as being grounded on belief in the flatness of the earth. From of old, in China, circles were divided into $365\frac{1}{4}$ parts, so that the sun described daily one Chinese degree; and the equator began to be employed as a line of reference, concurrently with the ecliptic, probably in the second century B.C. Both circles, too, were marked by star-groups more or less clearly designated and defined. Cometary records of a vague kind go back in China to 2296 B.C.; they are intelligible and trustworthy from 611 B.C. onward. Two instruments constructed at the time of Kublai Khan's accession in 1280 were still extant at Peking in 1881. They were provided with large graduated circles adapted for measurements of declination and right ascension, and prove the Chinese to have anticipated by at least three centuries some of Tycho Brahe's most important inventions. The native astronomy was finally superseded in the 17th century by the scientific teachings of Jesuit missionaries from Europe.

Egypt.— Astrolatry was, in Egypt, the prelude to astronomy. The stars were observed that they might be duly worshipped. The importance of their heliacal risings, or first visible appearances at dawn, for the purposes both of practical life and of ritual observance, caused them to be systematically noted; the length of the year was accurately fixed in connection with the annually recurring Nile-flood; while the curiously precise orientation of the Pyramids affords a lasting demonstration of the high degree of technical skill in watching the heavens attained in the third millennium B.C. The constellational system in vogue among the Egyptians appears to have been essentially of native origin; but they contributed little or nothing to the genuine progress of astronomy.

Babylon.— With the Babylonians the case was different, although their science lacked the vital principle of growth imparted to it by their successors. From them the Greeks derived their first notions of astronomy. They copied the Babylonian asterisms, appropriated Babylonian knowledge of the planets and their courses, and learned to predict eclipses by means of the "Saros." This is a cycle of 18 years 11 days, or 223 lunations, discovered at an unknown epoch in Chaldaea, at the end of which the moon very nearly returns to her original position with regard as well to the sun as to her own nodes and perigee. There is no getting back to the beginning of astronomy by the shores of the Euphrates. Records dating from the reign of Sargon of Akkad (3800 B.c.) imply that even then the varying aspects of the sky had been long under expert observation. Thus early, there is reason to suppose, the star-groups with which we are now familiar began to be formed. They took shape most likely, not through one stroke of invention, but incidentally, as legends developed and astrological persuasions became defined. The zodiacal series in particular seem to have been reformed and reconstructed at wide intervals of time. Virgo, for example, is referred by P. Jensen, on the ground of its harvesting associations, to the fourth millennium B.c., while Aries (according to F. K. Ginzel) was interpolated at a comparatively recent time. In the main, however, the constellations transmitted to the West from Babylonia by Aratus and Eudoxus must have been arranged very much in their present order about 2800 B.C. E. W. Maunder's argument to this effect is unanswerable. For the space of the southern sky left blank of stellar emblazonments was necessarily centred on the pole; and since the pole shifts among the stars through the effects of precession by a known annual amount, the ascertainment of any former place for it virtually fixes the epoch. It may then be taken as certain that the heavens described by Aratus in 270 B.C. represented approximately observations made some 2500 years earlier in or near north latitude 40°.

In the course of ages, Babylonian astronomy, purified from the astrological taint, adapted itself to meet the most refined needs of civil life. The decipherment and interpretation by the learned Jesuits, Fathers Epping and Strassmeier, of a number of clay tablets preserved in the British Museum, have supplied detailed knowledge of the methods practised in Mesopotamia in the 2nd century B.C. They show no trace of Greek influence, and were doubtless the improved outcome of an unbroken tradition. How protracted it had been, can be in a measure estimated from the length of the revolutionary cycles found for the planets. The Babylonian computers were not only aware that Venus returns in almost exactly eight years to a given starting-point in the sky, but they had established similar periodic relations in 46, 59, 79 and 83 years severally for Mercury, Saturn, Mars and Jupiter. They were accordingly able to fix in advance the approximate positions of these objects with reference to ecliptical stars which served as fiducial points for their determination. In the Ephemerides published year by year, the times of new moon were given, together with the calculated intervals to the first visibility of the crescent, from which the beginning of each month was reckoned; the dates and circumstances of solar and lunar eclipses were predicted; and due information was supplied as to the forthcoming heliacal risings and settings, conjunctions and oppositions of the planets. The Babylonians knew of the inequality in the daily motion of the sun, but misplaced by 10° the perigee of his orbit. Their sidereal year was $4\frac{1}{2}^{m}$ too long, and they kept the ecliptic stationary among the stars, making no allowance for the shifting of the equinoxes. The striking discovery, on the other hand, has been made by the Rev. F. X. Kugler that the various periods underlying their lunar predictions were identical with those heretofore believed to have been reached independently by Hipparchus, who accordingly must be held to have borrowed from Chaldaea the lengths of the synodic, sidereal, anomalistic and draconitic months.

Greece.--A steady flow of knowledge from East to West began in the seventh century B.C. A Babylonian sage founded a school about 640 B.C. in the island of Cos, and perhaps counted Thales of Miletus (c. 639–548) among his pupils. The famous "eclipse of Thales" in 585 B.C. has not, it is true, been authenticated by modern research; yet the story told by Herodotus

appears to intimate that a knowledge of the Saros, and of the forecasting facilities connected with it, was possessed by the Ionian sage. Pythagoras of Samos (fl. 540–510 B.C.) learned on his travels in Egypt and the East to identify the morning and evening stars, to recognize the obliquity of the ecliptic, and to regard the earth as a sphere freely poised in space. The tenet of its axial movement was held by many of his followers—in an obscure form by Philolaus of Crotona after the middle of the 5th century B.C., and more explicitly by Ecphantus and Hicetas of Syracuse (4th century B.C.), and by Heraclides of Pontus. Heraclides, who became a disciple of Plato in 360 B.C., taught in addition that the sun, while circulating round the earth, was the centre of revolution to Venus and Mercury. A genuine heliocentric system, developed by Aristarchus of Samos (fl. 280–264 B.C.), was described by Archimedes in his Arenarius, only to be set aside with disapproval. The long-lived conception of a series of crystal spheres, acting as the vehicles of the heavenly bodies, and attuned to divine harmonies, seems to have originated with Pythagoras himself.

The first mathematical theory of celestial appearances was devised by Eudoxus of Cnidus (408–355 B.C.). The problem he attempted to solve was so to combine uniform circular movements as to produce the resultant effects actually observed. The sun and moon and the five planets were, with this end in view, accommodated each with a set of variously revolving spheres, to the total number of 27. The Eudoxian or "homocentric" system, after it had been further elaborated by Callippus and Aristotle, was modified by Apollonius of Perga (fl. 250–220 B.C.) into the hypothesis of deferents and epicycles, which held the field for 1,800 years as the characteristic embodiment of Greek ideas in astronomy. Eudoxus further wrote two works descriptive of the heavens, the *Enoptron* and *Phaenomena*, which, substantially preserved in the *Phaenomena* of Aratus (fl. 270 B.C.), provided all the leading features of modern stellar nomenclature.

Greek astronomy culminated in the school of Alexandria. It was, soon after its foundation, illustrated by the labours of Aristyllus and Timocharis (c. 320–260 B.C.), who constructed the first catalogue giving star-positions as measured from a reference-point in the sky. This fundamental advance rendered inevitable the detection of precessional effects. Aristarchus of Samos observed at Alexandria 280–264 B.C. His treatise on the magnitudes and distances of the sun and moon, edited by John Wallis in 1688, describes a theoretically valid method for determining the relative distances of the sun and moon by measuring the angle between their centres when half the lunar disc is illuminated; but the time of dichotomy being widely indeterminate, no useful result was thus obtainable. Aristarchus in fact concluded the sun to be not more than twenty times, while it is really four hundred times farther off than our satellite. His general conception of the universe was comprehensive beyond that of any of his predecessors.

Eratosthenes (276–196 B.C.), a native of Cyrene, was summoned from Athens to Alexandria by Ptolemy Euergetes to take charge of the royal library. He invented, or improved armillary spheres, the chief implements of ancient astrometry, determined the obliquity of the ecliptic at 23° 51′ (a value 5′ too great), and introduced an effective mode of arc-measurement. Knowing Alexandria and Syene to be situated 5.000 stadia apart on the same meridian, he found the sun to be 7° 12′ south of the zenith at the northern extremity of this arc when it was vertically overhead at the southern extremity, and he hence inferred a value of 252,000 stadia for the entire circumference of the globe. This is a very close approximation to the truth, if the length of the unit employed has been correctly assigned.

Among the astronomers of antiquity, two great men stand out with unchallenged pre-eminence. Hipparchus and Ptolemy entertained the same large organic designs; they worked on similar methods; and, as the outcome, their performances fitted so accurately together that between them they re-made celestial science. Hipparchus fixed the chief data of astronomy—the lengths of the tropical and sidereal years, of the various months, and of the synodic periods of the five planets; determined the obliquity of the ecliptic and of the moon's path, the place of the sun's apogee, the eccentricity of his orbit, and the moon's horizontal parallax; all with approximate accuracy. His borrowings from Chaldaean experts appear, indeed, to have been numerous; but were doubtless independently verified. His supreme merit, however, consisted in the establishment of astronomy on a sound geometrical basis. His acquaintance with trigonometry, a branch of science initiated by him, together with his invention of the planisphere, enabled him to solve a number of elementary problems; and he was thus led to bestow especial attention upon the position of the equinox, as being the common point of origin for measures both in right ascension and longitude. Its steady retrogression among the stars became manifest to him in 130 B.C., on comparing his own observations with those made by Timocharis a century and a half earlier; and he estimated at not less than 36" (the true value being 50″) the annual amount of "precession."

The choice made by Hipparchus of the geocentric theory of the universe decided the future of Greek astronomy. He further elaborated it by the introduction of "eccentrics," which accounted for the changes in orbital velocity of the sun and moon by a displacement of the earth, to a corresponding extent, from the centre of the circles they were assumed to describe. This gave the elliptic inequality known as the "equation of the centre," and no other was at that time obvious. He attempted no detailed discussion of planetary theory; but his catalogue of 1,080 stars, divided into six classes of brightness, or "magnitudes," is one of the finest monuments of antique astronomy. It is substantially embodied in Ptolemy's *Almagest* (see PTOLEMY).

An interval of 250 years elapsed before the constructive labours of Hipparchus obtained completion at Alexandria. His observations were largely, and somewhat arbitrarily, employed by Ptolemy. Professor Newcomb, who compiled a very instructive table of the equinoxes severally observed by Hipparchus and Ptolemy, with their errors deduced from Leverrier's solar tables, found palpable evidence that the discrepancies between the two series were artificially reconciled on the basis of a year 6^m too long, adopted by Ptolemy on trust from his predecessor. He nevertheless held the process to have been one that implied no fraudulent intention.

The Ptolemaic system was, in a geometrical sense, defensible; it harmonized fairly well with appearances, and physical reasonings had not then been extended to the heavens. To the ignorant it was recommended by its conformity to crude common sense; to the learned, by the wealth of ingenuity expended in bringing it to perfection. The *Almagest* was the consummation of Greek astronomy. Ptolemy had no successor; he found only commentators, among the more noteworthy of whom were Theon of Alexandria (fl. A.D. 400) and his daughter, Hypatia (370–415).

Arabia.—With the capture of Alexandria by Omar in 641, the last glimmer of its scientific light became extinct, to be rekindled, a century and a half later, on the banks of the Tigris. The first Arabic translation of the Almagest was made by order of Harun al-Rashid about the year 800; others followed, and the Caliph al-Mamun built in 829 a grand observatory at Baghdad. Here Albumazar (805–885) watched the skies and cast horoscopes; here Tobit ben Korra (836–901) developed his long unquestioned, yet misleading theory of the "trepidation" of the equinoxes; Abd-ar-rahman al-Sūfi (903–986) revised at first hand the catalogue of Ptolemy; and Abulwefa (939–998), like al-Sūfi, a native of Persia, made continuous planetary observations, but did not (as alleged by L. Sédillot) anticipate Tycho Brahe's discovery of the moon's variation. Ibn Junis (*c.* 950–1008), although the scene of his activity was in Egypt, falls into line with the astronomers of Baghdad. He compiled the Hakimite Tables of the planets, and observed at Cairo, in 977 and 978, two solar eclipses which, as being the first recorded with scientific accuracy, were made available in fixing the amount of lunar acceleration. Nasir uddin (1201–1274) drew up the Ilkhanic Tables, and determined the constant of precession at 51″. He directed an observatory established by Hulagu Khan (d. 1265) at Maraga in Persia, and equipped with a mural quadrant of 12ft. radius, besides altitude

and azimuth instruments. Ulugh Beg (1394–1449), a grandson of Tamerlane, was the illustrious personification of Tatar astronomy. He founded about 1420 a splendid observatory at Samarkand, in which he re-determined nearly all Ptolemy's stars, while the Tables published by him held the primacy for two centuries.

ASTRONOMY OF THE MIDDLE AGES

Arab astronomy, transported by the Moors to Spain, flourished temporarily at Cordova and Toledo. From the latter city the Toletan Tables, drawn up by Arzachel in 1080, took their name; and there also the Alfonsine Tables, published in 1252, were prepared under the authority of Alphonso X. of Castile. Their appearance signalized the dawn of European science, and was nearly coincident with that of the *Sphaera Mundi,* a text-book of spherical astronomy, written by a Yorkshireman, John Holywood, known as Sacro Bosco (d. 1256). It had an immense vogue, perpetuated by the printing-press in fifty-nine editions. In Germany, during the 11th century, a brilliant attempt was made to patch up the flaws in Ptolemaic doctrine. George Purbach (1423–1461) introduced into Europe the method of determining time by altitudes employed by Ibn Junis. He lectured with applause at Vienna from 1450; was joined there in 1452 by Regiomontanus (*q.v.*); and was on the point of starting for Rome to inspect a manuscript of the *Almagest* when he died suddenly at the age of thirty-eight. His teachings bore fruit in the work of Regiomontanus, and of Bernhard Walther of Nuremberg (1430–1504), who fitted up an observatory with clocks driven by weights, and developed many improvements in practical astronomy.

Copernicus.—Meantime, a radical reform was being prepared in Italy. Under the searchlights of the new learning, the dictatorship of Ptolemy appeared no more inevitable than that of Aristotle; advanced thinkers like Domenico Maria Novara (1454–1504) promulgated *sub rosa* what were called Pythagorean opinions; and they were eagerly and fully appropriated by Nicolaus Copernicus during his student-years (1496–1505) at Bologna and Padua. He laid the groundwork of his heliocentric theory between 1506 and 1512, and brought it to completion in *De Revolutionibus Orbium Coelestium* (1543). The colossal task of remaking astronomy on an inverted design was, in this treatise, virtually accomplished. Its reasonings were solidly founded on the principle of the relativity of motion. A continuous shifting of the standpoint was in large measure substituted for the displacements of the objects viewed, which thus acquired a regularity and consistency heretofore lacking to them. In the new system, the sphere of the fixed stars no longer revolved diurnally, the earth rotating instead on an axis directed towards the celestial pole. The sun too remained stationary, while the planets, including our own globe, circulated round him. By this means, the planetary "retrogradations" were explained as simple perspective effects due to the combination of the earth's revolutions with those of her sister orbs. The retention, however, by Copernicus of the antique postulate of uniform circular motion impaired the perfection of his plan, since it involved a partial survival of the epicyclical machinery. Nor was it feasible, on this showing, to place the sun at the true centre of any of the planetary orbits; so that his ruling position in the midst of them was illusory. The reformed scheme was then by no means perfect. Its simplicity was only comparative; many outstanding anomalies compromised its harmonious working. Moreover, the absence of sensible parallaxes in the stellar heavens seemed inconsistent with its validity; and a mobile earth outraged deep-rooted prepossessions. Under these disadvantageous circumstances, it is scarcely surprising that the heliocentric theory, while admired as a daring speculation, won its way slowly to acceptance as a truth.

The *Tabulae Prutenicae,* calculated on Copernican principles by Erasmus Reinhold (1511–1553), appeared in 1551. Although they represented celestial movements far better than the Alfonsine Tables, large discrepancies were still apparent, and the desirability of testing the novel hypothesis upon which they were based by more refined observations prompted a reform of methods, undertaken almost simultaneously by the landgrave William IV. of Hesse-Cassel (1532–1592), and by Tycho Brahe. The landgrave built at Cassel in 1561 the first observatory with a revolving dome, and worked for some years at a star-catalogue finally left incomplete. Christoph Rothmann and Joost Bürgi (1552–1632) became his assistants in 1577 and 1579 respectively; and through the skill of Bürgi, time-determinations were made available for measuring right ascensions. At Cassel, too, the altitude and azimuth instrument is believed to have made its first appearance in Europe.

Tycho **Brahe** and **Kepler.**—Tycho's labours were both more strenuous and more effective. He perfected the art of pre-telescopic observation. His instruments were on a scale and of a type unknown since the days of Nasir ud-din. At Augsburg, in 1569, he ordered the construction of a 19-ft. quadrant, and of a celestial globe 5ft. in diameter; he substituted equatorial for zodiacal armillae, thus definitively establishing the system of measurements in right ascension and declination; and improved the graduation of circular arcs by adopting the method of "transversals." By these means, employed with consummate skill, he attained an unprecedented degree of accuracy, and as an incidental though valuable result, demonstrated the unreality of the supposed trepidation of the equinoxes.

No more congruous arrangement could have been devised than the inheritance by Johann Kepler of the wealth of materials amassed by Tycho Brahe. The younger man's genius supplied what was wanting to his predecessor. Tycho's endowments were of the practical order; yet he had never designed his observations to be an end in themselves. He thought of them as means towards the end of ascertaining the true form of the universe. His range of ideas was, however, restricted; and the attempt embodied in his ground-plan of the solar system to revive the ephemeral theory of Heraclides failed to influence the development of thought. Kepler, on the contrary, was endowed with unlimited powers of speculation, but had no mechanical faculty. He found in Tycho's ample legacy of first-class data precisely what enabled him to try, by the touchstone of fact, the successive hypotheses that he imagined; and his untiring patience in comparing and calculating the observations at his disposal was rewarded by a series of unique discoveries. He long adhered to the traditional belief that all celestial revolutions must be performed equably in circles; but a laborious computation of seven recorded oppositions of Mars at last persuaded him that the planet travelled in an ellipse, one focus of which was occupied by the sun. Pursuing the inquiry, he found that its velocity was uniform with respect to no single point within the orbit, but that the areas described, in equal times, by a line drawn from the sun to the planet were strictly equal. These two principles he extended, by direct proof, to the motion of the earth; and, by analogy, to that of the other planets. They were published in 1609 in *De Motibus Stellae Martis.* The announcement of the third of "Kepler's Laws" was made ten years later, in *De Harmonice Mundi.* It states that the squares of the periods of circulation round the sun of the several planets are in the same ratio as the cubes of their mean distances. This numerical proportion, as being a necessary consequence of the law of gravitation, must prevail in every system under its sway. It does in fact prevail among the satellite-families of our acquaintance, and presumably in stellar combinations as well. Kepler's ineradicable belief in the existence of some such congruity was derived from the Pythagorean idea of an underlying harmony in nature; but his arduous efforts for its realization took a devious and fantastic course which seemed to give little promise of their surprising ultimate success. The outcome of his discoveries was, not only to perfect the geometrical plan of the solar system, but to enhance very materially the predicting power of astronomy. The Rudolphine Tables (Ulm, 1627), computed by him from elliptic elements, retained authority for a century, and have in principle never been superseded. He was deterred from research into the orbital relations of comets by his conviction of their perishable nature. He supposed their tails to result from the action of solar rays, which, in traversing their mass, bore off with them some of their subtler particles to form trains directed away from the sun. And through the process of waste thus set on foot, they finally dissolved into the aether, and expired

"like spinning insects." (*De Cometis; Opera*, 2d. Frisch, t. vii. p. 110.) This remarkable anticipation of the modern theory of light-pressure was suggested to him by his observations of the great comets of 1618.

The formal astronomy of the ancients left Kepler unsatisfied. He aimed at finding out the cause as well as the mode of the planetary revolutions; and his demonstration that the planes in which they are described all pass through the sun was an important preliminary to a physical explanation of them. But his efforts to supply such an explanation were rendered futile by his imperfect apprehension of what motion is in itself. He had, it is true, a distinct conception of a force analogous to that of gravity, by which cognate bodies tended towards union. Misled, however, into identifying it with magnetism, he imagined circulation in the solar system to be maintained through the material compulsion of fibrous emanations from the sun, carried round by his axial rotation. Ignorance regarding the inertia of matter drove him to this expedient. The persistence of movement seemed to him to imply the persistence of a moving power. He did not recognize that motion and rest are equally natural, in the sense of requiring force for their alteration. Yet his rationale of the tides in *De Motibus Stellae* is not only memorable as an astonishing forecast of the principle of reciprocal attraction in the proportion of mass, but for its bold extension to the earth of the lunar sphere of influence.

Galileo.—Galileo Galilei, Kepler's most eminent contemporary, took a foremost part in dissipating the obscurity that still hung over the very foundations of mechanical science. He had, indeed, precursors and co-operators. Michel Varo of Geneva wrote correctly in 1584 on the composition of forces; Simon Stevinus of Bruges (1548–1620) independently demonstrated the principle; and G. B. Benedetti expounded in his *Speculationum Liber* (Turin, 1585) perfectly clear ideas as to the nature of accelerated motion, some years in advance of Galileo's dramatic experiments at Pisa. Yet they were never assimilated by Kepler; while, on the other hand, the laws of planetary circulation he had enounced were strangely ignored by Galileo. The two lines of inquiry remained for some time apart. Had they at once been made to coalesce, the true nature of the force controlling celestial movements should have been quickly recognized. As it was, the importance of Kepler's generalizations was not fully appreciated until Sir Isaac Newton made them the corner-stone of his new cosmic edifice.

Galileo's contributions to astronomy were of a different quality from Kepler's. They were easily intelligible to the general public; in a sense, they were obvious, since they could be verified by every possessor of one of the Dutch perspective-instruments, just then in course of wide and rapid distribution. And similar results to his were in fact independently obtained in various parts of Europe by Christopher Scheiner at Ingolstadt, by Johann Fabricius at Osteel in Friesland, and by Thomas Harriot at Syon House, Isleworth. Galileo was nevertheless by far the ablest and most versatile of these early telescopic observers. His gifts of exposition were on a par with his gifts of discernment. What he saw, he rendered conspicuous to the world. His sagacity was indeed sometimes at fault. He maintained with full conviction to the end of his life a grossly erroneous hypothesis of the tides, early adopted from Andrea Caesalpino; the "triplicate" appearance of Saturn always remained an enigma to him; and in regarding comets as atmospheric emanations he lagged far behind Tycho Brahe. Yet he unquestionably ranks as the true founder of descriptive astronomy; while his splendid presentment of the laws of projectiles in his dialogue of the "New Sciences" (Leyden, 1638) lent potent aid to the solid establishment of celestial mechanics.

MODERN ASTRONOMY

The Law of Gravitation.— The accumulation of facts does not in itself constitute science. Empirical knowledge scarcely deserves the name. *Vere scire est per causas scire.* Francis Bacon's prescient dream, however, of a living astronomy by which the physical laws governing terrestrial relations should be extended to the highest heavens, had long to wait for realization. Kepler divined its possibility; but his thoughts, derailed (so to speak) by the false analogy of magnetism, brought him no farther than to the rough draft of the scheme of vortices expounded in detail by René Descartes in his *Principia Philosophiae* (1644). And this was a *cul-de-sac.* The only practicable road struck aside from it. The true foundations of a mechanical theory of the heavens were laid by Kepler's discoveries, and by Galileo's dynamical demonstrations; its construction was facilitated by the development of mathematical methods. The invention of logarithms, the rise of analytical geometry, and the evolution of B. Cavalieri's "indivisibles" into the infinitesimal calculus, all acconiplished during the 17th century, immeasurably widened the scope of exact astronomy. Gradually, too, the nature of the problem awaiting solution came to be apprehended. Jeremiah Horrocks had some intuition, previously to 1639, that the motion of the moon was controlled by the earth's gravity, and disturbed by the action of the sun. Ismael Bouillaud (1605–1694) stated in 1645 the fact of planetary circulation under the sway of a sun-force decreasing as the inverse square of the distance; and the inevitableness of this same "duplicate ratio" was separately perceived by Robert Hooke, Edmund Halley and Sir Christopher Wren before Newton's discovery had yet been made public. But Newton was the only man of his generation who both recognized the law, and had power to demonstrate its validity. And this was only a beginning. His complete achievement had a twofold aspect. It consisted, first, in the identification, by strict numerical comparisons, of terrestrial gravity with the mutual attraction of the heavenly bodies; secondly, in the following out of its mechanical consequences throughout the solar system. Gravitation was thus shown to be the sole influence governing the movements of planets and satellites; the figure of the rotating earth was successfully explained by its action on the minuter particles of matter; tides and the precession of the equinoxes proved amenable to reasonings based on the same principle; and it satisfactorily accounted as well for some of the chief lunar and planetary inequalities.

Euler, Clairault and d'Alembert.—Newton's investigations, however, were very far from being exhaustive. Colossal though his powers were, they had limits; and his work could not but remain unterminated, since it was by its nature interminable. Nor was it possible to provide it with what could properly be called a sequel. The synthetic method employed by him was too unwieldy for common use. Yet no other was just then at hand. Mathematical analysis needed half a century of cultivation before it was fully available for the arduous tasks reserved for it. They were accordingly taken up anew by a band of continental inquirers, primarily by three men of untiring energy and vivid genius, Leonhard Euler, Alexis Clairault, and Jean le Rond d'Alembert. The first of the outstanding gravitational problems with which they grappled was the unaccountably rapid advance of the lunar perigee. But the apparent anomaly disappeared under Euler's powerful treatment in 1749, and his result was shortly afterwards still further assured by Clairault. The subject of planetary perturbations was next attacked. Euler devised in 1753 a new method, that of the "variation of parameters," for their investigation, and applied it to unravel some of the earth's irregularities in a memoir crowned by the French Academy in 1756; while in 1757, Clairault estimated the masses of the moon and Venus by their respective disturbing effects upon terrestrial movements. But the most striking incident in the history of the verification of Newton's law was the return of Halley's comet to perihelion, on the 12th of March 1759, in approximate accordance with Clairault's calculation of the delays due to the action of Jupiter and Saturn. Visual proof was thus, it might be said, afforded of the harmonious working of a single principle to the uttermost boundaries of the sun's dominion.

Lagrange and Laplace.—These successes paved the way for the higher triumphs of Joseph Louis Lagrange and of Pierre Simon Laplace. The subject of the lunar librations was treated by Lagrange with great originality in an essay crowned by the Paris Academy of Sciences in 1764; and he filled up the lacunae in his theory of them in a memoir communicated to the Berlin

Academy in 1780. He again won the prize of the Paris Academy in 1766 with an analytical discussion of the movements of Jupiter's satellites (Miscellanea, Turin Acad. t. iv.); and in the same year expanded Euler's adumbrated method of the variation of parameters into a highly effective engine of perturbational research. It was especially adapted to the tracing out of "secular inequalities," or those depending upon changes in the orbital elements of the bodies affected by them, and hence progressing indefinitely with time; and by its means, accordingly, the mechanical stability of the solar system was splendidly demonstrated through the successive efforts of Lagrange and Laplace. The proper share of each in bringing about this memorable result is not easy to apportion, since they freely imparted and profited by one another's advances and improvements; it need only be said that the fundamental proposition of the invariability of the planetary major axes laid down with restrictions by Laplace in 1773, was finally established by Lagrange in 1776; while Laplace in 1784 proved the subsistence of such a relation between the eccentricities of the planetary orbits on the one hand, and their inclinations on the other, that an increase of either element could, in any single case, proceed only to a very small extent. The system was thus shown, apart from unknown agencies of subversion, to be constructed for indefinite permanence. The prize of the Berlin Academy was, in 1780, adjudged to Lagrange for a treatise on the perturbations of comets; and he contributed to the Berlin Memoirs, 1781–1784, a set of five elaborate papers, embodying and unifying his perfected methods and their results.

The crowning trophies of gravitational astronomy in the 18th century were Laplace's explanations of the "great inequality" of Jupiter and Saturn in 1784, and of the "secular acceleration" of the moon in 1787. Both irregularities had been noted, a century earlier, by Edmund Halley; both had, since that time, vainly exercised the ingenuity of the ablest mathematicians; both now almost simultaneously yielded their secret to the same fortunate inquirer. Johann Heinrich Lambert pointed out in 1773 that the motion of Saturn, from being retarded, had become accelerated. A periodic character was thus indicated for the disturbance; and Laplace assigned its true cause in the near approach to commensurability in the periods of the two planets, the cycle of disturbance completing itself in about 900 (more accurately 9293) years. The lunar acceleration, too, obtains ultimate compensation, though only after a vastly protracted term of years. The discovery, just one hundred years after the publication of Newton's *Principia,* of its dependence upon the slowly varying eccentricity of the earth's orbit signalized the removal of the last conspicuous obstacle to admitting the unqualified validity of the law of gravitation. Laplace's calculations, it is true, were inexact. An error, corrected by J. C. Adams in 1853, nearly doubled the value of the acceleration deducible from them; and served to conceal a discrepancy with observation which has since given occasion to much profound research (see Moor;).

After Laplace.—The *Mécanique céleste,* in which Laplace welded into a whole the items of knowledge accumulated by the labours of a century, has been termed the "Almagest of the 18th century" (Fourier). But imposing and complete though the monument appeared, it did not long hold possession of the field. Further developments ensued. The "method of least squares," by which the most probable result can be educed from a body of observational data, was published by Adrien Marie Legendre in 1806, by Karl Friedrich Gauss in his *Theoria Motus* (1809), which described also a mode of calculating the orbit of a planet from three complete observations, afterwards turned to important account for the recapture of Ceres, the first discovered asteroid (see MINOR PLANET). Researches into rotational movement were facilitated by S. D. Poisson's application to them in 1809 of Lagrange's theory of the variation of constants; Philippe de Pontécoulant successfully used in 1829, for the prediction of the impending return of Halley's comet, a system of "mechanical quadratures" published by Lagrange in the Berlin Memoirs for 1778; and in his *Théorie analytique* du *système du* monde (1846) he modified and refined general theories of the lunar and planetary revolutions, P. A. Hansen in 1829 (*Astr.* Nach. Nos. 166–168, 179) left the beaten track by choosing time as the sole variable, the orbital elements remaining constant. A. L. Cauchy published in 1842–1843 a method similarly conceived, though otherwise developed; and the scope of analysis in determining the movements of the heavenly bodies has since been perseveringly widened by the labours of Urbain J. J. Leverrier, J. C. Adams, S. Newcomb, G. W. Hill, E. W. Brown, H. Gyldén, Charles Delaunay, F. Tisserand, H. Poincaré and others too numerous to mention. Nor were these abstract investigations unaccompanied by concrete results. Sir George Airy detected in 1831 an inequality, periodic in 240 years, between Venus and the earth. Leverrier undertook in 1839, and concluded in 1876, the formidable task of revising all the planetary theories and constructing from them improved tables. Not less comprehensive has been the work carried out by Professor h'ewcomb of raising to a higher grade of perfection, and reducing to a uniform standard, all the theories and constants of the solar system. The discovery of Neptune in 1846 by Adams and Leverrier marked the first solution of the "inverse problem" of perturbations. That is to say, ascertained or ascertainable effects were made the starting-point instead of the goal of research.

Practical **Astronomy.**—Observational astronomy, meanwhile, was advancing to some extent independently. The descriptive branch found its principle of development in the growing powers of the telescope, and had little to do with mathematical theory; which, on the contrary, was closely allied, by relations of mutual helpfulness, with practical astronomy. Meanwhile, the elementary requirement of making visual acquaintance with the stellar heavens was met, as regards the unknown southern skies, when Johann Bayer published at Nuremberg in 1603 a celestial atlas depicting twelve new constellations formed from the rude observations of navigators across the line. In the same work, the current mode of star-nomenclature by the letters of the Greek alphabet made its appearance. On the 7th of h'ovember 1631 Pierre Gassendi watched at Paris the passage of Mercury across the sun. This was the first planetary transit observed. The next was that of Venus on the 24th of November (O.S.) 1639, of which Jeremiah Horrocks and William Crabtree were the sole spectators. The improvement of telescopes was prosecuted by Christiaan Huygens from 1655, and promptly led to his discoveries of the sixth Saturnian moon, of the true shape of the Saturnian appendages, and of the multiple character of the "trapezium" of stars in the Orion nebula. William Gascoigne's invention of the filar micrometer and of the adaptation of telescopes to graduated instruments remained submerged for a quarter of a century in consequence of his untimely death at Marston Moor (1644). The latter combination had also been ineffectually proposed in 1634 by Jean Baptiste Morin (1583–1656); and both devices were recontrived at Paris about 1667, the micrometer by Adrien Auzout (d. 1691), telescopic sights (so-called) by Jean Picard (1620–1682), who simultaneously introduced the astronomical use of pendulum-clocks, constructed by Huygens eleven years previously. These improvements were ignored or rejected by Johann Hevelius of Danzig, the author of the last important star-catalogue based solely upon naked-eye determinations. He, nevertheless, used telescopes to good purpose in his studies of lunar topography, and his designations for the chief mountain-chains and "seas" of the moon have never been superseded. He, moreover, threw out the suggestion (in his *Cometographia,* 1668) that comets move round the sun in orbits of a parabolic form.

Paris Observatory.—The establishment, in 1671 and 1676 respectively, of the French and English national observatories at once typified and stimulated progress. The Paris institution, it is true, lacked unity of direction. No authoritative chief was assigned to it until 1771. G. D. Cassini, his son and his grandson were only *primi* inter pares. Claude Perrault's stately edifice was equally accessible to all the more eminent members of the Academy of Sciences; and researches were, more or less independently, carried on there by (among others) Philippe de la Hire (1640–1718), G. F. Maraldi (1665–1729), and his nephew, J. D. Maraldi, Jean Picard, Huygens, Olaus Römer and Nicolas de Lacaille. Some of the best instruments then extant were mounted

at the Paris observatory. G. D. Cassini brought from Rome a 17-ft. telescope by G. Campani, with which he discovered in 1671 Iapetus, the eighth in distance of Saturn's family of satellites; Rhea was detected in 1672 with a glass by the same maker of 34-ft. focus; the duplicity of the ring showed in 1675; and in 1684, two additional satellites mere disclosed by a Campani telescope of 100 ft. Cassini, moreover, set up an altazimuth in 1678, and employed from about 1682 a "parallactic machine," provided with clockwork to enable it to follow the diurnal motion. Both inventions have been ascribed to Olaus Romer, who used but did not claim them, and must have become familiar with their principles during the nine years (1672–1681) spent by him at the Paris observatory. Romer, on the other hand, deserves full credit for originating the transit-circle and the prime vertical instrument; and he earned undying fame by his discovery of the finite velocity of light, made at Paris in 1675 by comparing his observations of the eclipses of Jupiter's satellites at the conjunctions and oppositions of the planet.

Work at Greenwich. — The organization of the Greenwich observatory differed widely from that adopted at Paris. There a fundamental scheme of practical amelioration was initiated by John Flamsteed, the first astronomer royal, and has never since been lost sight of. Its purpose is the attainment of so complete a power of prediction that the places of the sun, moon and planets may be assigned without noticeable error for an indefinite future time. Sidereal inquiries, as such, made no part of the original programme in which the stars figured merely as points of reference. But these points are not stationary. They have an apparent precessional movement, the exact amount of which can be arrived at only by prolonged and toilsome enquiries. They have besides "proper motions," detected in 1718 by E. Halley in a few cases, and since found to prevail universally. Further, James Bradley discovered in 1728 the annual shifting of the stars due to the aberration of light (see ABERRATION), and in 1748, the complicating effects upon precession of the "nutation" of the earth's axis. Hence, the preparation of a catalogue recording the "mean" positions of a number of stars for a given epoch involves considerable preliminary labour; nor do those positions long continue to satisfy observation. They need, after a time, to be corrected, not only systematically for precession, but also empirically for proper motion. Before the stars can safely be employed as route-marks in the sky, their movements must accordingly be tabulated, and research into the method of such movements inevitably follows. We perceive then that the fundamental problems of sidereal science are closely linked up with the elementary and indispensable procedures of celestial measurement.

The history of the Greenwich observatory is one of strenuous efforts for refinement, stimulated by the growing stringency of theoretical necessities. Improved practice, again, reacted upon theory by bringing to notice residual errors, demanding the correction of formulae, or intimating neglected disturbances. Each increase of mechanical skill claims a corresponding gain in the subtlety of analysis; and vice versa. And this kind of interaction has gone on ever since Flamsteed reluctantly furnished the "places of the moon," which enabled Newton to lay the foundations of lunar theory.

Edmund Halley, the second astronomer royal, devoted most of his official attention to the moon. But his plan of attack was not happily chosen; he carried it out with deficient instrumental means; and his administration (1720–1742) remained comparatively barren. That of his successor, though shorter, was vastly more productive. James Bradley chose the most appropriate tasks, and executed them supremely well, with the indispensable aid of John Bird (1709–1776), who constructed for him an 8-ft. quadrant of unsurpassed quality. Bradley's store of observations has accordingly proved invaluable. Those of 3,222 stars, reduced by F. W. Bessel in 1818, and again with masterly insight by Dr. A. Auwers in 1882, form the true basis of exact astronomy, and of our knowledge of proper motions. Those relating to the moon and planets, corrected by Sir George Airy, 1840–1846, form part of the standard materials for discussing theories of movement in the solar system. The fourth astronomer royal, Nathaniel Bliss, provided in two years a sequel of some value to Bradley's performance. Nevil Maskelyne, who succeeded him in 1764, set on foot, in 1767, the publication of the *Nautical Almanac*, and about the same time had an achromatic telescope fitted to the Greenwich mural quadrant. The invention, perfected by John Dollond in 1757, was long debarred from becoming effective by difficulties in the manufacture of glass, aggravated in England by a heavy excise duty levied until 1845. More immediately efficacious was the innovation made by John Pond (astronomer royal, 1811–1836) of substituting entire circles for quadrants. He further introduced in 1821, the method of duplicate observations by direct vision and by reflection, and by these means obtained results of very high precision. During Sir George Airy's long term of office (1836–1881) exact astronomy and the traditional purposes of the royal observatory were promoted with increased vigour, while the scope of research was at the same time memorably widened.

Advances Elsewhere. — Meanwhile, advances were being made in various parts of the continent of Europe. Peter Wargentin (1717–1783), secretary to the Swedish Academy of Sciences, made a special study of the Jovian system. James Bradley had described to the Royal Society on July 2, 1719, the curious cyclical relations of the three inner satellites; and their period of 437 days was independently discovered by Wargentin, who based upon it in 1746 a set of tables, superseded only by those of J. B. J. Delambre in 1792. Among the fruits of the strenuous career of Nicolas Louis de Lacaille were tables of the sun, in which terms depending upon planetary perturbations were, for the first time, introduced (1758); an extended acquaintance with the southern heavens; and a determination of the moon's parallax from observations made at opposite extremities of an arc of the meridian 85° in length. Tobias Mayer of Gottingen (1723–1762) originated the mode of adjusting transit-instruments still in vogue; drew up a catalogue of nearly a thousand zodiacal stars (published posthumously in 1775); and deduced the proper motions of eighty stars from a comparison of their places as given by Olaus Romer in 1706 with those obtained by himself in 1756. He executed besides a chart and forty drawings of the moon (published at Gottingen in 1881), and calculated lunar tables from a skilful development of Euler's theory, for which a reward of £3,000 was in 1765 paid to his widow by the British government. They were published by the Board of Longitude, together with his solar tables, in 1770. The material interests of navigation were in these works primarily regarded; but the imaginative side of knowledge had also potent representatives during the latter half of the 18th century. In France, especially, the versatile activity of J. J. Lalande popularized the acquisitions of astronomy, and enforced its demands; and he had a German counterpart in J. E. Bode.

Between the time of Aristarchus and the opposition of Mars in 1672, no serious attempt was made to solve the problem of the sun's distance. In that year, however, Jean Richer at Cayenne and G. D. Cassini at Paris made combined observations of the planet, which yielded a parallax for the sun of 9·5″, corresponding to a mean radius for the terrestrial orbit of 87,000,000m. This result, though widely inaccurate, came much nearer to the truth than any previously obtained; and it instructively illustrated the feasibility of concerted astronomical operations at distant parts of the earth. The way was thus prepared for availing to the full of the opportunities for a celestial survey offered by the transits of Venus in 1761 and 1769. They had been signalized by E. Halley in 1716; they were later insisted upon by Lalande; an enthusiasm for co-operation was evoked, and the globe, from Siberia to Otaheite, was studded with observing parties. The outcome, nevertheless, disappointed expectation. The instants of contact between the limbs of the sun and planet defied precise determination. Optical complications fatally impeded sharpness of vision, and the phenomena took place in a debatable borderland of uncertainty. J. F. Encke, it is true, derived from them in 1822–1824 what seemed an authentic parallax of 8·57″, implying a distance of 95,370,000 m.; but the confidence it inspired was finally overthrown in 1854 by P. A. Hansen's announcement of its incompatibility with lunar theory. An appeal then lay to the

19th century pair of transits in 1874 and 1882; but no peremptory decision ensued; observations were marred by the same optical evils as before. Their upshot, however, had lost its essential importance; for a fresh series of investigations based on a variety of principles had already been started. Leverrier, in 1858, calculated a value of 8·95″ for the solar parallax (equivalent to a distance of 91,000,000m.) from the "parallactic inequality" of the moon; Professor Newcomb, using other forms of the gravitational method, derived in 1895 a parallax of 8·76″. For more recent researches on this problem *see* PARALLAX.

Improvements in Telescopes. — The first specimen of a reflecting telescope was constructed by Isaac Newton in 1668. It was of what is still called "Newtonian" design, and had a speculum 2in. in diameter. Through the skill of John Hadley (1682–1743) and James Short of Edinburgh (1710–1768) the instrument unfolded, in the ensuing century, some of its capabilities, which the labours of William Herschel enormously enhanced. Between 1774 and 1789 he built scores of specula of continually augmented size, up to a diameter of 4ft., the optical excellence of which approved itself by a crowd of discoveries. Uranus (*q.v.*) was recognized by its disc on March 13, 1781; two of its satellites, Oberon and Titania, disclosed themselves on Jan. 11, 1787; while with the giant 48-in. mirror, used on the "front-view" plan, Mimas and Enceladus, the innermost Saturnian moons, were brought to view on Aug. 28 and Sept. 17, 1789. These were incidental trophies; Herschel's main object was the exploration of the sidereal heavens. The task, though novel and formidable, was executed with almost incredible success. Messier (1730–1817) catalogued 103 nebulae and star clusters; Herschel discovered 2,500, laid down the lines of their classification, divined the laws of their distribution, and assigned their place in a scheme of development. The proof supplied by him in 1802 that double stars are mutually revolving threw open a boundless field of research; and he originated experimental inquiries into the construction of the heavens by systematically collecting and sifting stellar statistics. He, moreover, definitely established, in 1783, the fact and general direction of the sun's movement in space, and thus introduced an element of order into the maze of stellar proper motions. Sir John Herschel continued in the northern, and extended to the southern hemisphere, his father's work. The third earl of Rosse mounted, at Parsonstown in 1845, a speculum 6ft. in diameter, which afforded the first indications of the spiral structure shown in recent photographs to be a very prevalent characteristic of many nebulae. Down to near the close of the 19th century, both the use and the improvement of reflectors were left mainly in British hands; but the gift of the "Crossley" instrument in 1895, to the Lick observatory, and its splendid subsequent performances in nebular photography, brought similar tools of research into extensive use among American astronomers; and they are now, for many of the various purposes of Astrophysics, strongly preferred to refractors. At present the largest instruments are the 100-in. reflector at Mount Wilson, California, and the 72-in. reflector at Victoria, British Columbia.

Sidereal Astronomy. — The progress of science during the 19th century had no more distinctive feature than the rapid growth of sidereal astronomy (*see* STAR). Its scope, wide as the universe, can be compassed no otherwise than by statistical means, and the collection of materials for this purpose involves most arduous preliminary labour. The multitudinous enrollment of stars was the first requisite. Only one "catalogue of precision" — Nevil Maskelyne's of 36 fundamental stars — was available in 1800. J. J. Lalande, however, published in 1801, in his *Histoire céleste,* the approximate places of 47,390 stars. A valuable catalogue of about 7,600 stars was issued by Giuseppe Piazzi in 1814; Stephen Groombridge determined 4,239 at Blackheath in 1806–16; while through the joint and successive work of F. W. Ressel and W. A. Argelander, 324,000 stars were recorded in the *Bonn Durchmusterung* (1859–62). The southern hemisphere was subsequently reviewed on a similar duplicate plan by E. Schonfeld (1828–1891) at Bonn, by B. A. Gould and J. M. Thome at Córdoba. Moreover, the imposing catalogue set on foot in 1865 at thirteen observatories by the Astronomische Gesellschaft was duly completed; and adjuncts to it have, from time to time, been provided in the publications of the royal observatories at Greenwich and the Cape of Good Hope, and of national, imperial and private establishments in the United States and on the continent of Europe. But in the execution of these protracted undertakings, the human eye has been, to a large and increasing extent, supplemented by the camera. Photographic star-charting was begun by Sir David Gill in 1885, and the third and concluding volume of the *Cape Photographic Durchmusterung* appeared in 1900. It gives the co-ordinates of above 450,000 stars, measured by Professor J. C. Kapteyn at Groningen on plates taken by C. Ray Woods at the Cape observatory. And this comprehensive work was merely preparatory to the International Catalogue and Chart, the production of which was initiated by the resolutions of the Paris Photographic Congress of 1887. Eighteen observatories scattered north and south of the equator divided the sky among them; and the outcome of their combined operations aimed at the production of a catalogue of at least 2,000,000 strictly determined stars, together with a colossal map in 22,000 sheets, showing stars to the fourteenth magnitude, in numbers difficult to estimate. (*See* PHOTOGRAPHY, CELESTIAL.)

The investigation of double stars was carried on from 1819 to 1830 with singular persistence and ability at Dorpat and Pulkowa by F. G. W. Struve, and by his son and successor, O. W. Struve. The high excellence of the data collected by them was a combined result of their skill, and of the vast improvement in refracting telescopes due to the genius of Joseph Fraunhofer (1787–1826). Among the inheritors of his renown were Alvan Clark and Alvan G. Clark of Cambridgeport, Massachusetts; and the superb definition of their great achromatics rendered practicable the division of what might have been deemed impossibly close star-pairs. These facilities were remarkably illustrated by Professor S. W. Burnham's record of discovery, which roused fresh enthusiasm for this line of inquiry by compelling recognition of the extraordinary profusion throughout the heavens of compound objects. Discoveries with the spectroscope have ratified and extended this conclusion.

Stellar Proper Motions. — Only spurious star-parallaxes had claimed the attention of astronomers until F. W. Bessel announced, in December, 1838, the perspective yearly shifting of 61 Cygni in an ellipse with a mean radius of about one-third of a second. Thomas Henderson (1798–1844) had indeed measured the larger displacements of α Centauri at the Cape in 1832–33, but delayed until 1839 to publish his result.

The exhaustive ascertainment of stellar parallaxes, combined with the visible facts of stellar distribution, would enable us to build a perfect plan of the universe in three dimensions. Its perfection would, nevertheless, be undermined by the mobility of all its constituent parts. Their configuration at a given instant supplies no information as to their configuration hereafter unless the mode and laws of their movements have been determined. Hence, one of the leading inducements to the construction of exact and comprehensive catalogues has been to elicit, by comparisons of those for widely separated epochs, the proper motions of the stars enumerated in them. Little was known on the subject at the beginning of the 19th century. William Herschel founded his determination in 1783 of the sun's route in space upon the movements of thirteen stars; and he took into account those of only six in his second solution of the problem in 1805. But in 1837 Argelander employed 390 proper motions as materials for the treatment of the same subject; and L. Struve had at his disposal, in 1887, no fewer than 2,800.

Spectroscopy. — A beam of sunlight admitted into a darkened room through a narrow aperture, and there dispersed into a variotinted band by the interposition of a prism, is not absolutely continuous. Dr. W. H. Wollaston made the experiment in 1802, and perceived the spaces of colour to be interrupted by seven obscure gaps, which took the shape of lines owing to his use of a rectangular slit. He thus caught a preliminary glimpse of the "Fraunhofer lines," so called because Joseph Fraunhofer brought them into prominent notice by the diligence and insight of his labours upon them in 1814–15. He mapped 324, chose out nine, which

he designated by the letters of the alphabet, to be standards of measurement for the rest, and ascertained the coincidence in position between the double yellow ray derived from the flame of burning sodium and the pair of dark lines named by him "D" in the solar spectrum. There ensued 45 years of groping for a law which should clear up the enigma of the solar reversals. Partial anticipations abounded. The vital heart of the matter was barely missed by W. A. Miller in 1845, by L. Foucault in 1849, by A. J. Angstrom in 1853, by Balfour Stewart in 1858; while Sir George Stokes held the solution of the problem in the hollow of his hand from 1852 onward. But it was the synthetic genius of Gustav Kirchhoff which first gave unity to the scattered phenomena, and finally reconciled what was elicited in the laboratory with what was observed in the sun. On Dec. 15, 1859, he communicated to the Berlin Academy of Sciences the principle which bears his name. Its purport is that glowing vapours similarly circumstanced absorb the identical radiations which they emit. That is to say, they stop out just those sections of white light transmitted through them which form their own special luminous badges. Moreover, if the white light come from a source at a higher temperature than theirs, the sections, or lines, absorbed by them show dark against a continuous background. And this is precisely the case with the sun. Kirchhoff's principle, accordingly, not only afforded a simple explanation of the Fraunhofer lines, but availed to found a far-reaching science of celestial chemistry. Thousands of the dark lines in the solar spectrum agree absolutely in wavelength with the bright rays artificially obtained from known substances, and appertaining to them individually. These substances must then exist near the sun. They are in fact suspended in a state of vapour between our eyes and the photosphere, the dazzling prismatic radiance of which they, to a minute extent, intercept, thus writing their signatures on the coloured scroll of dispersed sunshine. Research has been powerfully aided by the photographic camera and by the concave gratings invented by H. A. Rowland (1848–1901) in 1882.

Solar Research. — Solar physics has profited enormously by the abolition of glare during total eclipses. That of July 8, 1842, was the first to be efficiently observed; and the luminous appendages to the sun disclosed by it were such as to excite startled attention. Their investigation has since been diligently prosecuted. The corona was photographed at Konigsberg during the totality of July 28, 1851; similar records of the red prominences, successively obtained by Father Angelo Secchi and Warren de la Rue, as the shadow-track crossed Spain on July 18, 1860, finally demonstrated their solar status. The Indian eclipse of Aug. 18, 1868, supplied knowledge of their spectrum, found to include the yellow ray of an exotic gas named by Sir Norman Lockyer "helium." It further suggested, to Lockyer and P. Janssen separately, the spectroscopic method of observing these objects in daylight. Under cover of an eclipse visible in North America on Aug. 7, 1869, the bright green line of the corona was discerned; and Professor C. A. Young caught the "flash spectrum" of the reversing layer, at the moment of second contact, at Xerez de la Frontera in Spain, on Dec. 22, 1870. This significant but evanescent phenomenon, which represents the direct emissions of a low-lying solar envelope, was photographed by William Shackleton on the occasion of an eclipse in Novaya Zemlya on Aug. 9, 1896; and it has been abundantly registered by exposures made during subsequent eclipses.

The photography of prominences in full sunlight was, after some preliminary trials by C. A. Young and others, fully realized in 1891 by Professor George E. Hale at Chicago, and independently by Henri Deslandres at Paris. The pictures were taken, in both cases, with only one quality of light, the violet ray of calcium, the remaining superfluous beams being eliminated by the agency of a double slit. The last-named expedient had been described by Janssen in 1867. Hale devised on the same principle the spectroheliograph (*q.v.*) an instrument by which the sun's disc can be photographed in calcium-light by imparting a rapid movement to its image relatively to the sensitive plate; and the method has proved in many ways fruitful.

Stellar Spectroscopy. — The likeness of the sun to the stars has been shown by the spectroscope to be profound and inherent. Yet the general agreement of solar and stellar chemistry does not exclude important diversities of detail. Fraunhofer was the pioneer in this branch. He observed, in 1823, dark lines in stellar spectra which Kirchhoff's discovery supplied the means of interpreting. The task, attempted by G. B. Donati in 1860, was effectively taken in hand, two years later, by Angelo Secchi, William Huggins and Lewis M. Rutherfurd. There ensued a general classification of the stars by Secchi into four leading types, distinguished by diversities of spectral pattern; and the recognition by Huggins of a considerable number of terrestrial elements as present in stellar atmospheres. Nebular chemistry was initiated by the same investigator when, on Aug. 29, 1864, he observed the bright-line spectrum of a planetary nebula in Draco. About seventy analogous objects, including that in the Sword of Orion, were found by him to give light of the same quality; and thus after seventy-three years, verification was brought to William Herschel's hypothesis of a "shining fluid" diffused through space, the possible raw material of stars. In 1874, Dr. H. C. Vogel published a modification of Secchi's scheme of stellar diversities, and gave it organic meaning by connecting spectral differences with advance in "age." And in 1895, he set apart, as in the earliest stage of growth, a new class of "helium stars," supposed to develop successively into Sirian, solar, Antarian, or alternatively into carbon stars. The classification which survives at the present time is that of the Draper Catalogue of stellar spectra observed at Harvard (1890) comprising 10,351 stars.

On Aug. 5, 1864, G. B. Donati analysed the light of a small comet into three bright bands. Sir William Huggins repeated the experiment on Winnecke's comet in 1868, obtained the same bands, and traced them to their origin from glowing carbon-vapour. A photograph of the spectrum of Tebbutt's comet, taken by him on June 24, 1881, showed radiations of shorter wavelengths but identical source, and in addition, a percentage of reflected solar light marked as such by the presence of some well-known Fraunhofer lines. Further experience has generalized these earlier results. The rule that comets yield carbon-spectra has scarcely any exceptions. The usual bands were, however, temporarily effaced in the two brilliant apparitions of 1882 by vivid rays of sodium and iron, emitted during the excitement of perihelion-passage.

An important contribution of the spectroscope to astronomy is the determination of velocities in the line of sight by measurement of the Doppler displacement of spectral lines. In 1868 William Huggins attempted these measurements; but no trustworthy results were obtained till much later. Probably the earliest results that can be counted successful were those of H. C. Vogel who in 1888 substituted photographic for eye observation. The first extensive catalogue of radial velocities of stars was published by W. W. Campbell in 1911.

Miscellaneous. — The first evening of the nineteenth century saw the discovery of the minor planet Ceres by Giuseppe Piazzi at Palermo. This was the forerunner of a host of similar discoveries now numbering more than a thousand. Progress was greatly accelerated when Max Wolf of Heidelberg in 1891 introduced the photographic method of searching for minor planets. Discovery of the satellites of planets continued during the nineteenth century. Between 1846 and 1851 William Lassell added Neptune's satellite, Hyperion attending Saturn, Ariel and Umbriel attending Uranus. The two satellites of Mars were found by Asaph Hall at Washington in 1877. The fifth (innermost) satellite of Jupiter was found by E. E. Barnard in 1892; and four more faint and remote Jovian satellites have been added in the present century. Saturn's outermost satellite Phoebe was found by W. H. Pickering in 1898.

In regard to the progress of astronomy since the latter part of the last century we can only refer here to the general tendencies; fuller information is given in the separate articles cn celestial objects and astronomical methods. One feature has been the development of statistical studies of the distribution, motions, and other characteristics of stars. Important work on the extension of the sidereal universe was done by H. von Seeliger who

must be counted the pioneer of modern statistical astronomy; but the subject received most impetus from the researches of J. C. Kapteyn. This was the main line of stellar investigation from about 1902–1912, but since then there has been something like a reaction to intensive study of individual stars. More recently the feature of stellar astronomy has been the application of atomic physics and the quantum theory to the conditions in the stars and nebulae. This closer linking of astronomy with physics (and in particular with thermodynamics) may be said to have originated in important pioneer investigations of the flow of radiation through a star's atmosphere by Arthur Schuster (1903) and Karl Schwarzschild (1908). The great possibilities in the interpretation of spectra were first made manifest by M. N. Saha (1920).

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ASTROPALIA, an Aegean island (classical Astypalaea, mediaeval *Stampalia*), with good harbours, situated in 36·5° N. and immediately west of 26·5° E. It was colonized by Megara, and its constitution and buildings are known from numerous inscriptions. The Roman empire recognized it as a free state, and in the middle ages it belonged to the noble Venetian family of Quirini. It was taken by the Turks in the 16th century, and is now noted for its sponges. The dialect, customs and dress of the people are interesting, and the fortified town picturesque. Pop. (1936) 2,006.

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ASTROPHYSICS, that branch of astronomy which deals with the physical constitution of the heavenly bodies or involves the use of instruments and methods specially dependent on physics. It is contrasted with "astrometry," which deals with the positions and motions of the heavenly bodies. There is no strict line of demarcation, but in a general way we can divide astronomical methods into those making use of general types of equipment (the telescope, camera, micrometer, etc.) and those involving distinctively physical apparatus (the spectroscope, photo-electric cell, thermo-couple, etc.). Similarly, on the theoretical side we distinguish between conclusions based on geometry or on the law of gravitation (spherical astronomy and celestial mechanics) and those depending on advanced knowledge of atomic physics and thermodynamics. But even if it were desirable to divide astronomy in this way into two separate branches, the attempt is frustrated by the fact that astrometrical data are commonly found by astrophysical methods, and astrophysical data by astrometrical methods.

Astrophysics came into prominence through the application of the spectroscope in the third quarter of the 19th century; and it is mainly in its limited meaning of celestial spectroscopy that we shall give an introduction to it here. The spectroscope, like a glorified prism, takes the light of a body, separates it into its different constituents (different wave lengths) and lays them out side by side for examination. Primarily this spectrum tells us what chemical elements are present in the source of light, each element having its own characteristic set of lines. (See SPECTROSCOPY.) The lines may appear either as bright emission lines, or as relatively dark lines on a background of continuous light. In either case they are a sign of the presence of the corresponding element, either shining on its own account or robbing the light that comes from lower down in the star of these particular constituents. In this way 57 terrestrial elements have been recognized in the sun certainly and nine doubtfully. But absence of the characteristic lines does not necessarily mean that the element is absent or scarce; it may often happen that the temperature and density of the source are not suitable for exciting the spectrum, so that the element, although abundant, does not disclose itself. In any case the spectroscope, like the telescope, reaches only the outermost layers or atmosphere of the star and cannot indicate the chemical composition of the interior.

The first results obtained with the spectroscope related to the chemistry of the stars and nebulae; but later a much wider field of application was found in relation to the physics of the heavenly bodies. It is just because it is an erratic tool for the chemist that the spectroscope is so valuable for the physicist. It will not show the spectrum of an element unless the physical conditions are suitable: conversely, if it does show the spectrum we can infer that the physical conditions in the star are suitable. For example, we see very prominently in the spectrum of Sirius a series of lines due to hydrogen, and very little besides. We have to ask ourselves, what are the physical conditions which would account for so great a stimulation of this hydrogen spectrum? The answer, given partly by laboratory experience and partly by general physical theory, goes a long way towards settling the temperature and density in the outer layers of Sirius.

At high temperature an atom may become ionized, that is to say one of the electrons in the system of the atom breaks loose. The element then emits an entirely different spectrum. Or two, three, four electrons may break loose; a different spectrum being shown in each case. Stars of fairly low temperature show the spectrum of the complete calcium atom; those of higher temperature show the spectrum of the atom deprived of one electron. At still higher temperature there is no indication of calcium and we infer that it has all become doubly ionized, the calcium atom with two electrons missing being known to give no lines in the part of the spectrum which astronomers can observe.

In the sun and stars, the lines of which we have been speaking appear as dark gaps in the band of light forming the spectrum. But in some of the nebulae they appear as isolated bright lines with little or no continuous background. It is commonly said that continuous spectrum indicates a solid or liquid or highly compressed gas; whilst a bright line spectrum indicates rarefied gas. This is not quite accurate, because a rarefied gas will show a continuous instead of bright line spectrum if we look at a sufficient thickness of it. It is a question of transparency. Light which is strongly emitted by any kind of atom is also strongly absorbed by it; and the internal absorption in a deep layer of material tends to even out the emission in different wave lengths. Thus, if the light is strongly emitted and absorbed, we receive only the emission from a few atoms in the forefront, these forming an opaque screen to the radiation behind; if the emission is weak we see down to a greater depth, and so the weakness is compensated by the greater number of atoms visible. For a deep layer at uniform temperature this compensation is so complete that the resulting spectrum is a continuous band independent of the nature of the material and depending only on the temperature; this is known as the "black-body" spectrum.

The continuous spectrum from a star is not very different from a black-body spectrum; in fact, it is much closer than we should expect, seeing that the observed layer of the star is by no means at a uniform temperature, the upper part being considerably cooler than the lower part. By measuring the distribution of energy in the spectrum we can determine the temperature; for, as the temperature of a black body rises, the radiation comes more and more from the blue end of the spectrum. This temperature is commonly called the "effective temperature" or sur-

face temperature of the star; it is strictly the mean temperature of the layers which we actually see. Deep down in the interior the temperature is, of course, far greater.

Bright line spectra are shown by the gaseous nebulae, by tails of comets, and by the uppermost layers (chromosphere and corona) of the sun when viewed transversely at the edge of the disc. We are then looking at extremely rarefied gas, and the layer, although enormously thick compared with terrestrial standards, is still thin enough to be transparent. Occasional bright lines are also found in the spectra of some stars superposed on the continuous spectrum. These probably indicate either specially disturbed conditions or that the star is surrounded by an extended nebulous envelope.

We commonly judge stars by their light, but it is quite practicable to measure the heat which they send to us across interstellar space. This is done by placing a thermo-couple at the focus of the telescope where the star's rays are concentrated. The chief difficulty is that a great deal of the heat is absorbed in our atmosphere, so that large and sometimes uncertain corrections must be applied in order to obtain the true output of heat by the star. (A. S. E.)

ASTRUC, JEAN (1684–1766), French physician and biblical critic, was born March 19 1684, at Sauve, in Languedoc, and died in Paris, where he was regius professor of medicine, May 5 1766. He published anonymously Conjectures *sur les mémoires originaux* dont *il paraît que* Moyse *s'est* servi *pour* composer *le livre* de la *Genèse* (1753), in which he laid the foundation of modern criticism of the Pentateuch by pointing out that two main sources can be traced in the book of Genesis.

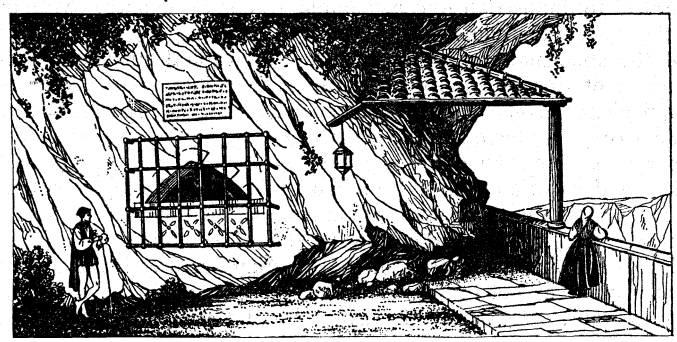
See Hauck, Realencyk. f. prot. *Theol.*, vol. ii. p. 162–170 (1897).

ASTURA, formerly an island, now a peninsula, coast of Latium, Italy, 7m. S.E. of Antium, at the south-eastern extremity of the bay of Antium. The name also belongs to the river which flowed into the sea at an anchorage immediately south-east. The mediaeval castle of the Frangipani, in which Conradin vainly sought refuge after the battle of Tagliacozzo in 1268, is built on the foundations of a large villa, with a series of tanks for pisciculture and a harbour for small boats. Along the coast, a mile to the north-west, a line of villas begins, which continues as far as Antium. To the south-east the coast seems to have been as sparsely populated in Roman times as it is now. Astura was the site of a favourite villa of Cicero, whither he retired on the death of his daughter Tullia in 45 B.C. It appears to have been unhealthy even in Roman times; according to Suetonius, both Augustus and Tiberius contracted here the illnesses which proved fatal to them.

ASTURES (ŭ), a warlike tribe occupying the mountains of the north-west of ancient Spain. They resisted the Roman conquest and were only reduced by Augustus; Asturica Augusta, Legio VII. Gemina and other strong places being planted to hold them down. Their name is preserved in the modern Spanish Asturias.

ASTURIAS, a principality of Spain, created (1388) by John I, of Lebn and Castile when his eldest son Henry married the daughter of the duke of Lancaster. The principality, now purely titular, belongs to the eldest son of the sovereign; administratively the principality is chiefly merged in the province of Oviedo, to describe which Asturias still survives in popular usage as a regional term. Clearly defined on three sides by mountain ranges which make the district a rough oval, and on the fourth side by a long straight coast-line, broken only by the projecting Cabo de Pefias, the Asturias are secluded from the rest of the peninsula and such outlook as they have is maritime. On the east the triple limestone massif of the Picos de Europa, reaching 2,6oom., leaves only a narrow strip for passage to the coast of old Castile; on the south the Cantabrian mountains shut off the central plateau to which no pass lower than 1,13om. gives access, the main road from Oviedo to León crossing by the Puerto de Pajares at 1,363m.; on the west the lower Sierras de Rafiadoiro and de Meira, running north-east to south-west, block the road to Galicia; between these sierras the bounddry-line of the Asturias runs without any special natural definition to the Ria de Rivadeo.

The abrupt descent from the Cantabrian crest, which reaches 2,3oom. in Peña Ubiña, brings down the rivers by steep courses set in deep valleys—in canyons, in the mountain limestone of the eastern Asturias—to the sea, nowhere more than 7okm. distant. A fan-shaped area drains to the Ria de Pravia by the converging rivers Narcea and Nalón; the town of Pravia stands at the apex of the fan. Besides these rivers and their tributaries, the Navia and Sella are the only important streams. To the east of this fan, behind the coast between Avilés and Caravia, lies the area of successive marine invasions in geological times. To one of these invasions is due the natural trench which forms the central



THE MOUNTAIN CLIFF TOMB IN ASTURIAS. OF PELAYO, THE ASTURIAN KING WHO ATTEMPTED TO RECONQUER CHRISTIAN SPAIN FROM THE MOORS IN THE 8TH CENTURY

valley of the Asturias east of Oviedo, and which continues along the line of the old sea-gulf narrowing out between the Picos de Europa and the Sierra de Cuera. This structural valley, neither the result of stream action nor occupied by any important stream, gives the principal interior line of communications in the Asturias. Along the coast the great Cantabrian platform, running from western Galicia to the mouth of the river Adour in France, is represented in the Asturias as elsewhere, by the gently rolling "downs," some 60 or 7om. in height and cut usually in sheer cliffs towards the sea, into which the platform, segmented by the rivers from the interior, has been moulded by the weather. To-day the platform is thickly populated, and one single coastal road connects the long line of small towns set on successive heights. The intervening rias are clogged with silt and afford no good harbours. The relief, of mountain, valley and coastal platform, the coal supply and the humidity of the climate determine jointly the character of the Asturias. The impenetrable Picos de Europa, in whose fastnesses the chamois still roams, sheltered the Christian nucleus of resistance to the Muslims, which developed into the kingdom of Oviedo and Asturias. In the early stages of this resistance the term Asturias (derived from the original inhabitants, the Astures, whose territory extended westwards from Ribudesella and as far as the Douro) covered loosely the Cantabrian territory held by the Christians; there were Asturias in the Liébana valley and as far east as Santander (Asturia de Sancto Anderio), and the name lingered long east of the Picos in the term Asturia de Santillana (Sancta *Illana*). But the important movement was westwards along the central valley, in which Cangas de Onís and Oviedo (alternating with Pravia) were successive headquarters or capitals of the small Christian State. After the capital of the enlarged State had been transferred to León by Ordono II. (914–924), the isolation of the Asturias and of Galicia, both from each other and from the repopulated territory on the central plateau, contributed to the weakness and lack of homogeneity of the kingdom of León. The mountain barrier between Léon and the Asturias made Oviedo at a later date a refuge for the Léonese king Bermudo II. during the raid of Almanzor.

The coal of the Asturias lies in distinct groups of small basins; the town of Tineo is the centre for the most westerly group, but the comparatively thick beds of anthracite coal have been little exploited there for lack of means of communication. The most important group at present is the central; here the coal lies in a series of folds of the mountain limestone, cut by the rivers Caudal and Nalon, on which Mieres and Langres are respectively

the centres of exploitation. The more northerly basins of Arnas and Ferroñes supply a soft coal with 45% of volatile substances, and, speaking generally, the coals of the Asturian basins form a descending scale of hardness from north to south. Iron ore is also extracted in the Asturias and blast furnaces have been erected at La Felguera to treat it. Zinc ores are mined in the Picos de Europa. The altitude at which the zinc is found, however, prevents operations in winter; the iron ores have a high percentage of silica; the coal seams are relatively thin and irregular and they dip steeply, so that the costs both of production and of transport are high. Thus the mineral resources of the Asturias have served to industrialize considerable tracts of country without bringing any high degree of prosperity. The temporary prosperity of the abnormal war years and the new capital sunk in consequence of this prosperity in improved machinery (calculated as equivalent to some eight millions of pounds sterling for the decennium 1915–25) have had the effect of raising in a more acute form in recent times the question of the protection by governmental decree of Asturian coal. With a humid climate and a high rainfall, nowhere less than 1,000mm. per annum, the Asturias are predominantly pastoral and the cow is the chief domestic animal. Horses and mules are bred on the Asturian pastures but they are not worked, except in the mines. The absence of a regular period of drought, together with favourable temperature conditions, makes maize the chief cereal cultivated; the soils do not, however. favour the cultivator and America and the mines attract labour more than the farm. The marked summer minimum of rainfall is sufficient to make ordinary summer irrigation desirable, but the typical Asturian irrigation is the winter flooding of lands by running water, partly to maintain the soil temperature and partly to secure the benefit of the fertilizing deposit of mud.

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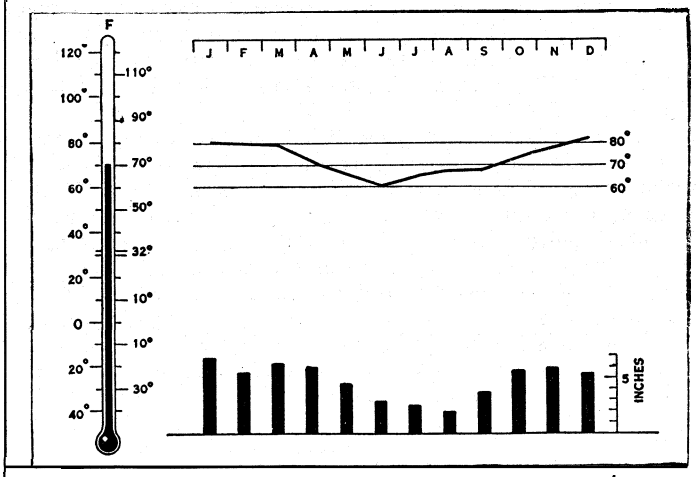
ASTYAGES, the last king of the Median empire. In the inscriptions of Nabonidos the name is written Ishtuvegu (cylinder from Abu Habba V R 64, col. 1, 32; Annals, published by Pinches, Tr. *Soc. Bibl.* Arch. vii. col. 2, 2). According to Herodotus, he was the son of Cyaxares and reigned 35 years (584–550 B.C.); his wife was Aryenis, the daughter of Alyattes of Lydia (Herod. i. 74). About his reign we know little, as the narrative of Herodotus, which makes Cyrus the grandson of Astyages by his daughter Mandane, is merely a legend; the figure of Harpagus, who as general of the Median army betrays the king to Cyrus, alone seems to contain any historical element, as Harpagus and his family afterwards obtained a high position in the Persian empire. From the inscriptions of Nabonidos we learn that Cyrus, king of Anshan (Susiana), began war against him in 553 B.C.; in 550, when Astyages marched against Cyrus, his troops rebelled, and he was taken prisoner. Then Cyrus occupied and plundered Ecbatana. The captive king was treated fairly by Cyrus (Herod. i. 130), and according to Ctesias (Pers., 5; cf. Justin i. 6) made satrap of Hyrcania, where he was afterwards slain by Oebares against the will of Cyrus, who gave him a splendid funeral. Alexander Polyhistor and Abydenus in their excerpts from Berossus, which Eusebius (*Chron.*, i. p. 29 and 37) and Syncellus (p. 396) have preserved, give the name Astyages to the Median king who reigned in the time of the fall of Nineveh (606 B.C.), and became father-in-law of Nebuchadrezzar. This is evidently a mistake; the name ought to be Cyaxares (in the fragments of the Jewish history of Alexander Polyhistor, in Euseb. Praep. *Ev.*, ix. 39, the name is converted into Astibaras, who according to the unhistorical list of Ctesias, was the father of Astyages), and there is no reason to invent an earlier King Astyages I., as some modern authors have done. The Armenian historians render the name Astyages by Ashdahak; *i.e.*, Azhi Dahaka (Zohak), the mythical king of the Iranian epics, who has nothing whatever to do with the historical king of the Medes.

(ED. M.)

ASUNCION (Nuestra Señora de la Asunción), capital of the republic of Paraguay, stands on the eastern bank of the Paraguay river in 25° 16′ 04″ S., 57° 42′ 40″ W., 935 mi. N of Buenos Aires. Pop. (1939) 109,426.

The city is connected with Buenos Aires and Montevideo by regular steamers. There is rail connection with Buenos Aires through cars being ferried over the Alto Paraná river betneen Posadas and Encarnación, time 52 hours; and a weekly air service is maintained between Asunción and the capitals of Argentina and Brazil. A spur of the Pan American highway branches north at Rosario, Argentina, to Asunción.



GRAPH OF THE TEMPERATURE AND RAINFALL OF ASUNCIÓN
The thermometer shows the annual mean temperature; the curve illustrates the monthly mean temperature. Columns indicate the normal rainfall for each month

Asunción is built opposite a wide stretch of the Paraguay, often called the Bay of Asunción. Its site is only 250 ft. above sea level but the hills rising gently back from the river furnish a healthier site for future growth. The city's streets are laid out in rectangular form and in the larger division or older city run northwest to southeast and are crossed by others at right angles. Many blocks are 240 ft. square and a number of streets are 45 ft. wide. Close to the river stands the famous palace built by Lopez II, now used for government offices. Barrio Cachingo is a new part of the city where streets run with cardinal points Dwelling houses of Asunción are largely one-story structures; recently taller buildings have become numerous. Prominent buildings are the House of Congress, National theatre, post and telegraph office, city hospital, Encarnación church, national library with many rare books, a new market and a college opened in 1928. The port of Asunción is one of the busiest parts of the city; here transshipment is made from small ocean-going vessels to those of lighter draught which handle upriver cargo (as far as Corumbá). Mean temperature at Asunción is about 72° F.; maximum, 105° F. December, January and February are the hottest months; the remaining months are cool or cold and occasionally frosts occur. The heaviest precipitation occurs about March and the lightest in August. The city is governed by a municipal junta consisting of six councilmen and an *intendente* or mayor who is appointed by the president of the republic; councilmen are elected by popular vote.

Among city improvements are some newly paved streets, sidewalks, extension of electric light and power service, installation of modern sewerage in certain districts, motor cars and a movement for extension of highways, new hotels, modern shops with large varieties of foreign goods and an active chamber of commerce. The pleasure and health resort of San Bernardino on Lake Ypacarái, a short distance by railway or road, is frequented in summer.

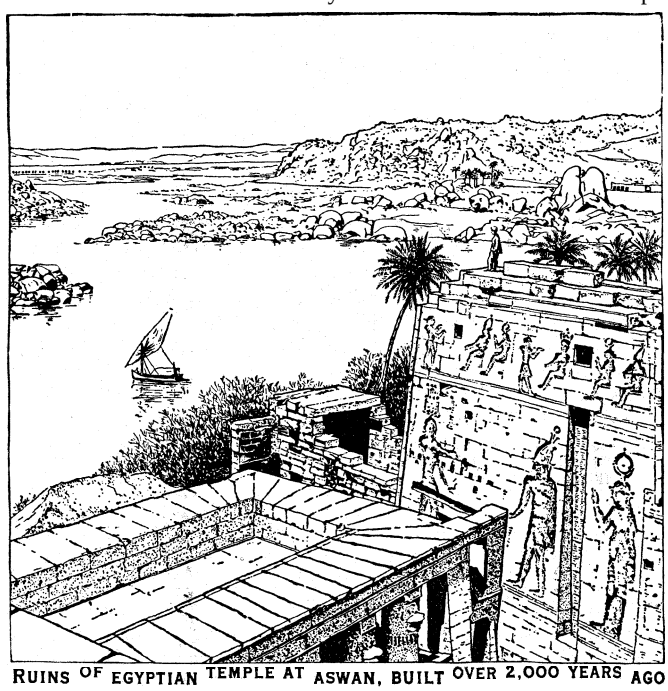
Sebastian Cabot, after his explorations in North America. turned to South America, and with a band of wanderers sailed up the Paraguay to the region where Asunción now stands. This event was about 1526–27. Subsequently Ayolas and Irala with other Europeans visited the spot where Asunción is situated and began a stockade in order to protect themselves from the Guaranís. These Indians, however, are said to have offered little resistance and ultimately assisted in laying out and building a

settlement. Ayolas sailed farther up the Paraguay river and never returned. In 1617 a seat of government was established at Buenos Aires, and Asunción was almost abandoned. Later other explorers came and Asunción for many years was the scene of cruelty, oppression, adventure, romance and bloodshed. Paraguay declared independence from Spain on Aug. 14, 1811, and Velasco, the Spanish governor, being in sympathy with the movement, was chosen a member of the Junta. Asunción still bears many marks of the terrible fighting that from time to time has made its streets run red with blood. In recent years, however, peace has reigned and considerable progress is recorded. (W. A. R.; X.)

ASVINS, in Vedic Hindu mythology, twir gods of light, and after Indra, Agni and Soma the most prominent in the *Rig Veda*, invoked in more than 50 hymns. As spirits of the Dawn they prepare her path in the sky. Called sons of the sun, offspring of the ocean, the youngest of the gods, "honey-hued," they are inseparable. The Boghaz-Keui inscription (c. 1400 B.C.) in Asia Minor mentions them with Indra and Varuna and they are unquestionably Zoroastrian, though they seem to be the Nasatya demons of the *Avesta*, and their resemblances to the Dioscuri are manifest. In the Epic era they survived chiefly as physicians and dentists and so rather lost caste. In modern Hinduism they have all but ceased to function.

See E. W. Hopkins, *Epic* Mythology (Strasbourg, 1915).

ASWAN or **ASSUAN,** a town of Upper Egypt on the east bank of the Nile, facing Elephantine island below the first cataract, and 590m. S. of Cairo by rail. It is the capital of a province of the same name—the southernmost province of Egypt. The principal buildings are along the river front, where a broad embankment has been built. Popular among Europeans as a winter health resort and tourist centre, Assuan is provided with large modern hotels (one situated on Elephantine island), and there is an English church. South-east of the railway station are the ruins of a temple



RUINS OF EGYPTIAN TEMPLE AT ASWAN, BUILT OVER 2,000 YEARS AGO
In the left background is Aswan dam, an engineering project responsible for the complete flooding of the island of Philae except from July to October. The boat with its one sail is characteristic of native craft navigating the Nile

built by Ptolemy Euergetes, and still farther south are the famous granite quarries of Syene. On Elephantine island are an ancient nilometer and other remains, including a granite gateway built under Alexander the Great at the temple of the local ram-headed god Chnubis or Chnumis (Eg. Khnum), perhaps on account of his connection with Amon (*q.v.*); two small but very beautiful temples of the 18th dynasty were destroyed there about 1820. In the hill on the opposite side of the river are tombs of the 6th to 12th dynasties, opened by Lord Grenfell in 1885–1886. The inscriptions show that they belonged to frontier-prefects whose expeditions into Nubia, etc., are recorded in them. Three and a half miles above the town, at the beginning of the cataract, the Assuan Dam stretches across the Nile and converts the river above it into a vast lake. Consequent on the rise of the water-level several islands have been wholly and others partly submerged, among the latter Philae (*q.v.*). On the east bank opposite Philae is the village of Shellal, southern terminus of the Egyptian railway system and the startingpoint of steamers for the Sudan.

In ancient times the chief city, called Yēb, capital of the frontier nome, the first of the Upper Country, was on the island of Elephantine, guarding the entrance to Egypt. Near the granite quarries on the eastern bank whence was obtained the material for many magnificent monuments—there grew up another city, at first dependent on, and afterwards successor to, the island town. This city was called *Swan*, the Mart, whence came the Greek *Syene* and Arabic *Aswân*. Syene is twice mentioned (as Seveneh) in the prophecies of Ezekiel, and papyri, discovered on the island, and dated in the reigns of Artaxerxes and Darius II. (464–404 B.C.), reveal the existence of a colony of Jews, with a temple to Yahu (Yahweh, Jehovah), which had been founded at some time before the conquest of Egypt by Cambyses in 523 B.C. In Roman times Syene was strongly garrisoned to resist the attacks of the desert tribes. Thither, in virtual banishment, Juvenal was sent as prefect by Domitian. In the early days of Christianity the town became the seat of a bishopric, and numerous ruins of Coptic convents are in the neighbourhood. On the conquest of Egypt by the Turks in the 16th century, Selim I. placed a garrison here, from whom, in part, the present townsmen descend. As the southern frontier town of Egypt proper, Assuan in times of peace was the entrepôt of a considerable trade with the Sudan and Abyssinia, and during the Mahdia (1884–99) it was occupied in force by British and Egyptian troops.

ASYLUM, a place of refuge. The derivation is of interest. In classical Greek, *ἡ σύλη* or *τὸ σῦλον* was the right of seizing the ship or cargo of a foreign merchant to cover losses incurred through him, and so came generally to mean the right of seizure or reprisal. The *ἀ* is privative: *τὸ ἄσυλον* means "the right of sanctuary." In ancient Greece an asylum was an "inviolable" refuge for persons in search of protection. All Greek temples and altars were inviolable, that is, it was a religious crime to remove by force any person or thing once under the protection of a deity. But this protecting right of a deity was recognized by common consent only in the case of a small number of temples. The right of sanctuary appears to have become limited to a few temples in consequence of abuses of it. Asylums in this sense were peculiar to the Greeks. The asylum of Romulus (Livy i. 8) cannot be considered as such. Under Roman dominion the rights of existing Greek sanctuaries were at first confirmed, but their number was considerably reduced by Tiberius. Under the empire the statues of the emperors and the eagles of the legions were made refuges against acts of violence. Generally speaking, the classes of persons who claimed the rights of asylum were slaves who had been maltreated by their masters, soldiers defeated and pursued by the enemy, and criminals who feared a trial or who had escaped before sentence was passed. (*See* classical dictionaries *s.v.*)

With the establishment of Christianity, the custom of asylum or sanctuary (*q.v.*) became attached to the church or churchyard. In modern times the word asylum has come to mean an institution providing shelter or refuge for any class of afflicted or destitute persons, such as the blind, deaf and dumb, etc., but more particularly the insane. (*See* INSANITY.)

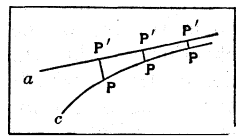
ASYLUM, RIGHT OF. This does not mean the right of a fugitive to demand protection but the right of a state to grant it. This latter flows from the principle of sovereignty (*q.v.*), but it is a right less and less insisted on with the progress of civilization. Asylum may be considered as equivalent to the exceptions to extradition (*q.v.*). Most nations reserve, or claim, a right of asylum for their own nationals. Portugal goes so far as to grant asylum for a fugitive who might, if delivered up, be put to death.

The right of neutral Powers to grant asylum to belligerent land forces is governed by articles 11, 12, 13, and 14 of The Hague

Convention V., 1907. The presence of belligerent warships in neutral ports is governed by The Hague Convention XIII., 1907 Generally such ships are not permitted to remain in neutral ports, roadsteads, or territorial waters for more than 24 hours.

Asylum in civil war is often claimed in South America for insurgents taking refuge in legations and consulates.

ASYMPTOTE, a line which approaches continually nearer to a given curve, but which does not meet it within a finite distance. More precisely speaking, if a curve (*c*) has an infinite branch and if there be a straight line (*a*) such that the distance *PP′* to a from a point *P* on *c* approaches zero as a limit, as *P* moves toward infinity, then a is called an asymptote to this curve. Geminus, writing in the first century B.C., remarked that: "Some lines exist which approach indefinitely and yet remain ἀσύμπτωτοι [literally, not-together-falling]." Elsewhere he gives the cases of the hyperbola and conchoid, each with its asymptote. The asymptote is often spoken of as a tangent to a curve at a point infinitely distant.



ASYUT, capital of a province of the same name in Upper Egypt, and the largest and best-built town in the Nile valley south of Cairo, from which it is distant 248 mi. by rail. The population rose from 32.000 in 1882 to 60,338 in 1937. Asyut stands near the west bank of the Nile across which, just below the town, is a barrage, completed in 1902, consisting of an open weir, 2,691ft. long and 111 bays or sluices, each 16½ft. wide, which can be opened or closed at will. At the western end of the barrage begins the Ibrahimia canal, nearly 200m. long, which supplies Middle Egypt and the Fayûm. The canal is skirted by a magnificent embankment, planted with shade trees, leading from the river to the town.

The town is famous for red and black pottery and for ornamental wood and ivory work, which find a ready market all over Egypt. It is one of the chief centres of the Copts. Here also is the northern terminus of the caravan route across the desert, which, passing through the Kharga oasis, goes south-west to Darfur. Asyut is the successor of the ancient Lycopolis (Eg. Sioout), capital of the 17th nome of Upper Egypt, and probably so called from the worship here of the jackal-headed Anubis. No ruins are visible, the mounds of the old city being for the most part hidden under modern buildings; but the slopes of the limestone hills behind it are pierced with an infinity of rock-cut tombs, some of which were large and decorated with sculptures, paintings and long inscriptions.

ATACAMA, a province of northern Chile, bounded north and south respectively by the provinces of Antofagasta and Coquimbo, and extending from the Pacific coast east to the Argentine boundary line. It has an area of 30,835 sq mi. lying in great part within the Atacama desert region, and a population (1902) of 71,446; (1940) 84,312. The silver and copper mines of the province are numerous, some of them ranking among the most productive known, but the majority are worked with limited capital and on a small scale. The silver ore was first discovered in 1832 by a shepherd at a place which bears his name, Juan Godoi. The nitrate and borax deposits are extensive and productive, and common salt is a natural product of large areas in the elevated desert regions of the Andes. The exports include copper and silver and their ores, nitrate of soda, borax and guano. The capital, Copiapó (pop. in 1940, 21,731), is situated on a small river of the same name 37m. from the coast and 51m. south-east by rail from Caldera, the principal port of this great mining district.

ATACAMA, DESERT OF, an arid, barren and saline region of western South America, covering the greater part of the Chilean provinces of Atacama and Antofagasta, the Argentine territory of Los Andes, and the south-western corner of the Bolivian department of Potosi. The higher elevations are known as the Puna de Atacama, which is practically a continuation southward of the great *puna* region of Peru and Bolivia. It is a broken, mountainous region, volcanic in places, saline in others, and ranges from 7,000 to 13,500ft. in general elevation. Its culminating ridges are marked by an irregular line of peaks and extinct volcanoes extending north by east from about 28° S. into southern Bolivia. On the eastern side, occasional rainfalls occur and streams from the snow-clad peaks produce some slight displays of fertility, but the general aspect of the plateaus, which are dry and cold in winter and in summer are swept by rainstorms and covered by occasional tufts of coarse grass, is barren and forbidding. They are also broken by great saline lagoons and dry salt basins. This region forms the Argentine territory of Los Andes and is habitable in places. On the western slope the land descends gradually to the Pacific, being broken into great basins, or terraces, by mountainous ridges in its higher elevations, widening out into gently sloping sandy plains below, famous for their nitrate deposits, and terminating on the coast with sharply-sloping bluffs, having an elevation of 800 to 1,500ft. and looking from the sea like a range of flat-topped hills. This desolate region, which is rainless and absolutely barren, and was considered worthless for three and a half centuries, is now a treasure-house of mineral wealth, abounding in copper, silver, lead, nickel, cobalt, iron, nitrates and borax. It is occupied by many mining settlements, and includes some of the most productive copper and silver mines of the world.

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(A. J. L.)

ATACAMENAN, an independent linguistic stock of South American Indians, formerly occupying the coastal region and western slope of the Andes in the Chilean provinces of Tarapacá and Antofagasta. Some authorities believe that in the latter province they extended eastwards into the Puna de Atacama. The culture of the Atacameiias was relatively simple, but apparently had some similarities with that of the adjacent high plateaus of southern Bolivia. Except for a small remnant in the vicinity of S. Pedro de Atacama, the Atacameiias appear to be practically extinct. Uhle's excavations in the region just north of Tarapaca reveal sites regarded by him as Atacameiian, deep pit graves containing flexed burials associated with coiled basketry, textiles and rather coarse red pottery with decorations derived largely from the older cultures of the Bolivian plateau.

See G. de Créqui-Montfort, *Fouilles dans la nécropole préhispanique de Calama; Les anciens Atacamas* (*xiv. Congress of Americanists,* pp. 551–565; M. Uhle, *La arqueologia de Arica y Tacna (Bol. Soc. Ecuatoriana de Historia,* vol. iii., pp. 1–48).

ATACAMITE, a mineral found originally in the desert of Atacama, and named by D. de Gallizen in 1801. It is a cupric oxychloride, having the formula $CuCl_2{\cdot}3Cu(OH)_2$, and crystallizing in the orthbrhombic system. Its hardness is about 3 and its specific gravity 3.7, while its colour presents various shades of green. Some of the finest crystals have been yielded by the copper-mines of South Australia, especially at Wallaroo. It occurs also, with malachite, at Bembe, near Ambriz, in West Africa. From one of its localities in Chile, Los Remolinos, it was termed Remolinite by Brooke and Miller. Small quantities of atacamite and of the very similar mineral footeite have been found in Arizona.

ATAMUALLPA or **ATABALIPA** (*atahu,* virile, and *allpa,* sweet) (c. 1502–1533), "the last of the Incas" (or Yncas) of Peru, was the favourite son of the Inca Huayna Capac, by Pacchas, the daughter of the conquered sovereign of Quito. His half-brother, Huascar, succeeded Huayna Capac in 1525, for, as Atahuallpa was not descended on both sides from the line of the Incas, Peruvian law considered him illegitimate. His father left him, however, the kingdom of Quito. In 1530 a quarrel arose between them over the suzerainty of an interjacent province. Civil war broke out, and in 1532, about the time that the Spanish

conqueror, Pizarro, was beginning his march inland from the coast, Huascar had been defeated and thrown into prison, and Atahuallpa had become Inca. Pizarro set out from San Miguel in Sept. 1532 enroute to Caxamarca, a favourite resort of the Incas, where Atahuallpa had his headquarters. Messengers passed frequently between them, and the Spaniards on their march were hospitably received by the inhabitants. On Nov. 15 Pizarro entered Caxamarca and sent his brother Hernando and Hernando de Soto to request an interview with the Inca. On the evening of the following day Atahuallpa entered the great square of Caxamarca, escorted by 3,000 or 4,000 of his followers, who were either unarmed or carried only short clubs and slings concealed under their garments. Pizarro's artillery and soldiers were strategically arranged in the buildings and streets opening on to the square. The interview was carried on by the priest, Vicente de Valerde, through an interpreter. He stated briefly and dogmatically the history and tenets of the Christian faith and the Roman Catholic policy, and called upon Atahuallpa to become a Christian and to acknowledge Charles V. as his master. To this extraordinary harangue the Inca pointed out to him vehemently certain difficulties in the Christian religion, acknowledged the obvious greatness of the emperor, and declined to accept either Christianity or Spanish sovereignty. He then took the Bible from the priest's hands, looked at it, and flung it resentfully to the ground. The priest retired to give an account of the interview to Pizarro, and Pizarro immediately gave the prearranged signal for attack. The Spaniards rushed out from all sides, and the Peruvians, astonished and defenceless, were cut down in hundreds. Pizarro himself seized the Inca, and in endeavouring to preserve his life, received the only wound inflicted that day on a Spaniard. Atahuallpa, thus treacherously captured, offered in ransom the famous roomful of gold and silver. He fulfilled his engagement, the Spaniards received $4,000,000 of bullion; but Pizarro still detained him until reinforcements should arrive. While in captivity Atahuallpa was accused of giving secret orders for the assassination of his brother, Huascar, and also of plotting the overthrow of the Spaniards. In the spring of 1533 (February) Almagro arrived from the coast with more than 150 Spaniards; rumours soon spread through the camp of a vast invasion from Quito; and Pizarro ordered the Inca to be brought to trial on the charges of murder, sedition and idolatry. He was condemned to death, and, as an idolator, to death by fire, an act of treachery which called forth the protest of the most influential of Pizarro's advisers — except the priest Valerde. But Pizarro feared the anger of his soldiery if he retracted, and Atahuallpa, having professed himself a Christian and received baptism, died by strangulation on Aug. 29, 1533. With him died the Peruvian empire.

The standard authority for these events is still Prescott's History *of* the Conquest of *Peru*. Where there is a discrepancy of opinion, he offers comparisons in his voluminous footnotes. (W. B. P.)

ATALANTA, a heroine, probably a by-form of Artemis, variously said to be daughter of Schoeneus of Boeotia or of Iasus and Clymene, of Arcadia. She was a renowned and swift-footed huntress. From her complex legend the following incidents are of interest: (1) She was exposed at birth, as her father wanted a son, but suckled by a she-bear (a beast connected with Artemis). (2) She took part in the Calydonian boar-hunt (see MELEAGER). (3) She offered to marry any one who could outrun her; those who lost were to be killed. Hippomenes (or Meilanion) was given three of the apples of the Hesperides (*q.v.*) by Aphrodite; when he dropped them, Atalanta stopped to pick them up, and so lost the race. Their son was Parthenopaeus, one of the Seven against Thebes. (4) She and her husband, proving ungrateful to Aphrodite, were led to profane a shrine with their loves, for which Cybele turned them into lions.

See Roscher's Lexikon, s.v.

ATARGATIS, a Syrian deity, known to the Greeks by a shortened form of the name, Derketo, and as Dea Syria, or in one word Deasura (Lucian, de Dea *Syria).* She is generally described as the "fish-goddess." The name is a compound of two divine names; the first part is the equivalent of the Phoenician Astarte (*q.v.*), the second is a Palmyrene name *'Athe* (?*tempus opportunum*). The home of the goddess was unquestionably Syria, especially Hierapolis (*q.v.*), where she had a great temple. From Syria her worship extended to Greece, Italy and the farthest west. The wide extension of the cult is attributable largely to Syrian merchants; whence we find traces of it in the great seaport towns.

Atargatis appears generally as the wife of Hadad (*q.v.*). They are the protecting deities of the community. She becomes ultimately a great Nature-Goddess, analogous to Cybele and Rhea (see GREAT MOTHER OF THE GODS); in one aspect she typifies the function of water in producing life; in another, the universal mother-earth (Macrobius, Saturn, i. 23); in a third (influenced, no doubt, by Chaldaean astrology), the power of destiny. The legends are numerous and of an astrological character.

ATATURK, KEMAL: see MUSTAFA KEMAL.

ATAULPHUS (the Latinized form of the Gothic Ataulf, "Father-wolf," from atta, father, and *vulfs,* wolf; Mod. Ger. Adolf, Latinized as Adolphus, the form used by Gibbon for the subject of this article), king of the Goths (d. 415). On the death of Alaric (*q.v.*) his followers acclaimed his brother-in-law, Ataulphus, as king. In 412 he quitted Italy and led his army across the Alps into Gaul. Here he fought against some of the usurpers who threatened the throne of Honorius; he made some sort of compact with that emperor and, in 414, married his sister, Placidia, who had been since the siege of Rome a captive in the camp of the Goths. The ex-emperor Attalus danced at the marriage festival, which was celebrated with great pomp at Narbonne. In 415 Ataulphus crossed the Pyrenees into Spain and died at Barcelona, being assassinated by a groom. The most important fact in his history is his confession, recorded by Orosius, that he saw the inability of his countrymen to rear a civilized or abiding kingdom, and that consequently his aim should be to build on Roman foundations and blend the two nations into one.

ATAVISM, sometimes called reversion, the term given in biology to the reproduction in a living person or animal of characteristics of an ancestor more remote than its parents (see HEREDITY). Loosely used, it connotes a reversion to an earlier type. Individuals reproduce unexpectedly the traits of earlier ancestors, and ethnologists and criminologists frequently explain by "atavism" the occurrence of degenerate species of man; but the subject is complicated by other possible explanations of such phenomena. Many cases of atavism or reversion have been satisfactorily explained as due to recombination of Mendelian iactors; and others are undoubtedly the result of arrested development (see EMBRYOLOGY).

ATAXIA, LOCOMOTOR: see LOCOMOTOR ATAXIA.

ATBARA RIVER. The last tributary of the Nile is the Atbara, which joins it 40 km. upstream of Berber. after a total course of about 1,266 kilometres. It rises as the Takazze in the Lasta hills, close to the eastern escarpment of Abyssinia, and rapidly deepens its valley into a steep-sided ravine deeply cut into the basalt plateau until only 16 km. from its source it is flowing in a ravine 600 metres deep; at some 50 km. E. of the mountains of Debra Tabor it turns northwards, being joined by numerous tributaries, some of which are large streams carrying a considerable volume in the rainy season. In about lat. 13° 12′ N., where the road from Adua to Gondar crosses it, the Takazze turns westwards, and under the name of Setit, joins the Atbara river coming from the south-east to form the main stream of the Atbara at a point 502 km. from the Nile.

Like most of the rivers of Abyssinia, the Takazze is in flood in July and August, being fed by the summer rains of the Abyssinian plateau, but after October it falls rapidly, and from November to May the Takazze is of small depth, while the Atbara sinks to a number of separate pools which afford watering places for the Arabs.

The Takazze begins to rise with the early rains of Abyssinia in May, and early in June the middle reaches of the river are affected. Here at this time, owing to the deficient supply, the permanent water-surface is at most points below the surface of the river bed, except in the deep pools, but as the upper river rises, water flows down and raises this water surface till running water appears again

in the bed of the river. The Atbara is often described as being torrential in character, but this is more true of its tributaries in the upper reaches than of the river itself. Its slope is not excessively high, and when it has risen in flood it flows steadily, the sudden rises and falls which occur being due to its tributaries rising on the Abyssinian tableland, fed by the heavy rains of July and August.

The Atbara flood commences in July, when the average discharge does not exceed 700 cubic metres per second; in August it increases to 2,150 cubic metres per second and falls to about 1,190 cubic metres per second in September; afterwards the river falls rapidly.

The silt brought down to the Nile from Abyssinia by the Atbara during the annual flood may amount to from 10 to 15 million metric tons.

ATBARA, BATTLE OF, April 8, 1898. (See EGYPT: *Sudan Campaigns,* 1896–1900.)

ATCHISON, a city of Kan., U.S.A., 42m. N.W. of Kansas City, on the Missouri river; the county seat of Atchinson county. It is served by the Burlington, the Rock Island, the Santa Fe, and the Missouri Pacific railways. The population was 12,630 in 1920, 13,024 in 1930 and 12,648 in 1940. The surrounding territory is an exceedingly rich agricultural section, and it contains deposits of the loess soil which is especially favourable to fruit growing. The city has three large iron and steel foundries, three flour mills, a plumbing supply house, and garment manufacturing plants.

Atchison stands fifth in manufacturing among cities of Kansas. It is an important wholesale centre for hardware, drugs, groceries, athletic equipment, paint, paper, fruit and candy. At Atchison are St. Benedict's college and Mount Saint Scholastica, each college having an enrolment of about 350 students.

The Atchison Globe founded in 1878 by E.W. Howe and owned and edited by him until 1911, is one of the best known papers in the Middle West. Atchison was founded in 1854 by a group of pro-slavery settlers, and was named after their leader, David R. Atchison, U.S. senator. The town was chartered in 1858

ATCHISON, TOPEKA AND SANTA FE RAILWAY COMPANY. Chartered by the State of Kansas in 1859, to construct and operate a railroad from Atchison on the Missouri to Topeka and in the direction of Santa Fe, N.M., with a grant of land 100 ft. wide along the route, this railroad remained dormant until 1871, when 75 m. of track was built. By the end of 1872, it was completed to the border of the State of Kansas. Subsequently it was continued through Pueblo, Colo., and Santa Fe to the Pacific coast, and east to Chicago. In 1900 an extension to San Francisco was opened, and through trains were run from Chicago to San Francisco. Kansas was covered with a network of lines, which were extended through Oklahoma and Texas to Galveston on the Gulf of Mexico. At Dec. 31, 1939, the mileage operated was 13,444. Net corporate income which in 1875 was $800,000, was $8,502,732 in 1939. The capital account on the latter date was $1,232,087,716. Freight revenue for 1939 was $127,530,776, with a total of 31,053,547 tons of revenue freight carried during the year. Passenger revenue for 1939 was $18,277,823, with 2,595,556 passengers carried. There were on Dec. 31. 1939, 18,693 preferred and 35,110 common shareholders. (E. J. EN.)

ATE, in Greek mythology, the personification of criminal folly or infatuation, the daughter of Zeus or of Eris ("strife"). She even made Zeus take a hasty oath which resulted in Heracles becoming subject to Eurystheus. Zeus thereupon cast her by the hair out of Olympus, after which she remained on earth, working evil and mischief (Iliad, xix. 91). She is followed by the *Litai* ("prayers"), the old and crippled daughters of Zeus, who are able to repair the evil done by her (Iliad, ix. 502). In later times Ate is regarded as the avenger of sin.

ATELLA, ancient Oscan town, Campania. Italy, 9 mi. N. of Naples and 9 mi. S. of Capua. 4 member of the Campanian confederation, it shared the fortunes of Capua, but remained longer faithful to Hannibal, and he transferred the inhabitants to Thurii before the Romans took the town (211) and settled exiles from Nuceria there. The town is famous as the cradle of early Roman comedy, the Atellanae Fabulae (*q.v.*).

ATELLANAE FABULAE, a sort of farce, popular in Republican and early Imperial Rome. The ancients derived the name, probably with justice, from the town Atella in Campania. If this is so, then the farces were of Oscan origin, very likely influenced by the Greek farces of Tarentum and other cities. Strabo (v. 3, 6) even says that in his own day (time of Augustus), although Oscan had died out, farces for performance at religious festivals were still written in it; but this need mean no more than that their language was rustic Latin. According to Livy (vii. 2, 11) they were often acted by amateurs, and to be an actor of *Atellanae* did not, like ordinary acting, involve loss of civic status. In the last century B.C., when a taste arose for farces (exodia) to be played after tragedies, perhaps on the analogy of Greek satyr-plays, Atellanae became a literary genre, and we have some fragments of a writer of them, L. Pomponius of Bononia (Bologna); see Ribbeck, Scaenicae Romanorum *poesis fragmenta;* there are also a few remnants of two or three other authors. We learn, from these and other sources, that there mere four stock characters, Maccus the glutton, Bucco the simpleton, Pappus (Pantaloon), and Dossenus (Punch, a clever, rascally hunchback); that the actors wore masks; that the plot was generally taken from everyday Italian life, but was sometimes para-tragic; and that the language was Latin, with all manner of oddities and extravagances of diction. They finally disappeared, owing to the popularity of the *mimus,* about the time of Tiberius.

See Schanz-Hosius, *Gesch.* der *röm. Literatur,* i. 245–248 (bibl.).

A TEMPO (Ital., in time), in music, a direction to resume the original tempo of a piece after this has been temporarily modified by a *più* lento (more slowly), *più* allegro (faster) or some similar direction.

ATESTE: see ESTE.

ATH, an ancient town in the province of Hainaut, Belgium, on the left bank of the Dender. Pop. (1930) 10,606. The fortress was dismantled after 1858 and its ramparts superseded by boulevards. The fine church of St. Julien (14th century) was destroyed by fire in 1817 (since rebuilt). A tower (Tour Burbant) forming part of the *donjon* of the fortress erected by Baldwin IV., count of Hainaut, about 1150, is thus the sole mediaeval relic. Ath is famous for its gild of archers; and the town militia has the privilege of being armed with bows and crossbows. Ath is also well known for its annual fête called le jour de *ducasse*—ducasse being the Walloon word for kermesse (*fête*)—held on the fourth Sunday in August. A procession escorting figures of two giants—Goliath, called locally Goyasse, and Samson, forms the chief feature of the celebration.

ATHABASCA or **ELK,** a river and lake of the province of Alberta, Canada. The river rises in the Rocky mountains near the Yellowhead pass in 52° 10′ N. and 117° 10′ W., and flows northeast as far as Athabasca landing, and thence north into Lake Athabasca. It is 740m. long and has a number of important tributaries, including the McLeod, Pembina, Lesser Slave, which drains the lake of that name, and Clearwater. Athabasca lake is 195m. long, west to east, from 20 to 32m. wide, has an area of 3,085 sq.m., and is 690ft. above the sea. It discharges its waters northward by Slave river and the Mackenzie system to the Arctic ocean. The Athabasca is navigable, with minor rapids, to Grand Rapids, where navigation is interrupted as far as Fort McMurray; thence to Athabasca lake it flows slowly and is suitable for river steamers.

ATHABASCAN, a linguistic family of North American Indians, one of the most widely spread on the continent, and also known as Dene or Tinneh. The Athabascan languages are sharply characterized and seem fairly conservative; at any rate they differ relatively little from one another, even where widely separated and therefore presumably long divergent. The culture of the Athabascan groups, however, conforms rather closely to that of the non-Athabascan tribes of the same areas; and to some extent the same is true of physique, although the majority of divisions belong to a broad-headed, tall type widely spread in northwestern North America and sometimes called the Athabascan type. The Athabascan peoples fall into three geographical divisions—the northern, south-western and Pacific coast.

The northern division occupied the Yukon and Mackenzie drainages and the head of the basin of the Frazer; in other words, the whole interior of Canada and Alaska north-west of Churchill river. In this vast stretch fronting on Hudson bay and the Arctic and Pacific, the Athabascans were resident on salt water at only one point—Cook inlet in Alaska. The culture was relatively uniform over the area, being wholly without agriculture and primarily dependent on either caribou or moose and deer hunting. Huts and vessels were prevailingly of skins or bark. clothing of dressed skins or fur cut and pieced to fit the body, society mainly non-exogamic, ritual of the simplest, life carried on in small bands without political coherence. The principal tribal groups in this division were: Khotana on the lower Yukon and Cook inlet; Kutchin, including the Loucheux, on the middle Yukon and east toward the lower Mackenzie; Ahtena, on Copper river; the Yellowknife, Dogrib, Slavey, Chipewyan, Hare and Beaver in Mackenzie drainage and eastward; to the south, in the plains. the Sarsi, neighbours of the Blackfeet and culturally assimilated to them; Nahane, including Tahltan, upper Yukon; Sekani, upper Frazer and Peace rivers; thence south in British Columbia to latitude 51°, the Babine, Carrier or Takulli and Chilcotin. In southern British Columbia, Washington and Oregon were three small Athabascan tribes or bands, now extinct, leading on the map like stepping stones to the Pacific division. The total population of this area covering a sixth of the continent perhaps did not exceed 30,000.

The Pacific coast division extended not quite continuously from Umpqua river in Oregon to the head of the Eel in California, with sea frontage of about half the total stretch of 300m. occupied. The Oregon groups are not well known, but included the Umpqua, Coquille, Chastacosta, Tututni, Chetco; the California ones were, from north to south, the Tolowa, Chilula, Hupa, Whilkut, Nongatl, Mattole, Lassik, Sinkyone, Wailaki, Kato. These were groups each speaking a fairly uniform dialect, not politically organized tribes. The population has been estimated at 7,000 for the California groups, was probably about the same in Oregon, and did not exceed 20,000 for the division.

The South-western division comprised the Navaho and Apache (including Lipan) in Arizona, New Mexico, Texas, Chihuahua, and Coahuila. These tribes are separately described. They now number about 30,000 souls, largely due to an apparent increase of the Navaho in the last two generations as they have been at peace and pastoral. A few hundred Athabascans attached to the Kiowa of the plains and known as Kiowa Apache are said to be of northern origin, but may have been an Apache band in origin.

No Athabascan tribe is known to have attained a degree of cultural advancement equal to that of the most advanced tribes of its area, with the possible exception of the Hupa in north-west California. Nowhere have Athabascans achieved notable national or political solidarity. They are, however, in general, hardy, and some of the south-western bands were long the terrors of their white and Indian neighbours.

Sapir has united the Athabascan languages with Tlingit and Haida into a larger Na-Dene family, which is contested by others; and according to report, not yet substantiated by evidence, he connects the Na-Dene group genetically with the Sino-Tibetan languages.

See Samuel Hearne, *Journey* (1795); *E.* Petitot, several works (1876–93); A. G. Morice, *Trans. Can. Inst.* (1889 *seq.*, and elsewhere); P. E. Goddard, *Univ. Calif.* Pub. *Am. Arch. Ethn.* (1904 seq.), *Am. Mus. Nat. Hist. Anthr. Pap.*, vols. viii., x. (1911–17); W. Matthews, *Bur. Am. Ethn. Rep.*, ii., iii., v. (1883–87), *Navaho Legends* (1897), *Am. Mus. Nat. Hist.* Mem. (1902); Franciscan Fathers of St. Michaels, Ariz., *An Ethnologic Dictionary of the Navaho Language* (1910). (A. L. K.)

ATHALARIC (516–534), king of the Ostrogoths, grandson of Theodoric, became king of the Ostrogoths in Italy on his grandfather's death (526). As he was only ten years old, the regency was assumed by his mother, Amalasuntha (*q.v.*). He died on Oct. 2, 534.

ATHALIAH, the daughter of Ahab, and wife of Jehoram, king of Judah. After the death of Ahaziah, her son, she usurped the throne and reigned for six years. She massacred all the members of the royal house of Judah (2 Kings xi. 1–3). The sole survivor, Joash, was concealed in the temple by his aunt, Jehosheba, wife of the priest, Jehoida. These organized a successful revolution in favour of Joash (2 Kings xi., 2 Chron. xxii. 10–12, xxiii., xxiv. 7). The story of Athaliah forms the subject of one of Racine's best tragedies.

ATHAMAS in Greek mythology, king of the Minyae in Orchomenus. His first wife was Nephele (see ARGONAUTS). Athamas and his second wife Ino incurred the wrath of Hera, because Ino had nursed Dionysus. Athamas went mad, and slew one of his sons, Learchus; Ino, to escape, threw herself into the sea with her other son Melicertes. Both were afterwards worshipped as marine divinities, Ino as Leucothea, Melicertes as Palaemon. Athamas, with the guilt of his son's murder upon him, was obliged to flee from Boeotia. He was ordered by the oracle to settle in a place where he should receive hospitality from wild beasts. This he found at Phthiotis in Thessaly, where he surprised some wolves eating sheep; on his approach they fled, leaving him the bones. (Apollodorus i.. 80–84; Hyginus, Fab. 1–5; Ovid, *Metam.* iv. 416. *Fasti,* vi. 485; Valerius Flaccus, i. 277; Schol. on Apoll. Rhodius. ii. 513.) The legend is probably founded on a very old custom of human sacrifice amongst the Minyae.

ATHANAGILD became king of the Visigoths (in Spain) in 534, having invoked the aid of the emperor Justinian for his revolt against his predecessor Agila.

He is chiefly remembered for the tragic fortunes of his daughters Brunechildis and Gavleswintha, who married two Frankish brother kings, Sigebert and Chilperic. Athanagild died in 547.

ATHANARIC (d. 381), a ruler of the Visigoths from about 366 to 380. He bore the title not of king but of judge, a title which may be compared with that of ealdorman among the Anglo-Saxon invaders of Britain. Athanaric waged an unsuccessful war with the emperor Valens (367 to 369), and the peace by which the war was ended was ratified by the Roman and Gothic rulers meeting on a barge in mid-stream of the Danube. Athanaric was a harsh and obstinate heathen, and his short reign was chiefly famous for his brutal persecution of his Christian fellow-countrymen. In 376 he was utterly defeated by the Huns, who a few years before had burst into Europe. Athanaric seems to have fled into Transylvania. Being attacked there by two Ostrogothic chiefs he sought, in 381, the protection of Theodosius I. at Constantinople, where he died a fortnight later.

ATHANASIUS "THE GREAT," saint and bishop of Alexandria, was born about 298, probably at Alexandria. He received a liberal education. From early years he was instructed in the Scriptures, that is the Septuagint and New Testament. He knew no Hebrew. These studies, combined with Greek learning, moulded his later thought. In mind and outlook he was a thorough Greek. There was nothing of the native Egyptian about him. As a lad, he attracted the attention of the bishop, Alexander, and was taken into his household. At some period he also came under the influence of St. Antony. His first literary work, comprising the "Contra Gentes" and "De Incarnatione Verbi," two parts of what is really one treatise, may be dated with tolerable certainty before 318, since it is entirely silent on the Arian controversy. It is an amazing production for a youth barely out of his teens. It shows more of the influence of Origen and Alexandrine thought than his later works, but in asserting man's need of redemption and the meeting of that need through the Incarnation, establishes once and for all the gospel for which he battled throughout his life.

Alexander had inherited from his predecessor the disorders caused by the schismatic ordinations of Meletius (*q.v.*), bishop of Lycopolis, who had intruded himself during the persecution into the diocese. To these in 319 were added the dissensions caused by the teaching of Arius. Arius taught that the Son of God was a created being. There was a time when He did not exist. He was, indeed, the first born of all creatures and surpassed them in dignity. Through Him all other creatures were made. But He could only be called divine in a limited and secondary

sense. Arius also denied the full humanity of Christ. He held that this semi-divine being only took a body through which He acted. The Council of Nicaea were forced to employ some technical term, not in Scripture, to rule out such teaching which contradicted the sense of Scripture. Thus they added to the Creed the test word *homo-ousios* that is "of one essence" or "substance." There is nothing materialistic about it in Greek. All that it asserts is that whatever the essential being of God is, namely divinity, the Father and the Son possess it equally. They also affirmed that the Son was "of the *ousia* or 'essential being,' of the Father," that is, He was not created out of nothing, He existed eternally. The question of the full humanity of Christ came into full prominence only at a later stage. (See ARIUS.) In 321 Alexander sent out his first encyclical letter defending the deposition of Arius by an Egyptian Synod. In this it is reasonable to trace the hand of Athanasius, now a deacon and the bishop's secretary. As such, he accompanied Alexander to Nicaea. He states that he himself spoke in the council, perhaps at unofficial debates, but we must not assign to him too large a part in the proceedings. As a deacon, he was not a member of the council. But his influence was such that the Arians soon came to recognize in him their most formidable antagonist. Alexander returned to his see and, five months after concluding negotiations with the Meletians, died. He had nominated Athanasius as his successor. In June 328 he was canonically elected, in spite of opposition from Meletians and Arians. The cry of the people "Give us Athanasius, the good, one of the ascetics" attest his popularity.

For seven years he occupied his see, devoting himself to the work of his diocese and visiting the monks in the desert. He was rewarded by the solid loyalty shown to him in his later troubles. Meanwhile the reaction against Nicaea was being fostered. It was assisted by Constantine's attempt to enforce unity by persecution, against which Athanasius protested. The policy of Eusebius of Nicomedia was to attack first the Nicene leaders. Eustathius of Antioch and others were deposed on various charges. Trouble was stirred up in Egypt. The Meletians were encouraged to make common cause with the Arians. Athanasius himself was embroiled with the emperor by refusing to admit Arius to communion. A whole series of charges were brought against him, which he had no difficulty in refuting at an audience with Constantine. But the attack was not abandoned. Constantine forced him to attend a Synod at Tyre in 335, which was resolved to condemn him. A commission was sent to Egypt to collect more evidence. Meanwhile Athanasius fled and appealed to Constantine in person. The Synod deposed him, but Constantine summoned the leaders to court. A new charge was now preferred, that he had threatened to stop the export of corn from Alexandria to Constantinople. Possibly the emperor feared his great influence. If so, it must have been due to his dominating personality. The patriarch of Alexandria had not yet had time to acquire the political importance that he later enjoyed, though the development of this was doubtless forwarded by the prominence of Athanasius. More probably the emperor regarded him as intransigent, and as an obstacle to that peace in Church and State on which his heart was set. He was banished unheard to Trier.

Constantine died a year and a half later. At once Athanasius returned, ignoring, perhaps unwisely, the sentence of deposition passed at Tyre. This gave his enemies excuse for declaring the see vacant, and filling it with an Arianiser. Of the sons of Constantine, Constantine II. and Constans were on the side of the Nicenes, Constantius to whom was allotted the East was an Arianiser. After several efforts the enemies of Athanasius succeeded in installing an Arian Gregory in the see of Alexandria by force of arms, with the consent of Constantius. Athanasius fled to Rome, where in the autumn of 340 Pope Julius held a council of Western bishops which acquitted him. He followed it by a sharp remonstrance to the bishops of the East. In spite of this, at the Dedication Council of Antioch in 341 the deposition of Athanasius was confirmed. This council marks a change of policy. Not only are the Nicene leaders to be attacked, but an effort is to be made to find a new and vaguer formulary to be substituted for that of Nicaea.

In 343 a new general council was held at Sardica, at the instigation of Constans. Constantius was too embarrassed by the Persian wars to refuse. Athanasius was vindicated, but the general result was only, by emphasizing religious differences, to deepen the political breach between East and West. In 346 Constans compelled his brother Constantius to act on the decision and restore Athanasius. So began "the golden decade" of his episcopal rule. But the East was still critical of Nicaea. In 350 Constans was murdered by the troops of the usurper Magnentius, who sent officers to seek the support of Athanasius, a singular proof of his influence in Egypt. Athanasius refused to entertain such overtures, but they formed a ground of accusation against him after the defeat of Magnentius by Constantius. When in 351 Constantius became sole emperor, the Arianisers had their chance. A council at Sirmium issued a new creed, orthodox as far as it went, but in practical effect anti-Nicene. Under pressure from Constantius the West was compelled to condemn Athanasius. Synods at Arles in 353 and Milan in 355 were forced by the most violent methods to consent to his deposition. This mas clinched by the exile of his friends, including Pope Liberius. Finally, in 356 he himself was attacked by imperial troops, but escaped to the desert.

For six years he was lost to sight, but his influence was never greater. He produced a stream of anti-Arian writings, including the three orations against the Arians. He watched the anti-Nicene party fall to pieces in the hour of its triumph. At the one extreme were the Anomoeans, so called because they taught that the Son was unlike (ἀνόμοιος) the Father. This teaching was only the honest assertion of what Arius had really believed. In the middle came the Homoeans, who wished by using the vague phrase that the Son was like (ὅμοιος) the Father to evade the real issue and include as many as possible in a State Church. They were pre-eminently the court party, who were content to subordinate religion to the requirements of the State. At the other end were the so-called Semi-Arians, whose formula was *homoi-ousios,* of like essence or substance. They were for the most part really orthodox, but had scruples about the Nicene "of one substance." It must be admitted the Nicene word was of dubious meaning. The term *ousia* might mean either a particular entity, or the common element shared by a class of particulars. Thus to say that the Son was "of one *ousia*" with the Father might be held to mean they were both only modes or aspects of the one God, a heresy which is technically called Sabellianism, after Sabellius who taught it. It is probable that the heretic Paul of Samosata had used the term to assert that God was unipersonal and that the term itself had been condemned in this sense. Marcellus of Ancyra, the ally of Athanasius used it in his teaching that the Logos had no eternal personal existence. It is true that in the Creed of Nicaea the distinct existence of the Son was guarded by the further phrase "of the essence of the Father," but the hesitations of the more old-fashioned theologians of the school of Origen can be explained. The weakness of the phrase *homoi-ousios* was that it was equally unscriptural, and did not by itself safeguard the full divinity of the Son, but Athanasius was prepared to accept it as an alternative with certain additions to strengthen it and to show that it meant more than that the Son was vaguely like the Father. The popular idea that the controversy between Catholics and Arians was simply "over a diphthong" ignores the complexity of the problem and the variety of shades of opinion.

Athanasius grasped the situation. The Semi-Arians received a shock by a creed put out by the Anomoeans at Sirmium in 357, commonly called the "Blasphemy." They were out-manoeuvred by the Homoeans at the Synods of Ariminum and Seleucia in 359. Then Athanasius produced his "De Synodis" exposing the hollowness of the Homoean position and appealing to the Semi-Arians to support the *homo-ousion* as the one safeguard against Arianism. Though the appeal failed at the moment it bore fruit later.

Constantius died in 361. Julian recalled the exiles. Athanasius was able to return for eight months. He used his time well. In 362 he summoned a council at Alexandria which had results out

of all proportion to its size and advanced the cause of reunion with the Semi-Arians. As we saw, the term ousia was ambiguous. It might mean either a particular being or a common essence. The same ambiguity belonged to the term hypostasis, though it inclined to the meaning of a particular entity. In the anathemas appended to the Creed of Nicaea *ousia* and hypostasis were employed as synonyms. This increased the suspicion of the East that the term *homo-ousios* really excluded any real distinctions in the Godhead. On the other hand writers who used the term hypostasis in the sense of "Person," to mark the distinctions in the Godhead seemed to those who used it in the other sense to be speaking of three gods. Athanasius saw that the dispute was at bottom a matter of the use of terms. In the important *Tomus* ad *Antiochenos* which records the decisions of the council, both uses of hypostasis were recognized and explained, and the term *homo*-ousios was cleared of ambiguity. The way was prepared for the acceptance of the later terminology, "One *ousia*," "*Three Hypos*-tases," corresponding to the Western, "One Substance," "Three Persons."

Julian was acute enough to see in Athanasius the foremost representative of the religion that he hated. He singled him out for persecution, and, in spite of the protests of his flock, forced him to take refuge in the desert. On the accession of Jovian in 363, who treated him with great honour, he returned, but when Valens became emperor of the East in 364, and revived the policy of Constantius, Athanasius was again compelled to withdraw for his fifth exile. After a few months Valens restored him, and for the remaining seven years of his life he was left undisturbed. The welfare of the empire demanded peace in Egypt, and peace in Egypt demanded the presence of Athanasius. Outside Egypt Valens was persecuting Semi-Arians and Nicenes alike. The policy of Athanasius was succeeding. The majority of the Semi-Arians were adopting the formula of Nicaea. Athanasius died in 373, before his cause had conquered. When Valens died in 378, Arianism fell and the cause for which Athanasius had fought proved triumphant.

Athanasius was one of the greatest characters in early church history. He was in the best sense of the term a great ecclesiastic. His aim in life was the highest welfare of the Church. Thus we may see in him the first of the great protagonists of spiritual liberty against the encroachments of the State. Unlike many of his contemporaries, he was no Byzantine. He was a free Greek, with a Greek's loyalty to truth at all costs. Though he had the courage of a martyr, he never courted martyrdom. But under the new conditions that followed the so-called conversion of Constantine, he discerned the peril that threatened the life of the Church, and was prepared to defend its spiritual independence even at the cost of his own life, against the State that threatened to stifle it by its embraces as it had formerly threatened to destroy it by persecution. In the administration of his diocese he won the loyalty of his flock. Though his exegetical writings have almost entirely perished, his letters show the true pastoral spirit. His return from exile was followed by a conspicuous revival both of religion and morality. Nor is our estimate of his character seriously shaken by the papyri recently discovered, one of them a possible autograph of Athanasius. Several of them come from a Meletian source and represent him as instigating outrages by the mob on Meletians, and as tyrannical, shifty and nervous about his own safety. (See W. Idris Bell, Jews and Christians in Egypt.) Those familiar with religious partisan literature will discount much of their animosity. At most they show that Athanasius in his earlier years was at times hard and impatient to his opponents. It was the fault natural to his character, and he had much provocation. And after all he may well have felt that it was a bishop's duty to put down false doctrine and disorder.

From the religious point of view, his supreme achievement was that by his unflinching constancy to the truth, combined with his willingness to tolerate a variety of expression, by his personal holiness and devotion he saved Christianity from compromising its assertion of the two fundamental truths of the unity of God and the divinity of Christ. Arianisrn was but the working out to its logical conclusion of the tendency of much earlier theology to regard the pre-existent Logos as a separate being side by side with the Father, a second and a secondary God. That was polytheism. It is the great strength of Athanasius that he was never the mere theologian. His earliest work the *De Incarnatione* showed that he had grasped the truth that lies at the heart of the Gospel, that man needs redemption. He is not only weak and ignorant, but rebellious. His formal theology in this work may be vague and confused. For the moment he is concerned with an apology for the Christian faith as a whole, not with its details.

The Incarnation meets man's deepest needs because it brings not only illumination but redemption. Only power from outside could deliver him from sin and death. His refusal to accept the Arian Christ rested on the conviction that one who was not fully God could neither reveal God, nor impart Divine life. To worship the Arian Christ would be idolatry. If at Nicaea he supported the homo-ousios it was because there was no other phrase that ruled out the speculations that undermined the truth of redemption. Speaking generally, he has a claim to be placed in the first rank of the great religious reformers, because he recalled Christianity from the barren paths of speculation, into which it had strayed since the time of Origen, to a new sense of the reality of the Gospel. There was a danger that the church might have degenerated into a mere philosophical sect. The Logos doctrine was for him not merely an explanation of the order of the universe, but a principle of salvation. He placed at the centre of Christian life the idea of Christ as eternal Son rather than eternal Word. There is a new awareness in his writings of the underlying hostility between the world and the church. No one has suffered more than Athanasius by being judged from collections of dogmatic utterances, divorced from their context, such as are found in histories of dogma. They can only be rightly studied in conjunction with his pastoral and ascetic writings. At the same time it is wrong to depreciate Athanasius as a thinker. He is rightly styled "The Father of Greek orthodoxy." In his works, though they are all in the strictest sense of the term "occasional writings," we find laid down the lines on which later orthodoxy developed. If his theology lacks the precision and refinement of later Greek thought, it is at least open to discussion whether this may not, in many cases, be a merit rather than a defect. The so-called "Athanasian Creed" is universally admitted to be later than the time of Athanasius.

Much discussion has centred round his use of *homo-ousios*. In spite of his loyalty to Nicaea, he very rarely employs it in his own earlier writings. After his visit to Rome he is less shy of it. We saw the ambiguity of the term resulting from its use in pagan philosophy. The precise meaning that he attached to it can only be gained by a study of his writings. He explicitly disclaims any philosophical use of it. His interest is in the religion of the plain man. The Son is as divine as the Father and therefore can be worshipped without idolatry and bestow Divine life, because it is His to bestow. He was hampered by the fact that he possessed no term to express the distinction of the Persons. Though he did more than any one else to fix the later terminology, yet it is doubtful if the phrase "three *hypostases*" ever occurs in his own writings. His final service to the later theology of the Trinity was that when the question of the divinity of the Holy Spirit emerged towards the close of the Arian controversy, he asserted that the Holy Spirit was homo-ousios with the Father and the Son, and based his assertion on similar grounds. The Spirit could not sanctify, unless He were fully and truly divine. In this teaching he anticipates later theology.[1]

[1] If the above view is correct, the view first put forward by Zahn and accepted in some form by Gwatkin, Harnack and Seeburg that homo-ousios really triumphed in the end as having been silently transformed into *homoi-ousios,* is seen to start from a failure to appreciate its non-technical use by Athanasius. The theory is vigorously combated by Bethune-Baker, Texts and Studies, vol. vii., who, however, fails to recognize a certain development in the outlook of Athanasius. Duchesne's verdict The Early History of the Church (vol. ii. E.T. p. 281) is a fair statement of the case. "The Nicene term was in no way ousted. . . . But the idea which the *homoi-ousios* accentuated was admitted, under another formula—that of the three hypostaser—as a useiul and even necessary explanation of the *homo-ousios*."

So too in Christology Athanasius is the precursor of later Greek thought. The accusation that he was an Apollinarian has recently been brought against him. It is true that in his earlier writings he uses language that, if it is pressed, might be taken to support Apollinarianism.[1] But he is not using it in any technical sense. It is indeed doubtful against whom his letter to Epictetus, and his language in the De Synodis is directed, but his statements make plain that when teaching was brought to his notice that denied the possession of a human mind and soul by Christ, he immediately resisted it with vigour. It is true that he never worked out a theology of the person of Christ and that his interest was centred round His divinity rather than His humanity, but his writings were often quoted in later controversy, and are in full accord with the theology of Chalcedon.

Lastly, in the history of Christian monasticism Athanasius holds an important place. In the East as contrasted with the West monasticism developed in independence of ecclesiastical organization. Its attitude to the church was in large part that of detachment. Hence it is conceivable that in Egypt a schism might have arisen. Hence the friendship of Athanasius with Antony and Pachomius and his reputation for asceticism were of practical importance. He was the first episcopal promoter of monasticism, and was rewarded by the unfailing support of the monks in all his difficulties. He enabled the ascetic spirit to find a home in the Catholic Church. Further, his visit to Rome had an important effect on Western monasticism. Monasteries of some kind existed in Italy, but his arrival gave the first great impulse to monastic life. His life of St. Antony is addressed to the Western monks and had great influence. It is by no means accidental that the champion of the faith of Nicaea should also be the patron of monasticism. He was the enemy of pagan compromise in Christian life no less than in Christian belief.[2]

BIBLIOGRAPHY.—The primary source for the life and teaching of Athanasius is his own writings. They will be found collected in Migne, P. G. xxv–xxviii. These volumes however include much that is not genuine. *The Interpretatio in Symbolum, De Incarnatione Dei Verbi* and *Quod Unus Sit Christus* are universally recognized as Apollinarian works. The De *Trinitate* et *Spiritu Sancto* is also to be rejected. There is a growing consensus of opinion that the two books Against *Apollinarius* and the Fourth Oration against *the Arians* are not the work of Athanasius. The *De Incarnatione Dei Verbi et contra Arianos* is dubious. Several other writings are also either spurious or suspect. An English translation of the most important works together with a life of Athanasius, by Robertson, is published in the *Nicene and Post-Nicene Fathers.* This includes also the Festal Letters, extant mostly only in Syriac. There is a panegyric by Gregory Nazianzen. The ancient ecclesiastical historians add little of value. More important is the *Historia Acephala* translated in Robertson. The best modern account in English, with full references, is to be found in B. J. Kidd, History of the Church, vol. ii. It says, however, little about recent German criticism. For this *see* A. Stuelcken, "Athanasiana" in *Texte und Untersuchungen,* N.F. iv. 4; E. Schwartz Nachrichten *von* der Kgl. *Gesellschaft* der *Wissenschaften zu Göttingen,* 1904, 1905, 1908, 1911. H. M. Gwatkin's *Studies of Arianism* is still important. A full account of the writings of Athanasius will be found in Bardenhewer's *Patrology.* All histories of dogma contain an account of his doctrine, *see* especially those of Harnack, Loofs, Seeburg and Tixeront. (E. J. B.)

ATHARVA VEDA, the 4th and apocryphal Veda of the Aryans, mainly composed of incantations preserved in two recensions, a fifth of it reproduces spells from the *Rig Veda.* For a long period it was not accepted as a canonical Veda.

[1]The charge of Apollinarianism is in part due to the growing conviction that the two Letters against Apollinarianism are not the work of Athanasius. The best statement of the case against his orthodoxy is in Raven's Apollinarianism. But the unfairness of his criticism is rightly censured by P. E. More in Christ the Word, pp. 208 ff. His ally Eustathius of Antioch, explicitly defended the fullness of Christ's human nature. And the disciples of Apollinarius were in no doubt about relation of Athanasius to their master on this point. See Lietzmann, Apollinarius von Laodicea, p. 276. A full discussion of the Christology of Athanasius will be found in E. Weigl, "Untersuchenden zur Christologie des heiligen Athanasius." Forschungen *zur* Christlichen Literatur- *und Dogmengeschichte* vol. xii., though he fails to distinguish between his genuine and spurious writings.

[2]*See* Hannay, *The Spirit and Origin of Christian Monasticism;* von der Goltz, in *Texte* und *Untersuchungen,* vol. xiv. N.F. who vindicates the authenticity of the De Virginitate and shows its importance for the understanding of Athanasius.

See R. C. Dutt, Civilisation of Ancient India (London, 1893); Farquhar, *Outline* of the Religious Literature of India (London, 1920).

ATHEISM is a term of varying application and significance (Gr. ἄθεος, "denying God," "godless," hence disbelief in or denial of God). Its meaning is dependent upon the particular type of "Theism" with which at the moment it is being contrasted.

Yet, as we should expect, there is some connecting link binding these various meanings together; and, for the most part, the connection is pretty easily shown. It is no mere accident that the same word "God" is used of the gods of Polytheism; of the god of Aristotle's *Metaphysics* (the unmoved hfover — not Creator— of the eternal heavens; a Being living, eternal, good; Who is Himself His own sole object of knowledge; Who produces motion passively by being loved, *Met.* 1072^a–3^a; 1074^b–5^a; cf. *Dante,* Paradiso xxiv., 130–2); of the Persons of the Christian Trinity; of the impersonal Absolute of modern philosophy (which unites within it all reality and all values). It is in the conception of "goodness" that the connecting link is found. Religion may in its origin be something very different from morality. It may be true (see R. Otto's The Idea of the Holy, Eng. trans., pp. 6, 14, 15) that "religious awe" "first begins to stir in the feeling of something uncanny, eerie or weird"; and the lines between "fear," "dread," "awe" and "reverence" may be hard to draw. Yet it dawns early upon the religious mind that the only worthy object of dread is that which is entitled to moral reverence (Isa. VIII. 13). The atheist therefore is conceived as the man who denies or despises what he ought not only to fear but to respect. It is intelligible, then, that the early Christians should be called "atheists" by their persecutors. The Christians denied, after all, many more gods than they acknowledged. The Pagan was morally offended at this wholesale rejection of familiar loyalties. It is equally intelligible that the Christians should retort the phrase (Martyrium *S.* Polycarpi, c. iii c. ix) on those who "blasphemed that worthy name by which they were called." For behind this sharp division of opinion lay a very real community of moral standard. Paganism had enough connection with morality to make it quite natural that Plato (*Politicus* 308 E) should speak of "godlessness" side by side with "insolence" and "injustice," and should contrast it with what leads to virtue (*cf.* Sophocles *Oed. Rex.,* 861; Xenophon *Mem.,* IV, 4).

Thus the profound saying of Feuerbach—"He alone is the true atheist to whom the *predicates* of the Divine Being, for example, love, wisdom and justice, are nothing; not he to whom merely the subject of these predicates is nothing" (Essence of Christianity trans., Evans, p. 21)—only brings to light what is implicit in the common usage. It is the explicit recognition of this truth which is characteristically modern. We are disposed to recognize today that a truly religious frame of mind (as the Kantian "awe of duty," such a "reverence" for the moral law as makes Kant "humble himself" before it) and further even an attitude of worship towards Christ, (as is implied when Baudelaire speaks of Jesus as Des *Dieux le plus* incontestable: *Les Fleurs* du *Mal* cxxviii), are compatible with a denial, or at least a doubt, of the ordinary theistic beliefs.

Yet even though we take Feuerbach's saying as giving the key to the true meaning of "Atheism" and so regard religion even in its humbler forms as a craving for the good (Odyssey III, 48), we must recognize that, side by side with the reverence for the Good as an Ideal—for the Divine "predicates"—there grows up in religion a belief in the realization of this ideal in the Universe, and commonly in its realization in a personal Being. So closely are these two elements connected that for many minds the rejection of the latter seems equivalent to a rejection of the former. In order to avoid this, and similar confusions, we must continue to recognize a variety of meanings for our term.

Thus Atheism might be defined (1) as a denial that there is any one supreme object of reverence; (2) as a denial that this object of reverence is also the all-inclusive reality ("Belief in a finite God," it has been said, "is not Theism"); (3) as a denial that there is any one all-inclusive reality at all. (For Hegel the atheist is the "pluralist" who acknowledges no ultimate unity. Spinoza, he says, is no atheist but an "acosmist." Of Hegel's principle, that "the Truth is the Whole" yet is also "essentially a result" to which the earlier stages of its development are vital, it is only the second half with which Spinoza seems to Hegel to be out of sympathy. See Logic of *Hegel,* Wallace's trans., pp. 275, 105, 106; Phenomenology, Baillie's trans, p. 17); (4) as a denial that the power which rules the world is worthy of our trust; (5) as a denial that this power is a Being with whom we may hold personal communion. (See C. C. J. Webb's *Gifford* Lectures.) Many modern philosophies might be described as atheistic in one or other of these senses; comparatively few as atheistic in all (*See* THEISM; PANTHEISM; TRINITY; ABSOLUTE). (C. J. SH.)

ATHEL, the name given to the tree *Tamarix aphylla* (*T. articulata*) of the Tamaricaceae. Originally a native of north-

eastern Africa and western Asia, it has since become naturalized in several other parts of the world. It was introduced into arid regions of southwestern United States where it became well established. The tree, which resembles certain conifers, will occasionally attain a height of 60 ft. and is readily distinguished by its jointed twigs with minute, ensheathing leaves and small sessile flowers borne in terminal panicles. J. S. Gamble records in his A *Manual* of Indian Timbers that the wood is used for many purposes including ploughs, ornaments, Persian uheels, fuel and charcoal. The bark is rich in tannin. Reproduction is accomplished equally as well by seeds, cuttings, or coppice. (E. S. Hr.)

ATHELM (d. 923), English churchman, is said to have been a monk of Glastonbury before his elevation in 909 to the see of Wells, of which he was the first occupant. In 914 he became archbishop of Canterbury.

ATHELNEY, a slight eminence of small extent in the low level tract about the junction of the rivers Tone and Parrett in Somersetshire, England. It was formerly isolated by marshes and accessible only by boat or artificial causeway, and under these conditions it gained its historical fame as the retreat of King Alfred in 878–879, when he was unable to withstand the incursion of the Danes. After regaining his throne he founded a monastery here in gratitude for the retreat afforded him by the island; no traces of it exist above ground, but remains have been excavated. There was also found here, in 1693, the celebrated Alfred jewel, bearing his name, and preserved in the Ashmolean museum at Oxford. An inscribed pillar commemorating the king was set up in 1801. The name of Athelney signifies the Isle of Princes (Ang. Sax. Aethelingaea). Athelney is a railway station on a branch of the Great Western railway.

ATHENA, the Attic (and Latin) form of the Homeric Athene, also called Pallas Athene, or simply Pallas, one of the most important goddesses in Greek mythology. No satisfactory derivation of the name Athena has been given; the name Pallas has been connected with the Greek *pallakē* ("maiden"). According to the legend, her father Zeus swallowed his wife Metis ("counsel") when she was pregnant with Athena, since he had been warned that his children by her might prove stronger than himself and dethrone him. Hephaestus (or Prometheus) subsequently split open his head with a hatchet, and Athena sprang forth fully armed. (Hesiod, Theogony, 886; Pindar, *Olymp.*, vii. 35.) According to Roscher, the manner of her birth represents the storm-cloud split by lightning; Farnell sees in it an indication that, as the daughter of Metis, Athena was already invested with a mental and moral character. It is probable that her epithet, *Tritogeneia,* originated in Boeotia, whence it was conveyed by colonists to Cyrene and thence to Libya, where there was a river Triton. Here some local divinity, connected with the water and also of a warlike character, was identified by the colonists with their own Athena. The legend of her birth was also associated with several other rivers and lakes of the same name. In any case, it is fairly certain that Tritogeneia means "water-born," although an old interpretation derived it from trifo, a supposed Boeotian word meaning "head."

In Homer Athena already appears as the goddess of .counsel, of war, of female arts and industries, and the protectress of Greek cities. Hence she is called Polias, *Poliouchos,* in many Greek states, and is frequently associated with *Zeus Polieus.* The most celebrated festival of the city-goddess was the Panathenaea at Athens and other places, and as *Panachais* she was protectress of the Achaean League (*q.v.*). At Athens she presided over the phratries or clans, and was known as *Apatouria* and *Phratria,* and sacrifice was offered to her at the festival Apaturia (*q.v.*). Her images, called Palladia (see Palladium), which guarded the heights, represented her with shield uplifted, brandishing her spear to keep off the foe. The cult of Athenia Itonia, whose earliest seat appears to have been among the Thessalians. made its way to Coronea in Boeotia, where her sanctuary was the seat of the Pan-Boeotian confederacy. Peculiar to Arcadia is the title Athena Alea, probably = "warder off of evil," although others explain it as = "warmth," and see in it an allusion to her physical nature as one of the powers of light. Farnell points out that she is certainly looked upon also as being in some way connected with the health-divinities, since in her temple she is grouped with Asclepius and Hygieia (see Hygieia).

She already appears as the goddess of counsel in the Iliad and in Hesiod. The Attic *bouleutai* took the oath by Xthena *Boulaia;* st Sparta she was Agoraia, presiding over the popular assemblies in the market-place; in Arcadia *Mēchanītis,* the discoverer of devices. Her connexion with the trial of Orestes (*q.v.*), the introduction of a milder form of punishment for justifiable homicide, and the institution of the court "at the Palladium" (Sanctuary of Pallas), show the important part played by her in the development of legal ideas.

The protectress of cities was naturally also a goddess of war. As such she appears in Homer and Hesiod and in post-Homeric legend as the slayer of the Gorgon and taking part in the battle of the giants. On numerous monuments she is represented as *Areia,* "the warlike," *Nikēphoros,* "bringer of victory," holding an image of Nikē (*q.v.*) in her outstretched hand. Martial music and the Pyrrhic dance, in which she herself is said to have taken part to commemorate the victory over the giants, and the building of warships were attributed to her. The epithets *Hippia, Chalinītis* ("the bridler"), and *Damasippos* ("horse-taming") usually referred to her as goddess of war-horses, may perhaps be reminiscences of an older religion in which the horse was sacred to her. As a war-goddess, she is the embodiment of prudent and intelligent tactics, entirely different from Ares (*q.v.*), the personification of brute force and rashness.

The goddess of war develops into the goddess of peace and the pursuits connected with it. She is prominent as the promoter of agriculture in Attic legend. The Athenian hero Erechtheus (Erichthonios), originally an earth-god, is her foster-son, with whom she was honoured in the Erechtheum on the Acropolis. Her oldest priestesses, the dew-sisters—Aglauros, *Herse,* Pandrosos—signify the fertilization of the earth by the dew and were probably at one time identified with Athena, who was also known as *Aglauros* and *Pandrosos.* Athena also gave the Athenians the olive-tree, which was supposed to have sprung from the bare soil of the Acropolis, when smitten by her spear, close to the horse (or spring of water) produced by the trident of Poseidon, to which he appealed in support of his claim to the lordship of Athens. She is also connected with Poseidon in the legend of Erechtheus, not as being in any way akin to the former in nature or character, but as indicating the contest between an old and a new religion. This god, whose worship was introduced into Athens at a later date by the Ionian immigrants, was identified with Erechtheus-Erichthonios, and thus was brought into connexion with the goddess, in order to effect a reconciliation of the two cults. Athena was said to have invented the plough, and to have taught men to tame horses and yoke oxen. Various arts were attributed to her—shipbuilding, the goldsmith's craft, fulling, shoemaking and other branches of industry. As early as Homer, she takes especial interest in the occupations of women, she makes Hera's and her own *peplos* (robe), and spinning and weaving are often called "the works of Athena." The custom of offering a beautifully woven *peplos* at the Panathenaic festival is connected with her character as *Ergane,* the goddess of industry. As patroness of the arts, she is associated with Hephaestus and Prometheus, and in Boeotia she was regarded as the inventress of the flute.

As in the case of Aphrodite and Apollo, Roscher deduces all the characteristics of Athena from a single conception—that of the goddess of the storm or the thunder-cloud. There seems, however, little reason for regarding her as a nature-goddess at all, but rather as the presiding divinity of states and cities, of the arts and industries—in short, as the goddess of the whole intellectual side of human life.

Little is known of the ceremonies or festivals which attended her worship, except those at Athens, where the following, among others, were celebrated: (1) the *Skirophoria,* with a procession from the Acropolis to the village of Skiron, in the height of summer, the priests who were to entreat her to keep off the

summer heat walking under a sunshade *(Skiron)* held over them; (2) The *Chalkeia* ("feast of smiths"), at which the birth of Erechtheus and the invention of the plough were celebrated; (3) The *Pluntēria* and *Kalluntēria* (feasts of washing and adorning), at which her ancient wooden image and *peplos* in the Erechtheum and the temple itself were cleaned, with a procession in which bunches of figs (frequently used in lustrations) were carried; (4) *Arrhēphoria,* or *Errēphoria,* perhaps = *Hersēphoria,* "dew-bearing," at which two maidens of noble birth, between seven and 11 years of age, carried certain unknown sacred objects from the temple of Athena on the Acropolis to that of Aphrodite "in the gardens," and returned with certain other objects to the Acropolis. Two other maidens began the weaving of the new *peplos* for the statue of Athena Polias, which was presented to the goddess every year; (5) the *Panathenaea* (*q.v.*) at which the new robes for the image of the goddess were carried through the city, spread like a sail on a mast; (6) Mention should also be made of the Argive ceremony, at which the *xoanon* (ancient wooden statue) of Athena was washed in the river Inachus, a symbol of her purification after the battle with the giants.

The usual attributes of Athena were the helmet, the aegis (*q.v.*), the round shield with the head of Medusa in the centre, the lance, an olive branch, the owl, the cock and the snake. Of these the aegis is probably intended as a battle-charm, like the Gorgon's head on the shield and the faces on the shields of Chinese soldiers; the owl probably represents the form under which she was worshipped in primitive times, and subsequently became her favourite bird (the epithet *Glaukōpis,* meaning "keen-eyed" in Homer, may have originally signified "owl-faced"); the snake, a common companion of the earth-deities, probably refers to her connexion with Erechtheus-Erichthonios. As to artistic representations of the goddess, we have first the rude figure which seems to be a copy of the Palladium; secondly, the still rude but otherwise more interesting figures of her on the early painted vases; and thirdly, the type of her as produced by Pheidias, from which little variation appears to have been made. Of his numerous statues of her, the three most celebrated were set up on the Acropolis. (1) Athena *Parthenos,* in the Parthenon. It was in ivory and gold, and 30 ft. high. She was represented standing, in a long tunic; on her head was a helmet, ornamented with sphinxes and griffins; on her breast was the aegis, fringed with serpents and the Gorgon's head in centre. In her right hand was a Nikē or winged victory, while her left held a spear, which rested on a shield on which were represented the battles of the Amazons with the giants; (2) A colossal statue said to have been formed from the spoils taken at Marathon, the so-called Athena *Promachos;* (3) Athena *Lemnia,* so called because it had been dedicated by the Athenian cleruchies in Lemnos. In this she was represented without arms, as a brilliant type of virgin beauty. The two last statues were of bronze. From the time of Pheidias calm earnestness, self-conscious might, and clearness of intellect, were the main characteristics of the goddess. The eyes, slightly cast down, betoken an attitude of thoughtfulness; the forehead is clear and open; the mouth indicates firmness and resolution. The whole suggests a masculine rather than a feminine form.

From Greece the worship of Athena extended to Magna Graecia, where a number of temples were erected to her in various places. In Italy proper she was identified with Minerva (*q.v.*).

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ATHENAEUM, a name originally applied in ancient Greece to buildings dedicated to Athena, and specially used as the designation of a temple in Athens, where poets and men of learning were accustomed to meet and read their productions. The academy for the promotion of learning which the emperor Hadrian built (about *A.D.* 135) at Rome, near the Forum, was also called the Athenaeum. Poets and orators still met and discussed there, but regular courses of instruction were given by a staff of professors in rhetoric, jurisprudence, grammar and philosophy. The institution, later called Schola Romana, continued in high repute till the 5th century. Similar academies were founded in the provinces and at Constantinople by the emperor Theodosius II. In modern times the name has been applied to various academies, as those of Lyons and Marseilles and the Dutch high schools; and it has become a very general designation for literary and scientific clubs, the most famous club of the name being that which was founded in London by Sir Walter Scott and Thomas Moore in 1824. It is also familiar as the title of several literary periodicals, notably of the London literary weekly founded in 1828 by James Silk Buckingham and successfully established by C. W. Dilke. The *Athenaeum* was absorbed by the *Nation* in 1921.

ATHENAEUS, of Naucratis in Egypt, Greek rhetorician and grammarian flourished about the end of the 2nd and the beginning of the 3rd century *A.D.* Suidas only tells us that he lived "in the times of Marcus"; but the contempt with which he speaks of Commodus (died 192) shows that he survived that emperor. Athenaeus himself states that he was the author of a treatise on the *thratta* — *a* kind of fish mentioned by Archippus and other comic poets — and of a history of the Syrian kings, both of which works are lost. We still possess the *Deipnosophistae* ("dinner-table philosophers" or "authorities on banquets") in 15 books. The first two books, and parts of the 3rd, 11th and 15th, are extant only in epitome, but otherwise we seem to possess the work entire.

It is an immense store-house of miscellaneous information, chiefly on matters connected with the table, but also containing remarks on music, songs, dances, games, courtesans. It is full of quotations from writers whose works have not come down to us. It professes to be an account given by the author to his friend Timocrates of a banquet held at the house of Laurentius (or Larentius) a scholar and wealthy patron of art. It is thus a dialogue within a dialogue. The conversation ranges from the dishes before the guests to literary matters of every description, including points of grammar and criticism; and they are expected to bring with them extracts from the poets, which are read aloud and discussed at table. The plan is clumsy, but as a repertory of fragments and morsels of information the work is invaluable for Athenaeus refers to nearly 800 writers.

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ATHENAGORAS, a Christian apologist of the 2nd century *A.D.,* was, according to an emendator of the Paris Codex 451 of the 11th century, a native of Athens. The only sources of information regarding him are a short notice by Philip of Side, in Pamphylia *(c.* 420 *A.D.),* and the inscription on his principal work, the *Apology.* The inscription describes the *Apology* as the "Embassy of Athenagoras, the Athenian, a philosopher and a Christian, concerning the Christians, to the Emperors Marcus Aurelius Antoninus and Lucius Aurelius Commodus, etc." The date of the *Apology* (Πρεσβεία περὶ Χριστιανῶν) may be fixed at about 177 *A.D.* Athenagoras also wrote a discourse on the resurrection of the body, which is not authenticated otherwise than by the titles on the various manuscripts. In the *Apology,* he refutes the accusations brought against the Christians of atheism, eating human flesh and licentiousness. The discourse on the resurrection attempts to prove the truth of the doctrine from consideration of God's purpose in the creation of man, His justice and the nature of man himself. Athenagoras is a powerful and clear writer, who strives to comprehend his opponents' views and is acquainted with the classical writers. He used the *Apology* of

Justin, but hardly the works of Aristeides or Tatian. His theology is strongly tinged with Platonism.

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Translations: Humphreys (1714); B. **P.** Pratten (*Ante-Nic.* Fathers, Edinburgh, **1867**); P. A. Eberhard (Miinchen, 1913).

Literature: **A.** Harnack, Gesch. der altchr. Litt., pp. 526–58, and similar works by O. Bardenhewer and A. Ehrhard; Herzog-Hauck, Realencyk.; G. Kriiger, Early Chr. Lit., p. 130 (where additional literature is cited). In 1559 and **1612** appeared in French a work on True and Perfect Love, purporting to be a translation from the Greek of Athenagoras; it is a palpable forgery.

ATHENODORUS, the name of two Stoic philosophers of the 1st century B.C., who have frequently been confounded.

(1) ATHENODORUS CANANITES (*c.* 74 B.C.–A.D. 7), so called from his birthplace Canana, near Tarsus, was a friend of Strabo, from whom we derive our knowledge of his life. (See also Cic. Ep. ad. *Att.*, xvi. ii. 4, 14, 4.) He taught the young Octavian (afterwards Augustus) at Apollonia, and was a pupil of Poseidonius at Rhodes. Subsequently he appears to have lectured in the great cities of the Mediterranean. His influence over Augustus was strong and lasting. He followed him to Rome in 44. In later years he was allowed by Augustus to return to Tarsus in order to remodel the constitution of the city. He succeeded (c. 15–10 B.C.) in setting up a timocracy in the imperial interest. Sir W. M. Ramsay is inclined to attribute to the influence of Athenodorus the striking resemblances which can be established between Seneca and Paul, the latter of whom must certainly have been acquainted with his teachings. According to Eusebius and Strabo he was a learned scientist for his day. He helped Cicero in the composition of the De *Officiis.* His works are not certainly known, and none are extant. (See Sir W. M. Ramsay in the *Expositor*, Sept. 1906, p. 268 seq.)

(2) ATHENODORUS CORDYLION, also of Tarsus, was keeper of the library at Pergamum, and was an old man in 47 B.C. He settled in Rome, where he died in the house of the younger Cato.

Among others of the name may be mentioned:

(3) ATHENODORUS OF TEOS, who played the cithara at the wedding of Alexander the Great and Statira at Susa (324 B.C.); (4) a Greek physician of the 1st century A.D., who wrote on epidemic diseases; and two sculptors of whom (5) one executed the statues of Apollo and Zeus which the Spartans dedicated at Delphi after Aegospotami; and (6j the other was a son of Alexander of Rhodes, whom he helped in the Laocoon group.

ATHENRY, county Galway, Eire, 14 mi. inland from Galway on the Great Southern railway. Pop. (1936) 1,048. Its name is derived from the *Ath-na-riogh,* the ford of kings; and it grew to importance after the Anglo-Norman invasion as the first town of the Burgs and Berminghams. There are remains of walls erected in 1211 and a castle of 1238. A Dominican monastery was founded by Myler de Bermingham in 1241, and repaired by the Board of Works in 1893. Of the Franciscan monastery of 1464 little is left. The town returned two members to the Irish parliament from the time of Richard II. to the Union; but it never recovered from the wars of the Tudor period, culminating in a successful siege by Red Hugh O'Donnell in 1596.

ATHENS, the capital of the republic of Greece (Ἀθῆναι, *Athenae,* modern colloquial Greek Ἀθήνα), situated in 23° 44' E. and 37° 58' N., towards the southern end of the central and principal plain of Attica. There are various theories with regard to the origin of the name. It is now held that it is derived from the patron goddess Athene, whose name, like others ending in *-ηνη,* is thought to be pre-Hellenic.

I. TOPOGRAPHY AND ANTIQUITIES

The Attic plain, τὸ πεδίον, slopes gentiy towards the coast of the Saronic gulf on the south-west; on the east it is overlooked by Mt. Hymettus (3,370 ft.); on the northeast by Pentelicus (3,640 ft.) from which, in ancient and modern times, an immense quantity of the finest marble has been quarried; on the northwest by Parnes (4.600 ft.), and on the west by Aegaleus (1,534 ft.), which descends abruptly to the bay of Salamis. In the centre a ridge, perhaps the ancient Anchesmus, but now known as Turcovuni, runs from north-east to south-west and culminates in the sharply pointed Lycabettus (1,112ft.), now called Hagios Georgios from the monastery which crowns its summit. Lycabettus, the most prominent feature in the Athenian landscape, directly overhung the ancient city, but was not included in its walls. This range separates the valleys of the Cephissus and Ilissus. The former, rising in Pentelicus to the north-west, enters the sea at Phalerum, but in summer dwindles to an insignificant stream. The latter, coming from Hymettus, skirts the city on the south-west and is now usually dry owing to denudation caused by the destruction of the forests. This desiccation of Attica was first noticed by Plato. Separated from Lycabettus by a depression to the south-west, through which flows a brook, now a covered drain (probably the Eridanus), stands the remarkable oblong rocky mass of the Acropolis (512ft.), rising precipitously on all sides except the western; close to it on the west is the lower rock of the Areopagus, Ἄρειος πάγος (370 ft.), the seat of the famous council; the name (see also AREOPAGUS) has been connected with Ares, but is more probably derived from the Ἀραί or Eumenides. Farther west are three elevations; to the north-west the so-called "hill of the Nymphs" (341 ft.), on which the modern observatory stands; to the west the Pnyx (351 ft.), and to the south-west the loftier Museum hill (482 ft.). A cavity to the west of the observatory is supposed to be the ancient Barathron or place of execution. The distance from the Acropolis to the nearest point of the sea coast at Phalerum is a little over three miles.

Influence of the Geographical Position.— The situation of Athens naturally favours the growth of a powerful community. For the first requisites of a primitive settlement — food supply and defense — it afforded every advantage. The Attic plain, notwithstanding the lightness of the soil, furnished an adequate supply of cereals; olive and fig groves and vineyards were cultivated from the earliest times, and pasturage for sheep and goats was abundant. The surrounding mountains are broken towards the north-east by an opening between Hymettus and Pentelicus towards Marathon, and are traversed by the passes of Deceleia, Phylē and Daphne on the north and north-west, but the distance between these and the city was sufficient to obviate the danger of surprise by an invading land force. On the other hand Athens, like Corinth, Megara and Argos, was sufficiently far from the sea to enjoy security against the sudden descent of a hostile fleet. Yet the three natural harbours, Peiraeeus, Zea and Munychia, favoured maritime commerce and the sea power which formed the basis of Athenian hegemony. The climate is temperate, but liable to sudden changes; the mean temperature is 63°·1 F, the maximum (in July) 99°·01, the minimum (in January) 31°·55. The summer heat is moderated by the sea-breeze or by cool northerly winds from the mountains (especially in July and August). The clear, bracing air, according to ancient writers, fostered the intellectual and aesthetic character of the people and endowed them with mental and physical energy. For the architectural adornment of the city the finest building material was procurable in abundance; Pentelicus forms a mass of white, blue-veined marble; another variety, somewhat similar in appearance, but generally of a bluer hue, was obtained from Hymettus. For ordinary purposes grey limestone from Lycabettus and the adjoining hills, limestone from the promontory of Actē (the so-called "poros" stone), and conglomerate were largely employed. For the ceramic art admirable material was at hand in the district north-west of the Acropolis. The water supply then, as now, being insufficient for a large and growing city, was supplemented by an aqueduct constructed in the time of the Peisistratids and by others of the Roman period. A great number of wells were also sunk and rain-water was stored in cisterns.

Sources for Athenian Topography.— For the purposes of scientific topography observation of the natural features is followed by exact investigation of the architectural remains, a process demanding high technical competence, acute judgment and practical experience, as well as wide and accurate scholarship. The building material furnishes evidence no less important than the character of the masonry, the design and the modes of ornamentation. The testimony afforded by inscriptions is often of

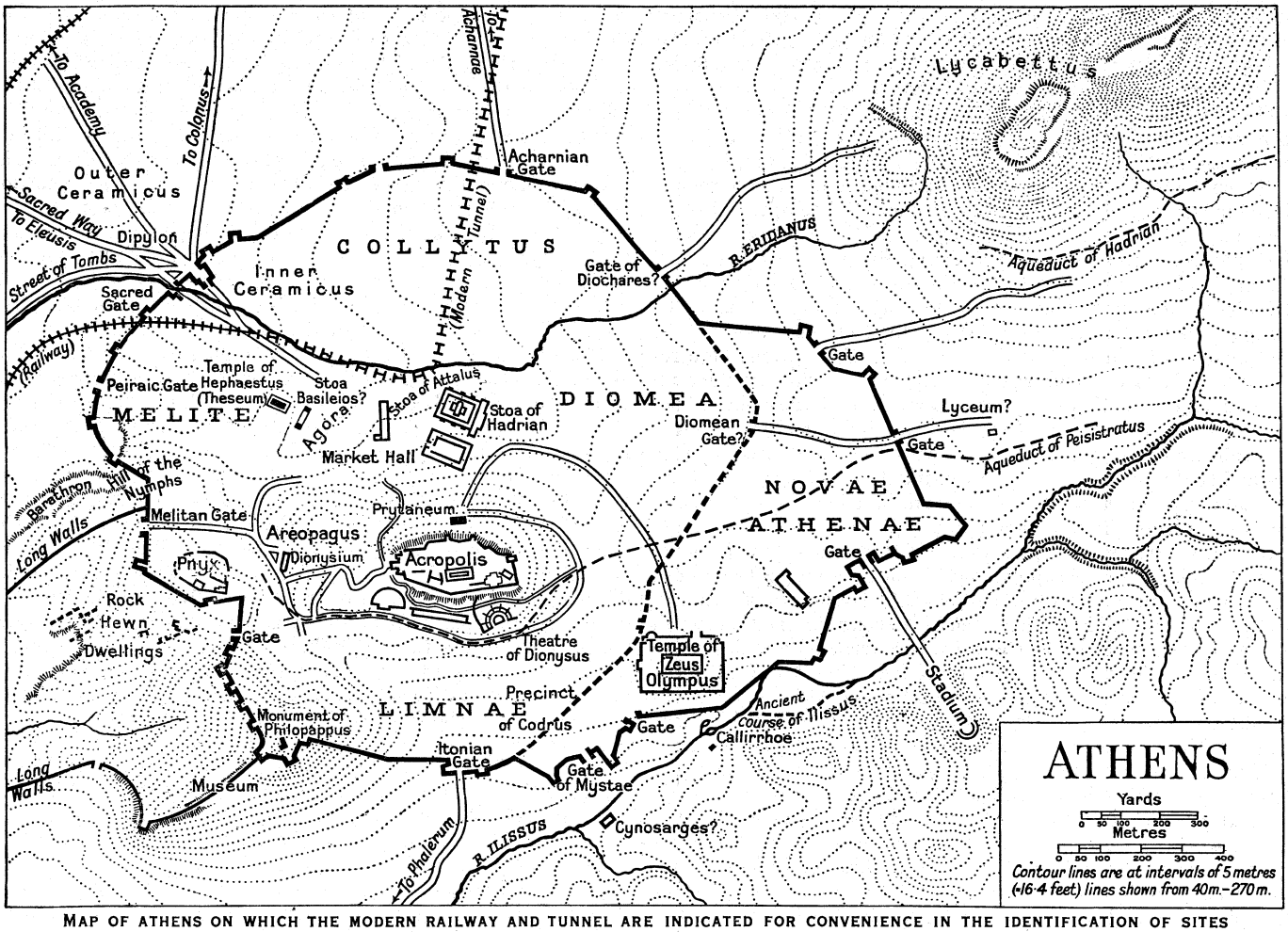
decisive importance. Next comes the evidence derived from ancient literature and specially from descriptions of the city or its different localities. The earliest known description of Athens was that of Diodorus, ὁ περιηγητής, who lived in the second half of the 4th century B.C. Among his successors were Polemon of Ilium (beginning of 2nd century B.C.) whose great κοσμικὴ περιήγησις gave a minute account of the votive offerings on the Acropolis and the tombs on the Sacred Way; and Heliodorus (second half of the 2nd century), who wrote 15 volumes on the monuments of Athens. Of these and other works of the earliest topographers only some fragments remain. In the period between A.D. 143 and 159 Pausaniss visited Athens at a time when the monuments of the great age were still in their perfection and the principal embellishments of the Roman period had already been completed. The first 30 chapters of his invaluable *Description* of *Greece* (περιήγησις τῆς Ἑλλάδος) are devoted to Athens, its ports and environs. His account, drawn up from notes taken in the main from personal observation, possesses an especial importance for topographical research, owing to his method of describing each object in the order in which he saw it during the course of his walks. His accuracy, which has been called in question by some scholars, has been remarkably vindicated by recent excavations at Athens and elsewhere. The literature of succeeding centuries furnishes only isolated references; the more important are found in the scholia on Aristophanes, the lexicons of Hesychius, Photius and others, and the *Etymologicum Magnum.* The notices of Athens during the earlier middle ages are scanty in the extreme. In 1395 Niccolo da Martoni, a pilgrim from the Holy Land, visited Athens and wrote a description of a portion of the city. Of the work of Cyriac of Ancona, written about 1450, only some fragments remain. which are well supplemented by the contemporaneous description of the capable observer known as the "Anonymus of Milan." Two treatises in Greek by unknown writers belong to the same period The Dutchman Johannes Meursius (1579–1639) wrote three disquisitions on Athenian topography. The conquest by Venice in 1687 led to the publication of several works in that city, including the descriptions of De La Rue and Fanelli and the maps of Coronelli and others. The systematic study of Athenian topography was begun in the 17th century by French residents at Athens, the consuls Giraud and Chataignier and the Capuchin monks. The visit of the French physician Jacques Spon and the Englishman, Sir George Wheler or Wheeler (16jo–1723), fortunately took place before the catastrophe of the Parthenon in 1687; Spon's *Voyage d'Italie, de Dalmatie, de Grèce et du Levant,* which contained the first scientific description of the ruins of Athens, appeared in 1678; Wheler's *Journey into Greece,* in 1682. A period of British activity in research followed in the 18th century. The monumental work of James Stuart and Nicholas Revett, who spent three years at Athens (1751–54), marked an epoch in Athenian topography and is still indispensable, owing to the demolition of ancient buildings which began about the middle of the 18th century. To this period also belong the labours of Richard Pococke and Richard Dalton, Richard Chandler, E. D. Clarke and Edward Dodwell. The great work of W. M. Leake (*Topography* of *Athens and the Demi,* 2nd ed., 1841) brought the descriptive literature to an end and inaugurated the period of modern scientific research.

Recent Research. — Recent investigation has thrown a new and unexpected light on the art, the monuments and the topography of the ancient city. Numerous and costly excavations have been carried out by the Greek Government and by native societies, and the six foreign archaeological schools, while accidental discoveries have been frequently made during the building of the modern town. The native archaeologists of the present day hold a recognized position in the scientific world; the patriotic sentiment of former times, which prompted their zeal but occasionally warped their judgment, has been merged in devotion to science for its own sake, and the supervision of excavations, as well as the control of the art-collections, is now in highly competent hands. The supreme importance of a study of Greek antiquities on the spot, long understood by scholars in Europe and in America, has gradually come to be recognized in England, where a close attention to ancient texts, not always adequately supplemented by a course of local study and observation, formerly fostered a peculiarly conservative attitude in regard to the problems of Greek archaeology. Since the foundation of the German Institute in 1874, Athenian topography has to a large extent become a specialty of German scholars, among whom Wilhelm Dorpfeld is distinguished by his architectural attainments and local knowledge. In recent years he has been succeeded by the American B. H. Hill, who has won fame by his researches on the Acropolis.

Prehistoric Athens. — The Acropolis is so well defended by nature and so accessible to the means of life and to the springs at its foot that it was occupied by man from the earliest times. Remains of the neolithic period similar to those from Thessaly and the Greek mainland have been found, and they are succeeded by plentiful traces of bronze age inhabitation. The first and second periods are represented, and in the third the rock was fortified like the citadels of Mycenae and Tiryns. A cyclopean wall runs round the natural edges of the rock and is best preserved at the south-west end behind the temple of *Nike* and at the north-east angle by the Erechtheum. Here there seems to have been an entrance leading perhaps to a "palace" of which traces are seen in two "Mycenaean" column bases in the foundations of the old Athena temple. Other walls assigned to the same date and many fragments of pottery, especially of the last phase of the bronze age, show that Athens, even in prehistoric times, was not insignificant. This is borne out by the Homeric reference to the "strong house of Erechtheus" (Od. vii. 81) and by the numerous traces of the same period throughout Attica. (*See* AEGEAN CIVILIZATION.) Remains of the early iron age are common on the Acropolis and also of the "Dipylon" or "Geometric" period which help to demonstrate that that phase of art was not suddenly introduced by invaders such as the Dorians, who never settled in Attica, but was merely one stage in the evolution of Greek culture, though probably affected by some external influence.

The **Pelasgicum.**—The early fortifications of the Acropolis, sometimes ascribed to the primitive non-Hellenic Pelasgi, must be distinguished from the Pelasgicum or Pelargicum, which was probably a wall, built around the base of the citadel and furnished with nine gates from which it derived the name of *Enneapulon.* Such a wall would protect the clusters of d ellings around the Acropolis as well as its springs, while the gates opening in various directions would give access to the surrounding country. This view, that of E. Curtius, alone harmonizes with the statement of Herodotus (vi. 137) that the wall was "around" (περί) the Acropolis, and that of Thucydides (ii. 17) that it was "beneath" (ὑπό) the fortress. Thus the citadel would have had an outer and an inner line of defense. The space enclosed by the outer wall was left unoccupied after the Persian wars in deference to an oracle. A portion of the outer wall has been recognized in a piece of primitive masonry discovered near the Odeum oi Atticus Herodes. Dorpfeld believes it to have extended from the grotto of Pan to the sacred precinct of Asclepius. It enclosed the spring Clepsydra, beneath the north-western corner of the Acropolis which is approached by a rock-cut staircase, and was once more included in the fortress during the War of Independence by the Greek chief Odysseus.

The **Pnyx.**—On the north-eastern slope of the Pnyx is an immense double terrace (395ft. by 212ft.), the upper part cut in the rock, the lower supported by a semicircular retaining wall of massive masonry. This has been thought to be prehistoric, but excavation has shown that it cannot be older than the 4th century, though there are traces of a yet older wall. The whole area seems to have formed a sanctuary, possibly of Zeus, but there is no reason to reject the opinion that this was the meeting-place of the Athenian assembly. The semicircular retaining wall was probably much higher and supported a large theatre-like structure which sloped down towards the rock-cut terrace. Here a cube of rock (11ft. square, jft. high) projects from the centre of the chord of the semicircle and is approached on each side by a flight of steps. This, which Curtius supposes to have been the primitive altar of Zeus Ὕψιστος may be safely identified with the orators' bema, ὁ λίθος ἐν τῇ Πυκνί (Aristoph. *Pax.* 680). Other cubes of



MAP OF ATHENS ON WHICH THE MODERN RAILWAY AND TUNNEL ARE INDICATED FOR CONVENIENCE IN THE IDENTIFICATION OF SITES

rock, apparently altars, exist in the neighbourhood. The Pnyx was clearly the seat of an ancient cult; the meetings of the Ecclesia were of a religious character and were preceded by a sacrifice to Zeus Ἀγοραῖος.

The Pnyx, the hill of the Nymphs and the Museum hill are covered with vestiges of supposed early settlements which extend towards the south-east in the direction of Phalerum. They consist of chambers, some of which were human habitations, cisterns, channels, seats, steps, terraces and tombs, all cut in the rock. This was held by Curtius to have been the site of the primaeval rock city, κραναὰ πόλις (Aristoph. *Ach.* 75), afterwards abandoned in favour of the Acropolis. This view is not generally accepted. Some of the rock tombs were afterwards converted, under pressure of necessity, into habitations, as in the case of the so-called "prison of Socrates," which consists of three chambers horizontally excavated and a small round apartment.

The **Areopagus.**—The Areopagus is now a bare rock possessing few architectural traces. The seat of the old oligarchical council and court for homicide was probably on its eastern height. Here were the altar of Athena Areia and two stones, the λίθος Ὕβρεως, on which the accuser, and the λίθος Ἀναιδείας, on which the accused, took their stand. Beneath, at the north-eastern corner, is the cleft which formed the sanctuary of the Σεμναί, or Erinyes. It is not certain whether this was the scene of St. Paul's address to the Athenians.

Hellenic Period.- he earliest settlement on the Acropolis was doubtless soon increased by dwellings at its base, which would naturally lie close to the western approach. After the building of the Pelargicum they seem to have extended beyond its walls towards the south and south-west—towards the sea and the Ilissus. The district occupied faced the sun and was sheltered by the Acropolis from northerly winds. The Thesean synoecism led to the foundation of new shrines partly on the Acropolis, partly in the inhabited district at its base both within and without the Pelargicum. Some are mentioned by Thucydides in a passage of capital importance for the topography of the city (ii. 15). By degrees the inhabited area took in the ground to the north-west, the nearer portion of the later Ceramicus, or "potters' field," and eventually extended north and east of the citadel, which, by the 5th century B.C., had become the centre of a circular or wheel-shaped city, πόλιος τροχοειδέος ἄκρα κάρηνα (oracle *apud* Herod. vii. 140). To this enlarged city was applied, about the second half of the 6th century, the special designation τὸ ἄστυ, which afterwards distinguished Athens from its port, Peiraeeus; the Acropolis was already ἡ πόλις (Thucyd. ii. 15). The city is supposed to have had a wall before the time of Solon, the existence of which may be deduced from Thucydides' account of the assassination of Hipparchus (vi. 57), but no certain traces have been discovered.

The Agora.—The centre of commercial and civic life was the agora or market. Here were the various public buildings which. when power was transferred to the archons, formed the offices of the administration. The site of the primitive agora (ἀρχαία hyoph) was perhaps in the hollow between the Acropolis and the Pnyx. Under the Peisistratids the agora was enlarged over the inner Ceramicus on the north-west, apparently reaching the northern declivities of the Areopagus and the Acropolis. After the Persian Wars the northern portion was used for commercial, the southern for political and ceremonial purposes. In the southern were the Orchestra, where the Dionysiac dances took place, and the famous statues of Harmodius and Aristogeiton by Antenor which were carried away by Xerxes; also the *Metroön,* or temple of the Mother of the Gods, the *Bouleuterion,* or council-chamber of the Five Hundred, the Prytaneum, the hearth of the combined communities, where the guests of the State dined, the temple of the Dioscuri, and the Tholos or *Skias,* a circular stone-domed building in which the Prytaneis were maintained at the public expense;

in the northern were the Leocorium, where Hipparchus was slain. the στοὰ βασιλική, the famous στοὰ ποικίλη, where Zeno taught, and other structures. Of all these buildings hardly a trace remains and their positions are largely conjectural.

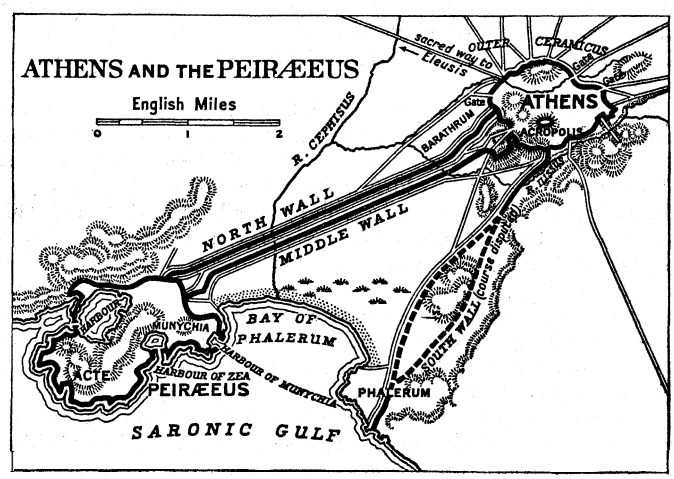
The **Enneacrunus.**—The Enneacrunus fountain has hitherto been generally identified with the spring Callirrhoe in the bed of the Ilissus, south-east of the Olympieum; it is apparently placed by Thucydides (ii. 15) close to that building, as well as the temple of Dionysus ἐν λίμναις and other shrines, the temples of Zeus Olympius and of Ge and the Pythium, which he mentions as situated mainly to the south of the Acropolis. On the other hand, Pausanias (i. 14. 1) mentions the Enneacrunus in his description of buildings undoubtedly in the region of the agora, and unless he is guilty of an unaccountable digression the Enneacrunus which he saw must have lain west of the Acropolis. Excavations here revealed a main road of surprisingly narrow dimensions winding up from the agora to the Acropolis. South-west of the point where the road turns towards the Propylaea was found a large rock-cut reservoir which Dorpfeld identifies with the Enneacrunus. This is supplied by a conduit of 6th-century tiles connected with an early stone aqueduct which runs beneath the Dionysiac theatre and the royal garden in the direction of the upper Ilissus. These waterworks were, according to Dorpfeld, constructed by the Peisistratids to increase the supply from the ancient spring Callirrhoe, which was furnished with nine jets and so known as Enneacrunus. This identification has been hotly contested and must still be regarded as undecided. Close by is a triangular enclosure of polygonal masonry, in which were found relics relating to the worship of Dionysus, a very ancient wine-press (ληνός) and a small temple. Built over this early precinct, which Dorpfeld identifies with the Dionysium ἐν λίμναις, or Lenaeum, is a basilica-shaped building of the Roman period, apparently sacred to Bacchus; in this was found an inscription containing the rules of the society of the Iobacchi. There is an obvious difficulty in assuming that λίμναι, in the sense of "marshes," existed in this area. So Dörpfeld's identification of the Dionysium, ἐν λίμναις cannot be regarded as proved; his view that another Pythium and another Olympieum existed here is still less probable; but this does not necessarily invalidate his identification of the Enneacrunus. The whole district was found to have been thickly built over; the mean dwelling-houses and crooked lanes confirm an ancient topographer's picture of the contrast between the modest private residences and the great public structures of the ancient city.

The Acropolis Before the Persian Wars.—The age of the Peisistratids (560–511 B.C.,) marked an era in the history of Athenian topography. In addition to the temple of Olympian Zeus and the Enneacrunus, they laid out the Academy and perhaps the Lyceum. The famous seat of the Platonic philosophy was a gymnasium enlarged as a public park by Cimon; it lay about a mile to the north-west of the Dipylon gate. The Lyceum, where Aristotle taught, was originally a sanctuary of Apollo Lyceius. It also contained a gymnasium and garden and lay to the east of the city beyond the Diocharean gate.

Little was known of the buildings on the Acropolis in the pre-Persian period till the Greek excavations under Kawadias from 1885 onwards. Then much of the débris of the sculpture and architecture ruined by the Persians was unearthed—a splendid series of archaic statues of maidens with the original colours still fresh, fragments of Attic vases from the ateliers of famous potters, bronzes and terra-cottas. Some fragmentary pedimental groups sculptured in soft limestone and highly painted are important as giving clues for the existence of early shrines. Attempts have been made to identify these as the Pandroseum, old Erechtheum and a small temple which would have stood on the site of the Parthenon, and have had one end apsidal like the old temple at Thermum, but none of the suggestions made are generally accepted. The most important discovery perhaps was that of the old Athena temple which stands on the supposed "House of Erechtheus," perhaps a palace shrine and the seat of the primitive cult of Athena.

This, the ancient Hecalompedon, is identified with an early temple, 100ft. long, the foundations of which immediately adjoin the south side of the Erechtheum. The foundations belong to the 7th century, except those of the colonnade, probably added by Peisistratus. According to Dorpfeld, this was the "old temple" of Athena Polias, mentioned in literature and inscriptions, in which was housed the most holy image (ξόανον) of the goddess which fell from heaven; it was burnt, but not completely destroyed, during the Persian War, and some of its entablature was built into the north wall of the Acropolis; it was subsequently restored, he thinks, with or without its colonnade—in the former case a portion of the peristyle must have been removed to make room for the caryatids porch of the Erechtheum; the building was burnt in 406 B.C. (Xen. Hell. i. 6. 1), and the fire is that mentioned by Demosthenes (In *Timocr.* xxiv. 155); its "opisthodomos" served as the Athenian treasury in the 5th and 4th centuries; the temple is the ἀρχαῖος νεὼς τῆς Πολιάδος of Strabo (ix. 16), and it was still standing in the time of Pausanias, who applies to it the same name (i. 27. 3). That the foundations are those of an old temple burnt by the Persians has been generally accepted, but other portions of Dorpfeld's theory—especially his assumption that the temple was restored after the Persian War—have been contested. Perhaps the temple was repaired to provide a temporary home for the venerated image; no traces of a restoration exist, but the walls probably remained standing after the Persian conflagration. The removal of the ancient temple was undoubtedly intended when the Erechtheum was built, but superstition may have prevented its demolition and the removal of the ξόανον. The temple consisted of an eastern cella with pronaos; behind this was the opisthodomos, divided into three chambers—possibly treasuries—with a portico at the western end. The peristyle, from the measurements of the stylobate and of the column drums built into the wall of the Acropolis, would have consisted of six Doric columns at the ends and 12 at the sides. A representation of the reception of Heracles to Olympus, sculptured in soft limestone and painted, occupied the pediment of the early temple. When Peisistratus added the colonnade it was replaced by a gigantomachy in marble. Fragments of both these groups exist and also some marble reliefs supposed to belong to its later frieze.

The Classical Period.—The almost complete destruction of the buildings on the Acropolis and in the city, among them many shrines which religious sentiment might have preserved, facilitated the magnificent architectural designs of Themistocles, Cimon and Pericles, while the rapid growth of the Athenian empire provided the necessary means for their execution. After the departure of the Persians the first necessity was the reconstruction of the defences. The walls, now built under the direction of Themistocles, embraced a larger area than the previous circuit, with which they coincided at the Dipylon gate on the north-west where the Sacred Way to Eleusis was joined by the carriage route to Peiraeeus and roads to the Academy and Colonus. The other important gates were the Peiraic and Melitan on the west; the Itonian on the south leading to Phalerum, the Diomeian and



MAP OF ANCIENT ATHENS AND ITS PORT TOWN. PEIRAEEUS, SHOWING LONG WALLS BUILT IN 460 B.C. CONNECTING THE PEIRAEEUS WITH THE CITY

Diocharean on the east, and the Acharnian on the north. The wall, strengthened with numerous towers, enclosed the quarters of Collytus on the north, Melite on the west, Limnae on the south-west and south, and Diomeia on the east. The remains have not been systematically excavated except by the Dipylon; sepulchral monuments built into the masonry illustrate the statement of Thucydides with regard to the employment of such material in the hasty construction. The circuit has been ascertained in its general lines; it is given by Thucydides (ii. 13. 7) as 43 stades (about 5½m.) exclusive of the portion between the points of junction with the long walls to Peiraeeus, but the whole circumference cannot have exceeded 37 stades.

The "Long Walls."—The design of connecting Athens with Peiraeeus by long parallel walls is ascribed by Plutarch to Themistocles. The "Long Walls" (*τὰ μακρὰ τείχη, τὰ σκέλη*) consisted of (*1*) the "North Wall" (*τὸ βόρειον τεῖχος*), (2) the "Middle" or "South Wall" (*τὸ δὶα μέσου τεῖχος*, Plato, *Gorg.* 555 E; *τὸ νότιον τεῖχος*); and (3) the "Phaleric Wall" (*τὸ Φαληρικὸν τεῖχος*). The north and Phaleric walls were perhaps founded by Cimon, and completed about 457 B.C. in the administration of Pericles; the middle wall was built about 44j B.C. The north wall, leaving the city near the modern observatory, ran from north-east to south-west near the present road to Peiraeeus, until it reached the Peiraeeus walls a little to the east of their northernmost bend. The middle wall, beginning south of the Pnyx near the Melitan gate, gradually approached the northern wall and, following a parallel course at an interval of 550ft., diverged to the east near the modern New Phalerum and joined the Peiraeeus walls on Munychia where they turn inland from the sea. The course of the Phaleric wall has been much disputed. The widely received view of Curtius that it ran to Cape Kolias (now Old Phalerum) on the east of the Phaleric bay is not now accepted. The wall proved indefensible and was abandoned towards the close of the Peloponnesian War; with the other two walls it was destroyed after the surrender of the city, and was not rebuilt by Conon in 393 B.C. The parallel walls fell into decay during the Hellenistic period and, according to Strabo (ix. 396), were demolished by Sulla.

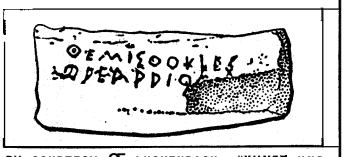
Peiraeeus.—The advantages Peiraeeus with its three harbours offered for defence and commerce were first recognized by Themistocles, in whose archonship (493 B.C.) its fortifications were begun. Before his time the Athenians used as a port the roadstead at the north-eastern corner of Phalerum bay partly sheltered by Cape Kolias. On the completion of the city walls, Themistocles resumed the construction of the Peiraeeus defences, which protected the larger harbour of Cantharus on the west and the smaller ports of Zea and Munychia, terminating in moles at their entrances and enclosing the promontory on the land and sea sides except a portion of the peninsula of Acte. The walls were about 10ft. in thickness and upwards of 60ft. in height, and were strengthened by towers. The town was laid out in straight, broad streets, intersecting at right angles, by the architect Hippodamus of Miletus under Pericles. In the centre was the agora of Hippodamus; on the western margin of the Cantharus harbour the emporium, or Deigma, the centre of commercial activity, flanked by porticoes; at its northern end, near the entrance to the inner harbour, was another agora, on the site of the modern market-place, and near it the *μακρὰ στοά*, the corn depot of the State. This inner and shallower harbour, perhaps the *κωφὸς λιμήν*, was excluded from the town precinct by the walls of Conon, which traversing its opening on an embankment (*τὸ δὶα μέσον χῶμα*) ran round the western promontory of Eetioneia, previously enclosed by the wider circuit of Themistocles. In the harbours of Zea and Munychia traces may be seen of the remarkable series of galley-slips in which the Athenian fleet was built and repaired. Those around Zea were roofed by a row of gables supported by stone columns, each gable sheltering two triremes. Among the other noteworthy buildings were the arsenal (*σκευοθήκη*) of Philon and the temples of Zeus Soter, the patron god of sailors, of the Cnidian Artemis, built by Cimon, and of Artemis Munychia situated near the fort on Munychia; traces of a temple of Asclepius, of two theatres and of a hippodrome remain. The fine marble lion which stood at the mouth of the Cantharus harbour gave Peiraeeus its mediaeval and modern names of Porto Leone and Porto Draco; it was carried to Venice by Morosini.

The Dipylon and Ceramicus.—The Ceramicus gives the best opportunities for studying both the cemeteries and walls of Athens. The latter divide the region into the inner and outer Ceramicus and three stages are clearly seen, the wall of Themistocles, the restoration by Conon in 393 B.C., and a reconstruction by Lycurgus some 60 years laters. The Dipylon gate belongs to the last stage and consists of an inner and outer double gate separated by a rectangular court and flanked by towers on either side. Just within it is a fountain house. South lies another gate by the side of the Eridanus and here issued the sacred way leading to Eleusis. Outside the city this is bordered by tombs, the marble reliefs of which stand in family groups above the level of the road and date mainly from the 4th century B.C. Two boundary stones inscribed *ὅρος Κεραμεικοῦ* have been found and tombs of all periods, classical, "Mycenaean" and "Geometric" which first yielded "Dipylon" ware. Monuments to some persons interred at the public expense suggest that this was the scene of Pericles' famous funeral speech. Excavations, not yet completed, have revealed the Pompeium, a shrine of the Tritopatreis, and sluices for diverting the waters of the Eridanus to irrigate gardens outside the city.

The Acropolis of the Classical Period.—The Acropolis ceased to be a fortress after the expulsion of Hippias; and was defended against the Persians by a wooden barricade. The fortifications were again demolished by the Persians, after whose departure the existing north wall was erected in the time of Themistocles; many fragments from the buildings destroyed by the Persians were built into it, possibly owing to haste, as in the case of the city walls. The fine walls on the south and east were built by Cimon after the victory of the Eurymedon, 468 B.C.; they extend considerably beyond the prehistoric circuit, the intervening space being filled up with the débris of the ruined buildings so as to increase the level space. On the north Cimon completed the wall of Themistocles at both ends and added to its height; the ground behind was levelled up on this side also, the platform of the Acropolis thus receiving its present shape and dimensions. The staircase leading down to the sanctuary of Aglaurus was enclosed in masonry. At the south-western corner, on the right of the old entrance, an early bastion was encased in a rectangular projection which formed a base for the temple of Nike.

The greater monuments of the classical epoch on the Acropolis are described in separate articles. (See PARTHENON; ERECHTHEUM; PROPYLAEA.) Next in interest to these is the beautiful little temple of Athena Nike, wrongly designated Nike *Apteros* (Wingless Victory), standing on the bastion mentioned; it was begun after 450 B.C. and was probably finished after the outbreak of the Peloponnesian War. The temple, which is entirely of Pentelic marble, is amphiprostyle tetrastyle, with fluted Ionic columns, resting on a stylobate of three steps; its length is 27ft., its breadth 18½ft., and its total height, from the apex of the pediment to the bottom of the steps, 23 feet. The frieze represents on the east a number of deities, on the north and south Greeks fighting with Persians, and on the west Greeks fighting with Greeks. Before the east front was the altar beneath which an earlier altar has been found. The irregularly shaped precinct was enclosed by a parapet about 3ft. 2in. in height, decorated on the outside with beautiful reliefs representing winged Victories engaged in the worship of Athena. The treatment of the drapery suggests that the parapet was added in the latter years of the Peloponnesian War. The temple was still standing in 1676; some eight years later it was demolished by the Turks, and its stones built into a bastion; on the removal of the bastion in 1835 the temple was reconstructed by Ross. At either corner of the Propylaea entrance were equestrian statues dedicated by the Athenian knights; the bases with inscriptions have beer, recovered. From the Propylaea a passage led eastwards along the north side of the Parthenon; facing the entrance was the colossal bronze statue of Athena Promachos by Pheidias, probably set up by Cimon in commemoration of the Persian defeat. The statue, 30ft. high, represented the goddess as fully armed; the gleam of her helmet and spear could be seen by the mariners approaching from Sunium (Pausanias i,

28). On both sides were numerous statues, one of Athena Hygeïa (whose altar lies at the south-east angle of the Propylaea), set up by Pericles to commemorate the recovery of a slave injured during the building of the Parthenon, a colossal bronze image of the wooden horse of Troy and Myron's group of Marsyas and Athena. Another statue by Myron, the Perseus, stood near the precinct of Artemis Brauronia, lying between the south-eastern corner of the Propylaea and the wall of Cimon. Adjoining it to the east was a large rectangular building, which was apparently fronted by a colonnade; this has been identified with the Χαλκοθήκη, a storehouse of bronze implements and arms. Beyond the Parthenon, a little to the north-east, was the great altar of Athena, and near it the statue and altar of Zeus Polieus. Immediately west of the Erechtheum is the Pandroseum or *temenos* of Pandrosos, the daughter of Cecrops, seen here by Pausanias (i. 27). This precinct, in which the sacred olive tree of Athena grew, has been fixed by an inscription. Between it and the Propylaea were a number of statues, among them the heifer of Myron, and perhaps his Erechtheus; the Lemnian Athena of Pheidias, and his effigy of his friend Pericles.



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OSTRACISM OF THEMISTOCLES

Sketch of *Ostrakon*, a piece of pottery on which an Athenian, about 471 B.C., wrote the name, "Themistocles of Phrearri," for whose expulsion he wished to vote

The Classical City, the **"Theseum."**—The reconstruction of the city after its demolition by the Persians was not carried out on the lines of a definite plan like that of the Peiraeeus. The houses were hastily repaired, and the narrow, crooked streets remained; the influence of Themistocles, who aimed at transferring the capital to Peiraeeus, was probably directed against any costly scheme of restoration, except on the Acropolis. The period of Cimon's administration, however, especially the interval between his victory on the Eurymedon and his ostracism 468–461 B.C., was marked by great architectural activity in the lower city as well as on the citadel. To his time may be referred many of the buildings around the agora (probably rebuilt on the former sites) and elsewhere, and the passage, or δρόμος, from the agora, to the Dipylon flanked by long porticoes. The Theseum proper, which lay to the east of the agora near the Acropolis, was built by Cimon: here he deposited the bones of the national hero which he brought from Scyros about 470 B.C.

The Hephaesteum, the so-called Theseum, is situated on a low hill, the Colonus Agoraeus, west of the agora. The best preserved Greek temple in the world, it possesses no record of its origin; the style of its sculptures and architecture suggests that it was built about the same time as the Parthenon, and finished by 421 B.C. It has been known as the Theseum since the middle ages, apparently because some of its sculptures represent the exploits of Theseus, but its identification with the temple of Hephaestus and Athena seen by Pausanias (i. 14. 6) is practically certain, notwithstanding the difficulty presented by the sculptures, which bear no relation to Hephaestus. The temple is a Doric peripteral hexastyle in *antis*, with 13 columns at the sides; its length is 104ft., its breadth 45½ft., its height, to the top of the pediment, 33 feet. The sculptures of the pediments have been lost, but their design has been ingeniously reconstructed by Sauer. The frieze contains sculptures only in the metopes of the east front and in those of the sides immediately adjoining it; the frontal metopes represent the labours of Heracles, the lateral the exploits of Theseus. As in the Parthenon, there is a sculptured frieze above the exterior of the cella walls; this, however, extends over the east and west fronts only and the east ends of the sides; the eastern represents a battle-scene with seated deities on either hand, the western a centauromachia. The temple is of Pentelic marble, except the foundations and lowest step of the stylobate, which are of Peiraic stone, and the frieze of the cella, which is in Parian marble. The preservation of the temple is due to its conversion into a church in the middle ages.

The Dionysiac Theatre and **Asclepieum.**—The Dionysiac theatre, situated beneath the south side of the Acropolis, was partly hollowed out from its declivity. The representation of plays was transferred here from the original Orchestra in the agora by the beginning of the jth century B.C.; it afterwards superseded the Pnyx as the meeting-place of the Ecclesia. Here the first structures were provisional and of wood, and traces have been found of the early orchestra and auditorium which had its seats in straight lines. This was replaced by a stone theatre during the administration of Lycurgus (337–323 B.C.), but the present arrangement of stage and orchestra date from Roman times. The stage-building consisted of a rectangular hall with square projections (παρασκήνια) on either side; in front of this was built in late Greek or early Roman times a stage with a row of columns which intruded upon the orchestra space; a later and larger stage, dating from the time of Nero, advanced still farther into the orchestra, and this was finally faced (probably in the 3rd century A.D.) by the "bema" of Phaedrus, a platform-wall decorated with earlier reliefs, cut down to suit their new position. The remains of two temples of Dionysus have been found adjoining the stoa of the theatre, and an altar of the same god adorned with masks and festoons; the smaller temple probably dates from the 6th century B.C., the larger from the end of the 5th or the beginning of the 4th century.

Immediately west of the theatre is the sacred precinct of Asclepius, where were discovered the foundations of the temple, together with several inscriptions and a great number of votive reliefs offered by grateful invalids. A Doric colonnade with a double row of columns extended along the base of the Acropolis for a distance of 54yd.; behind it in a chamber hewn in the rock is the sacred well mentioned by Pausanias. The colonnade was a place of resort for the patients; a large building close beneath the rock was probably the abode of the priests. East of the theatre and closely related to it was the Odeum of Pericles, the only building which can be assigned to him, though he may have designed the first plan of the theatre too. This was a large rectangular hypostyle hall with probably six rows of six marble columns, which would have replaced the original wooden columns at its restoration by Ariobarzanes of Cappadocia after its destruction by Sulla in 86 B.C. Plutarch says that the Odeum imitated the tent of Xerxes, but it is possible that he may be referring only to the roof of the building.

The Choragic Monument of **Lysicrates.**—The beautiful choragic monument, of Lysicrates, dedicated in the archonship of Euaenetus (335–334 B.C.), is the only survivor of a number of such structures which stood in the "Street of the Tripods" to the east of the Dionysiac theatre, bearing the tripods given to the successful choragi at the Dionysiac festival. It owes its preservation to its former inclusion in a Capuchin convent. The monument consists of a small circular temple of Pentelic marble, 21½ft. in height and gft. in diameter, with six engaged Corinthian columns and a sculptured frieze, standing on a rectangular base of Peiraic stone. The delicately carved convex roof, composed of a single block, was surmounted by the tripod. The frieze represents the transformation of the Tyrrhenian pirates by Dionysus into dolphins. Another choragic monument was that of Thrasyllus, which faced a cave in the Acropolis rock above the Dionysiac theatre. A portion of another, that of Nicias, was used to make the late Roman gate of the Acropolis. In one of these monuments was the famous Satyr of Praxiteles.

The Hellenistic Period.— After the age of Alexander, Athens was adorned with many new buildings, a tribute paid to her intellectual renown by foreign potentates or dilettanti, who desired to add their names to the list of its illustrious citizens and patrons. Among the first of these benefactions was the great gymnasium of Ptolemy, built in the neighbourhood of the agora about 250 B.C. Attalus I. set up a number of bronze statues on the Acropolis; Eumenes II. built the long portico west of the Dionysiac theatre; Attalus II. erected the magnificent Stoa near the agora, which has been identified by an inscription. The Stoa consisted of a series of 21 chambers, probably shops, faced by a double colonnade, the outer columns being of the Doric order, the inner unfluted, with lotus-leaf capitals, it possessed an upper storey fronted with Ionic columns.

The greatest monument, however, of the Hellenistic period, the colossal temple of Olympian Zeus, "unum in terris inchoatum pro magnitudine dei" (Livy xli. 20), stood by the Ilissus, south-east of the Acropolis. Its foundations were laid on the site of a small ancient shrine by Hippias, but the building in its ultimate form was for the greater part constructed under the auspices of Antiochus IV. Epiphanes, king of Syria, by the Roman architect Cossutius between 174 and 164 B.C., the date of the death of Antiochus. The work was apparently resumed under Augustus and, finally, in A.D. 129, completed and dedicated by Hadrian, who set up a chryselephantine statue of Zeus in the cella. The building was octostyle; its length was 318ft., its breadth 132ft. With the exception of the foundations and two lower steps of the stylobate, it was entirely of Pentelic marble, and possessed 104 Corinthian columns, 56ft. 7in. in height, of which 48 stood in triple rows under the pediments and 56 in double rows at the sides; of these, 16 remained standing in 1852, when one was blown down by a storm. The Olympieum of Hippias was to be of the Ionic order.

The **Roman** Period.—An earlier building of this period is the Horologium of Andronicus of Cyrrhus (the "Tower of the Winds"), still standing near the eastern end of the Roman agora. This may belong to the 2nd or 1st century B.C.; it is mentioned by Varro (*De re rust.* iii. 5. 1;), and therefore cannot be of later date than 35 B.C. It is an octagonal marble structure, 42ft. in height and 26ft. in diameter; the eight sides, which face the points of the compass, are furnished with a frieze containing inartistic figures in relief representing the winds; below it, on the sides facing the sun, are the lines of a sundial. It was surmounted by a weathercock in the form of a bronze Triton and contained a water-clock to record the time when the sun was not shining.

The new, or Roman, agora to the north of the Acropolis, perhaps mainly an oil market, was constructed after the year 27 B.C. It consisted of a large open rectangular space surrounded by an Ionic colonnade into which opened a number of shops or storehouses. The eastern gate was adorned with four Ionic columns on the outside and two on the inside, the western entrance being the well-known Doric portion of Athena Archegetis with an inscription recording its erection from donations of Julius Caesar and Augustus. The Agrippeum, a covered theatre, derived its name from Vipsanius Agrippa, whose statue was set up, about 27 B.C., beneath the north wing of the Acropolis propylaea, on the high rectangular base still remaining. At the eastern end of the Acropolis a charming circular temple of white marble with a peristyle of nine Ionic columns was dedicated to Rome and Augustus. The conspicuous monument which crowns the Museum hill was erected as the mausoleum of Antiochus Philopappus of Commagene, grandson of Antiochus Epiphanes, in A.D. 114–116. It was nearly square, but the only portion remaining is the slightly curved front with three niches between Corinthian pilasters; in the central niche is the statue of Philopappus.

The Emperor Hadrian was a lavish benefactor. He enlarged the circuit of the city walls to the east, enclosing the area now covered by the royal and Zappeion gardens and Constitution square. This was the City of Hadrian (Hadrianopolis) or New Athens (Novae Athenae); a handsome suburb with numerous villas, baths and gardens; its walls were fortified with rectangular towers. The Arch of Hadrian near the Olympieum marked the boundary between the new and the old cities. This is surmounted by a triple attic with Corinthian columns; the frieze above the keystone bears, on the north-westem side, the inscription αἵδ' εἶσ' Ἀθῆναι, Θησέως ἡ πρὶν πόλις and on the south-eastern, αἵδ' εἶσ' Ἀδριανοῦ καὶ οὐχὶ Θησέως πόλις. The library of Hadrian, mentioned by Pausanias, was probably in the vast rectangular enclosure, immediately north of the new agora. A portion of its western front, adorned with monolith unfluted Corinthian columns, is still standing—the familiar "Stoa of Hadrian"; another well preserved portion, with six pilasters, runs parallel to the west side of Aeolus street. The interior consisted of a spacious court surrounded by a colonnade of 100 columns, into which five chambers opened at the eastern end. A portico of four fluted Corinthian columns on the western side formed the entrance to the quadrangle. A Pantheon, a gymnasium and temples of Hera and Zeus Panhellenius were likewise built by Hadrian; the aqueduct, which he began, was completed by Antoninus Pius (A.D. 138–161); it is still in use.

The Stadium, in which the Panathenaic Games were held, was first laid out by the orator Lycurgus about 330 B.C. It was an oblong structure filling a depression, partly natural, partly artificial, near the left bank of the Ilissus beneath the eastern declivity of the Ardettus hill. The immense building, however, which was restored in 1896 and the following years, was that constructed in Pentelic marble about A.D. 143 by Tiberius Claudius Atticus Herodes, a wealthy Roman resident. The seats, rising in tiers, as in a theatre, accommodated about 44,000 spectators; the arena was 670 ft. in length and 109 ft. in breadth. The Odeum, built beneath the south-west slope of the Acropolis after A.D. 161 by Atticus Herodes in memory of his wife Regilla, is comparatively well preserved. The plan is that of the conventional Roman theatre; the semi-circular auditorium, which seated some 5,900 persons, is, like that of the Dionysiac theatre, partly hollowed from the rock. The orchestra is paved with marble squares. The facade, in Peiraic stone, displays three stories of arched windows. The whole building was covered with a cedar roof.

II. THE MODERN CITY

At the conclusion of the Greek War of Independence, Athens was little more than a village of the Turkish type, the poorly built houses clustering on the northern and eastern slopes of the Acropolis. The narrow crooked lanes of this quarter still contrast with the straight, regularly laid-out streets of the modern city, which extends to the north-west, north. south and east of the citadel. The greater commercial advantages offered by other cities were outweighed by the historic claims of Athens in the choice of a capital for the newly founded kingdom, and the seat of government was transferred hither from Nauplia in 1833. The new town was, for the most part, laid out by the German architect Schaubert. It contains several squares and boulevards, a large public garden and many handsome public and private edifices. A great number of the public institutions owe their origin to the munificence of patriotic Greeks, among whom Andreas Syngros and George Averoff may be especially mentioned. The old palace, designed by Friedrich von Gartner (1792–1847), is a tasteless structure; attached to it is a beautiful garden laid out by Queen Amalia. On the southeast is the newer palace.

The academy, built from designs by Theophil Hansen (1813–91), is constructed of Pentelic marble in the Ionic style: the colonnades and pediments are richly coloured and gilded. and may perhaps convey some idea of the ancient style of decoration. Close by is the university, with a colonnade adorned with paintings, and the National library with a handsome Doric portico of Pentelic marble. The observatory, connected with the university, stands on the summit of the hill of the Nymphs; like the academy, it was erected at the expense of a wealthy Greek, Baron Sina of Vienna. In the public garden is the Zappeion, a large building with a Corinthian portico, intended for the display of Greek industries; here also is a monument to Byron, erected in 1896. The Boulē, or parliament-house, possesses an excellent library. Other public buildings are the Polytechnic institute, built by contributions from Greeks of Epirus, the theatre, the Arsakeion (a school for girls), the Varvakeion (a high school), the military school (σχολὴ εὐελπίδων), the Gennadeion (a library attached to the American school), and several hospitals, schools and orphanages. The cathedral, a large modern structure, is devoid of architectural merit, but some of the smaller, ancient Byzantine churches are singularly interesting and beautiful. After the successive enlargements of the boundaries of Greece in 1881, 1912 and 1920 Athens increased rapidly as the focus of society, politics and trade. After 1922 whole new quarters sprang up to house the great influx of refugees from Asia Minor. especially in the Patēsia and Pangrati regions of the city, which now encircles Lycabettus. Neighbouring townships such as Marousi, Kēphisia, Psychiko, Ēraklion, Kallithea and Phalēron also grew correspondingly, particularly after the coming of the motor car and the improvements of the roads had made them popular resi-

dential suburbs. Athens and Peiraeeus are well served by electric tramways which run also to Phalēron. There is an electric railway to Peiraeeus and a suburban line to Kēphisia. There are motor omnibus services to all suburbs and to outlying towns in Attica such as Eleusis, Marathon and Laurium, and even to and from Thebes.

Museums.—The museums of Athens have steadily grown in importance, are well arranged, and the remnants of ancient art which they contain have fortunately escaped injudicious restoration. The National museum, founded in 1866, is especially rich in archaic sculptures and in sepulchral and votive reliefs. Among the most notable works of art are the bronze youths from Marathon and Cerigotto, the colossal archaic "Apollo" from Sunium, the Scopaic heads from Tegea, the Demeter relief from Eleusis and the sculptures of Damophon from Lycosura. Its unrivalled collection of prehistoric antiquities contains the treasures of Mycenae (found by Schliemann), Vaphio, Dendra and Tiryns, and rich series of vases and other objects from "Mycenaean" sites all over Greece and from Thessaly and from the Cyclades. There are also terra-cottas from Tanagra and Asia Minor; bronzes from Olympia, Delos and the Acropolis, and numerous painted vases, among them the unequalled white lecythi from Athens and Eretria. The Epigraphical museum contains an immense number of valuable historical inscriptions. The Acropolis museum (opened in 1878) possesses a singularly interesting collection of sculptures belonging to the "archaic" period of Greek art, all found on the Acropolis; here, too, are some fragments of the sculptures of the Parthenon and the reliefs from the parapet of the temple of Nike. In the Polytechnic there is a historical and ethnological museum, and the national gallery of paintings. The national collection of coins is accommodated in the Academy and the Byzantine museum is to be moved to a large villa on the Kēphisia road. In the old Turkish mosque near the library of Hadrian is the museum of decorative art which, though recently founded, is steadily increasing. There is a small museum of antiquities at Peiraeeus.

Scientific Institutions.--Owing to the numbers and activity of its institutions, both native and foreign, for the prosecution of research and the encouragement of classical studies, Athens had become once more an international seat of learning. The Greek Archaeological society, founded in 1837, numbered some distinguished scholars among its members, and displayed great activity in the conduct of excavations. There are also several Greek societies for encouraging the study of philology, Byzantine art, ethnology and other learned subjects. Of the foreign archaeological schools the French was founded in 1846, the German in 1874, the American in 1882, the British in 1886, the Austrian in 1898 and the Italian in 1909. (See GREEK ARCHAEOLOGY.)

Industry and Commerce.—In spite of some disadvantages from its situation and the resources of Attica, Athens prospered in industry and commerce until World War II. It is the centre of banking and of all mercantile business, export and import. With Peiraeeus it is, as the terminus of all the steamship and railway lines (the Peloponnesian, the Attic and the main line which connects with Salonika and the direct route to Paris or Berlin), the most important manufacturing town in Greece. There are cloth and cotton mills, distilleries, breweries, potteries, flour mills, soap factories, shipbuilding and engineering works, tanneries and chemical works and carpet factories, the last a new and rising industry established by the refugees from Asia Minor. Exports are normally wine, oil, tobacco, marble and cognac, and imports are coal, grain and manufactured articles of all kinds. Peiraeeus is also a great entrepôt for the Levant.

Peiraeeus.—Peiraeeus, which had never revived since its destruction by the Romans in 86 B.C., was, at the beginning of the 19th century, a small fishing village known as Porto Leone. When Athens became the capital in 1833 the ancient name of its port was revived, and after that time piers and quays were constructed, and spacious squares and broad regular streets were laid out. The town also acquired an exchange, a large theatre, a gymnasium, a naval school, municipal buildings and several hospitals and charitable institutions erected by private munificence. The harbour, in which ships of all nations may ordinarily be seen, as well as great numbers of the picturesque sailing craft engaged in the coasting trade, was improved by the construction of breakwaters and dry docks.

In 1932 a free zone was constituted, covering in 1937 an area of 217,067 sq.yd.

Population.—The population of Athens has rapidly increased. In 1834 it was below 5,000; in 1870 it was 44,510; in 1879, 63.374; in 1889, 107,251; in 1896, 111,486. Peiraeeus, which in 1834 possessed only a few hundred inhabitants, in 1879 possessed 21,618; in 1889, 34,327; in 1896, 43,848. The total population of Athens in 1907 was 167,479 and of Peiraeeus 67,982. In 1938 Athens had a population of 392,781 and Peiraeeus 284,079.

(J. D. B.; A. J. B. W.; X.)

III. HISTORY

1. The Prehistoric Period.—Archaeology gives the early history of Athens, for it is barely mentioned by Homer and the numerous legends have little historical value. Its neolithic inhabitants, of the race that occupied most of Greece and was related to that of the Danubian and Carpathian areas, were followed by a bronze-using folk akin to the islanders and Cretans, possibly a non-Hellenic people, Next came the mysterious makers of Minyan ware (see AEGEAN CIVILIZATION), and in the late bronze age Athens became a strong castle like Tiryns with traces of a "palace." Rich finds of "Geometric" vases indicate prosperity in the early iron age. Some try to associate this pottery with Dorians, though the Athenians always boasted they were children of the soil and free from admixture, that is to say Dorians. At the dawn of history proper the independent communities of Attica were absorbed into a central state of Athens under a monarchy (see THESEUS) of Ionian affinities, for the people were divided into four tribes whose names—Geleontes, Hopletes, Argadeis and Aegicoreis—recur in several true Ionian towns. The centralization (synoecism), to which many Greek peoples never attained, laid the foundations of Athenian greatness. But in other respects the new constitution tended to arrest development. When the monarchy was supplanted in the usual Greek fashion by a hereditary nobility, according to tradition, between about 1000 and 683 B.C., all power was appropriated by a privileged class of Eupatridae (*q.v.*), who owed their predominance to their control over legal procedure; the Geomoroi and Demiourgoi, who formed the bulk of the community, enjoyed no political rights. The aristocratic council of the Areopagus (*q.v.*) constituted the chief criminal court, and nominated the magistrates, among whom the chief archon (*q.v.*) passed judgment in family suits, controlled admission to the genos or clan, and consequently the acquisition of the franchise. This system was further supported by religious prescriptions which the nobles retained as a corporate secret. The Eupatridae also tended to become sole owners of the land, reducing the original freeholders or tenants to the position of serfs. During this period Athens seems to have made little use of her militia, commanded by the polemarch, or of her navy, which was raised in special local divisions known as naucraries; hence no military esprit de corps could arise to check the Eupatrid ascendancy. Nor did the commons obtain relief through any commercial or colonial enterprises as in many other Greek States. The first attack upon the aristocracy proceeded from a young noble named Cylon, who endeavoured to become tyrant about 630 B.C. The people helped to crush this movement; yet discontent must have been rife, for in 621 the Eupatrids commissioned Draco (*q.v.*), a junior magistrate, to draft and publish a code of criminal law. By this notable concession the nobles lost that exclusive legal knowledge which had formed one of their main instruments of oppression.

2. The Rise of **Athens.**—A still greater danger grew out of the widespread financial distress, which was steadily driving many of the agricultural population into slavery and threatened the entire state with ruin. After a protracted war with the neighbouring Megarians had accentuated the crisis, the Eupatridae gave to one of their number, the celebrated Solon (q v.), free power to remodel the whole state (594). By his economic legisla-

tion Solon placed agriculture once more upon a sound footing and encouraged commercial enterprise, thus laying the foundation of material prosperity. His constitutional reforms proved less successful, for, although he put into the hands of the people safeguards against oppression, he could not ensure their use in practice. After a period of party-feud among the nobles the new constitution was superseded by the autocratic rule of Peisistratus (*q.v.*), and his sons Hippias and Hipparchus. The age of despotism, which lasted, with interruptions, from 560 to 510, was a period of great prosperity. The rulers fostered agriculture, stimulated commerce and industry (notably the famous Attic ceramics), adorned the city with public works and temples, and rendered it a centre of culture. Their vigorous foreign policy first made Athens an Aegean Power and secured connections with mainland Powers. They also weakened the undue influence of the nobles and created a national Athenian spirit in place of the ancient clan-feeling.

The equalization of classes was already far advanced when, about 509, an Alcmaeonid named Cleisthenes (*q.v.*), who had taken the chief part in the final expulsion of the tyrants, acquired ascendancy as leader of the commons. His constitution (508–507) expressed the change of political feeling by providing a national basis of franchise and a new state organization. By making effective the powers of the Ecclesia (Popular Assembly) the Boulē (Council) and Heliaea, Cleisthenes became the true founder of Athenian democracy.

This revolution was accompanied by a conflict with Sparta and other powers, but in the ensuing wars Athens worsted powerful. enemies like Thebes and Chalcis (506). A bolder stroke followed in 500, when a force was sent to support the Ionians in revolt against Persia and helped to sack Sardis. After the failure of this expedition the Athenians became absorbed in a struggle with Aegina (*q.v.*). In 493 the prospect of a Persian invasion brought into power men like Themistocles and Miltiades (*qq.v.*), to whose firmness and insight the Athenians largely owed their triumph in the great campaign of 490 against Persia. After a second political reaction, the prospect of a second Persian war, and the naval superiority of Aegina, led to a strong policy. In 483 Themistocles overcame the opposition of Aristeides (*q.v.*), and passed his famous measure providing for a large increase of the Athenian fleet. In the great invasion of 480–479 the Athenians displayed a resolution which could not be shaken even by the evacuation and destruction of their native city. Though the traditional account exaggerates the services of Athens, the ultimate victory was chiefly due to the numbers and efficiency of her fleet and to the wise policy of Themistocles. (See SALAMIS; PLATAEA.)

3. Imperial Athens. — After the Persian retreat and the reoccupation of their city the Athenians continued the war with unabated vigour. Led by Aristeides and Cimon they rendered such prominent service as to receive in return the formal leadership of the Greek allies and the presidency of the newly formed Delian league (*q.v.*). The ascendancy acquired in these years eventually raised Athens to the rank of an imperial state. For the moment it tended to impair the good relations which had subsisted between Athens and Sparta since the first days of the Persian peril. But so long as Cimon's influence prevailed the ideal of "peace at home and the complete humiliation of Persia" was steadily upheld. Similarly the internal policy of Athens continued to be shaped by the conservatives. The only notable innovations since the days of Cleisthenes had been the reduction of the archonship to a routine magistracy appointed partly by lot (487), and the rise of the ten elective strategi (generals) as chief executive officers. (See STRATEGUS.) But the triumph of the navy in 480 and the great expansion of commerce and industry had shifted the political centre of gravity from the moderate democrats to the more radical party. Though Themistocles soon lost his influence, his party eventually found a new leader in Ephialtes, and after the failure of Cimon's foreign policy (see CIMON) triumphed over the conservatives. The year 461 marks the reversal of Athenian policy at home and abroad. By cancelling the political power of the Areopagus and multiplying the functions of the popular law-courts, Ephialtes abolished the last checks upon the sovereignty of the commons. His successor, Pericles, merely developed the full democracy so as to secure its effectual as well as its theoretical supremacy. The foreign policy of Athens was now directed towards an almost reckless expansion. (See PERICLES.) Besides securing her Aegean possessions and her commerce by the defeat of Corinth and Aegina, her last rivals on sea, Athens acquired an extensive dominion in central Greece and for a time quite overshadowed the Spartan land-power. The rapid loss of the new conquests after 447 proved that Athens lacked a sufficient land-army to defend permanently so extensive a frontier. Under the guidance of Pericles the Athenians renounced the unprofitable rivalry with Sparta and Persia, and devoted themselves to the consolidation and judicious extension of their maritime influence.

The years of the supremacy of Pericles (443–429) are the most glorious in Athenian history. In actual extent of territory the empire had receded somewhat, but in point of security and organization it now stood at its height. The Delian confederacy lay under Athenian control, and the points of strategic importance were largely held by cleruchies (*q.v.*; see also PERICLES) and garrisons. Out of a citizen body of over 50,000 freemen, reinforced by mercenaries and slaves, a superb fleet exceeding 300 sail and an army of 30,000 drilled soldiers could be mustered. The city, with its fortifications extending to the port of Peiraeeus, was impregnable to a land attack. Her commerce extended from Egypt and Colchis to Etruria and Carthage, and her manufactures, which attracted skilled operatives from many lands, found a ready sale all over the Mediterranean. With tolls, and the tribute of the Delian league (*q.v.*), a fund of 9,700 talents (£2,300,000) was amassed in the treasury.

Yet the material prosperity of Athens under Pericles was less notable than her brilliant attainments in every field of culture. No city ever adorned herself with such an array of temples, public buildings and works of art as the Athens of Pericles and Pheidias. Her achievements in literature are hardly less great. The Attic drama of the period produced many masterpieces, and the scientific thought of Europe in the departments of logic, ethics, rhetoric and history mainly owes its origin to a new movement of Greek thought which was largely fostered by the patronage of Pericles himself. Besides producing numerous men of genius herself Athens attracted all the great intellects of Greece. The brilliant summary of the historian Thucydides in the famous funeral speech of Pericles (delivered in 430), in which the social life, the institutions and the culture of his country are set forth as a model, gives an ideal picture of Athens in her greatest days.

The payment for public service which Pericles had introduced may have contributed to raise the general level of culture of the citizens, but it created a dangerous precedent and incurred the censure of notable Greek thinkers. Moreover, all this prosperity was obtained at the expense of the confederates, whom Athens exploited in a somewhat selfish and illiberal manner. The cry of "tyrant city" roused public opinion in Greece against Athens and brought on the Peloponnesian War (*q.v.*) which ruined the Athenian empire (431–404). The issue was determined less by any intrinsic superiority on the part of her enemies than by the blunders committed by a people unable to carry out a consistent foreign policy, and served since Pericles by none but selfish or short-sighted advisers. It speaks well for the patriotism of her commons that Athens, weakened by plague and military disasters, should have withstood for so long the blows of enemies from without, and the damage inflicted by traitors within her walls. (See ANTIPHON; THERAMENES.)

4. The Fourth Century. — After the complete defeat of Athens by land and sea, it was felt that her former services on behalf of Greece and her high culture should exempt her from total ruin. Though stripped of her empire, Athens obtained very tolerable terms from her enemies. The democratic constitution, which had been supplanted for a while by a government of oligarchs, was restored in 403 after the latter's misrule had brought about their own downfall. (See CRITIAS; THERAMENES; THRASYBULUS.) Indeed the spread of democracy elsewhere increased the prestige of the Athenian administration, which had now reached a high pitch of efficiency. Athenian art and literature in the 4th

century declined but slightly from their former standard; philosophy and oratory reached a standard which was never again equalled in antiquity. Athens took a prominent part with a view to upholding the balance of power, joining the Corinthian League in 395, and assisting Thebes against Sparta after 378, Sparta against Thebes after 369. Her generals and admirals, Conon, Iphicrates, Chabrias, Timotheus, distinguished themselves and partially recovered their country's predominance in the Aegean, with a teniporary renewal of the Delian league (*q.v.*). When Philip of Macedon began to grow formidable she seemed called upon once more to champion the liberties of Greece. This ideal, when put forward by Demosthenes and other orators, created great enthusiasm among the Athenians, who at times displayed their old vigour, notably in the decisive campaign of 338. But popular opicion repeatedly veered back in favour of the peace-party. With her diminished resources Athens could not indeed hope to cope with the great Macedonian king; however much we may sympathize with the patriots, we must admit that in the light of hard facts their conduct appears quixotic.

5. The Hellenistic Period.—Philip and Alexander, who sincerely admired Athenian culture and courted a zealous co-operation against Persia, treated the defeated city with marked favour. But the people would not resign themselves to playing a secondary part, and watched for every opportunity to revolt. For her outbreak after Alexander's death (323) the regent Antipater punished Athens by the loss of her remaining dependencies, the proscription of her chief patriots and the disfranchisement of 12,000 citizens. The Macedonian garrison prevented the city from taking a prominent part in the wars of the Diadochi. Cassander placed Athens under Demetrius of Phalerum (317–307), and after the temporary liberation by Demetrius Poliorcetes (306–300), under a dictator named Lachares, who lost the place again to Poliorcetes after a siege (295). The Athenians regained their liberty while Macedonia was thrown into confusion by the Celts, and in 279 rendered good service against the invaders with a fleet off Therinopylae. When Antigonus Gonatas threatened to restore Macedonian power in Greece, the Athenians, supported perhaps by Ptolemy, formed a defensive coalition; but in the ensuing "Chremonidean War" (266–263) a naval defeat off Andros led to the imposition of a Macedonian garrison. The latter was withdrawn in 229 by the good offices of Aratus of Sicyon (*q.v.*). At this period Athens was altogether overshadowed by the great Hellenistic monarchies and even by the new republican leagues of Greece; but the prestige of her past history now perhaps attained its zenith. Her democracy was respected by the Macedonian kings; the rulers of Egypt, Syria, and especially of Pergamum, courted her by gifts of buildings and works of art, to which the citizens replied by unbecoming flattery, even to the extent of creating new tribes named after their benefactors. If Athens lost her supremacy in the fields of science and scholarship to Alexandria, she became more than ever the home of philosophy, while Menander and the other poets of the New Comedy made Athenian life known throughout the civilized world.

6. Relations with the Roman Republic.—In 228 Athens entered into friendly intercourse with Rome, in whose interest she endured the desperate attacks of Philip V. of Macedonia (200–199). In return for help against King Perseus she acquired some new possessions, notably the great mart of Delos, which became an Athenian cleruchy (166). Athens indirectly brought about the conflict between Rome and the Achaean league which resulted in the loss of Greek independence, but remained herself a free town with rights secured by treaty. In spite of the favours of Rome, the more radical section began to chafe at the loss of their importance. This discontent was skilfully fanned by Mithridates the Great at the outset of his Roman campaigns. His emissary, the philosopher Aristion, induced the people to declare war against Rome and to place him in chief command. The town with its port stood a long siege against Sulla, but was stormed in 86. The conqueror allowed his soldiers to loot, but inflicted no permanent punishment upon the people. This war left Athens poverty-stricken and stripped of her commerce; her only importance now lay in the philosophical schools, which were frequented by many young Romans of note (Cicero, Atticus, Horace, etc.) as a sort of university (cf. Propeitius iv. 21). In the great civil wars Athens sided with Pompey, but received a free pardon "in consideration of her great dead." Similarly the triumvirs after Philippi condoned her enthusiasm for the cause of Brutus. Antony repeatedly made Athens his headquarters and granted her several new possessions, including Eretria and Aegina—grants which Octavian subsequently revoked.

7. The Roman Empire.—Under the new settlement Athens remained a free and sovereign city—a boon which she repaid by zealous Caesar-worship. Hadrian displayed his fondness for the city by raising new buildings and relieving financial distress. He amended the constitution and instituted a new national festival, the Panhellenica. Under the Antonines the endowment of professors out of the imperial treasury gave Athens a special status as a university. Her whole energies seem henceforth devoted to academic pursuits; the military training of her youth was superseded by courses in philosophy and rhetoric; the chief organs of administration, the revived Areopagus and the senior Strategus, became an education office. Save for an incursion by Goths in A.D. 267 and a temporary occupation by Alaric in 395, Athens spent the remaining centuries of the ancient world in quiet prosperity. The rhetorical schools experienced a revival under Constantine and his successors, when Athens became the *alma mater* of many notable men, including Julian, Libanius, Basil and Gregory of Nazianzus, and in her professors owned the last representatives of a humane and moralized paganism. The freedom of teaching was first curtailed by Theodosius I.; the edict of Justinian (529), forbidding the study of philosophy, dealt the death-blow to ancient Athens.

The authorities for the history of ancient Athens will mostly be found under GREECE: *History*, and the various biographies. The latest account of Athenian history will be found in the Cambridge Ancient History, vols. iii.–vi., which have full classified bibliographies. For general impressions, A. E. Zimmern, *The* Greek *Commonwealth* (Oxford, 1925) and W. S. Fergusson, *Hellenistic Athens* (London, 1911) should be consulted. (M. C.; A. J. B. W.)

8. Byzantine Period.—The city now sank into the position of a provincial Byzantine town, and is rarely mentioned in the chronicles. Already it had been robbed of many of its works of art, among them the Athena Promachos and the Parthenos of Pheidias, for the adornment of Constantinople, and further spoliation took place when the church of St. Sophia was built in A.D. 532. The Parthenon, the Erechtheum, the "Theseum" and other temples were converted into Christian churches and were thus preserved throughout the middle ages. The Emperor Constantine II. spent some months here in A.D. 662–663. In 869 the see of Athens became an archbishopric. In 995 Attica was ravaged by the Bulgarians under their Tsar Samuel, but Athens escaped; after the defeat of Samuel at Bēlasitza (1014) the Emperor Basil, who blinded 15,000 Bulgarian prisoners, came to Athens and celebrated his triumph by a thanksgiving service in the Parthenon (1018). From the Runic inscription on the marble lion from Peiraeeus it has been inferred that Harold Hardraada and the Norsemen in the service of the Byzantine emperors captured Peiraeeus in 1040. Like the rest of Greece, Athens suffered greatly from its Byzantine administrators. The letters of Acominatus, archbishop of Athens, towards the close of the 12th century, bewail the desolate condition of the city.

9. Period of Latin Rule: 1204–1458.—After the Latin conquest of Constantinople in 1204, Otho de la Roche was granted the lordship of Athens by Boniface of Montferrat, king of Thessalonica, with the title of Megaskyr (μέγας κύριος=great lord). His nephew and successor, Guy I, obtained the title duke of Athens from Louis IX. of France in 1258. On the death of Guy II., last duke of the house of la Roche, in 1305, the duchy passed to his cousin, Walter of Brienne. He was expelled in 1311 by his Catalonian mercenaries; the mutineers bestowed the duchy "of Athens and Neopatras" on their leader, Roger Deslaur, and, in the following year, on Frederick of Aragon, king of Sicily. The Sicilian kings ruled Athens by viceroys till 1385, when the Florentine Nerio Acciajuoli, lord of Corinth, defeated the Catalonians, seized the city and received the title of duke from the

king of Naples His palace was in the Propylaea; the lofty "tower of the Franks," which adjoined the south wing of that building, was possibly built in his time. The Acciajuoli dynasty lasted till June 1458, when the Acropolis was taken by the Turks under Omar, the general of the sultan Mohammed II., who had occupied the lower city in 1456. When the sultan entered Athens he was greatly struck by its ancient monuments and treated its inhabitants with comparative leniency.

10. *Period of Turkish Rule:* 1458–1833.—After the Turkish conquest Athens disappeared from the eyes of Western civilization. The Parthenon was transformed into a mosque; the existing minaret at its south-western corner was built after 1466. The Propylaea served as the residence of the Turkish commandant and the Erechtheum as his harem. In 1466 the Venetians succeeded in occupying the city, but failed to take the Acropolis. About 1645 a powder magazine in the Propylaea was ignited by lightning and the upper portion of the structure was destroyed. Under Francesco Morosini the Venetians again attacked Athens in Sept. 1687; a bomb fired during the bombardment of the Acropolis exploded a powder magazine in the Parthenon and the building was rent asunder. After capturing the Acropolis the Venetians employed material from its ancient edifices in repairing its walls. They withdrew in the following year, when the Turks set fire to the city. The central sculptures of the western pediment of the Parthenon, which Morosini intended to take to Venice, were unskilfully moved, and falling to the ground were broken to pieces. Several ancient monuments were sacrificed to provide material for a new wall with which the Turks surrounded the city in 1778.

In 1821 the Greek insurgents surprised the city, and in 1822 captured the Acropolis. Athens again fell into the hands of the Turks in 1826, who bombarded and took the Acropolis in the following year; the Erectheum suffered greatly, and the monument of Thrasyllus was destroyed. The Turks remained in possession of the Acropolis till 1838, when Athens was chosen as the capital of the newly established kingdom of Greece. On April 27, 1941, it was occupied by the Germans, who, however. had spared it from bombing. (For its modern history *see* GREECE.)

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(J. D. B.; A. J. B. W.)

ATHENS, a city of Georgia, U.S.A.. 73 mi. E. by N. of Atlanta, on a hill overlooking the Oconee river; the county seat of Clarke county.

Athens is on federal highways 78, 29 and 129; the city is served by the Southern, the Seaboard Air Line, the Gainesville Midland, the Georgia, and the Central of Georgia railways. The population in 1920 was 16,748, of whom 6,595 were Negroes; and was 20,650 in 1940 by the federal census. Athens was founded in 1801 as the seat of the University of Georgia (chartered 1785) for which the State Legislature had in 1784 set aside 40,000 acres of land. The first department, Franklin college, was opened in 1801; the college of agriculture and mechanic arts in 1872. In 1867 the Lumpkin law school (incorporated 1859), in 1872 the North Georgia agricultural college at Dahlonega (established 1871), and in 1873 the Georgia medical college at Augusta (founded 1829) became departments of the university. The school of pharmacy was established in 1903; the summer school (authorized 1897) in 1904; the schools of forestry, commerce, and journalism. in 1906, 1912, and 1915 respectively. The Peabody College of Education is also a part of the University of Georgia. The following institutions elsewhere in the State were also established, under the State Constitution of 1877, as branches or departments of the university: the Georgia school of technology, Atlanta (1885); the Georgia normal and industrial college for girls, now the State college for women, Milledgeville (1889); the Georgia industrial college for coloured youth, near Savannah (1890); the South Georgia normal school, now the State woman's college, Valdosta (1906); the Bowdon State normal college, Bowdon (1919); and the South Georgia agricultural and mechanical college, Tifton (1924).

Athens has an extensive wholesale trade, and is growing in importance as a manufacturing centre. In 1937 there were 31 factories within the city and the value of their output was $5,763,572. The leading products are cotton goods, cottonseed oil, hardnood handles, sash, doors, lumber, fertilizer, bed-springs and mattresses, articles of marble and granite, and brick and tile. The city was chartered in 1872.

ATHENS, a city of Ohio, U.S.A., 72 mi. S.E. of Columbus, on the Hocking river; the county seat of Athens county. It is on federal highways 50 and 33, and is served by the Baltimore and Ohio, the New York Central and the Chesapeake and Ohio railways. The population in 1940 was 7.696. The city occupies a site 70 ft. above the river, which almost encircles it, and commands views of some of the most beautiful scenery in the state. There are several prehistoric mounds in the vicinity. South of the city is a state hospital for the insane. The principal manufactures are office equipment, files and parquetry flooring. Parts of the Jackson, Ironton, and Hocking coalfields lie within the county.

Athens is the seat of Ohio university (co-educational), the oldest college north-west of the Ohio. When the Ohio Company, in 1789, made its contract for the purchase of land in the North-west Territory, Manasseh Cutler secured from Congress the donation of two entire townships as a perpetual endowment for a university. In 1801 he was appointed by the Territorial Legislature, one of the trustees of the Ohio University, to bring the lands into available use, and he proceeded up the Hocking river with a fleet of canoes, and with compass and chain fixed the boundaries of the university campus in the virgin forest. A charter for "the Ameri-

can University" was granted by the Territorial legislature in 1802; and in 1804 the new State legislature passed a modified act establishing "Ohio University" in the town of Athens. The college was opened in 1809. A building erected in 1817 is still in use. In recent years the total net enrolment of resident students has been about 3,500, of whom about 42% were women. The appropriations by the legislature for 1939–40 were $1,371,124.

Athens was made the county seat in 1805; was incorporated as a village in 1811; and was chartered as a city in 1911.

See S. P. Hildreth, *Biographical and Historical Memoirs of fhe early Pioneer Settlers of Ohio,* **p.** *114.*

ATHERSTONE, WILLIAM GUYBON (1813–1898), British geologist, one of the pioneers in South African geology, was born in 1813 in the district of Uitenhage, Cape Colony, and died at Grahamstown, June 26, 1898. He devoted the leisure of a long and successful medical practice to the pursuit of geological science. Atherstone's identification as a diamond of a crystal found at De Kalk, near the junction of the Riet and Vaal rivers (1867), led indirectly to the establishment of the great diamond industry of South Africa. He encouraged the workings at Jagersfontein, and he also called attention to the diamantiferous neck at Kimberley. He was one of the founders of the Geological Society of South Africa at Johannesburg in 1895; and was for some years a member of the Cape Parliament.

See the obituary by T. Rupert Jones, *Natural Science,* vol. xiv. (Jan. 1899).

ATHERSTONE, market-town, Warwickshire, England, 102½ mi. N.W. from London by the L.M.S. railway. Pop. (1931) 6,245; of rural district (est. 1938) 22,000. It lies in the upper valley of the Anker and is on the Coventry canal.

Atherstone (Aderestone, Edridestone, Edrichestone) is mentioned in Domesday Book among the possessions of Countess Godiva, the widow of Leofric. In the reign of Henry III. it passed to the monks of Bec in Normandy, who in 1246 obtained the grant of an annual fair at the feast of the Nativity of the Virgin, and the next year of a market every Tuesday. This market became so much frequented that in 1319 a toll was levied upon all goods coming into the town, in order to repair the roads, and in 1332 a similar toll was levied on all goods passing over the bridge called Feldenbrigge, near Atherstone. The September fair and Tuesday markets are still continued.

ATHERTON or **CHOWBENT,** urban district, Lancashire, England, 13 mi. W.N.W. of Manchester on the L.M.S. railway. Population (1938) 20,590. The cotton facto ies account for the rapid industrialization of the district. The manor was held by the Athertons from John's reign to 1738, when it passed by marriage to Robert Gwillym and subsequently to Lord Lilford. It is an early Nonconformist centre, with a chapel built in 1645. During the rebellion of 1715 this Nonconformist church headed by its pastor marched against the Pretender, a typical attitude for a weaving population. Up to 1891 the lord of the manor held a court-leet and court-baron annually in November, but in that year Lord Lilford sold to the local board the market tolls, stallages and pickages, and since this sale the courts have lapsed. The earliest manufactures were iron and cotton. Silk-weaving, formerly an extensive industry, has now almost entirely decayed. At the present time textile works, mining (coal) and quarrying, as well as iron foundries, are the most important sources of employment.

ATHETOSIS, the medical term for certain slow, purposeless movements of the hands and feet. The fingers are separately flexed and extended, abducted and adducted in an entirely irregular way. The hands as a whole are also moved, and the arms, toes and feet may be affected. The condition is usually due to some lesion of the brain which has caused hemiplegia, and is especially common in childhood. It is occasionally due to injury of the brain during birth. Athetosis never develops where there is no recovery of voluntary power. The movements are one-sided and may or may not continue during sleep. They cannot be arrested for more than a moment by will power, and are aggravated by voluntary movements. The prognosis is unsatisfactory, as the condition usually continues unchanged for years, though improvement occasionally occurs in slight cases, or even complete recovery.

ATHIAS, JOSEPH (died May 12 1700), Jewish rabbi and printer, was born in Spain and settled in Amsterdam. His editions of the Hebrew Bible (1661, 1677) are noted for beauty of execution and the general correctness of the text. He also printed a Judaeo-German edition of the Bible in 1679.

ATHLETE, in Greek and Roman antiquities, one who contended for a prize (ἆθλον) in the games; now a general term for any one excelling in physical strength (Gr. ἀθλητής; Lat. *athleta).* Originally denoting one who took part in musical, equestrian, gymnastic or any other competitions, the name became restricted to the competitors in gymnastic contests, and, later, to the class of professional athletes. Whereas in earlier times, competitors, who were often persons of good birth and position, entered the lists for glory, without any idea of material gain, the professional class. which arose as early as the 5th century B.C., was chiefly recruited from the lower orders, with whom the better classes were unwilling to associate, and took up athletics entirely as a means of livelihood. Ancient philosophers, moralists and physicians were almost unanimous in condemning the profession of athletics as injurious not only to the mind but also to the body. The attack made upon it by Euripides in the fragment of the *Autolycus* is well known. The training for the contests was very rigorous. The matter of diet was of great importance, this was prescribed by the *aleiptes,* whose duty it also was to anoint the athlete's body. At one time the principal food consisted of fresh cheese, dried figs and wheaten bread. Afterwards meat was introduced, generally beef or pork; but the bread and meat were taken separately, the former at breakfast, the latter at dinner. Except in wine, the quantity was unlimited, and the capacity of some of the heavyweights must have been, if such stories as those about Milo are true, enormous. In addition to the ordinary gymnastic exercises of the palaestra, the athletes were instructed in carrying heavy loads, lifting weights, bending iron rods, striking at a suspended leather sack filled with sand or flour, taming bulls, etc. Boxers had to practise delving the ground, to strengthen their upper limbs. The competitions open to athletes were running, leaping, throwing the discus, wrestling, boxing and the pancratium, or combination of boxing and wrestling. Victory in this last was the highest achievement of an athlete, and was reserved only for men of extraordinary strength. The competitors were naked, having their bodies salved with oil. Boxers wore the *caestus* (*q.v.*), a strap of leather round the wrists and forearms, with a piece of metal in the fist, which was sometimes employed with great barbarity. An athlete could begin his career as a boy in the contests set apart for boys. He could appear again as a youth against his equals, and though always unsuccessful could go on competing till the age of 35, when he was debarred, it being assumed that after this period of life he could not improve.

Amongst the Romans, athletic contests had no doubt taken place from the earliest times, but according to Livy (xxxix. 22) professional Greek athletes were first introduced at Rome by M. Fulvius Nobilior in 186 B.C. After the institution of the Actian games by Augustus their popularity increased, until they finally supplanted the gladiators. In the time of the empire, guilds or unions of athletes were formed, each with a temple, treasury and exercise-ground of its own. The profession, although it ranked above that of a gladiator or an actor, was looked upon as derogatory to the dignity of a Roman, and it is a rare thing to find a Roman name among the athletes on inscriptions. The system was entirely. and the athletes themselves nearly always, Greek *(See* also GAMES. CLASSICAL, and ATHLETIC SPORTS)

BIBLIOGRAPHY.—*See* Krause, *Gymnastik und Agonistik der Hellenen* (1841); Friedlander, *Sittengeschichte Roms,* ii.; Reisch, in Pauly-Wissowa, *Realencyk.*

ATHLETICS, WOMEN IN. During World War I women began to enter fields of sport which hitherto had been the private preserves of the male sex. Football, boxing, wrestling and field and track athletics, including the tug-of-war, became popular and were more or less efficiently practised by women. After the War France created a State department of sport, under the Ministry of Health and Education. The object of this department,

which has now become a ministry, was to provide every member of the republic with his or her game. It was early realized that to be included in the international team would be the aim and object of every athlete of either sex, and it was mainly due to the energetic promotion of international athletic matches for women by France, and their repeated invitations to England to take part therein, that the international and national governing bodies of women's athletics in many countries of the world have been brought into being.

France was responsible for the formation in 1921 of the *Fédération Sportive Féminine Internationale,* which is the supreme governing body of women's sport. At the inaugural meeting the countries represented were the United States, Czechoslovakia, France, Great Britain, Italy and Spain, but now the nations which send delegates to the F.S.F.I. congresses are: United States, France, Great Britain, Sweden, Czechoslovakia, Belgium. Italy, Japan, South Africa, Argentina, Australia, Austria, Brazil, Bulgaria, Canada, Chile, China, Denmark, Egypt, Spain, Estonia, Finland, Greece, Hungary, Latvia, Lithuania, Luxembourg, Norway, Holland. Peru, Poland, Portugal, Rumania, Switzerland, Turkey, Uruguay, Yugoslavia. In 1922 the English Women's Amateur Athletic Association was founded at the suggestion of the A A A. The English Association now legislates for more than 23,000 girls.

Some minor international meetings, in all of which Great Britain was successful, took place in the years immediately after the World War, but the first Olympic games for women were not held until 1922. The British women were once more successful, the general classification of points being: Great Britain 50, United States 31, France 29, Czechoslovakia 12 and Switzerland 6. At the first Olympiad the victors were as follows:—

Event	Winner	Country	Time or distance
			min. sec.
60 metres	Mejzlikova II.	Czecho-slovakia	$7\frac{3}{5}$
100 yards	Callebout	England	12
300 metres	M. Lines	England	$44\frac{4}{5}$
1000 metres	L. Bréard	France	3 12
100 yards hurdles	C. Sabie	U. S. A.	$14\frac{2}{5}$
440 yards relay	Great Britain		$51\frac{4}{5}$
			ft. in.
High jump (with run)	C. Hatt / N. Voorhees	England / U. S. A.	4 $9\frac{3}{16}$
Long jump (with run)	M. Lines	England	16 $6\frac{7}{8}$
Long jump (without run)	C. Sabie	U. S. A.	8 $2\frac{1}{8}$
Putting the weight (both hands)	L. Godbold	U. S. A.	66 $4\frac{3}{4}$
Javelin (both hands)	F. Pianzola	Switzerland	141 $10\frac{3}{8}$

The first Olympic games for women, held at Paris in 1922, were an attempt to revive the women's athletic festivals of classical antiquity. At that time athletics for women (apart from fencing) scarcely existed in Sweden. There was some interest in the schools and a few events at the schools annual sports at Stockholm. Meanwhile the propaganda committee of the Swedish National Athletic Association formulated special lines of work for the movement, resulting in women's competitions, but there were very few entries. In the summer of 1925 a strong team of English girl athletes visited Sweden, and, competing at Gothenburg and Falkenberg, aroused such interest that the *Sveriges Kvinnliga Idrottsförbund* (Women's Athletic Association) was at once formed and affiliated to the F.S F.I.

At the third congress of the F S.F.I. it was arranged that the second women's Olympiad should be held at Brussels in 1926, a venue later changed to Gothenburg in Sweden. The organizers had received entries from ten nations but, unfortunately, Italy and Yugoslavia were unable to send teams. The eight nations represented were Belgium, Czechoslovakia, France, Great Britain, Japan, Latvia, Poland and Sweden. The games lasted for three days of unbroken sunshine and the large attendance of spectators made it unnecessary for the organizers to call upon the Swedish sportsmen who had guaranteed the expenses of the games. When the contests were over and the final points assessed Great Britain came first with 50 points, then France 27, Sweden 20, Czechoslovakia 19, Japan 15, Poland 7 and Latvia 1. The results were as follows:—

Results at the Second Internatzonal Ladies' Games

Event	Performance	Winner	Nation
	min. sec.		
60 metres run	78	Radideau	France
100 yards run	$11\frac{4}{5}$	,,	,,
250 metres run	$33\frac{2}{5}$	Edwards	Gt. Britain
1000 ,, ,,	3 $8\frac{4}{5}$	Trickey	,, ,,
440 yards relay (4x110 yards)	495	Gt. Britain	,, ,,
rom metres walk	5 10	Crossley	,, ,,
100 yards hurdles	$14\frac{2}{5}$	Sychowa	Czecho-slovakia
	ft. in.		
Running high jump	4 $11\frac{1}{16}$	Bonze	France
,, long ,,	18 $0\frac{1}{2}$	Hitomi	Japan
Standing ,, ,,	8 $2\frac{1}{8}$	,,	,,
Discus (best hand)	124	Konopacka	Poland
Shot put (right hand 33 ft., $11\frac{1}{8}$ in.) (left hand 30 ft., $2\frac{1}{4}$ ins.)	64 $2\frac{11}{16}$	Vidalkowa	Czecho-slovakia
Javelin (right hand 97 ft, $3\frac{9}{16}$ in) (left hand 63 ft., $11\frac{7}{16}$ in.)	161 3	Adelskold	Sweden

The fourth congress of the F.S.F.I. took place in Gothenburg on Aug. 27–29, 1926; Belgium, Czechoslovakia, France, Germany, Great Britain, Italy, Japan, Lithuania, Luxembourg, Poland, Sweden and Switzerland were represented. At this congress it was decided to adopt and use the metric system only and to eliminate races at distances between 200 and 800 metres. The weight of the women's javelin was fixed at 600 grams (1·322lb.) and that of the shot and discus at 4 kilograms (8·8184lb.) and 1 kilogram (2·2046lb.) respectively. It was also agreed to take account only of best hand throws at the next games and to exclude walking contests from the list of records. The most important question dealt with was that of participation in the men's Olympic games, the I.O.C. having decided to include five events for women at the ninth Olympiad at Amsterdam in 1928. These resulted as follows:—

Event	Winner	Country	Time or Distance
			min. sec.
roo metres.	E. Robinson	U.S.A.	$12\frac{1}{5}$
800 metres.	L. Radke	Germany	2 $16\frac{4}{5}$
400 metres relay	Canadian Olympic Team	Canada	$49\frac{2}{5}$
High Jump	E. Catherwood	Canada	5 ft 3 in
Discus	H. Konopacka	Poland	129 ,, $11\frac{7}{8}$,,

Note. In each of the above events a new world's record was made.

It may be added that all the nations subsequently decided to take part, with the sole exception of Great Britain. At the fourth congress of the F.S.F.I. it was decided to hold the third international ladies' games at Prague in *1930.*

Each country has its own governing body and its annual national championships. Two important international matches have taken place in London, more than 25,000 spectators being present on each occasion. In 1924 Great Britain scored 56 points, France 24, Belgium 15, Czechoslovakia 13, Switzerland 7 and Italy 2. In 1925 there was a triangular match between Great Britain (56 points), Czechoslovakia (26 points) and Canada (23 points). Women's athletic sport is growing rapidly, and a high level of performance has been already reached, as may be seen from the table of world's records on pp. 614–6.

See F. A. M. Webster's *Athletics* of *To-day for Women* (Frederick Warne & Co., Ltd., London, 1930). (**F. A.** M. W.)

ATHLETIC SPORTS. Various sports were cultivated many hundreds of years before the Christian era by the Egyptians and several Asiatic races. The Irish, too. had a great festival known as the Lugnasad, or Tailtin games, which were celebrated several

WORIEN'S ATHLETIC RECORDS

Event	Record	Name	Nationality	Year
50 yards	5⅘ sec.	E. Robinson	U.S.A.	1929
60 metres	7 3/10 ,,	S. Walasiewicz	Polish	1933
75 yards	8⅘ ,,	L. Haydock	U.S.A.	1913
100 yards	11 1/10 ,,	E. Johnson	British	1932
100 metres	11⅘ ,,	S. Walasiewicz	Polish	1933
200 metres	24 1/10 ,,	S. Walasiewicz	Polish	1932
220 yards	25⅕ ,,	N. Halstead	British	1930
440 yards	56⅘ ,,	N. Halstead	British	1932
1,000 metres	3 min. 6⅗ sec.	L. Radke	German	1930
80 metres hurdles	11⅗ sec.	R. Englehard	German	1934
Field Events				
Running Long Jump	19 ft. 8⅜ ins.	K. Hitomi	Japanese	1932
Standing ,, ,,	8 ,, 5 1/10 ,,	B. C. Holliday	British	1927
Running High ,,	5 ft. 5f ,,	J. Shiley	U.S.A.	1932
Standing ,, ,,	3 ,, 9 7/10 ,,	Dupius	French	1925
880 yards walk	3 min., 54⅕ sec.	M. F. Hegarty	British	1927
Shot Put (8¾ lbs.)				
Best Hand	44 ft. 11⅜ ins.	G. Heublein	German	1931
Two Hands (Aggregate)	70 ,, 5 5/10 ,,	Jungkunz	German	1929
Discus (1 kilo)				
Best Hand	146 ,, 11½ ,,	J. Wajsowna	Polish	1934
Two Hands (Aggregate)	218 ,, 1⅘ ,,	H. Konopacka	Polish	1928
Javelin (600 grs.)				
Best Hand	153 ,, 4½ ,,	N. Gindele	U.S.A.	1933
Two Hands (Aggregate)	187 ,, 2 1/10 ,,	Haux	German	1929
Relays				
220 yards (4x55)	26⅖ sec.	Eureka H.S., Millrose, A.C.	U.S.A.	1924, 28
440 ,, (4x110)	51 ,,	George School	U.S.A	1924
660 ,, (220, 110, 220, 110)	1 min., 17⅕ sec.	London Olympiades	British	1928
400 metres (4x110)	48⅖ sec.	Canadian Olympic Team	Canadian	1928
1,000 metres (10x100)	2 min., 4⅖ sec.	English National Team	British	1929

centuries B.C. From such ancient festivals as these the early Greeks undoubtedly adopted the elements of their athletic exercises *(see* ATHLETE) which reached their highest development in the Olympic games and other periodical meetings of the time *(see* GAMES, CLASSICAL). After the Norman Conquest of England the nobles devoted themselves to the chase and the joust, but the people also had their sports. In the main these were in the nature of preparations for war. The chroniclers of the middle ages are, for the most part, silent concerning the purely recreational pastimes. We are told, however, that Henry V. "was so swift a runner that he and two of his lords, without bow or other engine, would take a wiid buck in a large park." Strutt *(Sports and Pastimes of the People of England)* chronicles the fact that young men of good family were taught to run, leap, wrestle and joust. Several ordinances of reigning sovereigns make it clear that the common people had their sports, but these, apparently, interfered with the practice of archery, and Edward III. prohibited weight-putting by statute. The popularity of feats of strength prevailed, however, and we find, later, that "casting of the barre" was a popular pastime with Henry VIII., who had also a penchant for throwing the hammer. In the reign of this monarch there appears to have been a great athletic revival. Opinion as to the value of athletics was sharply divided during the reign of Henry VIII. His secretary, Richard Pace, advised the sons of noblemen to practise sport and leave study and learning to the sons of meaner people. At about the same period Sir Thomas Elyot deprecated too much study and flogging for schoolboys and suggested that more satisfactory results might be obtained by a proper appreciation of athletic lore. On the other hand Roger Ascham, in his *Toxophilus,* declares that "running, leaping and quoiting be too vile for scholars." Up to the 16th century a great football match had been played annually at Chester, but in that century was abandoned in favour of a series of foot-races, which took place in the presence of the mayor. The Stuart kings were warm encouragers of sport, and James I. in the *Basilikon Doron,* written to his son, recommended all forms of manly exercise. During the Puritan rule and that of Charles II., however, athletic sport all but died out in England, only to be revived with renewed vigour in the early part of the 19th century.

An extraordinary variety of sports has been popular in the British Isles with people of all classes for the past 500 years, but so far as history and legend record Ireland boasts by far the most ancient organized sports, the Tailteann Games, or Lugnasad, traditionally established by Lugaid of the long arm, one of the gods of Dia and Anna, in honour of his foster-mother, Tailti, some 3,000 years ago. Cuchulain, the mythical Irish hero, is said to have taken part. For many centuries these games and others like them were kept up in Ireland, and though almost constant wars which harried the country finally destroyed their organization, yet the Irish were for many centuries a very important factor in British athletics, as well as in America and the British dominions overseas. The Tailteann Games were successfully revived at Dublin in 1924, following upon the eighth Olympiad at Paris in the same year.

The Scottish people have, like the Irish, ever delighted in feats of strength and skill, especially the Celtic Highlanders. Unfortunately many of the great Highland gatherings are still of a professional nature, which has prevented the Scottish athlete from attaining the truly world-wide prominence to which his performances justly entitle him.

The Briton does not lose his love of sport upon leaving his native soil, and the development of athletics in the United States and the British dominions has, in many events, forged far ahead of that of the Motherland. Since the institution of the modern Olympic Games at Athens in 1896, national championship meetings have been promoted annually on the Continent and throughout Scandinavia. In recent years America, Finland, France, Germany, Italy, Norway and Sweden have produced a number of extraordinary world's record-breakers.

The first regularly organized athletic meeting of modern times was that promoted by the Royal military academy, Woolwich, in 1849. A year later Exeter college, Oxford, inaugurated sports which have been continued annually down to the present day. The Exeter college meeting was undoubtedly the precursor of the Cambridge sports founded in 1857 and the Oxford sports which were first decided in 1860. The Oxford and Cambridge sports commenced in 1864 and the English championships in 1866.

In 1852 Kensington grammar school began to hold regular sports meetings, Harrow and Cheltenham and Durham university followed suit a year later, and from those days may be traced the growth of athletic sport in English schools which now has reached its climax in the public schools sports meeting promoted annually by the London Athletic Club. The London Athletic Club came into being in June, 1863, under the style of the Mincing Lane Athletic Club, the majority of the founders having their business in that centre of London trade. In the following year

two meetings were held at the West London grounds at Brompton. In the spring of 1866 the club changed its name to its present style of the London Athletic Club. The year 1864 marks a definite epoch in the history of modern athletics. On March 3 Cambridge visited Oxford for a match of eight events on the Christ Church cricket ground, the result being a draw, as each side won four events. The Oxford and Cambridge sports were not moved to London until 1867. In the same year, 1864, the Civil Service sports were started, and at the beginning of 1866 the Amateur Athletic Club was formed to "supply the want of an established ground upon which competitions in amateur athletic sports might take place between gentlemen amateurs." The first English championship meeting was promoted by the A A C. in 1866. Despite this fact active athletes continued to ally themselves more with the L.A.C. than the A.A.C. The year 1879 marked a point of cleavage and two championship meetings were held: one promoted by the A.A.C., which had up to that time been in the habit of holding the championships in the spring, immediately after the Oxford and Cambridge sports, the other being held later in the summer under the management of the L.A C. for the greater convenience of non-university athletes. In 1880 the English Amateur Athletic Association was founded, and British athletic sports, together with the promotion of the English championships, have remained under the jurisdiction of that body ever since.

Annual championship meetings are held in the dominions and all foreign countries, the programmes being based upon the list of events contested quadrennially at the Olympic games. Of late years in England a general tightening up of the rules has placed a period upon the time during which a man may represent his university. In 1927 the joint committees of the Oxford and Cambridge university athletic clubs adopted the following new regulations regarding the eligibility of competitors in inter-university contests:

"That the present eligibility rules governing the inter-university athletic sports be cancelled and the following substituted: The eligibility to compete in (1) the inter-university sports, relays and cross-country races shall be limited to members of the two universities who, on the date on which the meeting is held, have not exceeded four calendar years from the date of their matriculation in either university; (2) Any meeting in which the two universities compete as such, including those mentioned in (1). shall be limited to those who have not exceeded the age of 23 years on Oct. 1 preceding the meeting in question. These rules, (1) and (2) to take effect as from Oct. 1, 1927, but not to affect those who were resident members of the universities of Oxford and Cambridge before that date, to whom the old rules will apply." (For eligibility rules in U.S. universities, see ATHLETIC SPORTS: United *States.)*

Athletic sports are now usually understood to consist of those events recognized in the championship programmes of the different countries which, in their turn, are based upon the Olympic games schedule of events. This, however, does not apply so far as England is concerned. Apart from the numerous championship meetings and international, inter-county and inter-club matches, the majority of sports meetings in England are confined to flat race handicaps, the field events and hurdle racing are entirely ignored and it is true that only during the last few years the whole of the Olympic field events have been included in the A A A. open and district championships programmes, nor are the whole of these events even yet practised at Oxford and Cambridge, whereas in America nearly all of the items have been added to the A.A.U. and I C.A.A.A.A. championship programmes as soon as they were raised to Olympic status. The events included in the Oxford and Cambridge sports are 100yd., 440yd., 880yd., 1m., 3m., 120yd. high hurdles, 220yd. low hurdles, high and long jumps, pole vault and shot put. Of the above list the A.A A. Open English championships do not include the 3m. run and the 220yd. low hurdles, but add 4m. and 10m. walks, 440yd. low hurdles. 2m. steeplechase, throwing the hammer, discus and javelin, hop, step and jump. tug of war (catch weights), tug of war (100st.), 440yd. relay race (4 x 100), and 1m. relay race (4 x 440yd.). In 1920 there was instituted an annual relay meeting between Oxford and Cambridge. Up to 1927 no Blues had been awarded for this match, which now comprises 400yd., ½m., 1m., 2m., 4m., 480yd. high hurdles and 880yd. low hurdles, four runners, each covering an equal quarter of the distance, representing either university in each event.

(For the United States events, *see* the article TRACK AND FIELD SPORTS.)

Long before annual championship meetings were instituted in any country the desire to pit the athletes of one nation against those of another was clearly in evidence, and England was visited in 1844 by George Seward, an American professional runner, who achieved some signal successes, and in 1863 by Louis Bennett, called "Deerfoot," a full-blooded Seneca Indian, who established running records up to 12 miles. In 1884 a team of Irish athletes, among them the late Dr. W. J. M. Barry, a magnificent exponent of the heavy-weight field events, visited Canada and won several championships. In 1888 the Manhattan A.C., New York, sent to England a team and the Gaelic A.A. despatched a team to America. In 1890 the Salford Harriers were the guests of the Manhattan A.C. in New York, and the following year the Manhattan athletes went again to England. The first matches of a truly international character occurred, however, in 1894 and 1895, and were arranged by the famous Yale sprinter, C. H. Sherrill, who invented the crouch start. In 1894 the universities of Yale and Oxford met in London and the English blues proved successful by winning 5½ to 3½ events. The following year the London A.C. took to New York almost the strongest team that could be mustered in the British Isles. They competed against the New York A.C., but did not win a single event. Twelve thousand people witnessed this match on Manhattan Field. Fourteen events comprised the programme and three world's records were broken and one equalled. Two weeks later Cambridge was defeated by Yale in America by 8 events to 3. In 1899 Oxford and Cambridge combined forces for a match in London against Harvard and Yale, who were beaten by the odd event.

A summary of the most interesting meetings follows:—

1894	Oxford 5½	Yale 3½	in England
1895	Yale 8	Cambridge 3	in America
1899	Oxford and Cambridge 5	Yale and Harvard 4	in England
1901	Yale and Harvard 6	Oxford and Cambridge 3	in America
1904	Yale and Harvard 6	Oxford and Cambridge 3	in England
1911	Oxford and Cambridge 5	Yale and Harvard 4	in England
1921	Yale and Harvard 8	Oxford and Cambridge 2	in America
1921	Oxford and Cambridge 5	Yale and Harvard 5	in America
1923	Oxford and Cambridge 6½	Yale and Harvard 5½	in England
192 j	Oxford and Cambridge 6	Yale and Harvard 6	in America
1925	Oxford and Cambridge 9	Princeton and Cornell 3	in America
1926	Oxford and Cambridge 7	Princeton n d Cornell 5	in England
1927	Oxford and Cambridge 7	Yale and Harvarcl 4	in England
1929	Oxford and Cambridge 4	Yale and Harvard 8	in America
1929	Oxford and Cambridge 3	Princeton and Cornell g	in America

It is from the enterprise of such bodies as the Salford Harriers, Gaelic A.A., London A.C., Manhattan A.C. and New York A.C. and the early meetings between English and American universities that the present series of international matches between all countries throughout the world, apart from the Olympic Games, has grown, until no athletic season passes at the present time without each country engaging in several international matches with one or more other countries. The most important of all international festivals is, however, the revived Olympic Games. They were instituted by delegates from the different nations who met in Paris on June 16, 1894, principally at the instigation of Baron

Pierre de Coubertin, the result being the formation of an international Olympic Games committee with Baron de Coubertin at its head which resolved that games should be held every fourth year in a different country.

First Olympiad. — The first modern Olympiad took place at Athens, April 6–12, 1896, in the ancient stadium, which was rebuilt through the liberality of M. Averoff, a Greek merchant, and seated about 45,000 people. The programme of events included the usual field and track sports, gymnastics, wrestling, rope-climbing, lawn-tennis, fencing, rifle and revolver shooting, weight-lifting, swimming, the Marathon race and bicycle racing. Among the contestants were representatives of nearly every European nation, besides Americans and Australians. Great Britain took little direct interest in the occasion and was inadequately represented, but the United States sent five men from Boston and four from Princeton university, who, although none of them held American championships, succeeded in winning every event for which they were entered. The Marathon race of 42 kilometres (26m.), commemorative of the famous run of the Greek messenger to Athens with the news of the victory of Marathon (see MARATHON RACE), was won by a Greek peasant.

Second and Third Olympiads. — The second Olympiad was held in Paris in June, 1900. Again Great Britain was poorly represented, but American athletes won 18 of the 24 championship events. The third Olympiad was held at St. Louis, Mo., in the summer of 1904 in connection with the Louisiana Purchase Exposition, its success being due in great measure to the late James E. Sullivan, the physical director of the exposition, and Caspar Whitney, the president of the American Olympic Games committee. Although there were scarcely any entries except Americans, the programme contained far more events than those of the previous Olympiads, including sports of all kinds, handicaps, inter-club competitions and contests for aborigines. In the track and field competitions the American athletes won every championship except weight-throwing (56 lb.) and lifting the bar. The sports of the American Indians, Africans of several tribes, Moros, Patagonians, Syrians, Ainus and Filipinos were disappointing, their efforts in throwing the javelin, shooting with bow and arrow, weight-lifting, running and jumping proving to be feeble compared with those of the white races. The American Indians made the best showing.

Since that time, however, coloured athletes have attained to a remarkable prominence. At the Stockholm Olympiad, 1912, James Thorpe, an American Indian, won the pentathlon by a margin of 14 points and the decathlon with 8,412·955 points, which latter performance would have stood for many years as a world's record but that Thorpe was unfortunately declared a professional on the technicality of once, as a youth, having accepted a small payment for playing in a baseball game. At the same Olympiad, Louis Tewanami, another American Indian, finished second in the 10,000 metres world's championship. More recently France has produced one and America three negro long jumpers who have beaten 2 jft., while two of the best sprinters Great Britain has had since the war are H. F. V. Edward, a West Indian, and J. E. London, a native of British Guiana. A regular championship meeting is now held annually in Kenya Colony for East African natives, and there are also Egyptian championships.

The Greeks, however, were not altogether satisfied with the cosmopolitan character of the revival of the celebrated games of their ancestors, and resolved to give the revival a more definitely Hellenic stamp by intercalating an additional series to take place at Athens, in the middle of the quadrennial period. Their action was justified by the success which attended the first of this additional series at Athens in 1906. This success may have been partly due to the personal interest taken in the games by the king and royal family of Greece, and to the presence of King Edward VII., Queen Alexandra and the prince and princess of Wales; but to whatever cause it should be assigned it was generally acknowledged that neither in France nor in America had the games acquired the same prestige as those held on the classical soil of Greece. In 1906 the Governments of Germany, France and the United States made considerable grants of money to defray the expenses of the competitors from those countries. The 1906 intercalated games aroused much more interest in England than the earlier ones in the series, but although upwards of 50 British competitors took part in the contests, they were by no means representative in all cases of the best British athletes. The American representatives were slightly less numerous, but they were more successful. It was noteworthy that no British or Americans took part in the rowing races in the Bay of Phalerum, nor in the tennis, football or shooting competitions. The English fencing team (epée) was composed of Lord Desborough, Sir Cosmo Duff Gordon, Edgar Seligman, Charles Newton-Robinson, Lord Howard de Walden (spare man) and Theodore Cook (captain). They fought France to a dead heat in the final. The Marathon race, by far the most important event in the games. was won in 1906 by a British athlete, M. D. Sherring, a Canadian by birth. Nine hundred and one competitors, representing 19 countries, took part. In accordance with an unofficial method of scoring adopted by the special correspondents of the press, America finished first in the athletic section with $75\frac{1}{6}$ points, Britain second, 41 points, Sweden third, 28 points and Greece fourth, $27\frac{1}{2}$ points. The Greeks have never been able to repeat the intercalated series of games at Athens, partly owing to the expense, partly because the Athenian Stadium is not built for high speed round the corners.

Fourth Olympiad. — The games of the fourth Olympiad (1908) were held in London in connection with the Franco-British Exhibition of that year. An immense sensation was caused by the finish of the Marathon race from Windsor Castle to the stadium in the Exhibition grounds in London. The first competitor to arrive was the Italian, Dorando Pietri, whose condition of physical collapse was such that, appearing to be on the point of death, he had to be assisted over the last few yards of the course. He was, therefore, disqualified, and J. Hayes, an American, was adjudged the winner; a special prize was presented to the Italian by Queen Alexandra. In the whole series of contests the United Kingdom made 38 wins, the Americans 22 and the Swedes 7. In the Olympic Games proper (athletic track and field events section), British athletes, including two wins by colonials from Canada and South Africa, scored 25 successes and the Americans 18. In the track events eight wins fell to the British including two colonials and six to American athletes; but the latter gained complete supremacy in the field events, of which they won nine, while British competitors secured only two of minor importance.

The London Olympiad of 1908 may, however, well be regarded as marking the commencement of a fresh athletic era throughout the world. It is worthy of note that the United States, in pursuit of a progressive policy, has always at once included in the Amateur Athletic Union and inter-collegiate championship programme any new event which might be added to the Olympic syllabus. The English Amateur Athletic Association (A.A.A.), on the other hand, for many years ignored such events as throwing the javelin, discus and 56 lb. weight and the hop, step and jump, and allowed to fall into disuse, through lack of encouragement and facilities for competition, such excellent exercises as pole vaulting, shot putting and hammer throwing, and gave but little more attention to high and long jumping and hurdling.

In 1910 the English Amateur Field Events Association (A.F.E.A.) was formed and authorized by the A.A.A. to hold championships. The new championships instituted were standing high jump (J. E. Boyde, 4ft. 6in.), standing long jump (L. H. G. Stafford, 9ft. $11\frac{3}{4}$in.), hop, step and jump (M. D. Dineen, 41ft. 6in.), throwing the javelin (F. A. M. Webster, 118ft. 11in.), and 440yd. hurdle race (E. B. Grier, $63\frac{2}{5}$sec.). By 1914 the purpose of the A.F.E.A. had been fulfilled, for in that year the A.A.A. incorporated in its championship programme the javelin, discus, hop, step and jump, and the 440yd. low hurdles, but even then these events were not taken so seriously as the others.

Fifth Olympiad. — Meanwhile the holding of the fifth Olympiad (1912) had been allotted to Stockholm, and the Swedes had recalled from America that great athletic coach, Ernie Hjertberg, to make ready a national team. Finland, also, had produced a great distance runner in Hannes Kolehrnainen, and a set of magnificent heavy-weight field events men, such as Saaristo, Taipale and

Niklander, while France had come into prominence with the late Jean Bouin, a world's distance-running record holder, who was, however, beaten by Kolehmainen in both the 5,000 and 10,000 metres races. Germany, too, gained prominence with R. Rau, the sprinter, H. Braun, the middle-distance runner, and H. Leische, the high jumper. Great Britain did very badly and would have been completely disgraced but for the superb running of A. N. S. Jackson, Oxford university, who won the 1,500 metres from a number of American world's record breakers, and in so doing set up a new Olympic record for the distance; in the 400 metres relay race Great Britain was also successful.

It is significant that at the Stockholm Olympiad the United States finished first with a total of 85 points, Finland second with 29 points, Sweden third with 27 points and Great Britain fourth with 15 points. American athletes were again in the ascendant, but with their supremacy challenged by Finland and Sweden. Finland, Sweden, Norway and Denmark had now become definitely athletic countries; while France, Germany and the lesser European nations, such as Italy, Belgium and Holland, were all showing steady progress towards national athletic efficiency.

More International Matches. — About this time, too, the custom of holding international athletic matches became popular. Most notable of all these, perhaps, is the Scandinavian *Landskamp,* founded in 1917, in which Norway, Sweden and Denmark meet annually at Oslo, Copenhagen and Stockholm in rotation. France, too, entered the international arena with matches with Sweden and Belgium, and Great Britain began to hold a triangular international, in which England, Ireland and Scotland meet annually. The other European nations, in meeting each other, contest practically the whole of the Olympic programme, whereas from England's match with France are excluded such important events as javelin throwing, pole vaulting and the low hurdles, and in the case of the British triangular international the discus is also omitted. In any comparison of international prowess in field events it is only fair to note that neither discus nor javelin throwing is practised at Oxford and Cambridge, and that the hammer-throwing event has been abandoned, while these events are regular features at all American and foreign schools, colleges and universities. Examination of world, university and school records shows clearly that England has fallen far behind the other nations in athletics. This circumstance is directly traceable to the fact that no coaching, such as appertains in cricket, is given to English boys while they are still at school, whereas the youths of other nations enter the universities with their athletic education already far advanced.

The War Period. — After Stockholm came the World War, which prevented the Sixth Olympiad, although a vast stadium had been built to house it at the Griinewald, Berlin. Many doubtless thought that in those strenuous years all sports must come to an end. This was not to be. Alva Kranzlein, the American sprinter-hurdler-jumper, had returned to Germany, the land of his forefathers, to make ready the German Olympic team, and in Germany or Hblland he stayed throughout the war, laying the foundations of a great athletic future for those nations. He was probably the first person to discover, in the internment camp at Gravenhaag, Holland, the potentialities of H. F. V. Edward, the West Indian sprinter, who won so many A.A.A. championship titles.

In England championships were abandoned from 1914 to 1919. Athletic meetings of a sort continued to be held under an unofficial general amnesty, which allowed pure amateurs and those soldiers who had forfeited their amateur status to compete together. In Great Britain the London Athletic Club contrived to carry on the public schools sports meeting right through the war, thus assuring for Great Britain the nucleus of a fine supply of athletes of international standing when the days of war should be ended. This public schools sports meeting, which has done more than anything else to induce British boys, to pay more attention to athletics, commenced in 1890, in which year C. H. Mason presented a quarter-mile challenge cup to be competed for annually by public school boys at an L.A.C. meeting. In subsequent years other cups were given and in 1897 a number of L.A.C. members presented public schools challenge cups to commemorate the diamond jubilee of Queen Victoria. A public schools meeting was promoted that year and now the public schools sports meeting comprises 100, 440 and 880yd., 1m., 1m. walk, 120yd. hurdles, ¾m. steeplechase, high jump, long jump and pole vault, and junior competitions for boys between 14 and 16 years of age, at 100yd., 250yd. and high jump. This meeting is the most important fixture of the public schools athletic season.

Education of Athletes. — Here one may pause to draw attention to the splendid movement now in progress all over the world for the better athletic education of boys at school. In the United States the universities and colleges, as well as all schools of any standing, have their properly qualified athletic coaches. Inter-university, inter-collegiate and inter-school athletic meets are exceptionally popular, and the same may be said of the Scandinavian and many other European nations. France, in particular, has established a ministry of sport. In Scotland inter-scholastic championships have long been in vogue. In England the public schools sports meeting and also the public schools relay meeting, the latter under the auspices of the Achilles Club, are both established fixtures, and there is now an Inter-Schools Athletic Association (elementary schools) which, for the first time, held championships in 1925. But in no country, save possibly the United States, is there to be found anything approaching the Swedish schoolboys' athletic week, held annually in Stockholm, to which city school teams journey from every part of Sweden. (*See* the United *States* section of this article, and TRACK AND FIELD SPORTS.)

To revert, however, to the war period. The United States, unaffected by the struggle in its early stages, and Sweden, Norway and Denmark, which countries maintained their neutrality throughout this time of strife, forged rapidly ahead. In 1915 at Cambridge, Mass., Norman S. Taber (Brown university, U.S.A.), placed upon the books a new amateur mile world's record of 4mins. 12⅗secs., which, at last, eclipsed the professional mile time of W. G. George, who, in 1866, covered the distance in his match with W. Cummings at Lillie bridge, in 4mins. 12¾secs., a record which was broken only by Paavo Nurmi in 1925. Taber's race was the forerunner of a great many record-breaking performances.

In 1916 at Evanston, Ill., R. I. Simpson brought the 120yd. high hurdles record down to 14⅘secs., owing to certain modifications he made in the then accredited style of hurdling; and in 1920, a young Canadian, Earl Thomson, who had served in the Royal Air Force, still further reduced the record time to 14⅖secs. Two of the most noteworthy achievements of the war period were the performances accomplished in 1916 by J. E. Meredith (University of Pennsylvania, U.S.A.), who set up new world's records for the quarter-mile, which he ran in 47⅖secs., and the half-mile run in 1min. 52⅕secs. At Magdeburg, in 1913, A. R. Taipale (Finland) threw the discus 158ft. 11in. This performance is duly recognized as a record in Scandinavia, but has never been passed by the International Amateur Athletic Federation. Otherwise it would stand as the world's record.

Shortly after the signing of the Armistice, a great inter-allied military athletic meeting took place in the Pershing Stadium at Paris. Of signal importance at this time was the step taken by the authorities of the British services, who decided that the pre-war custom of rewarding athletic proficiency among soldiers and sailors by money prizes must forthwith cease. An inter-services athletic sports meeting was held in 1919, at which some of Great Britain's dominion soldiers, not yet demobilized, proved clearly that the dominions themselves would hold a strong hand at the next celebration of the Olympic Games. It is interesting to note that even after the United States had entered the World War, the national A.A.U. championships were not abandoned, whereas, in Great Britain, no championship meetings took place between 1914 and 1919.

Peace Conditions Return. — In the year of the restoration of the **A.A.A.** championships the governing body again elected to omit certain of the field events from the programme; nor have they since insisted upon the inclusion of these events, which score

equally with the track events at the Olympic Games, in such important contests as the triangular international between England, Scotland and Ireland, the annual match between England and France, and the inter-county championships. The governing body in 1925 decided to abandon the English national championships, after they had been held for only three years, and were just beginning to produce a really satisfactory crop of fine young English exponents of these field events. The A.A.A. championships are open to the whole world and hitherto Great Britain has always been outclassed at the A.A.A. championships proper in the majority of field events.

In Great Britain the sterling post-war work of the Oxonians, A. N. S. Jackson and B. G. D. Rudd, coupled with the exertions of the Cambridge men, P. J. Baker, G. M. Butler, R. S. Woods and W. R. Seagrove, was responsible for inducing university athletes to take a healthy interest in open competitions generally, and championship meetings in particular, outside the limited scope of their own university sports.

In 1919, the Inter-University Athletic Board of Great Britain and Ireland was constituted, comprising the universities and university colleges of Aberystwith, Bangor, Birmingham, Bristol, Cardiff, Durham, Leeds, Liverpool, Manchester, Nottingham and Sheffield; other universities, including London, have since joined the movement. At these provincial universities the whole of the Olympic events are practised, and year by year the records, especially in the field of events, improve.

The keen promotion of and competition in athletics at the provincial universities is hating a far-reaching effect upon British sport. Sidney Best, of Leeds university, has been one of the most prominent people in the movement, and it is largely due to his efforts that there has been laid out at Westwood, Leeds, a ground which caters for every form of sporting activity, and which has an athletic track and field that is the equal of any to be found in the world. Other provincial universities are rapidly acquiring their own grounds, and as these are made available at certain times for the use of the general public, it follows that the nation must derive the greatest benefit from the I.U.A.B. movement. Lack of suitable tracks, playing fields and pitches is a factor which is seriously handicapping the athletic development of England, but this state of things is being slowly remedied by the work of the National Playing Fields Association. Much remains to be done before Great Britain reaches the level of the Dominions in this respect.

The participation of the University of London in the championships of the Inter-University Athletic Board had the effect of raising the standard between the years 1925–27.

Seventh Olympiad. — It was decided to hold the seventh Olympiad at Antwerp in 1920, partly as a tribute to the Belgian people for the part they had played in the war, but principally in order that the true Olympic cycle might not be interrupted. There was a great outcry that the war-worn nations were not yet sufficiently recovered to participate in such a festival. P. J. Baker, Cambridge university, was appointed captain of Great Britain's athletic team; the whole Olympic side came under the control of Brig. Gen. R. J. Kentish, C.M.G., D.S.O., and the British team won golden opinions in Antwerp. Great Britain did better in actual competition at this Olympiad than she had ever done at any previous celebration of the games. Notable victories were gained by A. G. Hill in the 800 and 1,500 metres, by B. G. D. Rudd, the Oxonian, representing South Africa, who won the 400 metres, and by Percy Hodge, who broke the world's record in the 3.000 metres steeplechase. The British team succeeded also in winning the 1,600 metres relay race.

At the conclusion of the Antwerp games, the United States was first, Finland second, Sweden third and the British Isles fourth, the same order as obtained at the conclusion of the Stockholm games, but in the other positions there was a marked difference. France, for example, eighth at Stockholm, was now fifth, while Italy had moved up from the eleventh to the sixth place. America's strength lay in the sprints, hurdles, relay races and jumps. Finland gained honours across country, in the middle-distances races and the throwing events. Sweden scored heavily through the magnificent team work of her men, and Italy came into prominence by the fine walking of Ugo Frigerio.

Further proof of the taste which the public was acquiring for international competition was exemplified immediately after the games by the match between France, Sweden and the United States, which took place in Paris, and that even greater match at Queen's Club, London, between the United States and the British empire, which ended in a dead heat. This latter match has evidently come to stay; it was repeated in London in 1924, after the celebration of the eighth Olympiad at Paris. In 1921 the International Amateur Athletic Federation held an important congress at Geneva. New rules for international competitions were passed and the Olympic programme at last standardized. The years that followed the Antwerp Olympiad were years of wonderful progress. This is conclusively proved by the existing world's records.

Eighth Olympiad. — At the eighth Olympiad held in Paris in 1924, at which nearly 2,000 athletes, representing 45 different nations, took part in the track and field events the United States, in 27 events, scored 12 first places, made five of the nine new world's records, and established two of the five new Olympic records, while one of the two marks, equalling previous Olympic records, was also established by an American. Of the other countries Finland scored nine first places, Great Britain three. New Zealand one, and Italy one. The manner in which world's and Olympic records were broken or equalled at this Olympiad mas amazing. In the 400 metres trials record was broken successively by J. Imbach (Switzerland), H. M. Fitch (U.S.A.), and E. Liddell (Great Britain). In the final Liddell still further reduced the record to $47\frac{3}{5}$ seconds. In the 400 metres relay race the world's and Olympic record, $42\frac{1}{5}$secs., made by the United States, Antwerp 1920, was beaten, Great Britain, in the first trial heat, reducing the time to 42 seconds. This was equalled by Holland in the third heat, and in the sixth heat the United States further reduced it to $41\frac{1}{5}$ seconds. In the first heat of the semi-final the United States team set up a new world's record of 41secs., and duplicated this in the final.

Ninth Olympiad. — The ninth Olympiad, held at Amsterdam in 1928, with 47 countries contesting, was distinguished by the wide distribution of awards among the nations. Thus in the marathon an Algerian "with a face like the Pharaohs," El Ouafi, ran first, his victory counting for France; a Chilean ran second, a Finn third, with a Japanese fourth and an American fifth. The last with admirable candour explained his failure by saying "I ran too slow." In the same way association (soccer) football was won by Uruguay, with Argentina second, Italy third and Spain fourth. British India was first in field hockey. Douglas Lowe, winning the 800 metres for Britain, made an Olympic record, 1 $51\frac{4}{5}$ secs. In the broad jump E. B. Hamm made an Olympic record, 25 ft. $4\frac{3}{4}$ in., for the United States. Olympic records were also made for the United States in pole vaulting and discus throwing, while victory in the 16 lb. hammer throw went to Ireland. Counting by team achievements, Germany won the highest total, including greco-roman wrestling and weight lifting. Finland sent marvellous long distance runners. From Canada and the United States went excellent women athletes, a Canadian winning the high jump while an American won the 100 metre dash.

Tenth Olympiad, 1932. Eleventh Olympiad, 1936: For these, held at Los Angeles and Berlin respectively. see OLYMPIC GAMES.

Athletics in Great Britain. — In America, Scandinavia, on the European Continent and among the coloured races of the world, athletic progress of an amazing kind is taking place from year to year, but up to 1925 it seemed certain that Great Britain must fall so far behind as to be at last forced to abandon the struggle altogether. Prior to the World War the secret of Great Britain's failure in international contests generally, and at the Olympic Games in particular, was to be found in the circumstance that Oxford and Cambridge athletes took little or no part in athletic sport, outside the competitions confined to their own and each other's universities; whereas the ever-successful American Olympic teams have been composed of nearly 80% of university and collegiate athletes. On several occasions before the war tentative proposals had been put forward for the promotion of a joint Ox-

ford and Cambridge athletic club, similar in character to the Leander Club. It was proposed that membership should be open to all blues, and also to a limited number of other undergraduates from Oxford and Cambridge. With others, Kenneth Powell (King's college, Cambridge) and G. R. L. Anderson (Trinity college, Oxford) had planned a definite attempt to form such a club in the winter of 1914, but the outbreak of war frustrated their intentions. These two famous hurdlers fell on active service, and it was not until March 27, 1920, that the Achilles Club came into being. One of the reasons for its promotion was that for many years previously very few blues had taken any part in national athletics, and those who formed the club believed it to be most desirable that they should do so. They thought that the club, when properly established, would have great influence, and, although their chief purpose was the promotion of match (team and relay) athletics, they also hoped that such a club would help to improve the standard of athletics in Great Britain. The sponsors of the movement have every reason to be proud of their endeavours. Athletes wearing the gold trimmings of the Achilles Club have rendered Britain the most valuable services at the Olympic Games, in other international contests and in defending British national titles. The club is responsible for the public schools relay meeting, which is held annually, while other missionary work that has been done is magnificent. Achilles teams have toured abroad in Central Europe, America, France, Greece and Germany; and, at home, have competed in Ireland and Scotland against national and university teams and in England against county, regimental and public schools teams, with great educational benefit to their opponents.

A direct outcome of the influence of the Achilles Club is that British athletics have become less individual by the introduction of that team spirit which is so wholly in accord with British tradition and temperament. A cautious decentralization of authority recently embarked upon by the A.A.A. marks a further step in progress, since it has led to the formation of county amateur athletic associations, holding certain administrative and judicial powers within their own territories.

The essence of the county administrative scheme is found in the internal management of the sport by counties within their own areas, inter-county contests being an essential adjunct to the movement. At present Bedfordshire, which county instituted matches in 1925 with the London Athletic Club and the University of London A.C., has probably achieved the most signal progress. In this connection it may be stated that England has for years past been divided into northern, midland and southern areas for administrative purposes, and that the furtherance of the county scheme lay at first entirely in the hands of the south, a circumstance strongly resented by the northern and midland districts. The Midlands are now more strongly represented, but the north still holds aloof.

In 1925 the first English inter-county relay and team athletic championship, for the trophy presented by the Achilles Club, was held at Stamford Bridge, London; Middlesex proved the winners and have never since lost their championship title. The position, however, was an entirely unsatisfactory one. The fatal policy of booming certain events at the expense of others was once again fully in evidence, such events as hammer, discus and javelin throwing, the pole vault, hop, step and jump and the 440yd. low hurdles being excluded from the programme. The result was that Bedfordshire, exceptionally strong in the field events and hurdles, and several other counties, refused to take part in championships which were not considered fully representative of English athletic sport. A pronouncement was made subsequently that the championship programme would not be in any way augmented in 1926. Consequently the midland counties, comprising Bedfordshire, Gloucestershire, Leicestershire, Shropshire and Staffordshire, for the time being, abandoned all thought of taking part in the inter-county championships. The north also, although possibly from different motives, refused to have anything to do with the county scheme. In deference to the views of the counties, however, it was finally agreed to include in the 1926 programme the pole vault and throwing the discus, but this still leaves hammer and javelin throwing, the hop, step and jump and the 440yd. low hurdles outside the scheme.

The essential fact is that, up to 1906, the Amateur Athletic Association, which is the governing body of the sport in England, had been unable to establish any liaison with the English public schools, which should prove the great recruiting ground for future Olympic teams. On the other hand, the counties, by reason of their more personal local contact, have in a few years begun to till this field, as is witnessed by the number of schoolboys who gained their county athletic colours during 1927, and the far greater number of school authorities who sought the advice and assistance, for the coaching of schoolboys for the annual sports, of old champions and other county experts. Notable examples of the value of coaching promoted by county associations are found in the cases of H. A. Simmons, Taunton's school, Southampton, and G. M. Moll, Bedford, aged 15 (high jumpers) both capped for their counties in 1927, and F. R. Webster, Bedford school, who, at 12 years of age, achieved 7ft. $4\frac{3}{4}$in. in the pole vault and set up new junior records in Yorkshire, Norfolk and Bedfordshire. G. M. Moll's winning high jump of 5ft. 5in. in the public schools junior competition constitutes a world's record for a boy of under 16 years of age.

The year 1926 was notable in that it marked the readmission of Germany to international competition with the former Allied Powers. At Basle, Switzerland, in August of that year, a triangular international match took place, Germany winning with $127\frac{1}{2}$ points, France being second ($89\frac{1}{2}$) and Switzerland third (68). A month previously the first German athletes who had been allowed to compete in England since the war appeared at Stamford Bridge, London, to contest the English championships and were well received. That the German people had already made up their minds to signalize their readmission to the Olympic Games at the ninth Olympiad at Amsterdam in 1928 was at once evident. Five German sprinters and one single British representative qualified for the final of the English A.A.A. 100yds. sprint championship, which was won by R. Corts, Germany, in 10secs.; in the 880yd. race Dr. Otto Peltzer, Germany, not only defeated the 800 metres Olympic champion, D. G. A. Lowe, Great Britain, but, in doing so, set up a new world's record of 1min. $51\frac{3}{5}$secs. Later in the afternoon the German doctor was but narrowly defeated in the 440yd. race by J. W. J. Rinkel, of Cambridge university. In several other events German athletes placed prominently. In 1927 the Germans made an even more successful raid upon the English championship titles; H. Kornig won the 100yd. in $10\frac{1}{10}$secs., H. Houben, the 220yd. in $21\frac{4}{5}$secs., R. Dobermann, the long jump at 23ft. $11\frac{3}{4}$in. and G. Brechenmacher, the shot put at 46ft. $6\frac{1}{2}$in., while the Preussen Krefeld team took the 440yd. relay race (4 x 110yd.) in $42\frac{1}{5}$secs. In the case of the 1927 international match in which Germany defeated Switzerland, the German 400 metres relay team equalled the world's record of 41secs. France, also, was met and defeated, the result being Germany 89 points, France 62 points. In addition to his half-mile record, Dr. Peltzer set up a new world's record of 1min. $3\frac{3}{5}$secs. for 500 metres. J. Schlokat, after only two months' practice, made a new German javelin throwing record of 204ft. $11\frac{5}{8}$ in., H. Hoffmeister, a new discus record of over 154ft., while G. Brechenmacher is a shot putter of the 10ft. class and R. Dobermann a long jumper of the 21ft. class. Athletics have rapidly attained an amazing degree of popularity in Germany; the country is starred with new, well-equipped tracks and grounds, and there is no doubt that Germany is becoming an athletic force which even America will have to reckon with in the very near future. Meanwhile Great Britain and her dominions overseas are steadily improving, as is proved by the running of D. G. A. Lowe, J. W. J. Rinkel, R. Leigh-Wood and H. H. Hodge and the hurdling of Lord Burghley, F. R. Gaby, S. J. M. Atkinson (South Africa) and G. C. Weightman-Smith (South Africa), while the American development in such field events as throwing the discus and javelin, which, in the past, have been considered almost purely Scandinavian pastimes, is no less remarkable.

The general improvement throughout the world, and the resultant number of records which have been recently broken, is

due partly to more intensive competition, but even more largely to the direct application of science to athletic sport. Coaching, elsewhere than in Great Britain, is now a recognized and remarkably lucrative calling. This state of things obtains on the Continent. Capt. Helge Lovland, athletic director to Norway, won the decathlon at the 1920 Olympiad. In Great Britain alone is the profession of athletic coach regarded as an unfit means for a public schools or university man to earn his living, and, consequently, British athletes do not enjoy such efficient instruction as is obtainable in other countries.

The teaching of athletics has now become a highly specialized art, in which all the aids of science are being fully utilized. Medical men and dieticians play their part; massage is freely employed to improve the athletes' condition and cinematography, slow-motion films and fixed cameras are used in the study of technique, to record faults, and to make plain to the athlete himself his own shortcomings. Scientific exercises are designed by physical culturists, and questions of temperature, as affecting athletic performances, are well understood, as also are the stress and strain involved in certain athletic performances. Recently Prof. A. V. Hill, F.R.S., University of London, has perfected an electrical apparatus which enables him to calculate the rate of speed of a runner at any given point of a race or training run. This apparatus consists of a series of vertical plane coils set up at measured intervals beside a running track and connected in series electrically with a galvanometer. The man whose performances are to be studied wears a thin strap of magnetized steel round his waist and the exact instant at which he passes each coil is registered by a flick of the galvanometer and recorded as a sharp wave on photographic paper. The moving paper is furnished with accurate time marks to enable readings to a 100th of a second to be made By this means can be recorded:—

(1) The starting signal.
(2) Time over the whole distance.
(3) Time over every intermediate distance.
(4) Speed at any point.
(5) Acceleration at the beginning.
(6) Total time-lag in attaining full speed.
(7) Point of maximum speed.
(8) Gradual slowing down due to fatigue.

Other instruments are in process of perfection which will determine correct angles of departure and flight in the jumps and throwing events, and yet other apparatus which will enable the coach to see at a glance exactly where his pupils are going right and where they are going wrong.

Much has been done in the way of athletic research; but, even yet, the processes at work in the employment of the athletes' muscles are only beginning to be understood; science and its applications, however, are proceeding hand in hand and it is certain that performances still more remarkable than any that have preceded them will be produced by future generations of athletes.

For list of world's records, see OLYMPIC GAMES and RUNNING.

ALL-ROUND ATHLETICS

Up to 1927 England had no all-round athletic championship, such as almost every other country has instituted upon much the same basis as the modern Olympic games decathlon. In ancient times athletes were encouraged to excel in several branches of sport, often quite opposite in character. Thus the athlete held in highest honour at the Olympic games of ancient Greece (see GAMES, CLASSICAL) was the winner of the pentathlon, which consisted of running, jumping, throwing the javelin and the discus and wrestling.

An all-round championship was instituted in America in 1884, comprising 100yd., 440yd. and 1m. runs, 880yd walk, 120yd. hurdles, high and long jumps, pole vault, throwing the 16 lb hammer and the 56 lb. weight and the shot put. This contest has now been abandoned in favour of the orthodox pentathlon and decathlon run on Olympic lines.

The ancient athletic pentathlon was revived in modern times at the Hellenic Festival, Athens, 1906. The events comprised weight lifting, wrestling (team and individual), 1,500 metres walk, rope climbing and tug of war. At the Stockholm Olympiad, 1912, the pentathlon was revived, the events contested being long jump, javelin, 200 metres run, discus and 1,500 metres run. In that year was added to the Olympic programme the decathlon, comprising 100, 400 and 1.500 metres runs, 110 metres hurdles, long jump, high jump, shot put, discus, javelin and pole vault.

The conditions of the present pentathlon are such that all entrants compete in the first three events, in each of which the winner receives one point and the second man two points, and so on. The total points of the competitors are counted and the 12 men with the lowest scores qualify to compete in the discus throwing; after the discus throwing the best six compete in the 1,500 metres flat race. At the end of all five competitions the competitor having the lowest score is adjudged the winner.

The winner of the decathlon is the one who scores the highest number of points in the ten divisions. At the third congress of the International Amateur Athletic Federation, Geneva, 1921, it was decided that for a result similar to the best result obtained at the 1912, or previous, Olympic Games, 1,000 points should be awarded, other results to be valued in accordance with the decathlon table. If a result exceed the best "Olympic" result, correspondingly higher points to be awarded. The basis of scoring, therefore, works out as follows:—

OLYMPIC RECORD SCORES UP TO 1912, 1000 PTS.

Event.	Olympic record.	Additional pts.
100 metres	$10\frac{3}{5}$secs. (1912)	$\frac{1}{5}$sec.=47·6opts.
Long jump	760cm.=24·934ft	1cm.=2·45pts.
Shot put	15·34m.=50·394ft. (1912)	1cm.=1pt.
High jump	1·93m.=6·331ft. (1912)	1cm.=14pts.
400 metres	$48\frac{1}{5}$secs.=(1912)	$\frac{1}{5}$sec.=7·52pts.
110 metres hurdles	15secs. (1908)	$\frac{1}{5}$sec.=19pts.
Discus	45·21m.=148·326ft. (1912)	1cm.=0·38pts.
Pole vault	395cm.=12·959ft.(1912)	1cm.=5·4pts.
Javelin	61m.=200·131ft.(1912)	1cm.=0·27jpts.
1,500 metres	3mins. $56\frac{4}{5}$secs. (1912)	$\frac{1}{5}$sec.=1·20pts.
Pentathlon		
200 metres	$21\frac{3}{5}$secs. (1904)	$\frac{1}{5}$sec.=22pts.

Among the best decathlon performances so far returned are those of the Finns, P. Yrjöla and E. Jarvinen, 1st and and in the 1928 Olympiad, J Thorpe, the American-Indian who was disqualified after the 1912 games and H. M. Osborn, U S.A., the Olympic winner in 1924. The schedules of performances are as follows:—

Event	Yrjola (Finland)	Jarvinen (Finland)	Thorpe (America)	Osborn (America)
100 metres	$11\frac{4}{5}$ secs.	$11\frac{1}{5}$ secs.	$11\frac{1}{5}$ secs.	$11\frac{1}{5}$ secs.
	ft. in.	ft. in.	ft. in.	ft. in.
Long Jump	22 $1\frac{1}{2}$	22 $7\frac{1}{4}$	22 $3\frac{5}{16}$	22 $8\frac{7}{16}$
Shot Put	46 $3\frac{3}{4}$	44 $9\frac{1}{4}$	42 $1\frac{3}{16}$	37 $6\frac{3}{8}$
High Jump	6 $1\frac{3}{4}$	5 9	6 $2\frac{5}{16}$	6 $5\frac{5}{16}$
400 metres	$53\frac{1}{5}$ secs.	$51\frac{2}{5}$ secs.	$52\frac{1}{5}$ secs.	$53\frac{1}{5}$ secs.
110 m. hurdles	$16\frac{3}{5}$ "	$15\frac{3}{5}$ "	$15\frac{3}{5}$ "	16 "
	ft. in.	ft. in.	ft. in.	ft. in.
Discus	138 1	118 $3\frac{1}{4}$	121 $3\frac{15}{16}$	113 $2\frac{11}{16}$
Pole Vault	10 10	10 10	10 8	11 6
Javelin	182 9	182 $4\frac{1}{4}$	149 $11\frac{1}{4}$	153 $1\frac{15}{16}$
	min. secs.	min. secs.	min. secs.	min. secs.
1500 metres	4 44	4 $52\frac{2}{5}$	4 $40\frac{1}{10}$	4 50
Total Points Scored	8053.29	7931·50	7751·06	7710.895

In 1931 the official world's decathlon record was held by H. Sievert of Germany (established in Germany, July 7–8, 1934) whose score was 8,79046 points. At the Olympic Games of 1932, in Los Angeles, the decathlon was won by James Baush, of the United States, with a score of 8,462·235 points.

In addition to the above all-round athletic championships there is in the Olympic programme a modern pentathlon comprising:—

1. Revolver shooting, rapid at 25 metres (82ft. $0\frac{7}{16}$in.) with the competitor's best hand.
2. Swimming, 300 metres (328·09yd.) free style.
3. Epée fencing.
4. Riding, 5,000 metres (5,468·11yd.). (Horses provided and drawn for by competitors.)
5. Cross-country running 4,000 metres (4,374·61 yd.).

A modern pentathlon championship of Great Britain was instituted in 1924.

See also ARCHERY; ATHLETICS, WOMEN IN; BOXING; CRICKET; CYCLING; DISCUS THROWING; FENCING; FOOTBALL, ASSOCIATION; FOOTBALL, RUGBY; GYMNASTICS AND GYMNASIUM; HOCKEY; HURDLING; JAVELIN THROWING; JUMPING; LAWN TENNIS AND TENNIS; OLYMPIC GAMES; POLE VAULTING; POLO; PUTTING THE SHOT; ROWING; RUNNING; SKATING; SKI; STEEPLECHASING; TRACK AND FIELD SPORTS; WALKING RACES; WEIGHT THROWING; WRESTLING. (For Marathon Races *see* RUNNING).

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UNITED STATES

Whereas in England the tertn *athletic sports* usually denotes track and field athletics, in the United States this term and especially the term *athletics* include not only the track and field sports (*q.v.*) such as running, jumping, hurdling and throwing, but also team games, like football, baseball, basketball, ice hockey and, among women, field hockey, as well as such games as tennis, golf and polo. In America contests in running, jumping, throwing, weight-lifting, wrestling, boxing and shooting were popular throughout most of the colonial period and after the Civil War. It was, however, the inter-collegiate contests of the later 1860s and the 18 jos which gave to athletic sports stimulus that has continued to the present day. Thus, the American interest in athletics, beginning in earlier popular matches of skill and strength became, with the subsidence of pioneer conditions, intensified after 1870 by college contests, and since that time, fed not a little by college *alumni* and by immigration from the northern countries of Europe, especially England and Ireland, has developed and progressed until it has undoubtedly attained an important position in the national life.

National Athletic Bodies.—In the United States there are six bodies, national in their composition, which in function are either consultative and regulatory or executive, or both: the Amateur Athletic Union of the United States, the American Olympic Association, the Intercollegiate Association of Amateur Athletes of America, the National Amateur Athletic Federation, the National Collegiate Athletic Association and the National Federation of State High School Athletic Associations. The Amateur Athletic Union of the United States was founded in 1888. Through some 23 regional associations, covering the country on a geographical basis, the A.A.U. "recognizes all amateur sports and claims jurisdiction over" basketball, boxing, gymnastics, running, including hurdling, obstacle racing, steeple chasing, walking, jumping, pole vaulting, shot putting, throwing the hammer, weights, javelin and discus, swimming, tug-of-war, wrestling both catch-as-catch-can and greco-roman styles, weight-lifting, volley ball and indoor baseball and squash. In all of these sports the Union "has conducted national championships annually." It governs in matters of amateur status, national records and licensing of meetings to the extent that it requires all entrants in open meetings to be registered with it and to obtain its licence to compete therein. With the A.A U. are "allied" 23 other bodies, including two British and two Canadian, the rest being American organizations. Formal international relations for American athletes are maintained through the A.A.U., which is a certificating member of the International Amateur Athletic Federation, and the American Olympic Association of 79 member bodies which, through permanent representative organization, endeavours to perpetuate interest in the Olympic games and to exercise jurisdiction over all matters relating to American competition in them. Direct relations with American colleges and universities are maintained through membership of such institutions in various member associations and the Intercollegiate Association of Amateur Athletes of America (*see* below, and TRACK AND FIELD SPORTS).

The National Amateur Athletic Federation, founded in 1921, fosters amateur athletics, physical education and participation in the Olympic games, through its two divisions, for men and women. The men's division is made up of some 14 organizations, including the Army, Navy and Marine Corps of the United States, the Young Men's Christian Association, the Catholic boys brigade, and the National Collegiate Athletic Association, which provides contacts with the colleges. The women's division is composed on a different basis. Members include (1928) 21 national organizations, among which stand the American Child Health Association, the Girl Scouts, Inc., the Playground and Recreation Association of America and the Young Women's Christian Association national board, 14 schools of physical education, 101 colleges and universities attended by women, 43 normal colleges and schools, 92 private schools, 11 State departments of physical education, 25 city school systems, 45 individual public high schools, 48 local branches of the Young Women's Christian Association, 2 Young Women's Hebrew associations, 32 physical education and athletic groups, 17 women's clubs, corporations and commissions, and 98 individuals. This division "believes in the spirit of play for its own sake, and works for the promotion of physical activity for the largest possible proportion of persons in any given group, in forms suitable to individual needs and capacities, under leadership and environmental conditions that foster health, physical efficiency and the development of good citizenship."

As regards American college sport and certain phases of interscholastic relations, some 118 universities and colleges unite in the National Collegiate Athletic Association, whose principal functions are deliberative and advisory and which divides the country into eight athletic districts, each containing a number of universities under the leadership of a vice president. The N.C.A.A. promulgates rules for inter-collegiate competition in association football, baseball, basketball, boxing, gymnastics, ice hockey, lacrosse, swimming, track and field events, volley ball and wrestling, names committees to prepare such rules, and holds annually one national track and field meeting.

The Intercollegiate Association of Amateur Athletes of America, commonly called the "I.C.4A's" and organized in 1875, is a supervisory and executive body composed of 41 colleges and universities, about three-quarters of which are situated in the eastern States. Declaring its "absolute jurisdiction among its members over all forms of track and field athletics," it conducts under its own rules two annual competitions; a February indoor meeting, and a May track and field championship meeting. The I.C.4A. veterans division is composed of former college athletes and officers of the association. It occupies a position somewhat analogous to that of the Achilles club in England. In 1927 some 88 varsity track and field meetings, 17 freshman track and field meetings, and 70 cross-country runs were held under various auspices according to I.C.4A rules. Among national bodies the National Federation of State High School Athletic Associations endeavours to link together the athletic associations of the high schools in the several States for the improvement of competition in all sports and for freedom of action within the field of secondary school athletics. A total of 29 such associations are thus federated. In addition, the American Federation of Labor is doing much to bring sport into the leisure of its members.

Regional Athletic Bodies.—The most significant development in the field of inter-collegiate athletics during the past half century has been the athletic conference. Following upon such athletic organizations of the 1870s as the Rowing Association of American colleges and the competitive relation that sprang from inter-collegiate contests in more academic fields, the athletic conference may be defined as a group of collegiate institutions. from 4 to 22 in number, which band themselves together for competi-

tion in one or many sports under uniform standards and rules of eligibility. The Southern Intercollegiate Athletic Association was founded in 1894, followed by the Intercollegiate conference ("Western Conference" or "Big Ten") one year later, the Maine Intercollegiate Track and Field association in 1896, the Northwest conference in 1904, the Missouri Valley conference in 1907, the Rocky Mountain Faculty Athletic conference in 1909, the Southwest conference in 1914, the Pacific Coast Intercollegiate conference in 1926 and the Eastern Intercollegiate conference in 1928. There exist (1928) 40 definitely organized conferences besides several loosely associated groups. From deliberative assemblies, many conferences have developed into executive and supervisory bodies furthering increased standards of academic work and delegating to officers police powers to enforce regulations and investigate infractions. Some stipulate that the control of athletics in member institutions shall rest with the faculties, lay down stringent rules concerning eligibility (residence, attendance, scholastic standing, interchange of lists of eligibles, signed statements from athletes attesting their own amateur status), training periods and the employment and compensation of coaches, and not only supervise competition between their member institutions in football, baseball, basketball and other team games, but also arrange track and field, swimming, boxing and other meetings, whether conducted under conference or other rules. An estimate of the number of annual inter-collegiate contests for the year 1927 gives 5,000 in football, 8,000 in basketball and from 6,000 to 8,000 in baseball. Some 20 inter-collegiate intersectional track and field meetings, about the same number of collegiate State meetings, nearly 150 dual, 8 triangular and one or more quadrangular meetings, take place each year. At least 9 relay carnivals are held annually by universities, college conferences and other associations.

For high schools, each of the 48 States has its own interscholastic athletic association which, bearing many resemblances to the college conference, exercises an increasingly strict supervision over school competition in all sports. In Alabama, California, Delaware, Florida, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Pennsylvania, Virginia and West Virginia, the State High School Athletic Association is allied with the State department of physical education, which is a part of the State department of public instruction. Each State high school athletic association holds annually at least one State-wide track and field meeting and many send representatives to compete in inter-scholastic meetings held by various national bodies. Attempts to estimate the number of inter-scholastic football, basketball and baseball games have proved futile, although one authority has given 80,000 as a possible annual minimum.

In each larger American city there exist one or more amateur athletic clubs, which possess houses often luxuriously appointed, with facilities for all forms of indoor athletic exercise (gymnasiums, swimming pools, running tracks, squash and tennis courts, etc.), as well as outdoor playing fields. Such clubs, usually affiliated with the A.A.U. through its regional associations, draw many of their more expert members from the ranks of former college athletes. Many industrial and commercial establishments make much of athletic sports and games, and some provide football and baseball fields for their employés as a branch of company personnel or welfare work. Besides the State and local associations that unite in the A.A.U., the Young Men's Christian Association and the Young Men's Hebrew Association are providing centres for all branches of sport.

College Athletics. — During the past 30 years, athletics in the American college and university have undergone a significant change, in both theory and practice. The middle of the 19th century saw the establishment of inter-collegiate competition. The first Harvard-Yale boat race was rowed on Lake Winnepesaukee in 1852; the first inter-collegiate baseball game, between Amherst and Williams, came seven years later, and the first inter-collegiate football contest was played by Princeton and Rutgers in 1869. three years before the first Oxford-Cambridge football match. In those days inter-collegiate athletic rivalry was informal and important principally to undergraduates. Later, with the increase in *alumni*, it became more and more the concern of the graduates. With the earlier years of the 20th century, however, the faculties of colleges and universities began to attempt to recover, especially as regards football, the authority which 60 years previously they had exercised over the administration of college sport. To these efforts and to the foresight of certain graduates, is due the division of college sport into two categories: inter-collegiate and intra-mural. Only in 1927 did consideration of problems of inter-collegiate athletics lead to a statement of their purposes, first for the Intercollegiate Conference ("Big Ten") and afterward for the N.C.A.A. The ideals of inter-collegiate competition are set as a series of "objectives," — that is, the theoretical ends which athletic competition between colleges should serve:

"General primary objectives of inter-collegiate athletics: (1) To supplement and broaden modern education. In order to take full advantage of opportunities of inter-collegiate sport to this end the entire inter-collegiate sport programme should be made a definite part of the general educational scheme. (2) To promote the all round welfare of an increased number of participants, — physical (health, motor skills), recreational (pleasure in sport), social (increased 'social insight,' good will), moral and spiritual (strengthening of essential attitudes and behaviour through illustration and practice). (3) To strengthen by illustration and example individual, university and public conceptions of sportsmanship (group, sectional, national, international: regard for player or adversary in victory or defeat, proper balance in victory, courage in defeat, fairness of attitude), team play, clean and healthful living, true winning spirit (tenacity, honesty of purpose), self-control, self-confidence, citizenship (respect for rules of game under stress, and for wise discipline and authority), fortitude. (4) To develop group consciousness, morale and spirit in the sense of loyalty to the institution, and to fellow members of the college community. (5) To reflect through representation the spirit of the institution (intellectual ability and achievement, moral tone and idealism, genuine sportsmanship through behaviour and conduct).

"Secondary objectives of intercollegiate athletics: (1) To serve as the peak of an all inclusive physical educational pyramid in opportunity for specialization and superior achievement. (2) To improve mental health for players and spectators by supplying wholesome absorbing interest. (3) To foster wholesome stimulating recreational opportunity for students, faculty, *alumni* and general public. (4) To provide opportunity to 'animal spirits' for legitimate physical expression. (5) To further the educational viewpoint and needs by securing and maintaining active interest of *alumni* and general public in the educational institutions through the field of greatest common interest and appeal."

With a view to diffusing more widely among student bodies the benefits to be gained from sport, most of the colleges and universities of the United States have initiated athletic competition between the groups into which undergraduates are divided by their daily associations and loyalties (fraternities, halls of residence, classes, etc.). The movement has owed much to the inter-college contests of Oxford and Cambridge, but little directly to the inter-house matches of English public schools. In these intra-mural programmes American colleges include all branches of sport, although football is less widely played by intra-mural teams than might be expected. The "objectives" of intra-mural sports, according to Prof. Mitchell, who has developed a remarkable interest in them at the University of Michigan, are recreation, the forming of social contacts, "group spirit" (solidarity through loyalty), better physical health, permanent interest in sports, the development of varsity material, bodily prowess (strength, endurance, neuro-muscular co-ordination), and mental alertness as expressed in improved academic achievement.

The endeavour of faculties to regain the administrative control of undergraduate athletics has led to the formulation of the doctrine of "faculty control," which provides that the teaching staffs shall be responsible for the administration and practice of athletic activities of all students. A corollary of the doctrine, to the effect that all teams, inter-collegiate and intra-mural, should be

coached not by seasonal coaches but by members of faculties, has led rather frequently to the elevation of coaches to academic status and full-year appointments, more rarely to American adaptation of the Oxford and Cambridge system of athletic mentors who assist in the development of college and university teams and crews. Especially at mid-western universities, no distinction appears to be held between, on the one hand, men who teach academic subjects for their livelihood and coach teams as an avocation, and on the other, men who as a career coach teams and teach physical education. In most of the American universities the administrative control of athletics is divided between representatives of interested groups: *alumni* and former students, faculties, trustees, who usually delegate their authority, and undergraduates, who are generally a minority upon committees, if indeed they sit with them at all. Townsmen, also, are beginning to exercise a direct influence upon college athletic administration. The influence and the practical nature of *alumni* interest are manifested through the offices of graduate treasurer, graduate manager of athletics and similar positions that, occupied by *alumni*, not infrequently dominate athletics in a college, and often in a salutary fashion. There is generally, however, an athletic association of undergraduates, somewhat resembling the amalgamated clubs of Oxford and Cambridge colleges and the athletic associations of certain newer English and Scottish universities, that still awards insignia and may name undergraduate managers and assistants, but has lost much of the power it possessed at the turn of the century through the encroachments of the *alumni* and the movement toward "faculty control" of college sport.

The central problem of athletic administration is generally considered to be financial. Athletic revenues range from as low as $4.300 at a small college of 229 undergraduates to $1,104,000 at a large university of 4,283 students. As at Oxford and Cambridge, gate receipts from varsity football games provide the great bulk of the support for all other branches of inter-collegiate athletics. At a few eastern institutions inter-collegiate football pays also for intramural sports. For example, although at the United States Military academy (West Point, N.Y.) intra-mural sports are considered to be of great value in the training of army officers, the current expense of all athletics is borne principally by sales of football tickets and not by appropriation from public funds. Most of the State and western universities make the cost of intra-mural programmes, except the use of facilities, a charge upon their instructional budgets. When the use of facilities is in question, preference is almost invariably given to candidates for inter-collegiate teams. The situation presents sharp contrasts with the practice at the older English universities of financing college sport from subscriptions to amalgamated clubs. American profits from football, after all expenses chargeable to that sport have been paid, have ranged (1925–27) to as high as $500,000 at a few larger universities, and football profits of from $200,000 to $300,000 from a season's schedule or fixture list are by no means uncommon at colleges of moderate size. Exceptions should, however, be noted in the case of a comparatively small number of institutions where because football has either not been sufficiently exploited, or in spite of exploitation has not yielded profits, the game shows a deficit and athletics are mainly supported by student fees. In most of the colleges of the United States, therefore, football is made to show a profit. When this consideration, respecting not alone football but any other sport, receives an emphasis that makes it paramount in the shaping of an institution's athletic policies, the result is a commercialism which no amount of "faculty control" appears powerful enough to abate. From the necessity of providing, out of football gate receipts, large sums of money, not alone for other inter-collegiate sports, but also equipment used in programmes of intra-mural athletics and of "physical education," has developed the need of accommodating huge numbers of spectators at even the less important football games and hence the building of great stadiums, or arenas, of reinforced concrete and in many cases of much architectural merit, owned by college athletic associations, in which matches take place. Statistics concerning the largest or most famous stadiums are as follows:—

Stadiums

Place and Name	Capacity
Chicago (Grant Park)	125,000
Philadelphia (Sesquicentennial)	125,000
Los Angeles (Coliseum)	105,000
Berkeley (University of California)	90,000
Palo Alto (Stanford University)	88,000
New York (Yankee Stadium)	82,000
New Haven (Yale University Bowl)	80,000
Pasadena, Cal. (Rose Bowl)	80,000
Philadelphia (U. of Pa., Franklin Field)	76,000
Columbus, O. (Ohio State University)	75,000
Ann Arbor (University of Michigan)	72,000
Urbana. Ill. (University of Illinois)	70,000
Cambridge (Harvard University)	55,000
Notre Dame (University of Notre Dame)	55,000

Prompted in part by large increases in funds made available from football gate receipts, many universities have embarked upon ambitious athletic building programmes, opened golf courses, erected "baseball cages" and "field houses" (huge barn-like structures of brick for practicing track and field events, basketball, certain features of baseball, etc.), enlarged gymnasiums and installed indoor tracks, basketball courts, swimming pools, tanks for indoor practice at the oar and other facilities, built training quarters, boat houses and locker accommodations, acquired increased acreage for playing fields, and generally augmented material facilities, indoor and outdoor, for all branches of athletics. Accommodations for women's sports have not kept pace with those for men except in a few instances.

The medical supervision of college athletics is receiving increased attention, and at a few institutions, notably Stanford university, the physiological health of the student is being closely interwoven with the athletic programmes. In figures collected for the Carnegie Foundation for the Advancement of Teaching, football exhibits the highest incidence of athletic injuries and accidents, with a total of 12 serious injuries (chronic sprains, fractures, concussions, exhaustion, internal injuries, *myositis ossificans*) among each 100 players,—17·7% among inter-collegiate contestants, 5·1% among intra-mural players; boxing, the next highest, 5·2%; lacrosse, 4.7%; association football, 4·0%; wrestling, 3·4%; baseball, 2·2%; cross-country running, 1.5%; ice hockey, 1·4%; basketball, 1·3%; track and field, 1·2%; rowing, 0·2%; and swimming and fencing, no serious injuries. The proportion of injuries for all sports is about 3%. Serious injuries are, of course, much more common in inter-collegiate than in intra-mural sport. Usually, injuries to varsity players are treated at the expense of the athletic association, which also provides, notably at Dartmouth. Harvard, Oberlin and the United States Military academy. facilities for team surgeons and trainers. Whatever the incidence of athletic injuries, the disadvantages that they imply should be judged, not absolutely, but in comparison with physical and moral values received by participants. Because no trustworthy method of measuring such values has been devised, they remain a matter of personal conviction.

With the growth of the notion of "faculty control" of college athletics, there has developed a tendency to exalt the position of the coach, not alone in respect of his status and tenure, but also as regards his relative importance as a member of the college family. Because it is widely recognized that the influence of the coach, whether salutary or debasing, among college students is very large, an increasing care is taken in the selection and appointment of men for such posts. Among Europeans the impression seems to be current that the widely known college coaches in the United States are men of some medical training, whereas they have come from all walks of life,—business, medicine, the law, teaching and the profession of arms,—and many have risen from the position of trainer or even of rubber and masseur. The leaders in the calling, including, for example, those most prominent in the councils of the American Association of Football Coaches, are men of university and in some instances of medical training, but the man of achievement in the field is as likely to be of more humble origin as he is to belong to a more select group. Recent

recruiting to the ranks of college coaches from among graduates of schools of physical education, like the Young Men's Christian Association Training colleges at Springfield, Mass., and Chicago, Ill., and the schools at the University of Illinois and Teachers college (Columbia university), Oberlin, Michigan, and most of the other State universities, is changing the situation. State universities are led to offer courses in physical education because State laws require that the subject shall be taught in public schools and teachers must be trained for the work. The number of coaches who with a hope of bettering their position have attended summer schools of coaching and physical education, no matter of what attainment such schools may be, is growing rapidly. Salaries of coaches vary over a wide range. On the whole, head coaches employed on a seasonal basis without appointment to faculties receive the highest pay. Of these, 12 have (1938) salaries running from $10,000 to $12,000, although one professor of physical education on permanent appointment as director and coach is paid $14,000. The maximum salary among college track and field coaches is $8,000. With faculty status, typical salaries ranged between $5,000 and $10,000, the majority being found at the lower levels, with a minimum of $2,400 or $2,500. Considering the unprecedented rise in salaries paid to college professors in the United States, the average of coaches' salaries is not alarmingly high, except when contrasted at individual institutions with the compensation of teachers of academic subjects. Most universities and colleges have from 3 to 20 coaches for all branches of athletics taken together. Coaching in intra-mural athletics, where less is at stake, being regarded as a less specialized task, is generally entrusted to assistants and to major students in graduate or undergraduate departments of physical education. Such departments and schools are providing an increasing supply of trained men for college coaching and for the teaching of physical education in schools, but the value of their training varies widely.

In the United States college sports are classified as major or minor. A major sport is a branch in which public appearance or distinguished service as a representative of a university or college on a team or crew is adjudged to be worthy of an award of a "letter" (the right to wear the initial of the college; *e.g.*, "C" for Columbia, "M" for Michigan, "P" for Purdue, etc.) upon a sweater or athletic uniform. For the minor sports there is the lesser award of "numerals" (of the class of the year in which graduation is anticipated), or second-string or other insignia. Major sports universally include football, basketball, rowing, track and field athletics sometimes embracing cross-country running, rowing, baseball (declining in college popularity in some sections), and occasionally fencing (Columbia), ice hockey (Dartmouth), and swimming (Yale). Minor sports usually are reckoned to include lacrosse, tennis, wrestling, boxing, swimming, association football, golf, polo, fencing and occasionally rifle shooting, gymnastics, water polo, trap shooting, and on the Pacific coast English "rugger." Programmes of intra-mural sports may include any or most of the major and minor sports and also volley ball, soft ball, touch football (a variant of American football without tackling), speedball, handball, any of the six varieties of indoor baseball, foul throwing or shooting adapted from basketball, horseshoe pitching and occasionally, squash, bowling and hiking. Awards for intra-mural sports take the form of "numerals," medals, cups, plaques or pennants. All awards in major and minor sports are generally made by committees of athletic associations on nomination by captains or coaches or both. The University of Iowa has abolished distinctions between major and minor sports. Sports for women, played under women's rules, include field hockey and basketball, in which most women's inter-collegiate matches take place, swimming, running, jumping and volley ball. Wellesley college (Mass.) rows. Certain colleges and universities (*e.g.*, Bowdoin, Dartmouth. Minnesota) especially favour winter sports, like skiing, snow-shoeing, ski-jumping, skating and ice hockey.

College sport is essentially amateur, and all conferences and practically all individual institutions have strict regulations to protect the amateur status of contestants. Rules of eligibility exhibit a tendency to uniformity: (1) an athlete must have completed one year's academic work before entering inter-collegiate competitions; (2) the playing of transferred students, migrants or "tramp" athletes is discouraged and has been in fact practically eliminated; (3) competition in inter-collegiate contests is generally limited to three years for each athlete; (4) a reasonable standard of academic work must be maintained; (5) an athlete must conform to the rule that "an amateur sportsman is one who engages in sport soieiy for the physical, mental or social benefits he derives therefrom, and to whom the sport is nothing more than an avocation" (part of the N.C.A.A. rule; the I.A.A.F., A.A.U., and I.C.4A. rule is not dissimilar). (See AMATEUR.) In spite of this amateur rule, athletes in the past have received money payments, scholarships and aids in the form of clothing or nominal jobs, generally in a covert and devious manner, and seldom with the open approval of college or university authorities. Such practices are decreasing, but there is still room for more common honesty in college sport, among the more rabidly partisan college alumni, and among needy young men who aspire through athletic subsidies to the advantages of a college education.

The part played by the undergraduate in college sport in the United States involves far less responsibility than at English universities and even at certain English public schools. The strategy and tactics of all branches are almost universally the affair of the trainer and the coach. The paternal attitude of the college, manifest for many years in the academic and disciplinary aspects of university life, extends even to athletics. Thus has been lost much of one of the greatest benefits that college sport can confer. As regards inter-collegiate contests, the proportion of students participating has not greatly changed since about 1900, about 20 to 25%. Owing, however, to the fostering of intra-mural athletics the country over, the total percentage of participation in all sports now lies between about 45% and 65% of all undergraduates, a proportion which is still rather below some estimates for Oxford and Cambridge. Much of the increased participation in intra-mural athletics is due to the fact that a student who takes part in them to the satisfaction of the department of physical education thereby satisfies one of the "credit" requirements for graduation.

Although the formal relationships of American college athletes with college athletes of other countries find expression through the A A.U. and the Olympic games, even more promising for international amity is the series of university track and field meetings inaugurated through the efforts of Dr. C. W. Kennedy, of Princeton, John T. McGovern, of Cornell, and Bevil Rudd, old Oxford blue, whereby in each year except Olympic years athletes from Oxford, Cambridge, Harvard and Yale compete alternately in England and the United States. The athletes lodge together, dine and train together, and exchange coaching suggestions where such assistance proves helpful. The plan, which provides a near approach to the ideals of amateur international competition, has led to further contacts between Oxford and Cambridge, and Cornell, Pennsylvania, Princeton and Syracuse universities in lacrosse, tennis, golf and other sports.

School Athletics. — In American tax-supported public schools and also in private schools, athletics bear many resemblances to college athletics. State departments of physical education, now parts of the educational systems of 17 States, generally exert a wholesome influence toward the uniting of physical education and athletics as regards both theory and practice. Playing field space has increased greatly, and few modern high school buildings are without gymnasiums, swimming pools, indoor running tracks and basketball courts. In the Middle West a number of well-appointed high school buildings have been erected from the proceeds of basketball games, a beneficent commercialism that parallels the situation in certain colleges. Much attention has been devoted to the selection of games and events suitable to school age, especially by the Playground and Recreation Association of America and the women's division of the N A A F. The results have proved salutary. Indeed, the whole programme of physical education and athletics in public high schools has been

revised, strengthened and better adapted to the tastes, capabilities and circumstances of boys and girls. Of especial significance are the tendency to have school teams coached by teachers, whether of physical education or of other subjects, somewhat after the method in English schools, the use of playgrounds and equipment by school athletes and teams after school hours under the supervision of qualified teachers, the work of the Sportsmanship Brotherhood, one of whose functions it is to hold the ideals of sportsmanship before school boys and girls, and the spread of school-boy athletic leagues, generally under wholesome and non-commercializing supervision. Indeed, the tone of high school athletics is in some respects relatively superior to the tone of athletics in American universities and colleges. In this field the Public School Athletic League, of New York city, organized in 1907, is the pioneer. It has equipped over 5,000,000 school boys and is supervising the play of 600,000 boys a year. Competitors in its meetings number from 7,000 to 8,000. Considered to be the most powerful single agency in the reduction of juvenile delinquency, the league has profoundly affected youthful athletic activities in the cities of the United States and Europe. As regards the salutary development of sport in high schools, much appears to depend upon the degree in which the authority of the principal is made to match his responsibilities. At American private schools, sport parallels closely in miniature the athletic activities of colleges and universities. On the whole, private school playing fields and other equipment tend to be better and more extensive than those of all but the more fortunate of public schools, and athletics are possibly a shade better supervised on the average. Teams representing private schools meet freely those representing public schools in most branches of sport. The future of school athletics in the United States would be the brighter if those responsible for it could assure its development independently of certain influences of college sport, which now tend to impair it.

Publicity and Sports Writers.—A study made for the American Society of Newspaper Editors (1927) indicates that, of 125 newspapers studied, one-third, published in cities of 50,000 population and over, devote to sport an average of more than 10 columns daily and from 10 to 30 columns on Sundays. A few publishers of metropolitan papers, all of which usually exceed this space, are adopting a policy of emphasizing amateur sports. The best of the sports coluinnists and special writers, some of whom syndicate widely, exert a commendable influence through their writings, but this is not the case with the more commercialized and sensational writers and newspapers. The undue attention lavished by sports writers, usually at the solicitation of university publicity agents, upon professional coaches and college athletes has been gravely detrimental to the best interests of amateur sport in the United States.

See articles: ATHLETICS. WOMEN IN; ATHLETE; OLYMPIC GAMES; TRACK AND FIELD SPORTS; BASEBALL; FOOTBALL: GOLF; LAWN TENNIS; ETC.

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(H. J. S.)

ATHLONE, urban district, County Westmeath. Eire. Pop. (1936) 7,257. It is 78 mi. W. of Dublin on the Great Southern railway. A castle and a bridge over the river were built by John de Grey, bishop of Norwich and justiciar of Ireland, in 1210. It became the seat of the presidency of Connaught under Elizabeth, and withstood a siege by the insurgents in 1641. In the war of 1688 the possession of Athlone was considered of the greatest importance, and it consequently sustained two sieges, the first by William III. in person, which failed, and the second by General Godart van Ginkel (*q.v.*). In 1797 the town was strongly fortified on the Roscominon side, but the works are now dismantled. Athlone was incorporated by James I., and returned two members to the Irish parliament, and afterwards one member to the imperial parliament till 1885.

The river Shannon divides the town into two portions, the Leinster side (east), and the Connaught side (west), which are connected by a bridge, opened in 1844. There is a swivel railway bridge. The rapids of the Shannon at this point are obviated by means of a lock communication with a basin, which renders the navigation of the river practicable above the town. Some trade by water is carried on with Limerick, and with Dublin by the river and the Grand and Royal canals. Athlone is an important agricultural centre and has a considerable cotton factory. The famous Athlone woollen mills burned in 1940, and many of its workers migrated to England. There are two parish churches, St. Mary and St. Peter, both erected early in the 19th century, of which the first has near it an isolated church tower of earlier date. There are three Roman Catholic chapels, a courthouse and other public offices. Early remains include portions of the castle, of the town walls (1576), of the abbey of St. Peter and of a Franciscan foundation. On several islands of Lough Ree, to the north, are ecclesiastical and other remains.

ATHOL, a town of Worcester county, in northern Massachusetts, U.S A. It lies in the valley of hfiller's river at a varying altitude of from 510 to 1.200 ft., and is served by the Boston and Maine railway. The area is 3j sq.mi. The population in 1940 Federal census was 11,180. The varied manufactures include fine tools, shoes and leather goods, toys, mill machinery, tables, crib.. cradles, towel racks, combs, sashes, doors, nindowpanes, blinds, gears, vises, drills, tents, celluloid goods, meat choppers, and popcorn products. A municipal Memorial building with an auditorium was completed in 1924, and in 1936 the high school building (erected in 1893) was remodeled.

Athol was settled in 1735 and incorporated as a township in 1762. It was named by its largest landowner, Col. John Murray, after the ancestral home of the Murrays, dukes of Atholl.

ATHOLL or **ATHOLE,** mountainous district in north Perthshire, Scotland, area about 450sq.m., bounded on the north by Badenoch, on the north-east by Braemar, on the east by Forfarshire, on the south by Breadalbane, on the west and north-west by Lochaber. It is watered by Tay, Tummel, Garry, Tilt, Bruar and other streams. Glen Garry and Glen Tilt are the chief glens, and Loch Rannoch and Loch Tummel the principal lakes. The population is mainly in Dunkeld, Pitlochry and Blair Atholl. The only cultivable soil is in the large valleys, but deer-forest and shootings on moor and mountain are very extensive. It is said to have been named Athfotla (Atholl) after Fotla, son of the Pictish king Cruithne, and was under the rule of a Celtic mormaer (thane or earl) until the union of the Picts and Scots under Kenneth Macalpine in 843.

ATHOLL, EARLS AND DUKES OF, the Stewart line of the Scottish earls of Atholl, which ended with the 5th Stewart earl in 1595, the earldom reverting to the crown, had originated with Sir John Stewart of Balveny (d. 1512), who was created earl of Atholl about 1457 (new charter 1481). The 5th earl's daughter Dorothea married William Murray, earl of Tullibardine (cr. 1606), who in 1626 resigned his earldom in favour of Sir Patrick Murray, on condition of the revival of the earldom of Atholl in his wife and her descendants. The earldom thus passed to the Murray line, and John Murray, their only son (d. 1642), was accordingly acknowledged as earl of Atholl (the 1st of the Murrays) in 1629.

JOHN STEWART, 4TH EARL OF ATHOLL, in the Stewart line (d. 1579), son of John, 3rd earl, succeeded his father in 1542. As one

of the principal Catholic nobles of Scotland, he was especially trusted by Mary, Queen of Scots, but after the murder of Darnley in 1567 he joined the Protestant lords against her, and was included in the regency of James VI. on her abdication. But in 1568 he was again advocating her cause. He had failed in 1572 to prevent Morton's appointment to the regency, but in 1578 he succeeded with the earl of Argyll in driving him from office. In March James dissolved the regency and Atholl was appointed lord chancellor. On May 24 Morton succeeded in regaining his guardianship of James. Atholl and Argyll, who were now corresponding with Spain in hopes of assistance from that quarter, then advanced to Stirling with a force of 7,000 men, when a compromise was arranged, the three earls being all included in the Government. While on his way from a banquet held on April 20 1579 to celebrate the reconciliation, Atholl was seized with sudden illness, and died April 25, not without strong suspicions of poison.

On the death, in 1595, of his son John, 5th earl of Atholl, the earldom in default of male heirs reverted to the crown.

JOHN MURRAY, 1ST EARL OF ATHOLL in the Murray line (see above), died in 1642. On the outbreak of the civil war he called out the men of Atholl for the king, and was imprisoned by the marquess of Argyll in Stirling Castle in 1640.

JOHN MURRAY, 2ND EARL and 1ST MARQUESS (cr. 1676) of Atholl (1631–1703), son of the 1st earl was born May 2, 1631. In 1653 he was the chief supporter of Glencairn's rising, but was obliged to surrender with his two regiments to Monk, Sept. 2, 1654. After the restoration Atholl received many high offices in Scotland. He at first supported Lauderdale's tyrannical policy, but after the raid of 1678, called the "Highland Host," in which Atholl was one of the chief leaders, he joined in the remonstrance to the King against the severities inflicted upon the Covenanters, and was deprived of his office of justice-general and passed over for the chancellorship in 1681. In 1679, however, he was present at the battle of Bothwell Brig; in July 1680 he was made vice-admiral of Scotland, and in 1681 president of Parliament. In 1684 he was appointed lord-lieutenant of Argyll, and invaded the country, capturing the earl of Argyll after his return from abroad in June 1685 at Inchinnan. The excessive severities with which he was charged in this campaign were repudiated with some success by him after the Revolution. (A. Lang, *Hist.* of Scotland, iii. 407.) At the Revolution he wavered, showing no settled purpose but waiting upon the event, but he took part in the proclamation of William and Mary as king and queen at Edinburgh. After Dundee's insurrection he was imprisoned for a few weeks. In 1690 he was implicated in the Montgomery plot and subsequently in further Jacobite intrigues. In June 1601 he received a pardon, and acted later for the Government in the pacification of the Highlands. He died on May 6 1703. He married Amelia, daughter of James Stanley, 7th earl of Derby (through whom the later dukes of Atholl acquired the sovereignty of the Isle of Man).

JOHN MURRAY, 2ND MARQUESS and 1ST DUKE OF ATHOLL (1660–1724), was born on Feb. 24, 1660. He was a supporter of William and the Revolution in 1688, taking the oaths in Sept. 1689, but was unable to prevent the majority of his clan, during his father's absence, from joining Dundee under the command of his brother James. In 1703–04 an unsuccessful attempt was made by Simon, Lord Lovat, who used the duke of Queensberry as a tool, to implicate him in a Jacobite plot against Queen Anne; but the intrigue was disclosed by Robert Ferguson, and Atholl sent a memorial to the Queen on the subject, which resulted in Queensberry's downfall. He vehemently opposed the Union during the years 1705–07, and according to Lockhart, he could have raised 6,000 of the best men in the kingdom for the Jacobites. On the occasion, however, of the invasion of 1708, he took no part, on the score of illness, and was placed under arrest at Blair Castle. On the downfall of the Whigs and the advent of the Tories to power, Atholl returned to office, and from 1712 to 1714 was high commissioner. On the accession of George I. he was again dismissed, but at the rebellion of 1715, while three of his sons joined the Jacobites, he remained faithful to the Government, whom he assisted in various ways, on June 4 1717 apprehending Robert Macgregor (Rob Roy), who, however, succeeded in escaping. He died Nov. 14 1724.

KATHERINE MARJORY, DUCHESS OF ATHOLL, wife of the 8th duke, entered the House of Commons for Kinross and West Perth in 1923, and in 1924 became parliamentary secretary to the Board of Education. She was a daughter of Sir J. H. Ramsay of Banff, the historian, and herself edited and contributed to a *Military* History of Perthshire (1660–1902).

The *Atholl Chronicles* have been privately printed by the 7th duke of Atholl (b. 1840). *See* also S. Cowan, *Three Celtic Earldoms* (1909).

ATHOS, the most eastern of the three peninsular promontories which extend, like the prongs of a, trident, southwards from the coast of Macedonia into the Aegean Sea. Before the 19th century the name Athos was usually confined to the terminal peak of the promontory, which was itself known by its ancient name, Acte. The peak rises like a pyramid, with a steep summit of white marble, to a height of 6,350ft., and can be seen at sunset from the plain of Troy on the east and the slopes of Olympus on the west. On the isthmus are distinct traces of the canal cut by Xerxes before his invasion of Greece in 480 B.C. The peninsula is remarkable for the beauty of its scenery, and derives a peculiar interest from its unique group of monastic communities with their mediaeval customs and institutions, their treasures of Byzantine art and rich collections of documents. It is about 40m. in length, with a breadth varying from 4 to 7m.; its whole area belongs to the various monasteries.

Owing to the timely submission of the monks to the Turks after the establishment of their empire in Europe and especially after the capture of Salonika (1430), their privileges were respected by successive sultans. Under the present constitution, which dates from 1783, the general affairs of the commonwealth are entrusted to an assembly (*σύναξις*) of 20 members, one from each monastery; a committee of four members, chosen in turn, styled *epistatae* (*ἐπιστάται*), forms the executive. The president of the committee (6 *πρῶτος*) is also the president of the assembly, which holds its sittings in the village of Karyes, the seat of government since the 10th century. The 20 monasteries, which all belong to the order of St. Basil, are: Laura (*ἡ Λαῦρα*), founded in 963; Vatopédi (*βατοπέδιον*), said to have been founded by the emperor Theodosius; Rossikón (*Ῥωσσικόν*), the Russian monastery of St. Pantelei'mon; Chiliándari (*Χιλιαντάριον*: supposed to be derived from *χίλιοι ἄνδρες* or *χίλια λεοντάρια*, founded by the Serbian prince Stephen Nemanya, 1159–95); Iveron (*ἡ μονὴ τῶν Ἰβήρων*), founded by Iberians, or Georgians; Esphigmenu (*τοῦ Ἐσφιγμένου*: the name is derived from the confined situation of the monastery); Kutlumush (*Κουτλουμούση*); I'andocratoros (*τοῦ Παντοκράτορος*); Philotheu (*Φιλοθέου*); Caracallu (*τοῦ Καρακάλλου*); St. Paul (*τοῦ* dyiov *Παύλου*); St. Denis (*τοῦ ἁγίου Διονυσίου*); St. Gregory (*τοῦ* dyiov *Γρηγορίου*); Simópetra (*Σιμόπετρα*); Xeropotámu (700 *Ξηροποτάμου*); St. Xenophon (*τοῦ* dyiov *Ξενοφῶντος*); Dochiaríu (*Δοχειαρείου*); Constamonitu (*Κωνσταμονίτου*), Zográphu (*τοῦ Ζωγράφου*); and Stavronikitu (*τοῦ Σταυρονικίτου*), the last built, founded in 1545. Dependent on the several monasteries are 12 sketae (*σκῆται*) or monastic settlements, some of considerable size, in which a still more ascetic mode of life prevails: there are, in addition, several farms (*μετοχία*), and many hundred sanctuaries with adjoining habitations (*κελλία*) and hermitages (*ἀσκητήρια*). The monasteries, with the exception of Rossikón (St. Pantelei'mon) and the Serbo-Bulgarian Chiliándari and Zográphu, are occupied exclusively by Greek monks.

The population of the holy mountain was 4,858 in 1928; about 3,000 are monks (*καλόγεροι*), the remainder being lay brothers (*κοσμικοί*). The monasteries, which are all fortified, generally consist of large quadrangles enclosing churches; standing amid rich foliage, they present a wonderfully picturesque appearance, especially when viewed from the sea. Their inmates, when not engaged in religious services, occupy themselves with husbandry, fishing and various handicrafts; the standard of intellectual culture is not high, A large academy, founded by the monks of Vatopédi in 1749 for a time attracted students from all parts of the East, but eventually proved a failure, and is now in ruins. The muniment rooms of the monasteries contain a marvellous series of documents, including chrysobulls of vari-

ous emperors and princes, *sigilla* of the patriarchs, *typica,* iradés and other documents, the study of which will throw an important light on the political and ecclesiastical history and social life of the East from the middle of the 10th century. Up to comparatively recent times a priceless collection of classical manuscripts was preserved in the libraries; many of them were destroyed during the War of Greek Independence (1821–29) by the Turks, who employed the parchments for the manufacture of cartridges; others fell a prey to the neglect or vandalism of the monks, who, it is said, used the material as bait in fishing; others have been sold to visitors, and a considerable number have been removed to Moscow and Paris.

See V. Langlois, *Le Mont Athos et ses monastères,* with a complete bibliography **(1867)**; Duchesne and Bayet, *Mémoire sur une mission en Macidoine et au Mont Athos* **(1876)**; Texier and Pullan, *Byzantine Architecture* **(1864)**; A. Riley, *Athos, or tlze Mountain of the Monks* (1887); P. Meyer, "Beiträge zur Kenntniss der neueren Geschichte und des gegenwärtigen Zustandes der Athosklöster," in *Zeitschrift* fur *Kirchengeschichte* (1890); G. Millet, J. Pargoire and L. Petit, *Recueil des inscriptions chrétiennes de l'Athos* (1904).

ATHY, urban district, County Kildare, Eire, 45 mi. S.W. of Dublin on a branch of the Great Southern railway. Pop. (1936) 3,628. It is intersected by the river Barrow, the crossing of which was disputed from earliest times, and the name of the town is derived from a king of Munster killed here in the 2nd century. There are remains of Woodstock castle of the 12th or 13th century. White castle, built in 1506 and rebuilt in 157j, is still occupied. Both defend the ford. There are also an old town gate and ancient cemetery with slight monastic remains. Previous to the Union, Athy returned two members to the Irish parliament. There are good water communications, by a branch of the Grand canal to Dublin, and by the river Barrow, navigable from here to Waterford harbour.

ATINA, the name of three ancient towns of Italy. (1) A town (mod. *Atena*) of Lucania, upon the Via Popillia, 7m. N. of Tegianum, towards which an ancient road leads, in the Diano valley. Walls of rough cyclopean work may have had a total extent of some two miles. There are remains of an amphitheatre and numerous inscriptions, including one carved upon the paving blocks of the ancient forum (or market place). (2) a town (mod. *Atina*) of the Volsci, 12m. N. of Casinum, and about 14m. E. of Arpinum; (3) a town of the Veneti, mentioned by Pliny.

ATITLAN or **SANTIAGO DE ATITLAN,** a town in the department of Sololb, Guatemala, on the southern shore of Lake Atitlán. The population in 1942 was about 5,000, almost all Indians. Cotton-spinning is the chief industry. Lake Atitlbn is 24 mi. long and 10 mi. broad, with 64 mi. circumference. It occupies a crater more than 1,000 ft. deep and about 4,700 ft. above sea-level. The peaks of the Guatemala Cordillera rise round it, culminating near its southern end in the volcanoes of San Pedro (7,000 ft.) and Atitlán (11,719 ft.). Although the lake is fed by many small mountain torrents, it has no visible outlet, but probably communicates by an underground channel with one of the rivers which drain the Cordillera. Mineral springs abound in the neighbourhood. The town of Sololb (*q.v.*) is near the north shore of the lake.

ATKARSK, a port and railway junction on the river Medvyeditsa, with a grain elevator, in the Saratov province of the U.S.S.R. Population 19,326. Lat. 51.52° N. Long. 44.58" E.

ATKINSON, EDWARD (1827–1905), American economist, was born at Brookline (Mass.) on Feb. 10, 1827. For many years he was engaged in managing various business enterprises, and became, in 1877, president of the Boston hlanufacturers' Mutual Fire Insurance Co., a post which he held till his death. He was a strong controversialist and a prolific writer on economic subjects. He was appointed in 1887 a special commissioner to report upon the status of bimetallism in Europe. He also made a special study of mill construction and fire prevention, and invented an improved cooking apparatus, called the "Aladdin oven." He died at Boston on Dec. 11, 1905. His principal works were *Right Methods of Preventing Fires in Mills* (1881); *Distribution of Products* (1885); *Industrial Progress of the Nation* (1889); *Taxation and Work* (1892); and *Margin of Profits* (1902).

ATKINSON, SIR HARRY ALBERT (1831–92), New Zealand statesman, was born at Chester, England, and migrated to New Zealand in 1855. He distinguished himself in the Waitara war of 1860–65, and entered parliament in 1863. As minister of defence in Sir Frederick Weld's ministry (1864–65) he was identified with the "self-reliance" policy of using colonial troops only against the Maori. In 1873 he re-entered parliament, and in 1874 became treasurer. Except during six months in 1876, he thenceforth held that post whenever his party was in power. From Oct. 1874 to Jan. 1891 Atkinson was only out of office for about five years. He was three times premier, and was always the most formidable debater and fighter in the ranks of the Conservative opponents of the growing Radical party.

He was mainly responsible for the abolition of the provinces into which the colony was divided from 1853 to 1876. He repealed the Ballance land tax in 1879, and substituted a property tax. In 1880 and again in 1888 he raised the customs duties, among other taxes, and gave them a quasi-protectionist character. In 1880 he struck 10% off all public salaries and wages; in 1887 he reduced the salary of the governor by one-third, and the pay and number of ministers and members of parliament. By these means revenue was increased, expenditure checked, and the colony's finance reinstated. Atkinson advocated compulsory national assurance, and the leasing as opposed to the selling of crown lands.

Defeated in the general election of Dec. 1890 he became speaker of the legislative council. While leaving the council chamber after the sitting of June 28, 1892, he died suddenly of heart disease. Though brusque in manner and never popular, he was esteemed as a vigorous, upright, and practical statesman.

ATKINSON, ROBERT (1839–1908), British philologist, was educated at Trinity college, Dublin. He became professor of Romance languages there in 1869, and in 1871 was professor of Sanskrit and comparative philology. In 1884 he became Todd professor of Celtic languages in the Irish academy. In Celtic studies Atkinson was a pioneer. He edited: *The Passions and Homilies from tlze Leabhar Breac* (1887); *Three Shafts of Death* (Tri Bior-gaoithe an Bhais, 1890), and also wrote introductions for many of the facsimiles issued by the Irish academy.

ATKYNS, CHARLOTTE, LADY (1758–1836), English actress, née Charlotte Walpole, who married Sir Edward Atkyns in 1779. She was in France during the Revolution, and was a faithful friend of the royal family.

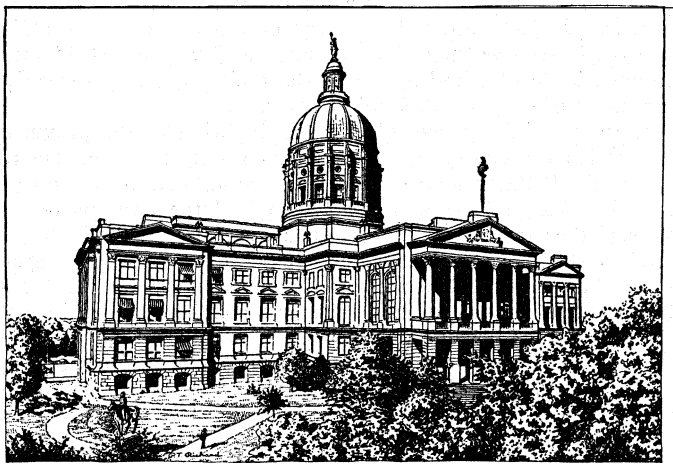
See F. Barbey, *A Friend of Marze Antoinette* **(1906)**.

ATLANTA, the capital of Georgia, U.S.A., and its largest city, in the north-central part of the State, 8 m. from the Chattahoochee river; lying mostly in Fulton county, of which it is the county seat, but partly also in De Kalb county. It is on the Dixie and the Bankhead highways, has a municipal airport, and is scrvcd by 15 lines of eight railways: the Atlanta, Birmingham and Coast, the Atlanta and West Point, the Central of Georgia, the Georgia, the Louisville and Nashville, the Nashville, Chattanooga and St. Louis, the Seaboard Air Line, and the Southern. It is the largest city between Washington and New Orleans, the commercial and financial capital of the south-east, and also an important manufacturing and educational centre. The population was 89,872 in 1900; 154,839 in 1910; 200,616 in 1920, of whom 62,796 were Negroes and 4.738 foreign born; and was 270,366 (after several annexations of territory) in 1930 by the federal census; and 302,388 in 1940.

The city lies on the Allegheny watershed, at an altitude of 1,000–1,17j ft., and is surrounded by the foothills of the Blue Ridge mountains. The rainfall is evenly distributed through the year, and the average mean monthly temperature ranges between 43·2° in January and 78·1° in July. The air is bracing, and deaths from sunstroke are unknown.

Atlanta owes its existence and development to the railroads. In 1836 the present site of the Union station was selected for the southern terminus of a projected State railway; and within a few decades, as one railway after another built from other directions to the same point, it became the principal transportation centre in the southern States The city was laid out in a circle nith a radius of 1¾ m, which had for its centre the old Union

station. The original area has been increased by successive annexations of territory in all directions until it is now 31·4 sq.mi., and the metropolitan area includes about 221 sq.mi. As the city was almost completely destroyed by Sherman's raid in 1864, it is nearly all of recent construction. In 1920 a city planning commission was established, and it secured the adoption of a zoning ordinance (1922) which helped promote the diffusion of population. There are beautiful streets and residence sections, among them Peachtree street, Ponce de Leon avenue, Pace's Ferry road, Druid Hills, Ansley Park, and Morningside Park. The business section has many large hotels and sky-scrapers; its principal oflice-buildings contain over 2,500,000 sq.ft. of floor space. The streets are over-crowded with traffic, and projects for widening some of them are under consideration. The principal railway station, the Terminal, is modern and well equipped. The old Union station is still used by three roads.



BY COURTESY OF THE ATLANTA CHAMBER OF COMMERCE

THE STATE CAPITOL BUILDING AT ATLANTA. COMPLETED IN 1889
Beside a collection of portraits of famous Georgians, the capitol building contains an extensive law library. The equestrian statue on the left represents General John Brown Gordon, distinguished in the American Civil War

The State Capitol, built in 1884–89, is designed after the National Capitol in Washington. The Federal Reserve Bank is a magnificent building of Georgia marble. The Fulton county court house, of granite and terra-cotta tile, the city auditorium-armoury, which has a hall seating 6,000, the Federal building and the Carnegie library (opened 1902) are other conspicuous public buildings. The Georgia training school for girls, a State reformatory institution, is about 7m. outside the city. On the southern boundary of the city are the State home for Confederate veterans; the Federal penitentiary, one of the three prisons maintained by the U.S. Government; and Ft. McPherson, a large army post of the 4th Corps Area, which has its headquarters in the city. There are many points of historic interest in and near the city, especially in connection with the Civil War. The home of Joel Chandler Harris, the author of "Uncle Remus," is kept as a memorial to him; and the old red brick building in which Woodrow Wilson began the practice of law still stands. There is a statue of Henry W. Grady in front of the city hall, and the memory of this beloved orator and editor, who did much to mitigate the bitterness between the North and the South after the Civil War, is further cherished in the names of the largest city hospital and one of the leading hotels.

There are 61 parks, squares, and open spaces in the city, with a total area of 1,200 acres. They include 24 playgrounds for children, 62 double tennis-courts, two nine-hole golf courses, 12 baseball diamonds, three football fields, six swimming pools, and two basketball courts—all maintained by the city for public use. The largest parks are Piedmont (185 ac.); Grant (144 ac.), which contains Ft. Walker, a part of the breastworks in the battle of Atlanta; and Lakewood (386 ac.), which is used as fair-grounds by the South-eastern Fair Association. There are several fine country clubs outside the city; and in all (public and private) there are ten golf courses here in the home of Bobby Jones.

The city pumps its water-supply from the Chattahoochee river, and the present equipment is sufficient to supply a population 50% larger than is now served. The sewerage system (a double system, with one set of pipes to carry off storm water, and another for the sewage) extends to 90% of the total street mileage, and additional mains are under construction. Coal comes from mines near by in Alabama, Tennessee, and Kentucky, and is cheap. Electrical energy is brought in by nine long-distance high-tension transmission lines, from various water-power developments.

Most of the industries use electric power.

The power company operates also a steam heating plant, which provides heat from underground mains for offices and other buildings in the central business district. The assessed valuation of property for purposes of taxation was $344,830,716 in 1940, representing an actual value of about $570,000,000. There were 97.200 telephones in use that year, and in 1940 the number of licences issued for privately owned passenger motor cars in the city and Fulton county was 92,684. The cost of living in Atlanta runs 7 or 8% below the average for American cities.

Atlanta's trade area embraces the entire southeastern quarter of the United States. In 1939 there were 809 wholesale houses and 3.833 retail establishments in the city, and 152 transport companies operating 2,000 motor trucks for commercial hauling exclusively; 500 cars of merchandise and package freight moved out daily over the various railways; and the post-office receipts were $3,628,823. While Atlanta ranks 28th in population (1940) among the cities of the United States, it ranks 21st in amount of postal receipts and 13th in bank clearings. It is the seat of the sixth federal reserve bank. Debits to individual accounts in the city's banks amounted to $2,449,500,000 in 1940 and clearing-house exchanges to $3,009,000,000. Retail sales for 1939 totalled $172,299,000, or $567 per capita; sales by the wholesale establishments, $465,115,000.

There were 902 manufacturing establishments within the city limits in 1939, and the aggregate value of their output was $172,000,000, about 19% of the total for the state. Many more are located outside the city, within the metropolitan area. Printing and publishing, especially of agricultural and trade journals, is an important industry. The leading manufactures include cotton goods, cottonseed oil, furniture and other lumber products, fertilizer, agricultural machinery and implements, and (as in all modern American cities) confectionery, ice-cream and bakery products; but there are no dominating industries, and more than 1,500 commodities are made within the metropolitan area. Many industries of national scope have established branches at Atlanta, either for production or for storage and distribution of their goods.

The public-school system comprises (1940) 76 elementary schools, four junior and four senior high schools, with a total enrolment of 69,000. In 1921–22 on the occasion of a special appropriation of $4,000,000 for the development of the school plant, a comprehensive survey of the system was made, and plans were mapped out to meet anticipated needs as far ahead as 1940. The free public library (organized 1899, when the city accepted a double offer from Andrew Carnegie and the Young Men's Library Association) has an annual circulation of over 630,000 volumes. It maintains eight branches, and conducts a school for training librarians, which since 1925 has been affiliated with Emory university. There are 586 churches within the metropolitan area (301 of them maintained by coloured people) representing 20 denominations. Charitable institutions and agencies, about 40 in number, are financed through a "community fund."

Atlanta has many institutions for the higher education of both white and coloured students. The Georgia institute of technology (opened 1888) is a part of the State university (see ATHENS). Oglethorpe university (originally conducted at Midway, destroyed during the Civil War, and reopened at Atlanta in 1916), the *alma mater* of Sidney Lanier, occupies beautiful blue granite buildings on a campus of 137ac. north of the city. Emory university (founded by the Methodist Episcopal Church South in 1914) incorporates Emory college, named after Bishop John Emory of Maryland (d. 1835), which was conducted 1837–1919

at Oxford, Georgia. It has endowments of $4,362,745, and its campus of 160ac. is just outside the city, in Druid Hills. Agnes Scott college for women is in the suburb of Decatur (*q.v.*) and the Georgia military academy is at College park, 7m. to the south-west. Besides the professional schools of the universities there are the Atlanta theological seminary (Congregational), the Atlanta law school, the Atlanta-Southern dental college, the Atlanta college of pharmacy and the Southern college of pharmacy. The institutions for coloured students include Atlanta university (founded 1865 by the American Missionary Association), the pioneer in advocating and furnishing opportunities for cultural education for negroes, with which W. E. Burghardt du Bois was associated for many years; Morehouse college, established in Augusta, in 1870, by the Baptist Home Missionary Society; Clark university, founded in 1870 by the Freedmen's Aid Society of the Methodist Episcopal Church; Morris Brown university, founded in 1882 by the African Methodist Episcopal Church; and Gammon theological seminary (Methodist Episcopal) established and endowed in 1883 by Dr. Elijah Gammon.

Three daily newspapers are published: the *Constitution* (established 1868), edited 1880–89 by Henry W. Grady (1850–89), and from 1889 to his death by Clark Howell (1863–1936), the *Journal* and the *Georgian*.

On Stone Mountain, a hill of naked granite 15m. E. of Atlanta, a magnificent memorial to the Southern Confederacy is under construction. When completed, a military procession of hundreds of figures chiselled in bold relief will sweep across the perpendicular cliff (800ft. high and 5,000ft. long) on the north side of the mountain, "reviewed" by a central group representing the Confederate High Command, including Jefferson Davis, Robert E. Lee, Stonewall Jackson and a colour-bearer. The work was begun by Gutzon Borglum and continued by Augustus Lukeman. A vast memorial hall will be quarried out, to serve as a depositary for records and relics of the Confederacy.

History.—In 1821 this region was ceded to the State of Georgia by the Creek Indians. In 1825 a lottery was held, and land lot no. 78, on which the greater part of the city stands, was drawn by Jane Doss, who sold it the following year for $50. The first cabin was built in 1833, by Hardy Ivy. Near his dwelling the railway engineers in 1836 drove their stake to mark the end of the proposed State railroad. The village was appropriately called Terminus at first, but in 1843, when a town charter was secured, the name was changed to Marthasville, in honour of the daughter of Gov. Wilson Lumpkin; and in 1847, when the city was incorporated, it was again changed to Atlanta, which was probably suggested by the name of the railroad (the Western and Atlantic). The population in 1850 was 2,572; in 1860, 9,554. During the Civil War the city was the seat of military factories and a depot of supplies. In 1864 it became the objective of Sherman's invasion of Georgia from Chattanooga. The battle of Atlanta was fought on July 22, and other severe engagements took place in the vicinity through July and August. On Sept. 2 the Union troops entered the city; the citizens were ordered to leave, and the place was turned into a military camp. When, on Nov. 15, Sherman started on his "march to the sea," the city was fired and a large part of it burned. The military government of Georgia was established here in 1865, and in 1868 Atlanta was made the capital of the State. The International Cotton Exposition was held here in 1881; the Piedmont Exposition in 1887; and in 1895 the Cotton States and International Exposition, which had exhibits from 37 states and 13 foreign countries.

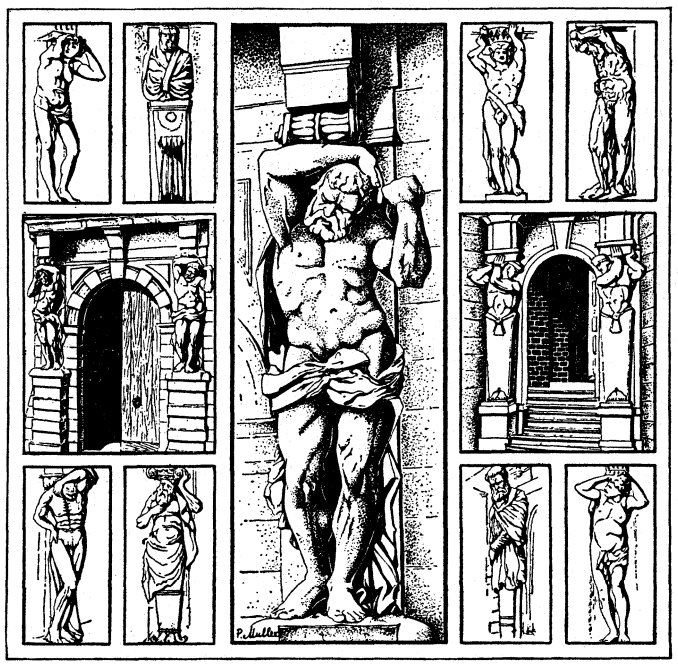
ATLANTA, BATTLES ROUND. The fighting round Atlanta (July 20–Sept. 2, 1864), the last phase of the Atlanta campaign (May–Sept.), ended with Sherman, the Federal general, forcing his opponent *Hood* to evacuate "the Gate City of the South." Having manoeuvred *Hood's* predecessor, *J. E. Johnston*, across the Chattahoochee (July 9), Sherman had before him a twofold objective, the capture of Atlanta and the destruction of the Confederate army. If the two ends could be compassed by a single stroke, so much the better; but Sherman had already decided that, if to take Atlanta he must let the enemy army escape, the capture of the city was the more important task. He believed that the fall of Atlanta would sound the death-knell of the Confederacy and to attain that he "was willing to meet the enemy in the open field but not behind well-constructed parapets" (Sherman). If Atlanta was, as *Johnston* wrote, "too strong to be taken by assault and too extensive to be invested," still the Confederate army could be forced to evacuate it by cutting off its sources of supply. Three railways fed Atlanta, viz., the Augusta, Montgomery and Macon lines. Sherman was warned by Grant that *Lee* might send reinforcements from Virginia, and these troops would probably follow the Augusta route, as *Longstreet* had done the previous year. Therefore Sherman decided to destroy the Augusta railway east of Decatur, hoping to put it out of action long enough to complete his operations against Atlanta and to close in upon the city from the north and east. His left wing, McPherson's Army of the Tennessee (XV., XVI. and XVII. Corps) was ordered to advance from Roswell and strike the railway between Decatur and Stone mountain, Schofield's Army of the Ohio (XXIII. Corps) to march straight upon Decatur, where it would be joined by McPherson, and Thomas with the Army of the Cumberland (IV., XIV. and XX. Corps) to advance upon Atlanta. *Johnston* meant to fight for Atlanta. He had prepared a line of defence behind Peach-tree Creek forming a semicircle round the north of the city, with its flanks resting on the Chattanooga and Augusta railways. The forces of the two combatants were now more nearly equal than they had ever been. For Sherman had to leave strong detachments north of the Chattahoochee to protect his communications against cavalry raids, and *Johnston* hoped to hold his fortified lines with the Georgia militia, which the State Governor was sending to Atlanta, and with his three corps attack the Federals in flank. But *Johnston* was superseded by *Hood*, one of his corps commanders (July 17). This step, generally regarded as one of *Davis's* worst mistakes, was forced upon the President by certain influential Georgians, who represented that *Johnston* was intending to abandon Atlanta without a battle. The Government could get no definite statement of his plans from *Johnston*, whose relations with the President had been strained since the autumn of 1861.

It was decided that a more aggressive policy must be adopted, and *Hood*, who had won a well-deserved reputation as a fighting general under *Lee*, was appointed in *Johnston's* place. *Johnston* on turning over the command had explained to his successor his plans for an offensive, and *Hood* decided to execute them forthwith. But he could only use two corps for his offensive, as only 2,500 militia had arrived. The disposition of Sherman's armies invited attack. The two flanks were 10m. apart and there was a big gap between Thomas's left and Schofield's right. *Hardee* was ordered with his own and *Stewart's* corps to attack Thomas's army, when crossing Peach-tree creek, and drive it down into the pocket between the creek and the river. But the Federals held their ground and beat off all the Confederate onslaughts (July 20). On the night of the 21st *Hood* withdrew his troops into an inner line of entrenchments and sent *Hardee's* corps round the east of Atlanta to fall upon the exposed flank and rear of McPherson's army, which seemed to be threatening a movement against the Macon railway. *Hood* intended, as soon as *Hardee's* attack threw the Federal left into confusion, to move out his other two corps from their entrenchments in succession and hoped to roll up the Federal line from left to right. After a 15m. night march *Hardee* reached a position in the thick woods where his right overlapped McPherson's left, which had just occupied the entrenchments vacated by the Confederates. The Federals were taken by surprise, as their cavalry was away tearing up the Augusta railway and Sherman himself imagined *Hood* to be evacuating Atlanta. But the unexpected appearance of the XVI. Corps in rear of McPherson's left prevented the Confederates from falling upon the enemy rear, and the onslaughts of *Hardee* on their left and of *Cheatham's* corps, which advancing from its lines took up the attack against the Federal front, were finally repulsed by the Army of the Tennessee, which fought this battle, known as the battle of Atlanta (July 22), the bloodiest of the whole campaign, practically unaided. It lost its commander, McPherson, who was killed at the outset. Logan took over the

temporary command, but Howard was formally appointed McPherson's successor (July 27). The railway bridge over the Chattahoochee was rebuilt (July 25), and for the greater security of his communications Sherman decided to advance against the Macon railway by his right flank instead of continuing the movement round the east of Atlanta. The Macon and Montgomery railways ran over the same line as far as Eastpoint, 3m. south of Atlanta. It was impossible for an army holding Atlanta to protect the latter railway, which crossed the Chattahoochee into Alabama. The safety of Atlanta therefore depended upon *Hood's* ability to keep the Macon railway intact. Sherman now transferred the Army of the Tennessee to the extreme right and sent his cavalry round both sides of Atlanta against this railway. As Howard was moving into position south-west of Atlanta (July 28) S. D. *Lee*, who had replaced *Cheatham* in command of *Hood's* old corps, attacked his right at Ezra Church with his own and part of *Stewart's* corps. *Hood's* third attempt to strike a heavy blow was repulsed with comparative ease, and *Davis*, alarmed at these costly failures, urged upon *Hood* a more cautious policy. Sherman continued to extend his lines to the right, moving Schofield (Aug. 1) with the XXIII. and XIV. Corps beyond Howard's army in the hope of capturing the railway above Eastpoint. But the insubordination of the XIV. Corps commander frustrated this attempt. Sherman now decided that he had stretched his lines as far as he could with safety. His cavalry raids failed to do any permanent damage to the railway. He therefore determined to cut loose from his base and throw his whole force (less one corps) against the Macon railway several miles south of Atlanta. He began the withdrawal of Thomas's and Howard's armies from their lines (Aug. 25), sending back the XX. Corps to entrench a position in front of the Chattahoochee railway bridge and leaving Schofield in his lines facing Eastpoint, where he kept up a series of demonstrations. By the night of the 27th the Federal forces were echeloned along the Atlanta-sandtown road and next day commenced a left wheel pivoting upon Schofield. Thomas struck the Montgomery railway at Red Oak, 7m. below Eastpoint, and Howard at Fairburn, 5m. farther south-west. The 29th was devoted to a thorough destruction of the railway track. On the 30th Howard reached the Flint river and pushed the XV. Corps across. Schofield had come up into line on Thomas's left the previous day and now moved up from Red Oak towards Eastpoint to cover the passage of the army trains, which carried 15 days' rations for the troops. *Hood* meanwhile was completely mystified by Sherman's withdrawal from before Atlanta. He had despatched *Wheeler* with over half his cavalry (Aug. 10) on an extensive raid against Sherman's communications, and on Aug. 27 he jumped to the conclusion that in consequence of *Wheeler's* raid Sherman was retreating across the Chattahoochee. On the 30th his cavalry brought him news that part of the Federal army was south of Atlanta, and he despatched *Hardee's* and *Lee's* corps under the former's command to Jonesboro to drive back the advancing enemy. *Hardee* attacked Howard (Aug. 31) but failed to drive him across the Flint river. Schofield and Thomas reached the Macon railway at and below Rough and Ready station and marched down towards Jonesboro, tearing up the track as they advanced.

Hood, when he learned that the enemy had reached the railway, ordered the return of *Lee's* corps to Atlanta. He inferred from his information that only the right wing of Sherman's army was on the railway and that a general attack upon Atlanta from the south was threatened. *Hardee* was left (Sept. 1) to defend Jonesboro. Sherman devoted his attention to the thorough destruction of the railway down to Jonesboro, until learning of *Lee's* departure he endeavoured too late to envelop *Hardee's* corps. *Lee* had been stopped half way on his return to Atlanta and ordered to cover the withdrawal of the remainder of *Hood's* army during the night from Atlanta. The XX. Corps occupied the city (Sept. 2). *Hood* marching round east of the railway effected a junction with *Hardee* at Lovejoy's station to interpose between Sherman and Andersonville, where 34,000 Federal prisoners were confined. Sherman did not push his advance farther south but rested content with the capture of Atlanta. *(See* AMERICAN CIVIL *WAR.)* (W, B. Wo.)

ATLANTES, in architecture, male figures used as supports for an entablature, a balcony or other architectural projection, especially when such figures are posed as though they were actually upholding great weights, like Atlas carrying the world. When male figures resemble the female caryatides (*q.v.*) they are more properly known as canephorae *(see* CANEPHORAE); when they are only half figures they are known as *gaines.* The earliest example



of true atlantes occurs on a colossal scale in the temple of Zeus at Agrigentum (c. 500 B.C.). They were favourite motifs in the later Renaissance, particularly in Italy, Germany and France.

ATLANTIC, a city in the south-west part of Iowa, U.S.A., 50m. E. by N. of Omaha; the attractive county seat of Cass county. It is at the intersection of highways 6 and 71 and is served by the Rock Island railway. It has an intermediate landing field for aeroplanes, lighted with beacons by the post office department. The population according to the federal census of 1940 was 5,802. Atlantic is the trade centre for a rich farming region, and has large corn-canning plants, flour mills and grain elevators, poultry-feeding yards and packing houses. It was chartered as a city in 1869.

ATLANTIC CITY, a city of Atlantic county, New Jersey, U.S.A.; a famous seaside resort, on the Atlantic ocean, 55 mi. S.E. of Philadelphia and 110 mi. S.-by-W. of New York. It is served by the Pennsylvania-Reading Seashore lines, by trolley (tram) and motor coach lines and by aeroplane service. It has had an airport since 1919. The residential population was 50,707 in 1920, of whom 10,946 were Negroes and 7,009 were foreign-born whites; according to the federal census residents numbered 64,094 in 1940. This population is increased by visitors to 300,000 in August, and the average daily population for the year is about 100,000. It is estimated that there are 15,000,000 visitors yearly.

The city lies on a low, sandy island (Absecon island), 10 mi. long with varying widths of from one-tenth of a mile to three-quarters of a mile, separated from the mainland by a narrow strait and 4 or 5 mi. of meadows, partly covered with water at high tide. In winter it is warmed by the Gulf stream and protected by the pine belt of New Jersey, and the heat of summer is moderated by the water on all sides. The percentage of sunshine is above the average, and there is little fog. These climatic advantages, added to its accessibility, have given it a unique position as an all-year-round playground, a resort for convalescents, and a favourite meeting place for conventions. There are about 1,000 hotels and several sanatoria. The assessed valuation of property in 1940 was $92,206,000.

The "Boardwalk," built of steel and concrete with a wooden flooring, 60 ft. wide in the central section and extending 8 mi.

along the ocean front, is the promenade of the nation. It is connected with six great recreation piers, which reach out over the ocean 1,000–2,500 ft. and on the other side is lined with sumptuous hotels, shops, restaurants and places of diversified amusements. For those who do not wish to walk, there are 2,500 licensed wheeled chairs. Surf bathing, horseback riding along the beach, fishing, yachting and wildfowl shooting are popular amusements. There are five country clubs with good golf courses, on which golf is played the year round.

Absecon lighthouse, on the north end of the beach, is 167 ft. high.

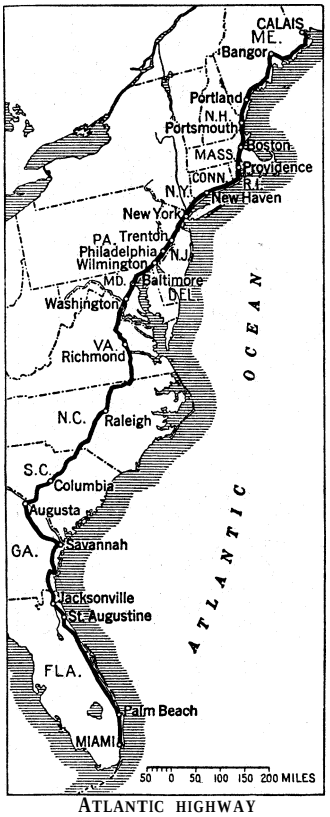
There was a settlement of fishermen on the island in the latter part of the 18th century. The movement to develop it as a seaside resort for Philadelphia began about 1845. and after the completion of the Camden and Atlantic City railway in 1854 the growth of the city was rapid. The first pier was opened in July 1882, and was destroyed by a storm in September of the same year. The city was incorporated in 1854 and adopted a commission form of government in 1912.

ATLANTIC COASTAL HIGHWAY runs from New York city to Miami, Florida. It is about 1,600m. in length and is for the most part hard surfaced or paved excepting between Wilmington, North Carolina, and Savannah, Georgia. This route follows the same general course as that of the Atlantic highway except between Petersburg, Va., and Savannah, Ga., and provides an excellent opportunity for viewing the coast lands of the intervening States. (See ATLANTIC HIGHWAY.)

ATLANTIC COAST LINE RAILROAD COMPANY, a Virginia corporation which operates in the States of Virginia, North Carolina, South Carolina, Georgia, Florida and Alabama. It is the outgrowth of the gradual consolidation of more than 80 separate railroad corporations and the construction and purchase of a large amount of additional mileage connecting therewith. The Richmond and Petersburg Railroad Company, chartered by the State of Virginia in 1836, was the basic or parent company, into which the other railroads were merged and consolidated. The first step was taken in 1898, when this company absorbed the property of the Petersburg Railroad Company, another Virginia corporation, chartered in 1830, and changed its name to Atlantic Coast Line Railroad Company of Virginia, with less than 100 m. total mileage. In 1900, the Company absorbed the property of the Wilmington and Weldon Railroad Company, chartered by the State of North Carolina in 1834, and of other companies, and again changed its name to Atlantic Coast Line Railroad Company. Upon this merger the railroad lines of the Atlantic Coast Line Railroad Company were extended from Richmond and Norfolk, in Virginia, to Charleston and Columbia, in South Carolina; with branch and feeder lines extending throughout eastern Virginia and eastern North Carolina and eastern South Carolina, with a total mileage of about 1,760 miles. In 1902 the Atlantic Coast Line Railroad Company acquired the Plant System, extending from Charleston, S.C., to Tampa, Fla., and Montgomery, Ala., with many branch lines. This purchase gave the Atlantic Coast Line a total of 4,138 miles. Additional track constructed and acquired had brought the total mileage up to 5,101·02 in 1940.

The territory served by the Atlantic Coast Line is one of the largest and most important producers in the United States of perishable fruits and vegetables, and this railway line ranks among the leading carriers of these commodities. Passenger travel is important also because of the large number of tourists that annually visit Florida and other points in the southeastern States. The Atlantic Coast Line operates a number of trains, both seasonal and year-long, designed to encourage this traffic. The capitalization of the Company on March 31, 1940 consisted of common stock 823,427 shares, with a par value of $82,342,700; preferred stock 1.967 shares, with a par value of $196,700; funded debt outstanding, $144,448,100; total $226,987,500. (G. B E.)

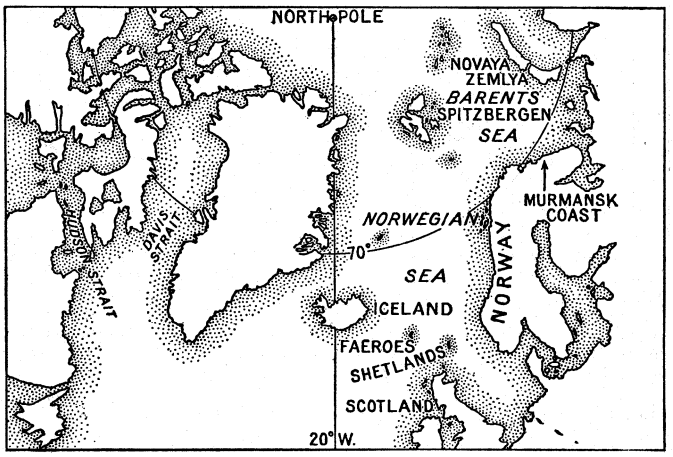
ATLANTIC HIGHWAY, one of the first great American thoroughfares to have a name, is notable for the fact that it passes through the greatest cities of the East and is surrounded by the historic points of interest of the 13 original States. Extending from Calais, Me., to Miami, Fla., it is all hard or paved roadway as far as South Carolina, and again in Florida. Bangor, Portland, Boston, Providence, New York, Trenton, Philadelphia, Wilmington, Baltimore, Washington, Richmond, Raleigh, Augusta, Jacksonville, St. Augustine and Palm Beach are some of the centres of population that lie along its route. Bordering upon the Atlantic ocean through much of its 2,240m., it affords scenes of great beauty, varying from the roaring surf and rock-bound cliffs of Maine to the coral reefs and opalescent blue of Florida's quiet waters.



ATLANTIC HIGHWAY

ATLANTIC OCEAN, the name given to the vast stretch of sea dividing the continents of Europe and Africa from the New World. The term is supposedly derived from Atlantis, presumed to be a submerged continent below the present ocean.

Extent.— The Arctic basin which stretches from Bering strait across the North Pole to Spitzbergen and Greenland belongs essentially to it, as in the south does the Weddell sea, south of South Georgia (fig. 1.). The utilization of the Arctic and Antarctic circles as boundaries has neither geographical nor physical justification. The Atlantic ocean has therefore a share in both the seas of ice. From a consideration of winds, currents and temperature it is best to count the equatorial boundary of the North Atlantic at about latitude 5° N. In contrast to the South Atlantic it is very rich in islands, in variety of coastline, and in land-locked seas. The latter include the Caribbean sea, the Gulf of Mexico, the Gulf of St. Lawrence, Hudson bay, Baffin bay on the west, and the Mediterranean sea, Black sea, North sea and Baltic sea on the east. Between



THE NARROW GATEWAY OF THE NORTH ATLANTIC

Spitzbergen and Novaya Zemlya on the one hand and the Murmansk coast on the other lies the Barents sea; between Spitzbergen, Iceland, the Faeroes, Shetlands and Norway lies the Norwegian sea. The southern outlets from the Arctic basin are relatively narrow. Hudson strait is 80km. broad, Davis strait 240km., Denmark strait between East Greenland and Iceland 260km., and the passage between Iceland and north Scotland 850km. The total of all this is only 1,430km. In the South Atlantic on the other hand, between Cape Horn and South Africa, Antarctic and Atlantic meet on a 6,500km. front, and the South Atlantic is therefore much

colder and rawer than the North Atlantic. The Atlantic is, broadly, **S**-shaped and narrow in relation to its length, with the result that writers have spoken of an Atlantic valley. From the Bering strait in the north to Coats land in the south the distance is 21,000km. The breadth from Newfoundland to Ireland is 3,375km. and from Cap San Roque (Brazil) to Cap Palmas only 2,900km. Southwards from these latter it becomes broader and

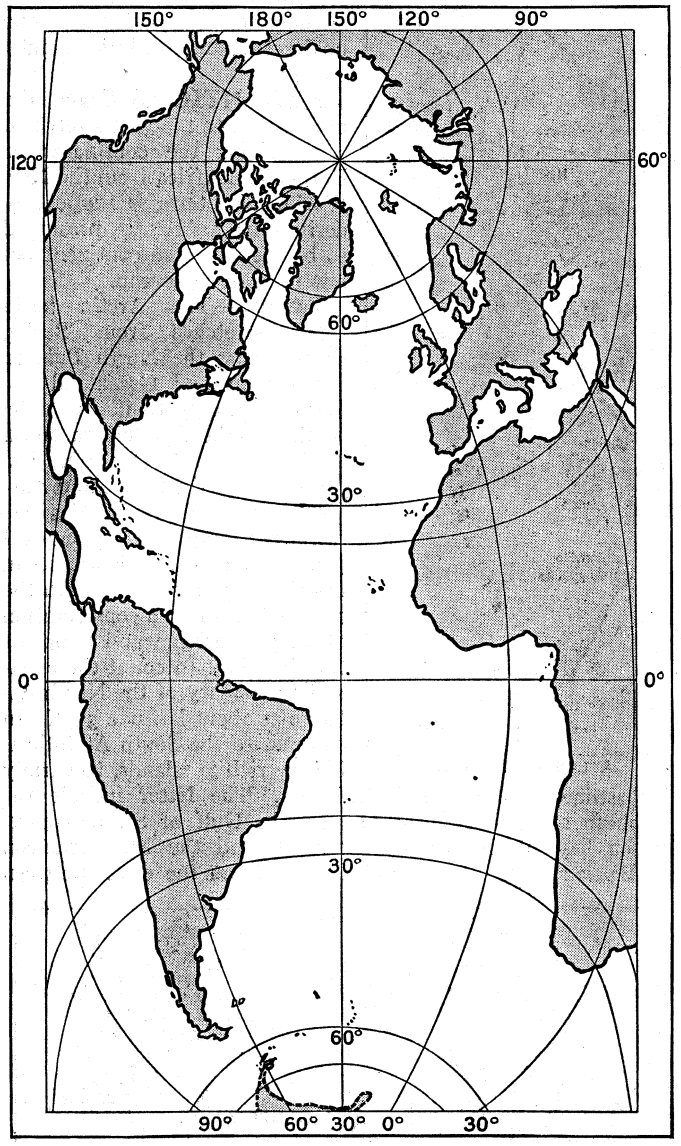


FIG. 1.— THE ATLANTIC OCEAN FROM BERING STRAIT TO WEDDELL SEA
Broadly S-shaped, and narrow in proportion to its length, the area of the Atlantic with its dependent seas is estimated at 106.4 million sq.km. It receives the waters of many of the great rivers of the world, including the St. Lawrence, Mississippi, Orinoco, Congo and Niger, as well as that of the rivers flowing into the Baltic and Mediterranean. The land area drained is nearly four times that drained by the Pacific ocean

is bordered by very simple coasts almost without islands. Drake straits, between Cape Horn and the South Shetlands, give a passage 900km. wide into the Pacific. Kossinna reckons the area of the Atlantic without its dependent seas at 82.4 million sq km. and with its dependent seas at 106.4 million sq.km. By way of comparison, one may mention that the North sea has an area of 0.6 million sq km. Although not the most extensive of the great oceans the Atlantic has by far the largest drainage area. The "long slopes" of the continents on both sides are directed towards the Atlantic, which accordingly receives the waters of a large proportion of the great rivers of the world, including the St. Lawrence, the Mississippi, the Orinoco, the Amazon, the rivers of the La Plata, the Congo, the Niger, the Loire, the Rhine, the Elbe and the great rivers of the Mediterranean and the Baltic. Sir J. Murray estimated the total area of land draining to the Atlantic to be 34,788,000sq.km., or, with the Arctic area, nearly 51,000,000 sq.km., nearly four times the area draining to the Pacific Ocean, and almost precisely four times the area draining to the Indian Ocean. (In this article m. represents metre.)

Islands.—Among purely oceanic islands without a foundation of continental rock, usually the result of volcanic action, we have Jan Mayen, Iceland (105,000sq.km.), Fernando Noronha (near Cap San Roque), Ascension, St. Helena (123sq.km.), Tristan da Cunha, and Bouvet islands (54° S. Lat.). Mainly volcanic, but with a sedimentary foundation are the Azores, Canaries, Madeira and Cape Verde islands. Purely continental are Spitzbergen and the Bear islands, the British isles, Newfoundland, the Great Antilles, the Falkland islands, South Georgia and the South Orkneys. The Bermudas (Lat. 30° N.) are the most northerly coral-reef islands of the world. All Atlantic islands of oceanic origin together have an area of 0.5 million sq.km. In this connection it seems best to consider Greenland as a part of the North American continent.

Relief of **the** Bed.—The foundations of our knowledge of the relief of the Atlantic bed may be said to have been laid by the work of H M S. "Challenger" (1873–1876), the German ship "Gazelle" (1874–1876) and the U.S. surveying vessel "Blake" (1877 and later). Large numbers of additional soundings have been made in later years by cable ships, by the expeditions of H.S H. the prince of Monaco, the German "Valdivia" expedition (1898), and the combined Antarctic expeditions (1903–1904), especially by the "Scotia." In the so-called Weddell sea, where the "Scotia" worked, the "Deutschland" in 1911–12 took many soundings towards the Antarctic continent. In 1925–27 the "Meteor" (German) took about 60,000 soundings by acoustic methods in the South Atlantic, thus rounding off our knowledge of the relief of the Atlantic bottom.

For the Arctic basin we have F. Nansen's maximum sounding of 3,850m., and we know that at the North Pole Peary failed to reach bottom with a sounding of 2,743m. In the Norwegian sea there are many depths of more than 3,000m., but the Barents sea is fairly shallow (300–400m.). The submarine ridge from East Greenland through Iceland and the Faeroes to North Scotland is such that a lowering of the water-level of 400m. would link Europe with Greenland. This ridge keeps the cold Polar bottom-water of the northern deeps away from the Atlantic. From this transverse ridge two branches stretch south-westwards, both probably of volcanic origin. The first projects from Iceland, the second, stretching from the Faeroes, includes the island of Rockall 500km. west of the Hebrides. The grand banks of Newfoundland are less than 200m. below sea level and between them and Iceland is the so-called "telegraph plateau," the level of which varies between depths of 500 and 4,000m. South of this plateau begins the dominant feature of the relief of the whole Atlantic, namely the central Atlantic rise. This keeps to the middle of the ocean as far south as Lat. 50° S., parallel to main curvings of the continental coasts on both sides; it stretches through over 100° of latitude. On this rise, the depths of water are usually less than 3,000m. and often less than 2,000m. On it lie the Azores, St. Paul's island, Ascension, Tristan da Cunha and Bouvet Island, and at the last of these the rise bends eastwards and goes to the Indian Ocean. On both sides of the rise are greater depths, of more than 5,000 or 6,000m. The greatest, those of over 6,000m. or approximately 3,000 fathoms, are called "Deeps" by Sir John Murray and he named them after famous marine explorers, *e.g.*, Nares Deep, north of Haiti and Porto Rico, with a depth of 8,526m., only 150km. from the coast, the deepest spot known in the Atlantic. More recently purely geographical names have been used, and we speak of a North American basin, a Brazilian basin and an Argentine basin. In the last, depths of 8,000m. have been found just North of the South Sandwich islands. East of the Central rise lie the deep Cape Verde depression, the West African depression and the Cape depression, always deeper than 5,000m., often than 6,000m. Some ridges branching out from the central rise in the South Atlantic influence greatly the water movements and temperatures of the depths.

Such are, to the West the Rio Grande ridge (30° S.), to the East the Walfish ridge, stretching S.W.–N.E. from Tristan da Cunha (35° S.) to the African coast near Walfish bay. On these two ridges depths of 900 or even only 700m. on some local pinnacles have been found, and the Walfish ridge is three times as long as the European Alps, with heights 4,000m. above the depths. The Atlantic thus possesses submarine mountains, of course with slopes less sharp than those of terrestrial ones.

Mean Depth and Bottom Deposits.—The average depth of the Atlantic according to Kossinna (1921) is 3,924m. without, or 3,332m. including the enclosed seas. This difference is due to the fact that the sea on large areas off many coasts is less than 100 fathoms or 200m. deep. This continental shelf occupies 13·3% of the area and the British isles lie upon a portion of it. The greater part of the bottom of the Atlantic is covered by a deposit of Globigerina ooze, roughly the area between 1,500 and 4,000m. deep, or about 53% of the whole. At a depth of about 5,000m., *i.e.*, in the "deeps," the Globigerina ooze gradually gives place to red clay. In the shallower tropical waters, especially on the central rise, considerable areas are covered by Pteropod ooze, a deposit consisting largely of the shells of pelagic molluscs. Diatom ooze is the characteristic deposit in higher southern latitudes. The terrigenous deposits consist of blue muds, red muds (abundant along the coast of Brazil, where the amount of organic matter present is insufficient to reduce the iron brought down by the great rivers so as to produce blue muds), green muds and sands, and volcanic and coral detritus. In the Arctic and Antarctic areas there are glacial muds, some from the Ice Age and some due to its survivals in modern glaciation. Even as far south as latitude 29" N. Murray found small stones of northern origin doubtless carried South by icebergs in the days when a great ice barrier stretched from South Greenland around to Scotland.

The origins and age of the Atlantic are unsettled. Neumayr (1885) thought that in Jurassic times there was a bridge-continent between North America and North Europe and one between South America and Africa, so that then the ocean lay only between the West Indies and south Europe. Wegener (1922) on the other hand thinks the Atlantic was formed in the Cretaceous period through a fracture between the Old and the New World, followed by the drift of America westward. J. Murray thought the Atlantic in the main extremely old, thus upholding a view of the permanence of this ocean basin.

Temperature Distribution.—The heat equator or line of highest average surface temperature of the water lies in all months north of the geographical equator, going from the Gulf of Guinea about 5° N. towards the coast of British Guiana and then northwest into the Caribbean sea to about 15° N. The yearly average of temperature on this line is about 27" C., and even far to the north, the isotherms keep a general direction E S E.–W.N.W., so the American side is warmer than the African. On the other hand north of 40° N. the European side is the warmer and the waters in the broad region from Newfoundland to Cape Hatteras are relatively cold. The Norwegian coast has a specially high temperature for its latitude and, even north of the Arctic circle, its fjords do not freeze. In the South Atlantic the Brazilian side is the warmer with an average temperature of 23" C. near Rio de Janeiro, while in the same latitude near Walfish bay, S.W. Africa, the temperature is 57°–59°. In higher southern latitudes the isotherms run nearly E. and W. save for local disturbances through the Cape current (Agulhas) and the Falkland current. Latitude for latitude, South Atlantic water is colder than that of the North. Near Bouvet island and South Georgia in lat. 54° S. we find the 0° C. isotherm, west of Ireland in 54° N. the 11° C. isotherm. Antarctic conditions thus reach into the temperate zone, and penguins have been seen even in the Great Fish bay, 16° S. The seasonal variation of the temperature of the surface waters is as little as 1°–4° C. in the tropics and in the colder regions, and may be 5°–8° C. in temperate latitudes.

Temperature decreases—save in the polar regions—from the surface to the depths; hut decreases in different places at different rates. In the inter-tropical regions at a depth of 400m. temperalures as low as 10° C. or even 8° C. and less have been noted. In middle latitudes, *e.g.*, in the Sargasso sea (*q.v.*) near the Bermuda islands the temperature may be as high as 17° C. at the same depth, and in latitude 30° S. we get 10°–12° C. and over at this depth. This striking fact can be explained only by supposing that in the equatorial region cold water rises nearly vertically from depths of 400–600m., whereas in middle latitudes warm surface water descends vertically to the depths.

In those parts of the Atlantic which are more than 1,000m. deep the temperature of the water depends mainly on the latitude at least south of the Tropic of Cancer. The Atlantic off Europe, helped by warm and very salt Mediterranean water flowing out through the Strait of Gibraltar, even at these great depths is warmer than the deep water of the inter-tropical region. The bottom temperatures are 2–2·5° C. in the North Atlantic, 0·5° C. in the Brazilian depression, 2·2° in the West African depression, zero and —0·4° C. in high southern latitudes. Differences of bottom temperatures are explained mainly by the form of the floor; transverse ridges stop the flow of the coldest water from higher latitudes, and the bottom temperature on their equatorial side is thus higher. In a similar manner the Greenland-Iceland-Shetland ridge with depth less than 500m. prevents the cold bottom water (temperature may be as low as —1·2° C.) of the Arctic and the Norwegian sea from entering the North Atlantic. This fact further helps the temperature of the European Atlantic waters, which are therefore of exceptionally high temperature for their latitude at every depth.

Salinity.—The Atlantic on the surface is by far the saltest of the great oceans. Its saltest waters arc found in the two trade-wind belts, one extending east and west in the North Atlantic between 20° and 30° N. lat., and another of almost equal salinity extending eastwards from the coast of South America in 10° to 20° S. lat. The average salinity in these two belts is 36·5–37·5‰. In the equatorial region between these belts the salinity is markedly less, especially in the eastern part, where only 34–30‰ is observed. North of the North Atlantic maximum the waters become steadily fresher as latitude increases until the channels opening into the Arctic basin are reached. In all of these, water of relatively high salinity usually appears for a long distance towards the north on the eastern side of the channel, while on the western side the water is comparatively fresh, especially in the vicinity of the Newfoundland Banks, but great variations occur at different seasons and in different years. In the higher latitudes of the South Atlantic the salinity diminishes steadily to 35‰ and tends to be uniform from east to west, except near the southern extremity of South America where the surface waters are very fresh (less than 34‰). In the true Polar sections of the Atlantic, *i.e.*, the Weddell sea in the south and the Arctic basin in the north, the surface water is relatively poor in salt, 34–30‰,

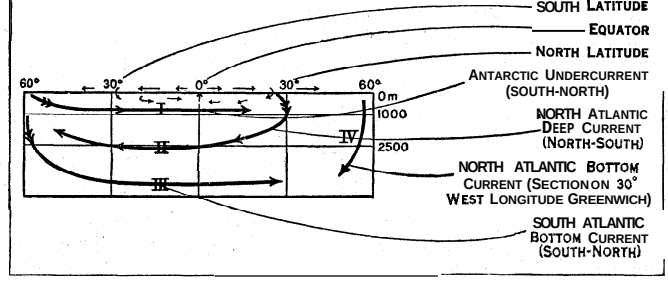


FIG. 2.—DIAGRAM OF THE DEEP WATER CURRENTS IN THE ATLANTIC OCEAN. SHOWING THE DEPTHS AND DIRECTION OF FLOW OF THE GREAT HORIZONTAL MOVEMENTS OF SEA WATER BENEATH THE SURFACE

especially where icebergs melt or the great Siberian rivers bring fresh water to the sea. Though this fresh water is very cold, its lack of salt makes it so light that it remains on the surface. Under this, one finds, however, warmer but salter water, a condition very different from that obtaining in the open ocean. In the Atlantic depths away from the ice regions the salt content of the water and its temperature both diminish with increasing depths, though this is strictly true only in the northern hemisphere. In the southern Atlantic depths, salt content and temperature decrease

only down to 800–1,000m. and then increase again slightly until a depth of 3,000m. is reached.

Circulation in the Atlantic Depths. — Modern chemical research on salt content at various depths has become very important and the observations made by the "Challenger" are now better understood. Fig. 2 shows a section through the Atlantic about longitude 30° W. with indications of the slow movements of great masses of water determined by very small, but distinct differences of salinity. The surface currents, important for climate and shipping, of course only affect the uppermost layers at the very most down to 300m., and are due to the winds; they have little relation to questions of salinity. In higher latitudes, at the ice-limit between the Falklands and Bouvet island, cold water poor in salt sinks to 800–1,000m. depth and moves thence northward as an Antarctic under-current (No. I. in fig. 2) beyond the equator to at least 20° N. In the Sargasso sea, on the other hand, warmer and very salt water sinks and moves, as an under-current at a depth of 1,500 to 3,000m., to the Antarctic zone; this is the North Atlantic under-current (No. II. in fig. 2). Affecting almost all the greater depths, we have a South Atlantic bottom current (No. III. in fig. 2) uniting with a weaker North Atlantic bottom current (No. IV. in fig. 2). There are thus in the Atlantic depths great horizontal movements, just as in the atmosphere there are layers with different characters and movements (trades, westerlies, etc.). But, whereas the equatorial belt divides the atmospheric circulatory system on its two sides, there are immense exchanges of water in the depths right across the equator.

Meteorology. — The difference between water-temperature and air-temperature just over the water is usually 1° C. or less in equatorial and temperate latitudes. Only in the region of the Gulf Stream near the American coast and towards the Polar regions is the air as much as 4°–6° C., colder than the water. North-westerly winter storms drive cold air (0°–5° C.) from North America eastwards into the Atlantic into regions where the water temperature may be 10°–15° C. On the other hand, on the Newfoundland banks with icebergs and cold water one finds in spring and summer that, if the wind is from the south, the air may be 10°–18° C. warmer than the water, and this is a main factor of the dangerous fogs there. On the whole, however, air temperatures over the Atlantic are distributed very much as are water temperatures at the surface. The wind circulation is much simpler than in the Indian ocean and is symmetrical about the meteorological equator which lies between lat. 2° N. and 10° N. Thus the two hemispheres have very similar and independent circulatory systems of air, though there are differences. The circulation in the South Atlantic is nearer than that of the North to a theoretical standard for a simple globe, as it is less influenced by land masses. Between latitudes 20° and 30° S. is a region of maximum pressure (anticyclone) and atmospheric pressure diminishes slowly northward and sharply southward. On the north side, the S.E. trade blows weakly in the southern summer but in the southern winter strongly, especially on the coast of North Brazil. On the African side, the S.E. trade always reaches beyond the equator and contributes to the rainy S.W. monsoon of the Gulf of Guinea (Cape Palmas to Gaboon). From the high pressure region towards the south there blow the N.W.–W. winds over a belt reaching from lat. 35° to 60° or 65° S. and they are felt around Cape Horn and Cape of Good Hope. They have been called "the roaring forties" because formerly ships sailing to India and Australia in lat. 40° to lat. 50° S. utilized these strong winds; storms are irequent here.

In the North Atlantic also there is a region of high pressure (anticyclone) across the ocean between lat. 20° and 30° N. The highest pressures are noted south of the Azores and west of Madeira. The northeast trade blowing thence southward is stronger in summer than in winter, especially near the Canaries and the Antilles; at this season it is felt as far north as the latitude of Gibraltar. On the north side of the high pressure region the conditions over the American continent cause considerable seasonal variations in the westerly winds. These blow relatively weakly towards North Europe in summer, but in winter, when North America has high pressure conditions, the barometric gradient towards the Atlantic is steep and the space between Labrador, Iceland, Jan Mayen and the North Cape is the great highway of a procession of cyclonic storms from the west; cyclonic storms also pass more or less parallel with them over the British isles towards the east.

Surface Currents. — In the "west wind zone," though this is the main direction, air movements are very varied as they are mostly movements in spirals of small diameter. The actual transport of air through space in these zones is therefore much less than in the zone of the almost constant if often more moderate trade wind. It thence follows that the trade winds have a far greater influence on the movement of surface water than have the westerlies of higher latitudes. The two Atlantic trade winds give rise to two great equatorial westward currents. On account of the earth's rotation the northern equatorial current turns into a N.W. direction, the southern into a S.W. one. As, further, the oceanographical and the meteorological equator lie north of the geographical equator, through the year a good deal of the water of the southern equatorial current passes north of Cape San Roque (N. Brazil) into the northern hemisphere and so reaches the north equatorial current on the coasts of Guiana and in the West Indies, and this current is thus much stronger than the south equatorial current on the coast of S. Brazil. Almost all water that streams westwards between latitudes 5° S. and 20° N. is eventually banked up in the Caribbean sea and just north of the Great Antilles with the result that there is a northern out-flow through the strait between Florida and the Bahamas. This is the origin of the Gulf Stream, though only a small fraction of the water of it comes from the Gulf of Mexico. This is one of the most important currents of the world, but it is markedly warm and rapid only in the uppermost layers. Even in Florida strait at a depth of 200m. the temperature is only 10° to 18° C. and the speed 0·4–0·8m. per second as contrasted with over 25° C. and 1·2 to 1·7m. per second at the surface. Generally speaking the suriace currents of the Atlantic and of all seas affect the sea to a depth less than 400–500m.

The Gulf Stream is separated by cold water (the cold wall) from the east coast of U.S A. as it flows northward to a region south of the Newfoundland banks. Here it mixes with the cold water of the Labrador current that comes from the west side of Baffin Bay; the interaction of these two currents causes powerful whirls near the southeast tail of the Newfoundland banks. Henceforth the Gulf Stream is so indefinite as to vary with the winds, and it is customary to speak of a Gulf Stream drift or an Atlantic drift, which moves towards and along the coast of Europe as far north as Norway and Spitzbergen. Here the sea temperatures on the S.W. coast remain above 0° C., and the sea water may have more than 35‰ of salts. In the Arctic this water sinks into the depths. A branch of the Gulf Stream drift, called the Irminger current, keeps the south and west coasts of Iceland free from ice. A third branch goes further north-westward and northward to the west coast of Greenland which is thus ice free for a large part of the year. Another branch reaches around Scotland into the North sea giving a mild and rainy climate. Not all the Gulf Stream drift goes north of lat. 50° N. An important part is deflected increasingly to the right near the Azores and forms a weak and variable Canaries current, which makes a small contribution to the northern equatorial current in the vicinity of the Cape Verde Islands. In the west centre of the mid-north Atlantic towards the Bermudas occurs the Sargasso sea with enormous masses of floating golden-yellow Gulf-weed (*Sargassum bacciferum*); this weed does not hinder ship movements. It is now thought that this Gulf-weed is a really pelagic plant and that only small amounts are torn from the coasts of the Antilles. Finally, in the north hemisphere, we must mention the Guinea current which can be discerned off the Liberia coast going south-eastwards but becomes far more marked from Cape Palmas eastward to the Gulf of the Cameroons. This is partly a re-action current compensating for the water driven west by the south equatorial current, but it is partly due to the south-west monsoon of this coast.

In the south Atlantic the Brazil current and south equatorial current have been mentioned. The Benguella current which contributes to the south equatorial current can be traced over a broad zone west of South Africa. In its path lie St. Helena and Ascension and it is composed of rather cool water flowing rapidly; this is specially marked near the coast of South West Africa. In the enormous stretches between lats. 30° and 60° S., under the influence of variable west winds. the surface current almost everywhere tends E.N.E. or N.E. (not E.S.E. or S.E. as we might perhaps expect from analogy with the Gulf stream); this fact is of enormous climatic importance, for cold water is thus brought to the neighbourhood of the Falkland islands, South Georgia, etc., and the eastern south Atlantic thus shows a large negative thermal anomaly being relatively 2°–5° C. too cold, whereas the eastern north Atlantic is abnormally warm.

Ice.—Pack ice from frozen sea water, and icebergs as fragments of the Antarctic ice-sheet and glaciers come especially from the gulf between Graham Land and Coats Land; *i.e.,* from the Weddell sea which stretches between lat. 60° S. and 78° S. The famous drift of Shackleton on the "Endurance" (1915) shows that there the ice moves clockwise and to the N.E. and attains open water near the South Orkneys and South Georgia. The average limit of large ice masses is thus near the South Shetlands in the west and near Bouvet island in the east. In some years one finds ice near Cape Horn and even north of the Falklands towards lat. 40° S. in such quantity as to be dangerous to ships. Such years were 1891–94 and 1906. This ice moves in the so-called Falkland current which sends cold water northwards parallel to the Patagonian shelf, and may be compared with the Labrador current; it is probable that this Falkland ice comes from the southernmost Pacific. In the north Atlantic the occurrence of ice fields and icebergs near the Newfoundland banks (about lat. 45° N.) is very important as this is near the most frequented of all ocean routes. It is the Labrador current that brings the ice southward, and the icebergs, especially, move along over the deep water outside; *i.e.,* east of the banks; thereafter they may swirl round for weeks between the Gulf stream and the Labrador current. This ice never reaches the coasts of Nova Scotia or U.S.A. and any ice sighted there comes from the Gulf of St. Lawrence. The ice of the Labrador current is seen between February and August and reaches farthest south (lat. 42° N.–43° N.) in May and June. From September to January the great seaway is practically free from ice. In some years the ice may reach as far south as lat. 40° N. or even 38° and the most dangerous zone is between long. 45° and 50° W. Collisions with icebergs have led to the southward deflection of the ocean route during the ice season and the presence of Newfoundland fogs in the same months has contributed to the same end. A vessel of the U.S. coast guard patrols the dangerous zone with signal apparatus during the critical periods. Polar ice is very important on the whole of the east side of Greenland, moving along the cold east Greenland current from the arctic basin. The east coast of Greenland therefore can rarely be reached without difficulty and it is almost uninhabited. The north and east coasts of Iceland are also blockaded for a large part of the year by ice that comes from the north and fills the bays. In the north of the Norwegian sea the boundary of ice floes stretches past Jan Mayen to the region west of Spitzbergen; in the Barents Sea it still remains far to the north of Norway and of the Russian coast.

Tides.—The vertical tidal differences and the direction of the tidal currents near the Atlantic coasts and harbours are well-known, but conditions over the open ocean are still very uncertain. The reasons for this are that one needs observations from a ship anchored over a period of *123* to 25 hr. and that we still lack instruments for measuring vertical changes in the conditions of the water in the open ocean. Probably the vertical tidal difference in the open Atlantic has a maximum of 0·5–1·0 m., as these values have been fixed for oceanic islands with sharp slopes down to the depths—Bermudas 1·0 m., Ascension 0·6 m., St. Helena 0·9 m. The tidal difference seems to be less between the tropics than in temperate and high latitudes. If the tidal waves from the great southern ocean between Cape Horn and the Cape of Good Hope are continued northward in the Atlantic deflection due to the earth's rotation. to the left in southern latitudes, to the right in northern ones, they must strengthen the tides on the coasts of South Brazil and the Argentine and on the coasts of Europe.

Large tidal differences have been observed in the harbours of Patagonia, moderate ones in the harbours of South and West Africa, large ones in the Spanish, French and West British harbours; they are quite small in the harbours of U.S.A. The funnel-shaped Bay of Fundy, Bristol Channel. Gulf of St. Malo all concentrate tides and give a local vertical tidal difference of more than 10 m.

Apparently the tidal currents are not restricted to coastal waters though as yet we have only a small number of observations; *e.g.,* south of the Azores, north of the Cape Verde Islands, the tidal current changes its direction from hour to hour and affects water to a great depth. Apparently this must be the same everywhere, as ebb and flow of the tide are cosmic phenomena.

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ATLANTIC OCEAN, COMMAND OF THE. The voyages of exploration, dating from the later 15th century, shifted the maritime centre of gravity from the Mediterranean sea to the Atlantic ocean. Portuguese navigators crept southward along the African coast, rounded the Cape of Good Hope, and blazed an all-sea route to India. Columbus, sailing westward for the same destination, stumbled instead into the Americas. Succeeding explorers gradually filled in the map of the new world. After the explorers came traders, colonists and buccaneers—Portuguese, Spaniards, Frenchmen, Englishmen and others—who fought the elements, the natives and each other, in a long-drawn-out struggle for empire in the Americas, and for control of the sea routes connecting the new world with the old.

Transformation of the Atlantic from a deserted waste into a vast arena of commercial and military activity, profoundly altered power relationships in the old world. Lands fronting only on the Mediterranean lost in relation to those facing the Atlantic. In a long succession of wars (brilliantly analyzed in the historical works of Capt. Alfred Thayer Mahan), Britain successfully contested the sea power of Spain, Holland and France. As a result of this epic struggle, Great Britain became the dominant Atlantic power. By 1815, after the victorious close of the Napoleonic wars, British sea power had come literally to envelop the vast land mass of Eurasia-Africa from the North cape to the coast of China.

This far-flung *Pax Britannica,* as it was sometimes called, rested upon a remarkable combination of poiitical, military, and technological factors. For reasons beyond the scope of this article, England experienced the industrial revolution earlier than its continental rivals. British imports of foodstuffs and raw materials and exports of manufactures flowed in ever increasing volume along the ship lanes to and from the British Isles. The profits from this traffic were divided between further industrial development and support of the royal navy which guarded the life lines of Britain's global empire.

Geography facilitated this task of the royal navy. The British Isles interposed a great barrier between northern Europe and the Atlantic ocean. To reach the ocean all sea-borne commerce to or from that region had to pass through the English channel or round the stormy northern tip of Scotland. The Rock of Gibraltar, taken by British arms in 1704, guarded the narrow strait which afforded the only marine exit from the Mediterranean down to the opening of the Suez canal. In Gibraltar, moreover, Britain possessed a formidable military stronghold separating the Atlan-

tic and Mediterranean coasts both of France and of Spain. The island of Malta, which passed into British hands during the Napoleonic nars, somewhat similarly divided the eastern and western basins of the Mediterranean. Portugal was the only European country which suffered no strategical handicap that rendered it inherently vulnerable to the pressure of British sea power; but Portugal possessed neither the manpower nor the material resources necessary to remain a serious contender for the Atlantic trident after the onset of the industrial revolution.

Geography thus compelled most of the transatlantic, and much of the coastal, traffic of Europe to pass through narrow seas under the guns of the royal navy. British squadrons, patrolling the channel and the North sea within easy reach of their protected anchorages, afforded a constant reminder that British sea power had repeatedly in the past, and presumably could again, cut off northern Europe from sea-borne supplies. British squadrons in the Mediterranean afforded an equally impressive reminder of Britain's presumptive ability to halt the flow of traffic to and from the ports of southern Europe. British fleets could usually engage their continental foes without uncovering either the British Isles or a safe line of retreat to their own defended bases. British forces in the channel and North sea were favourably situated to interrupt communications between any hostile coalition of northern and western continental powers. By blockading the Strait of Gibraltar, Britain could divide the naval strength of Spain, and especially of France, the country generally regarded during the 19th century as Britain's most dangerous maritime rival.

Primitive overland communications prevailing in Europe well down through the 19th century enhanced the strategical advantage which Britain derived from geographical position and a strong navy. There were no motor vehicles, almost no all-weather highways, and only the rude beginnings of a railway system upon the European mainland. Large-scale movements of people or freight were next to impossible except by sea—and Great Britain commanded the sea right up to the coast of Europe. There was no escape from the paralyzing effects of sea blockade, and no way of countering the superior mobility which gave British sea power such a leverage on the continent.

Defensively, Britain's position was likewise secure. The fleets which stood ready to block the ocean portals of Europe, simultaneously barred hostile approach to the British Isles. The automotive torpedo did not appear until 1860, and did not pass into general use for several decades thereafter. There were no submarines to steal through the blockade and raid British merchant shipping on the high sea. There were no bombing planes to rain destruction upon the ships, docks and factories of Great Britain.

British sea power dominated not only the ocean portals of Europe, but all navigable passages leading from the Atlantic to the Indian and Pacific oceans as well. Acquisition of the Cape of Good Hope (1805) and of the Falkland Islands (1832) clinched the royal navy's hold on the only two sea routes to India and the far east down to the opening of the Suez canal. Occupation of a strategical site in the Gulf of Aden at the foot of the Red sea (1839), together with naval stations at Gibraltar and Malta, assured Britain a secure hold on that marine shortcut which connected the Mediterranean sea with the Indian ocean in 1869.

British sea power likewise dominated the western Atlantic down to the end of the 19th century. During the American Revolution, it is true, the French fleet of Admiral François J. P. de Grasse had wrested control of North American waters long enough to compel the surrender of Cornwallis at Yorktown in 1781. The resulting establishment of the United States raised a potential threat to Britain's permanent dominance in that region by laying the foundations for an independent, well-located, and ultimately formidable power centre in North America. But it was more than a century before the new republic developed into a serious contender for command of the American seas. Meanwhile, from its bases in Nova Scotia, Bermuda and the West Indies, the royal navy continued to exert strong influence on sea communications throughout the western Atlantic. Squadrons operating from these bases blockaded United States ports in the War of 1812; and repeatedly thereafter the pressure of British sea power made itself felt at critical stages in Anglo-American diplomacy.

This was especially the case during the long struggle for control of the Central American isthmus and of the Atlantic approaches thereto. Britain already possessed Jamaica, Trinidad and other strategical positions in this region. In addition, British leaders coveted the Spanish island of Cuba which screened the gulf coast of the United States in much the same manner as the British Isles covered the coast line of northern Europe. Another British objective was to control the various routes for a ship canal to the Pacific. Success in those aims would have strengthened British influence throughout the western hemisphere, and in particular would have given Britain a leverage on the United States comparable to that which it already held over Europe.

American statesmen were awake to this danger. In framing the Monroe Doctrine (1823), in which the United States warned the monarchies of continental Europe to keep their hands off the newly liberated Spanish colonies in the western hemisphere, Secretary of State John Quincy Adams rejected overtures for a joint Anglo-American declaration, lest such a move estop the United States later from turning the Monroe Doctrine against Great Britain itself. That contingency actually arose in the 1840s when Britain and the United States began a seesaw struggle for key positions in the Caribbean and in Central America, on the outcome of which depended the future command of the western Atlantic.

An uneasy truce was reached in the Clayton-Bulwer Treaty of 1850. British pressure in this region was further eased from time to time by the diversionary effects of the Crimean War and subsequent European developments involving British interests. The phenomenal rise of United States industrial and military potential during and after the Civil War (1861–65), culminating in rapid naval expansion toward the close of the century, confronted Britain with the choice either of steadily strengthening its naval establishments in the American seas, or of gradually losing command of those waters and therewith any possibility of controlling the future isthmian canal.

European complications again resolved this dilemma in favour of the United States. At the close of the Napoleonic wars, the royal navy was safely superior to all continental rivals. The long struggle had produced no radical changes in naval design. Technical stability meant slow obsolescence, a decided advantage to the leading naval power. By mid-century, however, a technical revolution was in full swing. The transition from sails to steam, from solid shot to explosive shells, from smooth bores to rifles, from wooden walls to armour—all these and other technical advances speeded obsolescence, and gave Britain's continental rivals a chance to compete on more nearly even terms. These technical developments also produced unsettling effects on political relations and behaviour, which in turn stimulated naval expansion. The resulting sense of insecurity was further aggravated by the growth of German power potential after the Franco-Prussian War (1870), and by the world-wide struggle for colonies, raw materials, protected markets and other imperialistic phenomena, which accompanied the later stages of the industrial revolution.

In the late 1870s, France, Russia, Italy and then Germany all began modernizing and expanding their navies. For a time the British government tended to regard France and Russia as the most dangerous rivals. With that combination in view, the British admiralty in 1889 publicly announced a "two-power standard" as the irreducible minimum to insure Britain's control of European waters and of the long sea routes to India and the far east. Gradually, however, British anxiety was transferred to Germany. The British watched German industrial and military growth with misgivings, heightened after 1890 by the aggressive overtones of German foreign policy. When Germany in 1900 launched a naval building program designed to break Britain's exclusive grip on the European seas, the effect was to bring about a fundamental reorientation of British policy.

To meet the rising German threat required the utmost concentration of British naval strength in European waters. Simultaneously to contest in the American seas the rapidly growing naval

power of the United States was out of the question. Britain had no choice but to recognize American primacy in the western Atlantic; and British statecraft proceeded with considerable finesse to derive from this necessity as much benefit as possible. A continuing and generally successful effort was made to settle outstanding disputes with the United States and to cultivate American good will in order that that country might safely be stricken from Britain's list of potential enemies. In the Hay-Pauncefote treaty of 1901, British statesmen even relinquished their long cherished ambition to share in the control of the future isthmian canal. And by 1904 the British admiralty had begun reducing its squadrons in American waters.

The first fruits of this reorientation were soon apparent. When European sympathies ranged almost solidly against Britain during the Boer War (1899–1902), American statesmen countered with quiet but unwavering diplomatic support. Thereafter, as crisis followed crisis in Europe, and as the German empire made increasingly menacing gestures toward the western hemisphere, the weight of the United States was ranged consistently on the side of Great Britain in a manner that strongly suggested the possibility of an Anglo-American naval coalition if such were necessary to hold the Atlantic against the steadily encroaching menace from the European continent.

The German menace had the further effect of suppressing at least temporarily the ancient rivalry between Great Britain and France. The Anglo-French entente of 1904 left Britain free to develop a fleet base at Alexandria near the Mediterranean terminus of the Suez canal; and recognized a French protectorate over Morocco except for a coastal strip facing Gibraltar. This understanding was accompanied by marked improvement in Anglo-French naval relations, permitting withdrawal of British fleet units from the Mediterranean. The entente thus brought about a further strengthening of the northern sea frontier; but, like the parallel if less formal understanding with the U.S., this step too represented a dissipation of that exclusive command of the Atlantic which had once been the cornerstone of British naval policy.

While bargaining for allies and simplifying their strategic commitments, British statesmen steadily enlarged and strengthened the royal navy. Despite Germany's utmost efforts, the royal navy held its lead. In first-class capital ships, then regarded as the true index of naval power, the British fleet outranked Germany's in 1914 by a ratio of three to two. And the Anglo-French coalition, to which was added the naval resources of Russia, Japan, later Italy, and eventually the United States, held an overwhelming preponderance of naval force measured in tons and guns.

Following the outbreak of war in 1914, the Allies, under the leadership of Great Britain, skilfully translated this mathematical primacy into an effective command of the Atlantic and adjoining narrow seas. Within a few days their naval forces drove the German merchant flag from the high seas. Within a few weeks the German oversea cruiser squadrons were run down and destroyed or driven to cover. The main British fleet screened the transport of the British army to France. while the German fleet lay at anchor or cruised near its home bases in the North sea, unwilling to risk a decisive battle and powerless to break up the blockade which the Allies drew tighter during the winter of 1914–15.

In Feb. 1915, the German command countered the Allied blockade with a submarine offensive against merchant shipping in a "war zone" surrounding the British Isles. Shortage of submarines, threats of American intervention, and other factors presently led to partial relaxation of this initial assault on Allied communications, but not until it had revealed the frightful commerce-destroying ability of the submarine, previously regarded with scepticism as a more or less useful auxiliary of the fighting fleets.

The temporary slackening of the submarine offensive was followed by increased activity on the part of the German High Sea Fleet. Late in May 1916 the German and British fleets met in the battle of Jutland. In this, the only major fleet action of the whole war, the fate of the Allies hung momentarily in the balance. A decisive defeat, shattering British sea power and transferring command of the Atlantic to Germany, would have constituted irretrievable disaster. No such catastrophe occurred. The German fleet, with skilful handling and exceptional luck, managed to inflict serious injury and then escape, though not without substantial casualties, from the annihilation that would certainly have been the outcome of a finish fight with Britain's Grand Fleet.

The battle of Jutland apparently convinced the German command of its inability in this way to smash the Anglo-French command of the Atlantic and thereby to raise the blockade. Only the submarine remained. U-boat construction was stepped up. The scope and area of submarine operations were gradually enlarged. Finally in Feb. 1917 the German command ordered a general submarine offensive against all merchant shipping, neutral as well as belligerent, in a desperate gambling attempt to starve Britain into surrender before an effective antisubmarine defense could be developed, and before the eventually certain intervention of the United States could turn the tide for the Allies.

This plan almost succeeded. When the United States entered the war in April 1917, the U-boats were sinking merchant ships at an appalling rate. Existing defensive measures—chiefly arming merchantmen and patrolling the ship lanes—were proving totally inadequate. The logical recourse was to convoy cargo ships in groups under armed escort, a device already tried and proved in the case of troopships. Now with American bases and naval reinforcements, a general convoy system became feasible and was successfully put into operation. In the intensified war against the U-boats, raids were carried out against the German submarine bases, mine fields were laid across the two Atlantic exits from the North sea, and acoustical devices were developed for detecting the presence of submerged U-boats. With the aid of these and other defensive measures, foodstuffs, raw materials and munitions continued to flow along the Atlantic sea lanes to the British Isles, across the channel to France, and through the Mediterranean to Italy and the near east. An American army, eventually 2,000,000 strong, was ferried safely across the Atlantic to the battlefields of Europe; and simultaneously the Allies drew steadily tighter the blockade of the Central Powers, which, starving their peoples and their war industries, prepared the way for their political and military collapse in 1918.

The victory of 1918 completely altered the balance of naval forces in the Atlantic. The destruction of German sea power removed the threat which had chained the royal navy to European waters; which had suppressed the ancient antagonism of France and Britain; which had driven Great Britain and America into something approaching an alliance; which had compelled the royal navy to relinquish without a struggle its primacy in the American seas. Temporarily at least, British sea power held exclusive and undisputed sway over the eastern Atlantic and adjoining narrow seas. And following the victory over Germany there were accumulating indications that British statesmen and their naval advisers looked forward to early restoration of their former global command of the seas.

This trend had disturbing repercussions on Anglo-American relations. The war had caused an upsurge of navalism within the United States. Congress in 1916 had voted a construction program designed to give the United States a "navy second to none." Late in 1918 the administration had thrown its weight behind a supplementary building program which, if and when carried out, would have given the United States incomparably the strongest navy in the world. These mutually conflicting aims caused the close wartime association of Britain and America to cool rapidly after the Armistice. Anglo-American relations began to show an alarming tendency to revert to their 19th-century pattern of mutual distrust and animosity.

One especially aggravating factor from the American point of view was the continued existence of the Anglo-Japanese alliance. The reason for that pact had disappeared with the defeat of Germany, but neither party seemed willing to terminate it while the United States went on expanding its navy. American statesmen, in turn, were just as unwilling to modify their naval plans as long as the Anglo-Japanese alliance remained in force, since its mere existence was felt to involve at least a theoretical possibility of simultaneous attack in two oceans.

The Washington conference for the limitation of armaments

(1921–22) broke this deadlock. The Anglo-Japanese alliance was abrogated; naval building programs were drastically curtailed; a large number of older capital ships were scrapped; and the British, American and Japanese battleship fleets were stabilized in the ratio of 5-5-3. The United States, in effect, recognized Britain's paramount strategic interest throughout the eastern Atlantic and European narrow seas. Britain, in turn, tacitly disavowed any intention of contesting United States control of the American seas.

The consequent improvement of Anglo-American relations opened the way for a mutually advantageous redisposition of naval forces. The United States gradually shifted almost all its major fleet units to the Pacific. Britain postponed indefinitely the planned re-establishment of a battleship fleet in that ocean and concentrated British naval strength in European waters. Whether or not these dispositions reflected some definite understanding between the two governments, it is certain that the United States fleet came widely to be regarded as a symbol of Anglo-American solidarity in the Pacific, and British sea power in European waters as America's first line of defense in the Atlantic.

The Washington conference achieved no such happy solution of European naval problems. Irreconcilable differences between France and Britain on the one hand, and France and Italy on the other, appeared early in the negotiations. These differences grew out of the general failure to establish a stable power equilibrium in Europe after the war. At the outset it was largely an Anglo-French controversy. The British did not wholly share French fears of future aggression from a resurgent vengeful Germany. They believed rigorous repression of that country would seriously retard economic recovery. The prospect of French military hegemony over the continent aroused deep-seated opposition. The British ideal was still avoidance of military guarantees, a balance of power on the continent, and a two-power naval standard for European waters.

No continental power was able, or even seriously disposed at that time, to contest Britain's two-power standard in the capital-ship category. But capital ships were no longer the only index of naval power. The late war had hastened the development of two new weapons which were to play an increasing role in the control of the seas, especially narrow seas such as the Mediterranean, the channel, and the North sea.

One of these new weapons, the submarine, had forced Britain to the brink of disaster, despite the royal navy's command of the ocean's surface. The other new weapon, the aeroplane, promised to develop into an even greater threat not only to shipping but also to the ports and industrial installations of the British Isles. The terms of peace prohibited Germany from possessing these newer weapons. But France suffered no such restriction and was geographically situated to use both submarines and planes against Britain with maximum effect. These weapons were consequently valuable diplomatic levers to be relinquished only in return for British guarantees to France. Moreover, if France were left to depend solely on its own defensive resources, a larger force of cruisers and destroyers would be required to insure safe passage across the Mediterranean for French colonial troops from Africa.

Another source of French intransigence was Italy's emergence as a serious contender for control of the Mediterranean. The Italian navy was decidedly inferior to that of France, but the Italian government insisted on the right to match France in every category of naval craft. Since Italy was exclusively a Mediterranean country, whereas France fronted on the Atlantic as well, to accept naval parity with Italy was equivalent, in French eyes, to surrendering control of the Mediterranean, and with it the assured flow of supply and reinforcements from Africa.

The French finally yielded with respect to capital ships and aircraft carriers, and in these two categories accepted parity with Italy and tonnage quotas low enough to preserve Britain's two-power standard for European waters. But every proposal to limit submarines and aircraft broke against the unsatisfied French demand for guarantees. Neither France nor Great Britain could agree on cruiser quotas acceptable to each other or to the other naval powers. The most that could be achieved was a qualitative restriction limiting individual cruisers to 10,000 tons displacement and 8-in. guns. Thus the way was left open for renewal of competitive warship construction.

The fascist revolution of 1922 provided just the stimulus needed to produce this result. To the fascists the Mediterranean was Italy's "mare nostrum." Mussolini boasted his determination to carve from its borderlands a modern counterpart of the classical Roman empire. Since control of the Mediterranean was an essential feature of his imperial pipe dream, Mussolini had no interest in naval limitation save as a means of cheaply improving Italy's naval position at the expense of France and Great Britain.

In 1927 the United States sponsored a second naval conference, called to deal specifically with the cruiser problem. Neither France nor Italy took any part in this conference which was thus foredoomed to failure. Its sessions, held at Geneva, quickly deteriorated into an Anglo-American wrangle in which technical arguments and considerations were allowed to revive the ancient feud over freedom of the seas, and to recast the two great Atlantic powers in their abandoned roles of naval rivals and potential enemies.

A change of government in both countries inspired a fresh start. A third conference was held at London in 1930. Here some of the damage to Anglo-American relations was repaired, and a provisional solution of the cruiser controversy was achieved. But the continued intransigence of France and Italy still prevented any stable adjustment of naval relations among the Atlantic and Mediterranean powers.

Likewise inimical to this end was the naval resurgence of Germany. Under the treaty of Versailles Germany was forbidden to acquire any modern armoured ship displacing over 10,000 tons. To circumvent this restriction, German naval architects created the so-called pocket-battleships, "Deutschland," "Admiral Scheer," and "Admiral Graf Spee." These ships, designed as commerce raiders, technically conformed to the Versailles limitation, but their 11-in. guns definitely outclassed the 8-in. weapons allowed on cruisers built by signatories of the Washington Naval treaty. These ships upset existing arrangements for the protection of commerce, compelled every Atlantic power to reconsider its naval program, and in conjunction with other developments started a fresh cycle of competitive building.

One of these contributing causes was the nazi revolution of 1933, followed by Hitler's denunciation of the Versailles treaty. Naval rearmament accelerated rapidly under the nazis. Profiting from past experience, they concentrated mainly on commerce-raiding weapons. Their battle cruisers, "Scharnhorst" and "Gneisenau" (laid down in 1934), and even their great battleships, "Bismarck" and "Tirpitz" (1937), were conceived less as components of a massed fleet than as superraiders for attacking convoys on the high sea. The same objective was implicit in Germany's resumption of submarine building on a large scale. Yet in the face of these preparations manifestly directed primarily against Great Britain, Hitler won London's consent in 1935 to further German naval expansion up to 35% of British strength, with the possibility of eventual parity in submarines!

The Ethiopian crisis, later in 1935, focused attention on the deterioration which was taking place in the strategical position of France and Britain in the Mediterranean. Both London and Paris showed the greatest reluctance to take any steps which might force hostilities with Italy, and doubts were expressed in many quarters regarding the royal navy's continued ability to hold the Mediterranean against the air and sea power of Italy.

Formation of the Rome-Berlin axis in 1936 formally linked the growing danger in northern and in southern waters, and inclined the naval balance still more strongly against the Atlantic powers. But this event, followed by rapid deterioration of world conditions, provided the necessary stimulus for strenuous if tardy counter measures which were well under way when war intervened in Sept. 1939.

The first phase of the ensuing battle for the Atlantic lasted until the fall of France in June 1940. During this period the Anglo-French coalition drove German merchant shipping from the Atlantic, and maintained a fairly effective long-range blockade on the general model of the previous war. The German-controlled zone in the North sea was somewhat broader than in 1914–18, mainly because of the maritime role now played by shore-based aviation. It was consequently more difficult to intercept German blockade-runners entering or leaving the North sea. The blockade in the Mediterranean also fell somewhat short, thanks to Italy's "nonbelligerent" help in forwarding seaborne supplies to Germany. But these handicaps were offset by the close co-operation of the United States and other oversea countries in the use of various devices—pre-emptive buying, "navicerts," etc.—designed to cut at the source all traffic with the axis.

On the defensive side, the initial nonbelligerency of Italy postponed a showdown in the Mediterranean with resulting advantage to the Allies. Also the exclusion of axis men-of-war from a western hemi-

sphere "safety zone," guarded by a "neutrality patrol" under United States leadership, afforded considerable protection to Allied shipping entering and leaving North and South American ports. On the other hand, the modern submarine proved to be a far more difficult weapon to combat than the primitive U-boats of 1918, and the Allies were dangerously short of antisubmarine equipment during the early months of the struggle. Early raids by the pocket-battleships, and threatened raids by the more formidable German battle cruisers, compelled the Allies to deplete their main fleets in order to provide battleship escort for their troop and cargo convoys. And the lengthening range of German air power, especially after the occupation of Norway, gradually curtailed British use of the North sea.

The battle for the Atlantic took a radically different turn following conquest of the Low Countries, the fall of France and Italy's entry into the war. Britain lost French naval support at the very moment when its own sea power was seriously crippled by losses incurred in the retreat from Narvik and evacuation from Dunkirk. The sea and air power of Italy, reinforced by German units, imperilled and eventually barred the direct route to Suez, forcing British shipping to use the long alternative route around the Cape of Good Hope. This cut the total cargo-carrying capacity of the British merchant marine almost in half at the very moment when German acquisition of naval and air bases on the channel and on the west coast of France foreshadowed more destructive attacks on shipping in northern waters.

At this critical juncture, the United States, though still technically a nonbelligerent, assumed a more positive role in the battle for the Atlantic. Fifty American destroyers were turned over to Great Britain to make good previous naval losses. In return, the United States received long-term leases for ship and plane bases in Newfoundland, Bermuda and numerous points in the Caribbean. Congress voted a 70% increase in the navy, and early in 1941 a separate Atlantic fleet was established. American units were sent to relieve the British garrison in Iceland, which had become a vital convoy depot and focus of antisubmarine activity. Greenland was occupied to provide additional facilities for the Anglo-American sea and air patrol rapidly spreading over the north Atlantic. Transatlantic air-ferry service was developed for the delivery of planes and for the rapid transportation of important freight and personnel.

Early in 1942, after the United States had become a full belligerent, the axis opened a large-scale submarine offensive against coastal shipping in American waters. German U-boats also operated in considerable force along the south Atlantic ship lanes to India and the middle east. The Allied campaign (1942–43) to reopen the Mediterranean depended almost entirely upon sea-borne supply shipped through submarine-infested waters. Allied convoys approaching the British Isles, and those bound for the Russian ports of Murmansk and Archangel, had to battle their way against savage air and undersea attacks. It was publicly estimated at the close of 1942 that Allied shipping losses, chiefly from planes and U-boats, still exceeded those suffered during the worst period of 1917. And a considerable weight of Allied naval power had to be kept constantly available in northern waters in case Germany's formidable surface raiders, especially the superbattleship "Tirpitz," should break into the Atlantic shipping lanes as the "Bismarck" did briefly in 1941.

On the other side of the ledger was the ever tightening Allied blockade of axis Europe, and perceptible, if slow, progress in combating the axis war on shipping. With more and better equipment, the convoy system was strengthened and extended. Unprecedented ship building, especially in American yards, caught up and began to forge ahead of losses, though the latter still remained dangerously high. Bombing raids on axis ports and industrial centres progressively impaired Germany's capacity to build and service submarines and aircraft. Transoceanic cargo planes provided for the United Nations an increasingly important alternative means of transport beyond the reach of enemy raiders. Brazil's entry into the war strengthened the Allied position in the south Atlantic. The occupation of virtually all west African ports, including the French naval bases at Casablanca and Dakar, denied to axis raiders their last possible havens in southern waters. All these and other developments foreshadowed ultimate failure of the axis sea strategy which aimed at halting the flow of American armies and materiel across the Atlantic to the battlefields of Europe and Africa; at starving Great Britain into submission; at preventing sea-borne supplies reaching soviet Russia; and at breaking the United Nations' blockade of axis Europe.

Victory in the Atlantic, when achieved, would represent the collective effort of the United Nations, but chiefly of Britain, Canada and the United States. The strength of this coalition was derived in no small degree from the successful reintegration of the fundamental components of sea power. These components are: (1) a secure primary base, (2) relatively superior resources, and (3) favourable strategical position. Britain formerly possessed all three vis-à-vis both Europe and America. The rise of United States power potential, coinciding with changing conditions in Europe, had compelled Great Britain to recognize American primacy in the western Atlantic. The tremendous industrial growth of Germany, coinciding with the development of submarines and later aircraft, undermined the security of England's island base off the coast of Europe, endangered the far-flung network of sea communications which supplied British industry, and thereby weakened the whole structure of British sea power. The United States lacked England's favourable strategical positions for offensive action vis-à-vis continental Europe. But the United States enjoyed a secure base thousands of miles from Europe and Asia. The United States also possessed resources and industrial potential surpassing those of any other country. Britain could no longer command the Atlantic singlehanded against a determined war on commerce backed up by the industrial resources of continental Europe. The United States could not play Great Britain's historic role singlehanded, without huge continuing outlays for armaments on a scale sufficient to compensate for the lack of key strategical positions bearing on the nerve centres of the old world. Together Britain and America possessed in large degree the fundamental requisites for continued command of the Atlantic and adjoining narrow seas. Still it was by no means conclusive that even an Anglo-American coalition could hold these waters indefinitely unless some means were devised to control the European development of submarines, aircraft and other new weapons. Thus the problem of command of the Atlantic was destined at the close of World War II to merge into the larger problem of future power relationships within Europe and between Europe and the other continents facing the Atlantic. In this region, Britain and the United States in concert presented the strongest single power combination. Depending on the terms of peace following World War II, and on the future trend of Anglo-American relations, the English-speaking countries facing the Atlantic might come to represent a coalition of sea power as formidable, as stable, and as useful in the future as British sea power was in the period following the Napoleonic wars.

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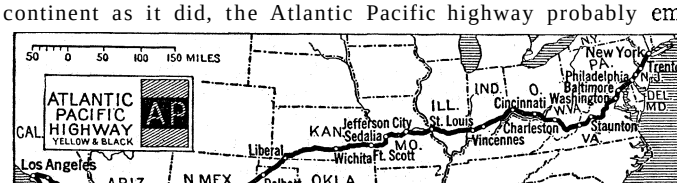
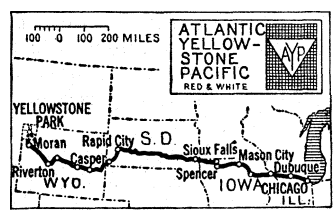
ATLANTIC PACIFIC HIGHWAY, the former name of a U.S. highway which extended from New York city to Los Angeles and San Diego, Calif., approximately 3,000 mi. in length. The name was discontinued with the adoption of state systems of numbering roads. and various parts of the highway were incorporated into–federal highways of different numbers. Spanning the continent as it did, the Atlantic Pacific highway probably em-



braced a greater variety of scenes and climate than any other American thoroughfare. Philadelphia, Wilmington, Baltimore, Washington. Covington, Charleston. Cincinnati. St. Louis. Wichita, Santa Rosa and Phoenix are among the cities which were included in its course.

ATLANTIC-YELLOWSTONE PACIFIC HIGHWAY running from Chicago, Ill., to Yellowstone park, about 1.562 mi. long. The name was gradually dropped, and sections of the highway became parts of various U.S. federal highways (18, 16, 20. etc.). Beginning close to the western shore of Lake Michigan, it passed through the low-lying farm country and touched upon the picturesque Black Hills of South Dakota, in which is situated Wind Cave National park. The Shoshone district, noted for its ranch resorts, and the Iowa lake region lay in its path, also the natural bridge of Wyoming and Jackson Hole, famous as a hunting resort.



Among the important cities along the route of the Atlantic-Yellowstone Pacific highway were Rockford, Dubuque, Mason City, Sioux Falls, Douglas and Casper.

ATLANTIS, ATALANTIS or **ATLANTICA,** a legendary island in the Atlantic ocean. Plato in the *Timaeus* describes how Egyptian priests, in conversation with Solon, represented the island as a country larger than Asia Minor with Libya, situated just beyond the Pillars of Hercules. Beyond it lay

an archipelago of lesser islands. Atlantis had been a powerful kingdom nine thousand years before the birth of Solon, and its armies had overrun the Mediterranean lands, when Athens alone had resisted. Finally the sea overwhelmed Atlantis, and shoals marked the spot. In the *Critias* Plato adds a history of the ideal commonwealth of Atlantis. It is impossible to decide how far this legend is due to Plato's invention, and how far it is based on facts of which no record remains. Mediaeval writers, receiving the tale from Arabian geographers, believed it true, and had other traditions of islands in the western sea, the Greek Isles of the Blest (q v.), or Fortunate Islands; the Welsh Avalon, the Portuguese Antilia (*q.v.*) or Isle of Seven Cities, and St. Brendan's island, the subject of many sagas in many languages. All except Avalon were marked in maps of the 14th and 15th centuries, and formed the object of voyages of discovery; St. Brendan's island until the 18th century. Somewhat similar legends are those of the island of the Phaeacians (Homer, Od.), the island of Brazil (*q.v.*), of Lyonnesse (*q.v.*), the sunken land off the Cornish coast, of the lost Breton city of Is, and of Mayda or Asmaide, the French Isle Verte and Portuguese *Ilha* Verde or "Green Island." The last appears in many folk-tales from Gibraltar to the Hebrides, and until 1853 was marked on English charts as a rock in 44° 48' N. and 26° 10' W. After the Renaissance attempts were made to rationalize the myth of Atlantis. It was identified with America, Scandinavia, the Canaries or Palestine. Ethnologists saw in its inhabitants ancestors of the Guanchos, the Basques or the ancient Italians. Even in the 17th and 18th centuries the credibility of the legend was seriously debated, and sometimes admitted, even by Montaigne, Buffon and Voltaire.

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ATLAS, in Greek mythology, son of the Titan Iapetus and Clymene (or Asia), brother of Prometheus. Homer, in the Odyssey (i. 52) speaks of him as "one who knows the depths of fhe whole sea, and keeps the tall pillars which hold heaven and earth asunder." In the first instance he seems to have been a marine creation. The pillars which he supported were thought to rest in the sea, immediately beyond the most western horizon. But as the Greeks' knowledge of the west increased, the name of Atlas was transferred to a hill in the northwest of Africa. Later, he was represented as a king of that district, turned into a rocky mountain by Perseus, who, to punish him for his inhospitality, showed him the Gorgon's head (Ovid, *Metam.*, iv. 627). In works of art he is represented as carrying the heavens or the terrestrial globe. The Farnese statue of Atlas in the Naples Museum is famous.

The plural form ATLANTES is the classical term in architecture for the male sculptured figures supporting a superstructure, as in the baths at Pompeii, and in the temple at Agrigentum in Sicily. In 18th century architecture half-figures of men with strong muscular development were used to support balconies (see CARYATID). A figure of Atlas supporting the heavens is often found as a frontispiece in early collections of maps, and is said to have been first thus used by Mercator. The name is hence applied to a volume of maps (see MAP), and similarly to a volume which contains a tabular conspectus of a subject, such as an atlas of ethnographical subjects or anatomical plates. It is also used of a large size of drawing paper.

ATLAS MOUNTAINS, the name for the mountain chains more or less parallel to the coast of north-west Africa. They extend from Cape Nun (west) to the Gulf of Gabès (east), a distance of 1,500m., traversing Morocco, Algeria and Tunisia. They are bounded on the north by the Mediterranean sea and on the south by the Sahara desert. They can be roughly divided into two main chains: (1) the Maritime Atlas from Ceuta to Cape Bon; (2) the inner and more elevated ranges, which, starting from Cape Ghir, run south of the coast ranges and are separated from them by high plateaux. The western inner ranges, described here as the Moroccan ranges, are the most important of the whole system. The Maritime Atlas and the inner ranges in Algeria and Tunisia are treated under the heading Eastern Ranges.

The Moroccan Ranges.—This section, known to the inhabitants of Morocco by its Berber name, Idráren Dráren ("Mountains of Mountains"), consists of five distinct ranges, varying in length and height, more or less parallel to one another and with a trend from south-west to north-east.

1. The main range (the Great Atlas) occupies a central position and is by far the longest and loftiest chain. It has an average height of over 11,000ft. The slopes are precipitous toward the Atlantic but long and gradual toward the Dahra district of the north-east. Only one or two peaks reach the line of perpetual snow, but several summits are snowclad during most of the year. The northern sides and tops of the lower peaks are often covered with dense forests of oak, cork, pine, cedar and other trees, with walnuts up to the limit of irrigation. Their slopes enclose well-watered valleys of great fertility, in which the Berber tribes cultivate tiny irrigated fields, their houses clinging to the hillsides. The southern flanks, being exposed to the hot dry winds of the Sahara, are generally destitute of vegetation.

At several points the crest of the range has been deeply eroded, thus forming devious passes. The central section, culminating in Tizi n 'Tagharat or Tinzár, a peak estimated at 15,000ft. high, maintains a mean altitude of 11,600ft., and from this great mass of schists and sandstones a number of secondary ridges radiate in all directions.

For a distance of 100m. the central section nowhere presents any passes accessible to caravans, but in the south-west two gaps afford communication between the Tensift and Sus basins, those respectively of Gindáfi and Bíbáwan. A few summits in the extreme south-west in the neighbourhood of Cape Ghir still exceed 11,000ft., and although less majestic, the average height of this district is greater than that of the Alps. The most imposing view is to be obtained from the plain of Marrákesh, immediately north of the highest peaks. Besides huge masses of old schists and sandstones, the range contains extensive limestone, marble, diorite, basalt and porphyry formations, while granite prevails on its southern slopes. The presence of enormous glaciers in the ice age is attested by the moraines at the Atlantic end, and by other indications farther east. The best-known passes are: (1) The Bíbáwan in the upper Wad Sous basin (4,150ft.); (2) the Gindáfi, giving access from Marrákesh to Tároudánt, rugged and difficult, but low; (3) the Tagharat, difficult and little used, leading to the Dra'a valley (11,484ft.); (4) the Gláwi (7,600ft.); (5) Tilghemt (7,250ft.), leading to Tafilelt.

2. The lower portion of the Moroccan Atlas (the Middle Atlas), lying north of the Great Atlas, is crossed by the pass from Fez to Tafilelt. Both slopes are wooded, and here only in Morocco does the lion still survive. From the north this range, which is only partly explored, presents a regular series of snowy crests.

3. The Anti-Atlas (Jebel Sarro or Lesser Atlas) runs parallel to and south of the central range, and has a mean altitude of 5,000ft., although some peaks and even passes exceed 6,000ft. The relation of the Anti-Atlas to the Atlas proper at its western end is not clear. Two more or less parallel ranges of less importance complete the western system:—

4. The Jebel Bani, south of the Anti-Atlas, a low, narrow rocky ridge with a height of 3,000ft. in its central parts; and

5. The mountains of Ghaiáta, north of the Middle Atlas, a series of broken mountain masses from 3,000 to 3,500ft. high, to the south of Fez, Táza and Tlemsen.

The Eastern Ranges.—The lesser range (Maritime Atlas) nearer the sea, calls for little detailed notice. From Ceuta, above which towers Jebel Músa (2,800ft.) to Melilla, a distance of 150m., the Rif mountains face the Mediterranean, and here, as along the whole coast eastward to Cape Bon, many rugged rocks rise boldly above the general level. In Algeria the Maritime Atlas has five chief ranges, several mountains rising over 5,000ft. The Jurjura range, extending through Kabylie from Algiers to Bougie, contains the peaks of Lalla Kedija (7,542ft.), the highest point of the maritime chains, and Babor (6,447ft.). (See ALGERIA.) The Mejerda range, which extends into Tunisia, has no heights exceeding 3,700ft. It was in these coast mountains that the Romans quarried the celebrated Numidian marbles.

The southern or main range of the eastern division, the Saharan Atlas, is linked by secondary ranges to the mountains of Morocco. The Saharan Atlas is essentially one chain, though known under different names: Jebel K'Sour and Jebel Amour on the west, and Jebel Aurès on the east. The central part, the Záb mountains, is of lower elevation, the Saharan Atlas reaching its culminating point, Jebel Chelia (7,611ft. above the sea), in the Aurès. This range sends a branch northward which joins the Mejerda range of the Maritime Atlas, and another branch runs south by Gafsa to the Gulf of Gabès. Here Mt. Sidi Ali bu Musin reaches a height of 5,700ft., the highest point in Tunisia. In the Saharan Atlas the passes leading to or from the desert are numerous, and in most instances easy. Both in the east (at Batna) and the west (at Ain Sefra) the mountains are traversed by railways, which, starting from Mediterranean seaports, take the traveller into the Sahara.

Geology.—The Atlas mountains were uplifted during the Alpine earth-movements (see ALPS). The movement commenced here at the end of the Jurassic period, was renewed in the Upper Cretaceous and continued into the Miocene. There is also evidence of folding during earlier periods (Variscan in the Moroccan Meseta). The direction of movement throughout the greater part of the mountains is from north to south, and the trend from east-north-east to west-south-west. The trend is continued eastward through Sicily into the Apennines, and westward into the Canary islands. Nappe structures have been recognized here, but the detailed stratigraphy and tectonics are not fully known.

History and Exploration.—The name Atlas given to these mountains by Europeans—but never used by the native races—is derived from that of the mythical Greek god who was supposed to dwell in these mountains. The Atlas are the home of Berber races, and those in the least accessible regions have been independent throughout their recorded history. Some mountain districts of Kabylia had never been visited by Europeans until the French military expedition of 1857. In general the Maritime range was well known to the Romans. The Jebel Amour mas traversed by the column which seized El Aghuat in 1852, and from that time dates the survey of the mountains.

The ancient caravan route from Mauretania to the western Sudan crossed the lower Moroccan Atlas by the Pass of Tilghemt and passed through the Oasis of Tafilelt, formerly known as Sajilmása, on the east side of the Anti-Atlas. The Moroccan system was visited, and in some instances crossed, by various European travellers carried into slavery by the Salli rovers, and was traversed by René Caillé in 1828 on his journey from Timbuktu, but the first detailed exploration was made by Gerhard Rohlfs in 1861–62. Previous to that almost the only special report was the misleading one of Lieut. Washington, in 1837.

In 1871 the first scientific expedition, consisting of Dr. (afterwards Sir) J. D. Hooker, John Ball and G. Maw, explored the central part of the Great Atlas. They ascended by the Ait Mizan valley to the Tagharat pass (11,484ft.), and by the Amsmiz valley to the summit of Jebel Tezah (11,972ft.). Dr. Oskar Lenz in 1879–80 surveyed a part of the Great Atlas north of Tárudant, determined a pass south of Iligh in the Anti-Atlas, and penetrated thence across the Sahara to Timbuktu. He was followed in 1883–84 by Vicomte Ch. de Foucauld, whose itineraries included parts of the first and middle ranges; three routes over the Great Atlas, which was, moreover, followed along both flanks for nearly its whole length; and six journeys across the Anti-Atlas, with a general survey of the foot of this range and several passages over the Jebel Bani. Then came Joseph Thomson, who explored some of the central parts, and made the ascent of Mt. Likimt, 13,150ft. (1888); and Walter B. Harris, who explored some of the southern slopes and crossed the Atlas at two points during his expedition to Tafilelt in 1894, In 1901 and again in 1905 the marquis de Segonzac, *a* Frenchman, made extensive journeys in the Moroccan ranges. A member of his expeditions, de Flotte Rocquevaire, made a triangulation of part of the western portion of the main Atlas. Since that time numerous travellers and scientists have visited and explored the mountains. *(See* also MOROCCO; ALGERIA; TUNISIA and SAHARA.)

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(J. I. P.)

ATLAS PORTLAND CEMENT COMPANY had its origin in the Mathey Cement company which was incorporated in New York State in 1885. This company underwent various corporate changes that in 1889 developed in embryo the present organization. In 1888 property at Coplay, Lehigh county, Pa., was acquired, and in 1889 *a* beginning for Atlas cement, was made with a mill turning out 200 barrels a day. In 1896 a second mill, in Northampton county, Pa., began operations with a capacity of 3,000 barrels a day. In 1900 a third mill started operation with a capacity of 10,000 barrels a day, and in 1905 a fourth mill, with a like capacity got under way at Northampton, Pa., 1905. The Company in 1905 opened two additional mills with *a* combined capacity of about 12,000 bbls. a day. Other acquisitions followed until, in 1930, it had plants producing 18,000,000 bbls. annually. On January 9, 1930 the Atlas Portland Cement Company was united with the Universal Portland Cement Company, under the name of the Universal Atlas Cement Company, a subsidiary of the United States Steel Corporation. The Universal Portland Cement Company had its beginning in 1896 as the Cement Department of the Illinois Steel Company, its original plant in Chicago producing 500 bbls. of cement daily. The Company continued to grow until in 1930, its total producing capacity was 17,300,000 bbls. annually. The capacity of the Universal Atlas Cement Co., largest cement producer in the world, is 33,590,000 bbls. annually. It manufactures Atlas and Universal (gray) Portland cements, Atlas White and Atlas Waterproofed White Portland cement, Atlas High-Early Strength, Unafine, Unaflo Oil Well cement, Atlas Lumnite cement and Gypsum Rock (B. F. A.)

ATMOLYSIS, a term invented by Thomas Graham to denote the separation of a mixture of gases by taking advantage of their different rates of diffusion through a porous septum or diaphragm. It is derived from Gr. *ἀτμός,* vapour: and *λύειν,* to loosen. (See DIFFUSION.)

ATMOSPHERE. The term "atmosphere" usually refers to the gaseous envelope covering the surface of the earth. The word is derived from the Greek words *ἀτμός,* smoke or vapour and *σφαῖρα,* globe or sphere. The early Greeks were probably the first to study the weather in a regular and systematic way and the wind was defined by Anaximander as "a flowing of the air." Hesiod in his treatise Works and *Days* discussed the origin of wind, and many observations of physical properties of the air were made by Ctesibus, Hero of Alexandria, and others. The material nature of air is clearly recognized in Hero's *Pneumatica.*

Anaximenes *(c.* 500 B.C.) regarded the air as the primordial substance from which all matter was condensed. During the time of Socrates meteorology was neglected, but Aristotle revived interest in the study of the atmosphere and wrote about the winds. He regarded the atmosphere as consisting of three regions; the lowest in which plants and animals exist he supposed to be immovable like the earth; the uppermost region adjoined the fiery heavens and moved with them; the division intermediate between the other two, he believed to be exceedingly cold. Meteors were considered by Aristotle to be exhalations from the earth, which became incandescent when they reached the hot upper layer.

Very little progress was made from this time until the early part of the 17th century, although it is said that during the 11th century the Arabs calculated the height of the atmosphere, from the duration of twilight, as 92 kilometres. In 1643, Torricelli, a student of Galileo, found that if a long glass tube sealed at one end was filled with mercury and the open end closed with the finger while the tube was inverted in a vessel containing mercury, the liquid sank only to a certain level. It thus became

possible to measure the pressure of the atmosphere, and the space above the mercury is still referred to as a Torricellian vacuum. This apparatus was called a barometer (*q.v.*) by Boyle and soon came into general use. Pascal demonstrated the decrease of the pressure of the air with altitude by measuring the height of the mercury column of a barometer at different points up a tower in Paris. In 1650 von Guericke (*q.v.*) found that he could pump air and was responsible for the famous experiment with the Magdeburg hemispheres.

That air consists chiefly of two gases was first recognized by Scheele (1772), but Cavendish (1781) was responsible for a large number of analyses of the air and found that 100 volumes contain 20·83 parts by volume of oxygen (*q.v.*) and 79·17 of nitrogen (*q.v.*). Similar experiments were carried out by Priestley (who thought the composition variable) and Lavoisier, but it was not until 1846 that it was definitely established by Bunsen that the composition of the atmosphere is not absolutely constant.

The Composition of the Atmosphere.— Air is a mixture of gases and is not a chemical compound. This is proved by the following:—(1) The composition of air is not constant, and the quantities present of the different components do not bear any simple relation to their atomic weights. (2) The constituents can be separated by diffusion and by the fractional distillation of liquid air. (3) Air dissolves in water in accordance with the law of partial pressures and hence air expelled from water contains an increased proportion of oxygen.

Below a height of 20km. (12½m.) the constituents of the atmosphere, with the exception of water vapour, are well mixed by winds and by diffusion. Slight changes in composition do occur, however, at the surface of the earth and these depend on latitude and the presence of large quantities of vegetation or sea-water. The permanent constituents of the air are generally present in the following proportions (according to Humphreys in the *Scientific Monthly,* 1927):—

Substance	Volume % in dry air
Total atmosphere	
Dry air	100·00
Nitrogen	78·03
Oxygen	20·99
Argon	0·9323
Water vapour	
Carbon dioxide	0·03
Hydrogen	0·01
Neon	0·0018
Krypton	0·0001
Helium	0·0005
Ozone	0·00006
Xenon	0·000009

The following table by Hann shows the variation with latitude.

	Nitrogen	Oxygen	Argon	Water vapour	Carbon dioxide
Equator	75.99	20·44	0·92	2.63	0·02
Latitude 50° N.	77·32	20·80	0·94	0·92	0·02
Latitude 70° N.	77·87	20·94	0·94	0·22	0·03

The composition also varies with altitude, but not to any very appreciable extent at heights at which respiration is still possible. The amount of water vapour present in the air is usually about 1·2% by volume, but in very cold weather this quantity falls almost to zero. At other times it may be as high as 5%.

The ozone (*q.v.*) of the atmosphere is produced by electrical discharges and is found over the sea and mountains. Probably it is never present in quantities greater than one part in ten millions and the amount varies with the seasons, being greatest in winter, and averaging 2·5 volumes per million of air. Large quantities of carbon dioxide, steam, nitrogen and hydrogen are constantly liberated from inside the earth by volcanoes; and carbon dioxide is the product of respiration of animals and plants. It is probable that when the earth was in the liquid state most of the nitrogen would remain free and would be retained by gravity rather than by chemical combination. The source of the oxygen presents difficulties: it may have been formed by the decomposition of volcanic carbon dioxide by plants; but this can only be effected by green plants in the presence of light, and, as most primitive plants are not green, it is more probable that there was an excess of oxygen in the first place and that it has been retained through the gravitational effect; however the balance of the quantity of oxygen in the air is maintained by the decomposition of carbon dioxide by plants. Lighter gases such as hydrogen and helium would tend to escape while the earth was still liquid, but would be retained when a solid crust had developed.

The Rare Gases.—During his experiments on the combination of nitrogen and oxygen by means of an electric spark, Cavendish, in 1785, observed that a small bubble of gas always remained after the absorption of the nitrogen oxides by potash and of the oxygen by "liver of sulphur." This was "certainly not more than $\frac{1}{120}$ of the bulk of the phlogisticated air (nitrogen) let up into the tube." Cavendish's observation was overlooked until in 1894 the late Lord Rayleigh noticed that atmospheric nitrogen is slightly denser than nitrogen prepared by chemical means (Atmospheric nitrogen, 1·25718; Chemical nitrogen, 1·25107). The difference could only be explained by the presence of an unknown gas in the air, and Lord Rayleigh and Sir William Ramsay used two methods to isolate this, one of which was a repetition of Cavendish's experiment on a large scale, while the other consisted in absorbing the nitrogen by heated magnesium. The new gas was found to be chemically inactive and hence was called argon (Gr. ἀργόν=lazy) (*q.v.*). During the course of the separation of argon from liquid air by fractional distillation, Ramsay and Travers (1898) discovered four more inert gases, which received the names helium, neon, krypton and xenon (*qq.v.*).

These five inactive gases are best characterized by their spectra, which are quite distinctive. They are all monatomic, *i.e.,* each molecule only contains one atom. Certain springs evolve these gases, and helium is found in some natural gas and also occluded in certain minerals, *e.g.,* broggerite.

Impurities.—Besides the normal constituents air always contains other substances which we can call "impurities." Organic and inorganic particles are always present to a certain extent, but are more plentiful over towns than elsewhere. The organic matter consists chiefly of plant spores and micro-organisms, and decreases in quantity when the temperature falls. Over the open sea the number of such particles is about one per cubic metre, while in crowded places it may rise to several thousand per cubic metre. Air may be sterilized by treatment with ozone if dry, by passing it through a hot tube, or partially by filtration through cotton wool. Inorganic dust is introduced into the atmosphere by the disintegration of meteors, volcanic eruptions, the combustion of fuel, and from the earth's surface by wind. The minute crystals of sodium chloride (common salt) found in the air owe their origin to ocean spray. The larger dust particles are visible as "motes" in a beam of light, but by far the greater number cannot be seen with the naked eye. In town air there are about 100,000 per cu. cm. but over the sea this number falls to some hundreds. The particles can be made to settle out by washing and scrubbing. Atmospheric dust is the chief cause of haze in dry weather. Very slight traces of radioactive substances are also found in the air.

A large number of gaseous impurities are present such as ammonia, oxides and acids of nitrogen, small quantities of hydrocarbons, sulphuretted hydrogen, carbon monoxide, sulphur dioxide and sulphurous and sulphuric acids, chlorine and hydrochloric acid. Nitrogen compounds (see NITROGEN) which are produced by electrical discharges, *e.g.,* during thunder-storms, and carried down by rain play an important part in the fertilization of the soil. Ammonia (*q.v.*) is also introduced by the decay of organic matter. Carbon monoxide is contained in the exhaust gases of petrol engines and is found in railway tunnels. Other impurities are released from various chemical works.

Height of the Atmosphere.— The height to which the atmosphere extends cannot be definitely stated, although at an altitude of 50m. the air cannot exert any measurable pressure. Three methods are available for the estimation of the height: (1) observation of meteors, (2) measurement of the duration of twilight, (3) observation of auroral displays. The first method gives results ranging from 1 jo to 300km., while the duration of twilight indicates a value of about 64km. at lat. 45°. It is difficult to make

reliable calculations from auroral displays, but it is claimed that these occur up to a height of 500km. If the density of the atmosphere remained uniform throughout with the same value as at the earth's surface, the air would form a layer only 8km. thick and this is sometimes called the "height of the homogeneous atmosphere." Half of the air is below a height of 5·8km. At low levels temperature is usually considered to decrease 0·56°C per 100 metres increase in altitude, but the rate is extremely variable. Above 2km. the temperature is on an average below 0°C and continues to fall up to 10km. (6m.) when it is about −55° C. At 37km. the temperature is practically the same as at 10km. The lower region of the atmosphere is known as the *troposphere* and extends up to 10km., beyond which clouds are not generally found, except in tropical latitudes.

The Outer Atmosphere. — The upper region of the atmosphere, above 10km., is called the *stratosphere* and is separated from the *troposphere* or lower region, by a boundary region known as the *tropopause*. In the stratosphere the temperature gradient runs parallel to the earth's surface, whereas at lower altitudes it is vertical, *i.e.,* in the former case the air is arranged in columns each with a given temperature, while in the troposphere there are layers of air at different temperatures. Knowledge of the upper atmosphere, its constitution and physical properties, is by no means complete, although sounding balloons have been used up to about 25km. Lindemann and Dobson have deduced from observations on meteors, that the stratosphere does not extend beyond about 60km. and they also conclude that above this level the temperature rises to about 30° C. This high temperature region they believe to extend up to 150km. at which height meteors become luminous. Evidence for such a warm region has also been brought forward by F. J. Whipple from a study of the abnormal audibility of explosions, but its existence has been questioned by Sparrow.

The behaviour of long wave-length electromagnetic radiation (wireless waves) points to the existence of a conducting layer of ionized gas (the Kennelly-Heaviside layer) at a level of 40km – 50km. during the day and rising to about 90km. at night. In the daytime this ionization could be caused by the ultra-violet (short wave-length) radiation from the sun, but its existence at night can only be explained if it is assumed that some substance is present which is capable of dissociation in the dark. It is believed that this substance is ozone. Various workers (Fabry and Buisson, 1921; Harrison and Dobson, 1925) have shown by studies of the absorption of solar radiation that there is a considerable quantity of ozone in the upper atmosphere and that it is probably formed by radiation of wave-lengths shorter than $\lambda = 2.000$ Å.U. ($2/10^5$ cm.). The region in which this ozone occurs would be expected to have an abnormally high temperature and electrical conductivity, because it absorbs strongly radiation of certain wave-lengths. This region may therefore be considered to be identical with that where meteors become luminous and wireless waves are reflected back to the earth's surface. Its upper boundary is probably at a level of about 150km. and since it contains ozone, oxygen must also be present. Moreover, as oxygen is less dense than ozone, it will tend to rise to even greater heights. At a height of 3,200km. according to Jeans, there can only be about 300,000 gas molecules per cubic centimetre.

Much information concerning the upper atmosphere may be derived from studies of spectrum photographs obtained from the displays of the Aurora Borealis. These displays take place at levels varying from about 80km. to 500km., but are most frequent at 106km. The auroral spectrum always contains a well-defined, strong, green line of wave-length $X = 5,577·35$ A.U., the origin of which remained a mystery for a long time. In 1925 M'Lennan and Shrum examined the radiation emitted by a mixture of oxygen and either helium or neon in excess, under the influence of an electrical discharge, and found a green line, $\lambda = 5,577·35$ Å.U., which was also shown with pure oxygen under low pressure. That nitrogen, in the same form as we know it, must exist at these great altitudes was shown by spectroscopic work carried out by Lord Rayleigh in 1921. Ozone, hydrogen and helium are also inferred. (*See* also AURORA POLARIS.)

Absorption of Radiation by the Atmosphere. — The blue colour of the sky is due to the fact that the air is not perfectly transparent and its particles reflect and scatter light, that from the blue end of the spectrum being most widely scattered. This effect also obscures the light of the stars. Very little of the sun's thermal radiation is absorbed by the air, which derives most of its heat from the earth by conduction and convection. A layer of air one metre thick absorbs about 0·007% of the radiant heat passing through it. Of the radiation incident on the outer atmosphere about 37% is lost by reflection and scattering. The fraction of the radiant energy from the sun which reaches the earth is termed the coefficient of transparency of the atmosphere. The absorption is chiefly dependent on the amount of water vapour, carbon dioxide and solid impurities present and consequently is much greater in the neighbourhood of towns. The following coefficients of transparency are given by Wild for one metre of air: — Dry, dust-free air, 0·99718, Dry air, containing dust, from a room, 0·99520, Dust-free air saturated with water vapour 0.99328. The ozone, which appears to be present at very high altitudes, is responsible for the removal of practically all the ultraviolet radiation of wave-length shorter than $\lambda = 2,885$ Å.U.

Since the temperature of the upper atmosphere is practically constant and no convection or condensation takes place there, it is important to consider what would be the effect of dust particles which might be forced into the stratosphere by volcanic eruption. After certain eruptions, *e.g.,* Krakatoa 1883, Mont Pele and Santa Maria 1902, Katmai 1912, a reddish halo was observed round the sun owing to the dust ejected to very great altitudes, and it was possible to calculate the size of the particles. It has been estimated that a quantity of dust of volume less than $\frac{1}{174}$ cu. km. distributed in the upper layers of the air, would reduce the intensity of solar radiation by 20%. It is possible to explain the occurrence of ice ages in this way. (*See* also SPECTROSCOPY; METEOROLOGY; CLIMATE AND CLIMATOLOGY.)

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ATMOSPHERIC ABSORPTION is a loss of power in transmission of radio waves due to a dissipation in the atmosphere. The "fading" of radio waves as often observed in broadcast reception over long distances may be, in part, the result of variations in the atmospheric absorption to which the waves are subject.

ATMOSPHERIC ELECTRICITY: *see* ELECTRICITY, ATMOSPHERIC.

ATMOSPHERIC NITROGEN FIXATION: *see* NITROGEN, FIXATION OF.

ATMOSPHERIC RAILWAY. About 1840–45 great interest was excited by a method of propelling railway trains through the agency of atmospheric pressure. Various inventors worked at the realization of this idea. On the system worked out in England by Jacob Samuda and S. Clegg a continuous pipe or main was laid between the rails, and in it a partial vacuum was maintained by means of air pumps. A piston fitting closely in it was connected to the leading vehicle of the train by an iron plate which passed through a longitudinal groove or aperture running the whole length of the pipe. This aperture was covered by a valve consisting of a continuous strip of leather, strengthened on each side with iron plates; one edge was fastened while the other was free to rise. Connected behind the piston was a frame carrying four wheels which lifted and sustained the continuous valve for a distance of about 15 feet. Thus the piston, having atmospheric pressure on one side of it and a vacuum equal to 15 or 16in. of mercury on the other, was forced along the tube, taking the train with it. It was installed on about two miles of line between Kingstown and Dalkey (Ireland) in 1843 and worked till 1855; it was also tried on the London and Croydon and on the South

Devon lines, but was soon abandoned. (See PNEUMATIC DISPATCH.)

For further particulars *see* three papers by J. Samuda, P. W. Barlow and G Berkeley, in *Proc. Inst. C.E.,* 1844 and 1845.

ATMOSPHERICS are electrical disturbances occasioned by lightning or other electrical changes in the atmosphere. They become manifest in radio reception as disturbing "crackling" sounds and are variously known as "static," "strays," "x's" or "noise."

ATOLL (native name *atollon* in the Maldive Islands), a horse-shoe or ring-shaped reef of coral enclosing a lagoon. It is found in low latitudes. Its form may be likened to that of a partly submerged dish with pieces broken from its edge, the ring of islands standing upon a conical pedestal. The dish is formed of hard coral and the shells of various reef-dwelling mollusca, covered, especially at the seaward periphery, with a film of living coral polyps that continually extend the fringe, and enlarge the diameter of the atoll. The lagoon tends to deepen when the land is stationary on account of the death of the coral animals in the still water, and the disintegration of the "hard" coral of the inner ring. while waves and storms tear off blocks of rock and pile them up at the margin, increasing the height of the islands, which in course of time usually become covered by vegetation. The lagoon entrance in the open part of the horse-shoe is always to leeward of prevailing winds. *See* CORAL REEFS.

ATOM, when ordinarily used in chemistry and physics, refers to the smallest particle of an element which can exist either alone or in combination with similar particles of the same or of a different element. The atom also refers to a quantity proportional to the atomic weight of an element. According to the theory of atomism, which dates from pre-Socratic times, the atom is one of the minute indivisible particles of which the whole universe is composed. (X.)

Through the important experimental discoveries of the second half of the 19th century it became gradually clear that the atoms of the elements, far from being indivisible entities, had to be thought of as aggregates built up of separate particles. Thus from experiments on electrical discharges in rarefied gases, and especially from a closer study of the so-called cathode rays, the existence of small negatively charged particles—the mass of which was found to be about 2,000 times as small as the mass of the lightest atom, the hydrogen atom—was recognized. These small particles, which may be regarded as atoms of negative electricity, are now, following Johnstone Stoney, generally called electrons. Through the investigations of J. J. Thomson and others convincing evidence was obtained that these electrons are a constituent of every atom. On this basis a number of the general properties of matter, especially as regards the interaction between matter and radiation, receive a probable explanation.

In fact, the assumption that electrons are vibrating around positions of stable equilibrium in the atom offered a simple picture of the origin of spectral lines, which allowed the phenomena of selective absorption and dispersion to be accounted for in a natural way. Even the characteristic effect of magnetic fields on spectral lines discovered by Zeeman could, as was shown by Lorentz, be simply understood on this assumption. The origin of the forces which kept the electrons in their positions remained for a time unknown, as well as the way in which the positive electrification was distributed within the atom. From experiments on the passage through matter of the high speed particles expelled from radioactive substances, however, Rutherford was in 1911 led to the so-called nuclear model of the atom. According to this the positive electricity is concentrated within a nucleus of dimensions very small compared with the total space occupied by an atom. This nucleus is also responsible for practically the whole of the atomic mass.

Properties of the Elements.— The nuclear theory of the atom has afforded a new insight into the origin of the properties of the elements. These properties can be divided into two sharply distinguished classes.

1. To the first class belong most of the ordinary physical and chemical properties. These depend on the constitution of the electron cluster round the nucleus and on the way in which it is influenced by external agencies. This, however, will depend on the attractive force due to the nucleus which keeps the cluster together. On account of the small size of the nucleus compared with the distance apart of the electrons in the cluster, this force will to a high approximation be determined solely by the total electric charge of the nucleus. The mass of the nucleus and the way in which the charges and masses are distributed among the particles making up the nucleus itself will only have an exceedingly small influence on the behaviour of the electronic cluster.

2. To the second class belong such properties as the radioactivity of the substance. These are determined by the actual internal structure of the nucleus. In the radioactive processes we witness, in fact, explosions of the nucleus in which positive or negative particles, the so-called α and β particles, are expelled with very great velocities.

The complete independence of the two classes of properties is most strikingly shown by the existence of substances which are indistinguishable from one another by any of the ordinary physical and chemical tests, but of which the atomic weights are not the same, and whose radioactive properties are completely different. Any group of two or more such substances are called isotopes (*q.v.*), since they occupy the same position in the classification of the elements according to ordinary physical and chemical properties. The first evidence of their existence was found in the work of Soddy and other investigators on the chemical properties of the radioactive elements. It has been shown that isotopes are found not only among the radioactive elements, but that many of the ordinary stable elements consist of isotopes, for a large number of the latter that were previously supposed to consist of atoms all alike have been shown by Aston's investigations to be a mixture of isotopes with different atomic weights. Moreover the atomic weights of these isotopes are whole numbers, and it is because the so-called chemically pure substances are really mixtures of isotopes, that the atomic weights are not integers.

The inner structure of the nucleus is still but little understood, although a method of attack is afforded by Rutherford's experiments on the disintegration of atomic nuclei by bombardment with α particles. Indeed, these experiments may be said to have started a new epoch in natural philosophy in that for the first time the artificial transformation of one element into another has been accomplished (*see* TRANSMUTATION OF THE ELEMENTS). In what follows, however. we shall confine ourselves to a consideration of the ordinary physical and chemical properties of the elements and the attempts which have been made to explain them on the basis of the concepts just outlined.

THE RELATIONSHIPS BETWEEN THE ELEMENTS

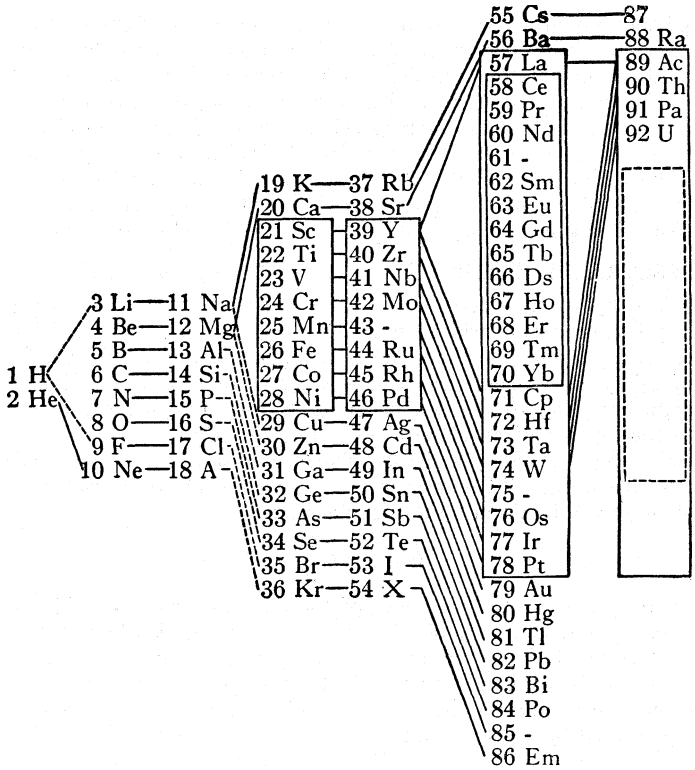
It was recognized by Mendelejeff that when the elements are arranged in an order which is practically that of their atomic weights, their chemical and physical properties show a pronounced periodicity. A diagrammatic representation of this so-called periodic table is given in Table I., which represents in a slightly modified form an arrangement first proposed by Julius Thomsen. In the table the elements are denoted by their usual chemical symbols, and the different vertical columns indicate the so-called periods. The elements in successive columns which possess homologous chemical and physical properties are connected by lines. The meaning of the square brackets around certain series of elements in the later periods, the properties of which exhibit typical deviations from the simple periodicity in the first periods, will be mentioned below.

Radiation.— The discovery of the relationship between the elements was primarily based on a study of their chemical properties. Later it was recognised that this relationship appears also very clearly in the constitution of the radiation which the elements emit or absorb in suitable circumstances. In 1883 Balmer showed that the spectrum of hydrogen, the first element in the table, could be expressed by an extremely simple mathematical law. This so-called Balmer formula states that the frequencies ν of the lines in the spectrum are given to a close approximation by

$$\nu = R\left(\frac{1}{(n')^2} - \frac{1}{(n')^2}\right) \qquad (1)$$

where R is a constant, and where n' and n'' are whole numbers. If n'' is put equal to 2 and n' is given successively the values 3, 4, . . . the formula gives the frequencies of the series of lines in the visible part of the hydrogen spectrum. If n'' is put equal to 1 and n' equal to 2, 3, 4, . . . a series of ultra-violet lines is obtained which was discovered by Lyman in 1914. To $n''=3$, 4, . . . correspond series of infra-red hydrogen lines which also have been observed.

TABLE I. *Periodic Table of the Elements*



Rydberg in his famous investigation of line spectra more than 30 years ago was able to analyse in a similar way many spectra of other elements. Just as in the case of hydrogen he found that the frequencies of a line-spectrum (such as that of sodium) could be represented by a formula of the type

$$\nu = T'' - T' \qquad (2)$$

where T''. T' can be approximately represented by

$$T = \frac{R}{(n - a_K)}, \qquad (3)$$

a_K is a constant for any one series, but takes different values a_1, a_2 . . . for the different series, while n takes a set of successive integral values. R is constant throughout for all spectra, and is the same constant as that appearing in (1); it is generally called the "Rydberg number." In many spectra the terms of most series are multiple, *i.e.,* the terms which we consider as forming a series do actually form two, three or more series corresponding to two, three or more slightly different values of a_K. Rydberg also discovered that the spectra of elements occupying homologous positions in the periodic table were very similar to each other, a similarity which is especially pronounced as regards the multiplicity of the terms.

Moseley's Discovery. — The study of X-ray spectra made possible by the work of Laue and Bragg brought out relations of a still simpler kind between different elements. Thus Moseley (*q.v.*) in 1913 made the fundamental discovery that the X-ray spectra of all elements show a striking similarity in their structure, and that the frequencies of corresponding lines depend in a very simple way on the ordinal number of the element in the periodic table. Moreover the structure of these spectra was very like that of the hydrogen spectrum. The frequency of one of the strongest X-ray lines for the various elements could, for instance, be given approximately by

$$\nu = N^2 R \left(\frac{1}{1^2} - \frac{1}{2^2}\right) \qquad (4)$$

and that of another line by

$$\nu = N^2 R \left(\frac{1}{2^2} - \frac{1}{3^2}\right) \qquad (5)$$

where R is again the Rydberg constant and N the ordinal number of the element in the periodic table. The extreme simplicity of these iormulae enabled Moseley to settle any previous uncertainty as to the order of the elements in the periodic table, and also to state definitely the empty places in the table to be filled up by elements not yet discovered.

In the nuclear model of the atom, the ordinal number of an element in the periodic table receives an extraordinarily simple interpretation. In fact, if the numerical value of the charge on an electron is taken as unity, this ordinal number, which is often called the "atomic number" (*q.v.*), can simply be identified with the magnitude of the nuclear charge. This law which was foreshadowed by J. J. Thomson's investigations of the number of electrons in the atom, as well as by Rutherford's original estimate of the charge on the atomic nucleus, was first suggested by van den Broek. It has since been established by refined measurements of the nuclear charge, and it has proved itself an unerring guide in the study of the relationship between the physical and chemical properties of the elements. This law also oifers an immediate explanation of the simple rules governing the changes in the chemical properties of radioactive elements following the expulsion of a or β particles.

THE QUANTUM THEORY

The discovery of the electron and of the nucleus was based on experiments, the interpretation of which rested on applications of the classical laws of electrodynamics. As soon, however, as an attempt is made to apply these laws to the interaction of the particles within the atom, in order to account for the physical and chemical properties of the elements, we are confronted with serious difficulties. Consider the case of an atom containing one electron: it is evident that an electrodynamical system consisting of a positive nucleus and a single electron will not exhibit the peculiar stability of an actual atom. Even if the electron might be assumed to describe an elliptical orbit with the nucleus in one of the foci, there would be nothing to fix the dimensions of the orbit, so that the magnitude of the atom would be an undetermined quantity. Moreover, according to the classical theory the revolving electron would continually radiate energy in the form of electromagnetic waves of changing frequency and the electron would finally fall into the nucleus. In short, all the promising results of the classical electronic theory of matter would seem at first sight to have become illusory. It has nevertheless been possible to develop a coherent atomic theory based on this picture of the atom by the introduction of the concepts which formed the basis of the famous theory of temperature radiation developed by Planck in 1goo.

This theory marked a complete departure from the ideas which had hitherto been applied to the explanation of natural phenomena, in that it ascribed to the atomic processes a certain element of discontinuity of a kind quite foreign to the laws of classical physics. One of its outstanding features is the appearance in the formulation of physical laws of a new universal constant, the so-called Planck's constant, which has the dimensions of energy multiplied by time, and which is often called the "elementary quantum of action." We shall not enter upon the form which the quantum theory exhibited in Planck's original investigations, or on the important theories developed by Einstein in 1905, in which the fertility of Planck's ideas in explaining various physical phenomena was shown in an ingenious way. We shall proceed at once to explain the form in which it has been possible to apply the quantum theory to the problem of atomic constitution. This rests upon the following two postulates: —

1. An atomic system is stable only in a certain set of states, the "stationary states," which in general corresponds to a discrete sequence of values of the energy of the atom. Every change

in this energy is associated with a complete "transition" of the atom from one stationary state to another.

2. The power of the atom to absorb and emit radiation is governed by the law that the radiation associated with a transition must be monochromatic and of frequency ν such that

$$h\nu = E_1 - E_2 \qquad (6)$$

where h is Planck's constant and E_1 and E_2 are the energies in the two stationary states concerned.

The first of these postulates aims at a definition of the inherent stability of atomic structures, manifested so clearly in a great number of chemical and physical phenomena. The second postulate, which is closely related to Einstein's law of the photoelectric effect, offers a basis for the interpretation of line spectra; it explains directly the fundamental spectral law expressed by relation (2). We see in fact that the spectral terms appearing in this relation can be identified with the energy values of the stationary states divided by h. This view of the origin of spectra has been found to agree with the experimental results obtained in the excitation of radiation. This is shown especially in the discovery of Franck and Hertz relating to impacts between free electrons and atoms. They found that an energy transfer from the electron to the atom can take place only in amounts which correspond with the energy differences of the stationary states as computed from the spectral terms.

The Hydrogen Spectrum. — From the Balmer formula (1) and the quantum theory postulates, it follows that the hydrogen atom has a single sequence of stationary states, the numerical value of the energy in the n^{th} state being Rh/n^2. Applying this result to the nuclear model of the hydrogen atom, we may assume that this expression represents the work necessary to remove the electron from the nth state to an infinite distance from the nucleus. If the interaction of the atomic particles is to be explained upon the laws of classical mechanics, the electron in any one of the stationary states must move in an elliptical orbit about the nucleus as focus, with a major axis whose length is proportional to n^2. The state for which n is equal to 1 may be considered as the normal state of the atom, the energy then being a minimum. For this state the major axis is found to be approximately 10^{-8} centimetres. It is satisfactory that this is of the same order of magnitude as the atomic dimensions derived from experiments of various kinds. It is clear, however, from the nature of the postulates, that such a mechanical picture of the stationary states can have only a symbolic character. This is perhaps most clearly manifested by the fact that the frequencies of the orbital revolution in these pictures have no direct connection with the frequencies of the radiation emitted by the atom. Nevertheless, the attempts at visualizing the stationary states by mechanical pictures have brought to light a far-reaching analogy between the quantum theory and the classical theory. This analogy was traced by examining the radiation processes in the limit where successive stationary states differ comparatively little from each other. Here it was found that the frequencies associated with the transition from any state to the next succeeding one tend to coincide with the frequencies of revolution in these states, if the Rydberg constant appearing in the Balmer formula (1) is given by the following expression:

$$R = \frac{2\pi^2 e^4 m}{h^3} \qquad (7)$$

where e and m are the charge and mass of the electron and h is Planck's constant. This relation is actually found to be fulfilled within the limits of the experimental errors involved in the measurements of e, m and h, and seems to establish a definite relation between the spectrum and the atomic model of hydrogen.

Correspondence Principle. — The considerations just mentioned constitute an example of the application of the so-called "correspondence principle" which has played an important part in the development of the theory. This principle gives expression to the endeavour, in the laws of the atom, to trace the analogy with classical electrodynamics as far as the peculiar character of the quantum theory postulates permits. On this line much work has been done in the last few years, and quite recently in the hands of Heisenberg has resulted in the formulation of a rational quantum kinematics and mechanics. In this theory the concepts of the classical theories are from the outset transcribed in a way appropriate to the fundamental postulates and every direct reference to mechanical pictures is discarded. Heisenberg's theory constitutes a bold departure from the classical way of describing natural phenomena but may count as a merit that it deals only with quantities open to direct observation. This theory has already given rise to various interesting and important results, and it has in particular allowed the Balmer formula to be derived without any arbitrary assumptions as to the nature of the stationary states. However, the methods of quantum mechanics have not yet been applied to the problem of the constitution of atoms containing several electrons, and in what follows we are reduced to a discussion of results which have been derived by using mechanical pictures of the stationary states. Although in this way a rigorous quantitative treatment is not obtainable it has nevertheless been possible, with the guidance of the correspondence principle. to obtain a general insight into the problem of atomic constitution.

SPECTRA OF ELEMENTS OF HIGHER ATOMIC NUMBER

The hydrogen spectrum may be considered as evidence of a step-like process in which an electron is captured and bound increasingly strongly in the field surrounding the nucleus, the stages of this process being the stationary states of the atom. Simple arguments lead to the conclusion that the stages corresponding to the binding of an electron by a nucleus of any given charge will be represented by a similar sequence of stationary states and that the energy W_n necessary to remove the electron from the n^{th} state will be given by the expression:

$$W_n = N^2 \frac{Rh}{n^2} \qquad (8)$$

where N is the atomic number of the elements under consideration. These states may be visualized as mechanical orbits of the electron in which the major axis is N times as small as the major axis in the corresponding orbit in the hydrogen atom. The spectrum associated with the binding process under consideration is represented by the formula:

$$\nu = N^2 R \left(\frac{1}{(n'')^2} - \frac{1}{(n')^2} \right) \qquad (9)$$

For $N=2$, this formula actually represents the spectrum which is emitted by a singly ionized helium atom, *i.e.*, a helium atom, which has lost one of its electrons. Spectra of this type have not yet been observed for values of N larger than 2, but it will be seen that formula (9) includes the approximate formulae (4) and (5) representing the frequencies of the strongest lines in the X-ray spectra of the elements. This may be understood if we assume that an X-ray spectrum is associated which changes in the state of binding of one of the electrons in the inner region of the atom, where, at least when the atomic number is large, the force on the electron due to the nucleus will far outweigh the forces due to the other electrons, and where consequently the presence of these electrons will have a comparatively small influence on the strength of the binding.

Influence of Electrons. — In general the mutual influence of the electrons is very considerable. Consider the stages by which an electron is captured by an atom of which the nucleus already has s electrons circulating round it. In the initial stages of this process while the orbits may be supposed to have dimensions which are large compared with the orbital dimensions of the electrons previously bound, the repulsive forces from these latter electrons may be assumed to neutralise s units of the nuclear charge, and the resultant force will be approximately the same as when an electron is circulating round a nucleus of atomic number N-S. In the later stages, when the dimensions of the orbit of the new electron are smaller, the other electrons can no longer be considered to act as a single central charge, and their repulsion cannot be easily determined. Thus the conditions become more complicated, and the stationary states can no longer be treated by picturing the motion of the new electron as following a Keplerian ellipse.

It has been found, however, that many features of the resulting spectra would be explained by assuming the added electron to move in a plane central orbit consisting of a sequence of quasi-elliptic loops. In contrast to a Keplerian orbit the single loops are not closed, but the successive maximum radii will be placed at constant angular intervals on a circle with the nucleus at the centre. For such central orbits it is possible, as was first shown by Sommerfeld, to select from the continuous multitude of possible orbits a set of orbits which may be taken as representing stationary states in the sense of the quantum theory. These states are labelled with two integral numbers; the one, denoted by n, corresponds to the integer appearing in the Balmer formula and is called the principal quantum number. The other, denoted by k, may be called the subordinate quantum number. For any given value of n, the number k can take the values 1, 2, 3 . . . n_n, corresponding to a set of orbits with increasing minimum distance from the nucleus. For a given value of k increasing values of n correspond to orbits which exhibit an increasing maximum distance from the nucleus, but which are similar in size and shape in the region where the electron comes nearest to the nucleus. For the work necessary to remove an electron in an n_k orbit completely from the nucleus, the theory leads to the following approximate expression

$$W_{n,k} = (N-s)^2 \frac{Rh}{(n-a_k)^2} \qquad (10)$$

where a depends only on the subordinate quantum number k, and approaches zero for increasing k.

If s is equal to N-1, we see that the $W_{n,k}$ when divided by h coincides exactly with Rydberg's expressions (3) for the spectral terms of the ordinary series spectra of the elements. These spectra may therefore be considered as evidence of processes, representing the last stage in the formation of a neutral atom, in which a nucleus of charge Ne, which holds already N-I electrons bound in its field, is capturing an N^{th} electron. In recent years it has been found that many elements under suitable conditions besides their ordinary spectra also emit spectra for which the terms can be represented by

$$T = p^2 \frac{R}{(n-a_k)^2} \qquad (11)$$

where p may take the integral values 2, 3, 4. . . . Comparing (11) with formula (10) we see that these spectra must be ascribed to atoms, which after having lost p electrons are rebinding an electron in the field of the remaining atomic ion.

This interpretation of series spectra, allows also the rules governing the possible combinations of spectral terms to be explained. In fact, it has been found that only those lines appear in the spectrum for which the k-values of the spectral terms involved differ by one unit. From an investigation of the constitution of the radiation which on classical electrodynamics would be emitted from an electron performing a central motion, this rule can be shown to be a simple consequence of the correspondence principle.

Multiplex Structure. — The multiplex structure exhibited by the terms of most series spectra makes it necessary to assume that the motion of the electron involved in the emission of these spectra is somewhat more complicated than the simple central motion described above. An analysis based on the correspondence principle indicates that this motion may be described as a central motion on which is superposed a uniform precession of the orbital plane round an invariable axis in space. For a time, however, it seemed very difficult to obtain any closer connection between the observed structures and the above hypothesis of the constitution of the atom. In particular the remarkable analogy between the finer structures of the optical spectra and the X-ray spectra, which had been brought out by the experiments, was very puzzling. The study of the strange anomalies exhibited by the effect of a magnetic field on the components of the optical multiplets has, however, quite recently led to the view that the electron itself carries. besides its electric charge, also a magnetic moment which may be associated with a swift rotation round an axis through its centre. This new assumption allows not only the anomalous Zeeman eflect to be accounted for, but affords at the same time a natural explanation for the empirical rules governing the dependency of the widths of the multiplet structures on the atomic number.

ATOMIC CONSTITUTION AND THE PERIODIC TABLE

Soon after the discovery of the electron it was recognized that the relationships between the physical and chemical properties of the elements expressed in the periodic table point towards a group-structure of the electronic distribution in the atom. Fundamental work on these lines was done by J. J. Thomson in 1904. After the discovery of the nucleus and the simple interpretation of the atomic number given above, his work has been followed up with great success especially by Kossel and Lewis.

It is suggested that the electrons within the atom possess a tendency to form stable groups, each containing a definite number of electrons which, in the neutral state of the atom, surround the centre of the atom like successive shells or layers. An explanation of the simple valency properties holding for the second and third period of the periodic table was, for instance, obtained by assuming that there was a tendency to form completed shells each containing eight electrons. The single valency of sodium and the double valency of magnesium are ascribed to the facility with which the neutral atoms of these elements can lose one or two electrons respectively, as the atomic ions remaining would then contain completed shells only. On the other hand the double negative valency of sulphur and the single negative valency of chlorine are ascribed to the tendency of their outermost shells to take up two or one additional electrons respectively in order to form a complete shell of eight electrons, like that contained in the neutral atom of the inactive gas argon.

Spatial Arrangement **of** Electrons. — Attempts have been made to associate the existence of such groups with statical configurations of electrons possessing a high degree of symmetry. The presence of groups of eight electrons for instance has been explained as an arrangement of electrons at the corners of a cube. However suggestive these ideas have been in affording pictures of the constitution of chemical compounds, they do not allow a direct connection with other properties of the atom to be established; the main difficulty being that stable spatial arrangements of the electrons are incompatible with the nuclear theory of the atom. In the meantime, however, it has been possible to connect the group structure of the electronic cluster in the atom with the quantum-theory interpretation of spectra. Thus the constitution of the neutral atom in its normal state can be investigated by imagining a process by which N electrons one after one are captured and bound in the field of force surrounding a nucleus of charge Ne.

To each step there corresponds a multitude of stages, *i.e.*, stationary states, in which the electron is more and more firmly bound to the atom. The final state, in which binding is strongest, corresponds to the normal state of the atomic ion. A definite connection between the spectra and the group structure was now established by assuming that, in the normal atom only a limited number of electrons can be bound in states visualized as orbits characterized by definite values of the quantum numbers n and k. The electrons bound in orbits corresponding to a given value of n are said to form an n-quantum group, which in its finally completed stage will contain n subgroups, corresponding to the possible values 1, 2 . . . n which k may take. For a sufficiently large nuclear charge, the strength with which the electrons in the different subgroups belonging to one and the same group are bound will be nearly equal.

In the gradual building up of the groups in atoms with increasing nuclear charge, it is, however, to be noted that when an n_k orbit appears for the first time in the neutral atom, the strength of the binding will depend very considerably on the value of k. This is due to the circumstance that this quantum number fixes the closest distance to which the electron may approach the nucleus. The screening of the nuclear charge by the other electrons in the atom may therefore be very different for orbits corresponding to different values of k, and the effect on the strength

of the binding can be so large that an orbit characterized by certain values of n and k may correspond to a stronger binding than an orbit for which n is smaller but k larger. This offers a natural explanation of one feature of the periodic table, namely that the periods grow gradually larger, while there appear sequences of elements which differ comparatively little in their chemical and physical properties. Such a sequence marks a stage in the development of an n-quantum group, which consists in the addition of a subgroup corresponding to a value of k which was previously not yet represented in that group, and which takes place after the building up of a group corresponding to a higher value of n has already begun. In fact, during the addition of the subgroup a temporary standstill will occur in the development of the latter group, the constitution of which will primarily determine the chemical affinity of the atom, since it contains the most loosely bound electrons.

In the accompanying table (Table II.) is given a summary of the structure of the normal state of the neutral atoms of the elements. The figures before the different elements are the atomic numbers, which give the total ncmber of electrons in the neutral atom. The figures in the different columns give number of electrons in orbits correspocding to values of the principal and subordinate quantum numbers standing at the top. A comparison with the periodic table (Table I) will show that those elements which in chemical respect are homologous, will have the same number of electrons in the electronic groups most loosely bound, containing the so-called valence-electrons. The atoms of elements which in Table I. are enclosed in brackets possess electronic configurations in which a subgroup is being added to a group, whose principal number is less than the group containing the typical valence-electrons. An especially conspicuous example of such a completion of an inner group is offered by the elements forming the family of the rare earths. Here we witness the addition of the fourth subgroup to the 4-quantum group, which begins first in Ce (58) while the addition of the third subgroup was already finished in Ag (47).

Table II. is in general agreement not only with the optical spectral evidence but also with that in the region of X-rays. As mentioned earlier, we see in X-ray spectra a change in the binding of an electron in the interior of the atom. This takes place when, for instance, by the impact of a swiftly moving particle on the atom, an electron is removed from one of the electronic groups, and its place is taken by an electron belonging to a group for which the binding energy is smaller. As an example it may be stated that the strong X-ray whose frequency is approximately represented by formula (4) is emitted when an electron has been removed from the 1-quantum group, and one of the 2_2 electrons performs a transition so as to occupy the empty place. The line represented approximately by formula (5) originates from a

TABLE II. Summary of the Structure of the Neutral Atoms

	1_1	2_1	2_2	3_1	3_2	3_3	4_1	4_2	4_3	4_4	5_1	5_2	5_3	5_4	5_5	6_1	6_2	6_3	6_4	6_5	6_6	7_1	7_2
1 H	1																						
2 He	2																						
3 Li	2	1																					
4 Be	2	2																					
5 B	2	2	1																				
⋮																							
10 Ne	2	2	6																				
11 Na	2	2	6	1																			
12 Mg	2	2	6	2																			
13 Al	2	2	6	2	1																		
⋮																							
18 A	2	2	6	2	6																		
19 K	2	2	6	2	6		1																
20 Ca	2	2	6	2	6		2																
21 Sc	2	2	6	2	6	1	2																
22 Ti	2	2	6	2	6	2	2																
⋮																							
29 Cu	2	2	6	2	6	10	1																
30 Zn	2	2	6	2	6	10	2																
31 Ga	2	2	6	2	6	10	2	1															
⋮																							
36 Kr	2	2	6	2	6	10	2	6															
37 Rb	2	2	6	2	6	10	2	6			1												
38 Sr	2	2	6	2	6	10	2	6			2												
39 Y	2	2	6	2	6	10	2	6	1		2												
40 Zr	2	2	6	2	6	10	2	6	2		2												
47 Ag	2	2	6	2	6	10	2	6	10		1												
48 Cd	2	2	6	2	6	10	2	6	10		2												
49 In	2	2	6	2	6	10	2	6	10		2	1											
⋮																							
54 Xe	2	2	6	2	6	10	2	6	10		2	6											
55 Cs	2	2	6	2	6	10	2	6	10		2	6				1							
56 Ba	2	2	6	2	6	10	2	6	10		2	6				2							
57 La	2	2	6	2	6	10	2	6	10		2	6	1			2							
58 Ce	2	2	6	2	6	10	2	6	10	1	2	6	1			2							
59 Pr	2	2	6	2	6	10	2	6	10	2	2	6	1			2							
⋮																							
71 Gp	2	2	6	2	6	10	2	6	10	14	2	6	1			2							
72 Hf	2	2	6	2	6	10	2	6	10	14	2	6	2			2							
⋮																							
79 Au	2	2	6	2	6	10	2	6	10	14	2	6	10			1							
80 Hg	2	2	6	2	6	10	2	6	10	14	2	6	10			2							
81 Tl	2	2	6	2	6	10	2	6	10	14	2	6	10			2	1						
⋮																							
86 Em	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6						
87 —	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6					1	
88 Ra	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6					2	
89 Ac	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6					2	1

transition by which a 3_3 electron takes the place Ieft open upon the removal of a 2_2 electron.

The question how many electrons there are in the various groups and subgroups has been subject to much discussion in the last few years. Table II. is the temporary result of this discussion and seems to give an adequate description of the spectral as well as the chemical evidence. It is clear that a full theoretical treatment of the problem cannot be obtained from considerations based only on the simple picture of central orbits. Such a treatment will essentially involve an examination of those features of the binding of the electrons, which appear in the multiplet structure of spectral lines. Indeed it is very probable that the idea that the electron itself has magnetic properties may give the clue to the interpretation of the empirical rules governing the number of electrons in the group structure of the atom.

Recent Progress.—Such is the outline of the theory of the atom and its structure as it stood in 1925. Since then the subject of atomic structure has undergone a remarkable development due to the establishment of rational quantum theoretical methods which enable a quantitative treatment to be given to a large number of atomic problems that, earlier, were accessible only to considerations of a more qualitative character. These methods take their origin from two sources. On the one hand the symbolic procedure of "quantum mechanics" initiated by Heisenberg, and briefly referred to above, has, thanks to the collaboration of a number of eminent physicists, developed into a structure which, as regards generality and consistency, may be compared with the theory of classical mechanics. On the other hand a new method of "wave mechanics" of great power and fertility has been developed by Schrodinger having its starting point in the pioneer work of de Broglie. (See QUANTUM THEORY.) This method utilizes the analogy between mechanics and optics emphasized already long ago by Hamilton. According to de Broglie, the motion of a material particle may be compared with the propagation of a train of waves, the frequency of which is related to the kinetic energy of the particle, as calculated on the relativity theory, by the general quantum relation $E=h\nu$. Indeed, this view may be considered as an inversion of the considerations by which Einstein was led to the hypothesis that the carrier of light energy had to be considered not as waves but as corpuscles—the so-called light quanta—which concentrated within a small volume contained the energy $h\nu$. Notwithstanding the indispensability of the wave theory of light for the account of ordinary optical experience, Einstein's hypothesis has proved most fruitful in explaining a number of phenomena, notably the important discovery of Compton of the change in the frequency which X-rays suffer when scattered by electrons. Similarly the view of de Broglie, strange as it is from the classical point of view, has received a striking support from the recent discovery of Davisson and Germer about the selective reflection of electrons from metal crystals. Indeed, in these experiments the electrons were found to behave as waves possessing the wave length anticipated from quantum theory.

The first indication of the importance of the wave idea in the problem of atomic constitution was the suggestion of de Broglie that the stationary states of an atom might be interpreted as an interference effect of the waves associated with a bound electron. A real advance in this direction, however, was first achieved by Schrodinger, who succeeded in replacing the classical equations of motion for the particles in the atom by a certain differential equation of a type similar to that known from the theory of elastic vibrations of solid bodies. As is well known from acoustics any such vibration can be resolved into a number of purely harmonic components, representing the fundamental tones of a musical instrument. It was now found that the "characteristic solutions" of the Schrodinger wave equation, corresponding to such purely harmonic vibrations, offer a detailed interpretation of the properties of stationary states. First of all the energy values appearing in the quantum theory of spectra are obtained by multiplying the frequencies of the characteristic vibrations by Planck's constant. Next Schrodinger succeeded in associating with the solution of his wave equation a continuous distribution of electric charge and current, which, when applied to a characteristic vibration, represents the electrostatic and magnetic properties of an atom in the corresponding stationary state. Similarly the superposition of two characteristic solutions corresponds to a continuous vibrating distribution of electric charge, which on classical electrodynamics would give rise to an emission of radiation, fulfilling the requirement of the quantum postulate and the correspondence principle as regards frequency as well as intensity and polarization.

These remarkable results have given rise to a renewed discussion regarding the physical nature of the constituents of the atom. Indeed, the view has been advocated that the wave idea offers a real picture of the atom, allowing a direct application of the methods of classical physics. On this view the wave mechanics represent a natural generalization of classical mechanics of material particles, to which it is related in the same way as the modern theory of optics based on the fundamental equations of electrodynamics is related to the more primitive theory of geometrical optics, which makes use of the idea of light rays. It would appear, however, that the situation is more complicated. Due to the very contrast between the ideas of quantum theory and the fundamental principles of classical physics, we cannot expect to be able to visualize atomic phenomena by means of our classical ideas. In the dilemma regarding the nature of light and the ultimate constituents of matter we witness a general feature of a dualism inherent in the quantum theory description. Indeed, the wave and particle ideas are both indispensable if we attempt to get a full description of experience. This situation is brought out very clearly by the recent development of the symbolic method of quantum mechanics, through which an intimate connection between the correspondence argument and Schrodinger's work is established. Just when due regard is given to the feature of dualism in question, the quantum theory can, unfamiliar as it is, still be regarded as a natural development of the ordinary description of physical phenomena.

In the problem of atomic constitution we meet with a very striking example of the dualism mentioned. Notwithstanding the wonderful power of the Schrodinger wave functions of illustrating properties of stationary states, the wave theory fails to account for the peculiar stability of these states, on which the interpretation of atomic phenomena rests so essentially. Indeed, we have here to do with the very feature of discontinuity or rather "individuality," by which the quantum theory departs from the ideas of classical physics, and of which we perhaps have the most striking example in the existence of the individual particles themselves. For the rest, the dualism of the quantum theory brings with it the conclusion that the use of the idea of stationary states excludes the possibility of following at the same time the behaviour of the single particles in the atom. Just this situation finds its adequate representation in the characteristic vibrations of the Schrodinger wave problem. This problem. in fact, is not a 3-dimensional one, as that of ordinary spatial description, but one which operates with a number of dimensions equal to the number of degrees of freedom of the whole atom. This fact has recently found an important application in the interpretation of a certain peculiar duplexity in the structure of spectra especially marked in the helium spectrum. This duplexity, which for a long time eluded explanation, has recently been explained by Heisenberg, who pointed out that we have here to do with an effect of the mutual interaction of the electrons in the atom, which exhibits a close correspondence with a classical resonance problem, but cannot be accounted for on the simple procedure of characterizing the behaviour of the individual electrons by quantum numbers. The justification of this procedure in a large number of applications rests on the circuinstance that in general the resonance effect is very small, the mutual influence of the various electrons on each other being, as already described, to a close approximation to that of a conservative central field of force.

It is impossible here to give anything but a vague idea of the abundance of details regarding the physical and chemical properties of the elements which have been explained by means of the new methods of quantum theory. It may still be mentioned that

the important contributions of Main Smith and Stoner to the interpretation of the periodic table—embodied already in the scheme of electron orbits given in the article—have been brought into most convincing connection with the so-called exclusion principle of Pauli and with the idea of the magnetic electron referred to already. Moreover a study of the fine structure of band spectra has led to the conclusion that the proton, or the nucleus of the hydrogen atom, also possesses an angular momentum and a magnetic moment. Quite recently even a successful attack on the fundamental problem of the origin of the so-called electron spin has been made by Dirac, whose work has opened new prospects. (See also ATOMIC WEIGHTS; CHEMISTRY; ELECTRICITY, CONDUCTION OF: in Gases; ISOTOPES; QUANTUM THEORY.)

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ATOMIC NUMBER, in chemistry, is the ordinal number of an element in the series of the elements arranged in accordance with the periodic law (*q.v.*).

The chemical elements were formerly arranged in the periodic classification in ascending order of their atomic weights, but this arrangement led to three pairs of anomalies, *viz.,* argon and potassium, cobalt and nickel, and tellurium and iodine, in which the order of the atomic weight obviously disagreed with the position of the elements as shown by their chemical properties. This discrepancy was completely cleared up in 1913 by H. G. J. Moseley, who measured the wave-length of X-rays given off by elements when bombarded with cathode rays and showed that the frequencies of these X-rays were characteristic for each element. The square root of the frequency of the principal rays increased proportionately with the rise in atomic number, and when this relationship is traced out with a group of elements including iron, cobalt, nickel and copper, it is found that cobalt precedes nickel although of higher atomic weight, and X-ray spectra reveal a similar inversion in the case of tellurium and iodine. Similarly, potassium (atomic weight 39·1) is placed next but one after chlorine (atomic weight 35·46), thus leaving the intermediate position for argon (atomic weight 40). In Moseley's own words these results show that "there is in the atom a fundamental quantity which increases by regular steps as we pass from one atom to the next. This quantity can only be the charge on the central positive nucleus." (Moseley in Philosophical *Magazine,* 1913 and 1914.) Chemical atoms are composed of positive units of electricity (protons) and of an equal number of negative units (electrons), the charge on any one of such units being $\pm 4{\cdot}77 \times 10^{-10}$ electrostatic units. The protons are concentrated in the nucleus which also contains a portion of the electrons, the remaining electrons being extra-nuclear or planetary. Thus an element of atomic weight *W* and atomic number N will have a nucleus consisting of *W* protons and W—N electrons surrounded by N planetary electrons. Accordingly the atomic number is (1) the ordinal number of the element, (2) the positive electrical charge on the nucleus, and (3) the number of planetary electrons surrounding the nucleus. (G. T. M.)

ATOMIC WEIGHTS. Atomic weights have been defined as "the relative weights of the atoms of chemical elements referred to a common standard." This statement still serves as the simplest indication of the fundamental idea involved, although it now needs amplification. The concrete development of the idea was first effected in 1803 by John Dalton, an English chemist, when he converted the vague atomistic theory of the ancient Greeks into a highly valuable scientific asset by means of the concept of atomic weights. The chemical atomic theory thus initiated has been strengthened by modern investigation, and is to-day entrenched in a well-nigh impregnable position.

Practical and Scientific Interest.—Atomic weights are quantities of great practical and theoretical importance. They record the operation of the chemical law of definite combining proportions; hence they are the basis of quantitative chemical analysis, and are in everyday use throughout the world. Because of the parallelism between gravitational effect and inertia, they record also the relative masses of the atoms of the elements. They possess an extraordinary degree of definiteness, since the law of combining proportions is one of the few known precise laws of the universe. Far deeper in meaning than the accidental astronomical "constants," such as the length of the day or the length of the year, the atomic weights of the simple elements and of the individual isotopes (see ISOTOPES) stand out as among the peculiar and basic attributes of those 92 elementary substances of which everything is composed. Their interpretation is closely concerned with our inferences concerning the nature of matter.

Dalton's Views.—Simple as the original concept of atomic weights seems to be, it nevertheless presents problems which are rather complex. For example, 22·997 grammes of sodium combine with 126·932 grammes of iodine to form sodium iodide. This ratio of the combining weights of these elements appears to be invariable. As Dalton pointed out, these weights must depend on the relative weights of the respective atoms; no other simple explanation is conceivable. There is in the experimental result, however, nothing which shows whether the sodium and iodine combine atom for atom, or whether one atom of sodium combines (for example) with two of iodine. Dalton himself perceived that this latter happening might in many cases occur; indeed it is the essence of his Law of Multiple Proportions. There is now every reason to believe that in this particular case of sodium and iodine the atoms actually combine one to one and that the numbers given above represent really the relative weights of the atoms of sodium and iodine; but there are many less simple cases. For instance, 126.932 grammes of iodine combine with 20·035 grammes of calcium; here the latter number represents only half the atomic weight of calcium; because every molecule of calcium iodide is believed on excellent evidence to contain two atoms of iodine for every atom of calcium (see VALENCY). Such a decision was beyond the reach of Dalton. It is based chiefly upon three subsequent discoveries to be briefly described.

Avogadro's Hypothesis.—In 1811 Count Amedeo Avogadro di Quaregna advanced the hypothesis, based upon Gay Lussac's Law of Volumes, that equal volumes of gases under like conditions of temperature and pressure contain the same number of molecules, a molecule being defined as consisting usually of two or more atoms. This hypothesis (which has since been so amply confirmed as to become, in many minds, a statement of fact) furnishes the most important means of deciding between the multiples or sub-multiples of the combining proportions which are to be taken as the atomic weights, because it fixes the molecular weights and formulas of volatile elements and compounds (see CHEMISTRY).

Dulong and Petit's Constant.—The second important means of deciding between possible multiples and sub-multiples of atomic weights was the discovery of Dulong and Petit (1818) that the atomic weight of an element is about equal to a constant number (6.3) divided by the specific heat. To be sure, this rule is not exact; but its inexactness is not usually great enough to affect it in its office of deciding the multiple or sub-multiple of the chemical combining proportion to be taken as the atomic weight. For example, the specific heat of calcium is about 0·16; therefore its atomic weight is shown to be about 39.4, whereas the exact value found by chemical means is 40·07.

Crystalline Similarity.—A third method of answering the question exists in the similarity of the crystal forms of similar salts of allied elements, discovered by E. Mitscherlich in 1821. If the atomic weight of one element entering into such isomorphous crystals is unknown, that multiple of the combining proportion of this element which corresponds to the formula indicated by the known salt will be the true atomic weight. (See ISOMORPHISM.)

The full significance and essential consistency of these three methods of solving Dalton's unsolved problem were not realized until 1858, when a table of atomic weights identical in principle with that used to-day was published by S. Cannizzaro. Previous doubts concerning the criteria just described had caused many

chemists to reject wholly the term "atomic weights," and to call the arbitrarily selected multiples merely by some such name as "proportion numbers" or "chemical equivalents." But the numbers now used (as regards the multiples chosen) inevitably involve the atomic theory, hence the adjective "atomic" is fitting. "Weight" also is fitting, since the values are determined by means of the gravitational balance. The term "atomic mass" applies consistently only when inertia is the basis of measurement. The term "chemical equivalent" is now used to signify the atomic weight divided by the valency (*q.v.*).

Standard of Atomic Weights. — The choice of the standard of atomic weights has varied. Dalton chose the smallest atomic weight, that of hydrogen, as his standard. Berzelius temporarily selected Oxygen=100 as the standard of his system. Later the chemical world returned to Dalton's practice, especially because (according to early work) it was believed that the atomic weight of oxygen is nearly the whole number 16, if hydrogen is taken as 1. Finally, after it had been shown by E. W. Morley and others that the ratio of the atomic weights of oxygen and hydrogen is in fact 15·878 to 1, it was decided, by general consent, in 1905, to abandon the standard H=1·000, retaining the standard O=16·000. The decision was based upon convenience. The permanent choice of O=15·878 would have changed by nearly one per cent. almost every other accepted value, and would have caused much confusion in previous quantitative statements. Besides, more atomic weights approach whole numbers when oxygen is taken as exactly 16·000 than when any other usual standard is chosen.

A more weighty reason lay in the fact that most of the values are experimentally determined by relation to oxygen, and are referred to hydrogen only through that element. Hence any subsequent change in the accepted ratio H:O (one of the most difficult to determine of all such ratios) would affect all the atomic weights, if hydrogen were chosen as the standard substance. The present unit of the system of atomic weights is therefore exactly the sixteenth part of the atomic weight of oxygen. The atomic weight of hydrogen thus becomes 1·0077. The choice, on the whole, was a wise one; it has been justified by modern research, and has proved to be peculiarly fortunate, because probably all atoms of oxygen are alike in weight (see ISOTOPES).

Atomic Numbers and Actual Weights. — Atomic weights are numbers; that is to say, they represent ratios and are therefore devoid of physical dimensions. They are, however, very different from the quantities designated by J. A. R. Newlands and H. G. J. Moseley "atomic numbers" (*q.v.*), which record the serial order of the places in the periodic classification of the chemical elements. No immediate knowledge of the actual weights of individual atoms is afforded by "atomic weights," unless the number of atoms in a given gross weight of some elementary substance is known. Various researches have shown that 16 grammes of oxygen contain about 606×10^{21} atoms; hence a single atom of oxygen must weigh 0·000,000,000,000,000,000,000,026,4 gramme. The actual weights of other kinds of atoms must be in due proportion.

Experimental Determination. — The exact values of the chemical combining proportions which form the basis of the table of atomic weights are found only by experimental work. Therefore, before the table is given, the necessary experimental methods may well be briefly described. The first and most generally useful method employed for the purpose has as its object the determination of the precise amount of one element which is necessary exactly to combine with a given amount of some other element of known atomic weight. The experimental technique is of the most refined quantitative chemical analysis. Early extensive and careful investigations of this kind were conducted by J. Berzelius, C. de Marignac, J. B. A. Dumas, J. S. Stas and many others. Recently most of the work in this direction has been conducted in the United States (E. W. Morley, W. A. Noyes, T. W. Richards, G. P. Baxter and others), although European investigators (especially B. Brauner and 0. Honigschmid) have made important contributions.

Experimental work of this kind naturally involves the observance of a number of essential conditions. Comparatively few compounds of any given element are fit to serve as a means of determining its atomic weight, for the reason that comparatively few substances may be prepared in a perfectly pure state. The choice of the compounds to be employed is in some ways the most crucial part of the whole process, for with some compounds no result worthy of consideration could be obtained, even using the greatest care possible.

Having chosen wisely, the experimenter must prepare the needful substances, whatever they may be, in a state of very great purity. He must never forget that every precipitate carries down with it contaminating impurities absorbed or included by the substance as it separates from the solution. He must remember always that no receptacle necessary to contain the substance is free from the possibility of being attacked or dissolved, thus affecting the result. Moreover, precipitates are never wholly insoluble; and most substances will volatilise if heated to an excessive temperature. These complicating circumstances combine often in unexpected ways to introduce impurity, and the experimenter must not only guard against these dangers, but must prove by adequate tests that no such complication has occurred. Moreover, above all, he must not forget that oxygen, nitrogen and water are almost omnipresent; and continual care must be exercised lest in some way one of these impurities may affect the substance which is serving as the basis of the work. For further statement of these and other precautions and for a brief description of apparatus suitable for avoiding many pitfalls, together with the details of an especially instructive complex case, the reader is referred to Carnegie Institution of Washington, Publication No. ***125.*** A critical summary by F. W. Clarke of all investigations up to 1920 is to be found in the third Memoir of vol. xvi. of the *Memoirs* of the *National* Academy of Sciences (Washington).

A Typical Experiment. — A simple case may best exemplify the method. In one of many experiments, 7·59712 grammes of ferric oxide (Fe_2O_3) prepared with the greatest care, were found to yield on reduction (by means of hydrogen at a high temperature) 5.31364 grammes of metallic iron. The loss of weight (2.28348 grammes) represents the oxygen present in the oxide. Hence, from the proportion $(2{\cdot}28348):(5{\cdot}31364)=O_3:Fe_2=3(16{\cdot}000):2x$, the atomic weight of iron is found to be 55.848 (G. P. Baxter and C. R. Hoover). The analysis was repeated many times in order to eliminate accidental errors.

Alternative Method. — Another general method of determining atomic weights (applicable only to gases or vapours) depends upon Avogadro's Rule, and resolves itself into the weighing of like volumes of different gases under like conditions of temperature and pressure. This is the only gravimetric method applicable to the six inert gases (helium, etc.) which do not form chemical compounds. The method determines molecular weights, not atomic weights; but the number of atoms in a molecule may be inferred in other ways, and therefore the atomic weights may be calculated from the data. The method involves experimental difficulties. The globe containing a gas inevitably weighs much more than the gas itself and is peculiarly subject to changes of buoyancy of the air. The exact measurement of temperature and pressure is not always easy, nor is the perfect purity of the gas to be weighed a condition readily secured. Moreover, Avogadro's Rule holds only for perfect gases; no actual gas fulfils exactly its requirements, because of the bulk occupied by the molecules themselves and their mutual attraction. On the whole, making allowance for these difficulties (see STOICHEIOMETRY), the method of determining molecular (and therefore atomic weights) by comparison of the densities of gases agrees remarkably well with the results obtained from chemical analysis (Lord Rayleigh, E. W. Morley, P. A. Guye, **A.** Leduc, E. Moles, G. P. Baxter).

Third Method. — A third method of determining atomic weights (like the last, a purely physical method) is that which determines the mass (or rather the ratio of mass to electric charge) of rapidly moving charged atoms or molecules by means of the deflection by electric and magnetic fields. It appraises (by means of impressions on a photographic plate of the positions of impact of the deflected particles) the relative atomic masses pertaining

to selected groups of atoms. In its original form it furnished the first experimental evidence not only that in some elements the atoms are all alike in weight, but also that in other elements this is not the case (Sir J. J. Thomson, 1912). Different varieties of a single chemical element, similar in every respect except as regards the weights and masses of their atoms, and apparently inseparable by natural agencies when once mixed, are called isotopes (F. Soddy). Under that head will be found a full description of this method of evaluating them, which was greatly improved by F. W. Aston, in his "mass-spectrograph."

Isotopes.—Many but not all of the elementary substances have been found by this third method to be isotopic or "complex." Hence elements may be divided into two classes: simple elements, probably possessing only one variety of atom, and isotopic elements, containing two or more varieties. The relative proportions of the several isotopes in a given elementary substance are shown roughly by the relative intensities of the "photographic" records; they can be shown exactly only by quantitative analysis, and then only when no more than two isotopes are present. Thus ordinary terrestrial chlorine (Cl=35·46) must consist of a mixture of about 30 atoms of Cl=37 to every 100 atoms of Cl=35.

Although the term "atomic weight" referred originally to the elementary substances (whether simple or isotopic) which actually occur on the earth's surface, it is applicable with even greater fitness to each isotope alone. Of all the isotopic elements only one, namely lead, has had the atomic weight of any individual isotope accurately determined by chemical analysis (Richards, Soddy, Honigschmid). The individual isotopes of this metal are unique because, so far as we can tell, they are end-products of the spontaneous disintegration of uranium, and other radioactive elements, in which the atoms of lead were segregated at the moment of their terrestrial birth and confined in the minerals producing them. Their abnormal atomic weights (determined by chemical methods of unquestioned trustworthiness) constituted at first the most convincing evidence of the existence of isotopes.

Table of Atomic Weights.—The following table of atomic weights of the chemical elementary substances as they exist on the surface of the earth is essentially the table issued in 1925 by the International Committee on Elements and Atomic Weights, but includes the newly discovered element hafnium, as well as two of the individual isotopes of lead which have been experimentally investigated by chemical methods. "Atomic numbers" are also given. Usually, the larger the atomic weight the larger the atomic number; but all isotopes of a given element have the same atomic number. Except for hydrogen, the atomic number is never more and usually less than half of the atomic weight.

Redefinition of Term.—The discovery of the spontaneous disintegration of radioactive elements and the finding of isotopes have modified our theoretical interpretation of the atomic weights. Because of these discoveries, two *a priori* premises (of a more or less philosophical nature), namely, first, the assumption that the atoms are indivisible (the elementary substances being absolutely permanent) and, second, the assumption that the atoms of a given chemical element are all alike in weight, must to-day be abandoned, but the premises are seen on close scrutiny to be by no means an essential part of the chemical atomic theory. Nevertheless, the old definition of atomic weights must be altered in order to correspond exactly to modern knowledge. A more complete and precise definition may be worded as follows: "Primarily, atomic weights are appropriate simple multiples (decided by theory) of the relative combining proportions or relative gas-densities of elementary substances calculated on a consistent basis. They represent the relative average weights of the atoms of given specimens of elementary substances referred to a common stand-

TABLE OF ATOMIC WEIGHTS OF THE CHEMICAL ELEMENTS

	Symbol.	At. No.	At. Wt.		Symbol.	At. No.	At. Wt.
Aluminium	Al	13	26·97	Manganese	Mn	25	54·93
Antimony	Sb	51	121·77	Mercury	Hg	80	200·61
Argon	A	18	39·91	Molybdenum	Mo	42	96·0
Arsenic	As	33	74·96	Neodymium	Nd	60	144·27
Barium	Ba	56	137·37	Neon	Ne	10	20·2
Beryllium (Glucinum)	Be	4	9·02	Nickel	Ni	28	58·69
Bismuth	Bi	83	209·00	Nitrogen (Azote)	N	7	14·008
Boron	B	5	10·82	Osmium	Os	76	190·8
Bromine	Br	35	79·916	Oxygen	O	8	16·000
Cadmium	Cd	48	112·41	Palladium	Pd	46	106·7
Calcium	Ca	20	40·07	Phosphorus	P	15	31·027
Carbon	C	6	12·000	Platinum	Pt	78	195·23
Cerium	Ce	58	140·25	Potassium (Kalium)	K	19	39·096
Cesium (Caesium)	Cs	55	132·81	Praseodymium	Pr	59	140·92
Chlorine	Cl	17	35·457	Radium	Ra	88	225·95
Chromium	Cr	24	52·01	Radon (Niton)	Rn	86	222·
Cobalt	Co	27	58·94	Rhodium	Rh	45	102·91
Columbium (Niobium)	Cb	41	93·1	Rubidium	Rb	37	85·44
Copper	Cu	29	63·57	Ruthenium	Ru	44	101·7
Dysprosium	Dy	66	162·52	Samarium	Sm	62	150·43
Erbium	Er	68	167·7	Scandium	Sc	21	45·10
Europium	Eu	63	152·0	Selenium	Se	34	79·2
Fluorine	F	9	19·00	Silicon	Si	14	28·06
Gadolinium	Gd	64	157·26	Silver	Ag	47	107·880
Gallium	Ga	31	69·72	Sodium (Natrium)	Na	11	22·997
Germanium	Ge	32	72·60	Strontium	Sr	38	87·63
Gold	Au	79	197·2	Sulphur	S	16	32·064
Hafnium (Celtium)	Hf	72	178·6	Tantalum	Ta	73	181·5
Helium	He	2	4·00	Tellurium	Te	52	127·5
Holmium	Ho	67	163·4	Terbium	Tb	65	159·2
Hydrogen	H	1	1·008	Thallium	Tl	81	204·39
Indium	In	49	114·8	Thorium	Th	90	232·15
Iodine	I	53	126·932	Thulium	Tm	69	169·4
Iridium	Ir	77	193·1	Tin	Sn	50	118·70
Iron	Fe	26	55·84	Titanium	Ti	22	48·1
Krypton	Kr	36	82·9	Tungsten (Wolfram)	W	74	184·0
Lanthanum	La	57	138·90	Uranium	U	92	238·17
Lead (ordinary)	Pb	82	207·20	Vanadium	V	23	50·96
" (from U)	Pb	82	206·06	Xenon	Xe	54	130·2
" (from Th)	Pb	82	208·	Ytterbium	Yb	70	173·6
Lithium	Li	3	6·940	Yttrium	Y	39	88·9
Lutecium	Lu	71	175·00	Zinc	Zn	30	65·38
Magnesium	Mg	12	24·32	Zirconium	Zr	40	91·

ard." Any such definition involves other definitions. An elementary substance is a substance which is not further disintegrated by ordinary chemical reactions. This definition avoids the implication that such a substance is incapable of disintegration by extra-chemical means. "Element" and "chemical elements" are sometimes used synonymously. "Atoms" are postulated as the smallest particles of such a substance under ordinary conditions. They are not necessarily incapable of disintegration under extreme conditions. Hence their name (from ἄ privative and τομός "divided, cut") is not now appropriate, but it will doubtless be retained; the term "chemical atom" would perhaps be better. The qualification involved in the word "average" above is necessary because of the discovery of isotopes. The weighted average of the atomic weights of the isotopes in any particular isotopic or "complex" elementary substance is that which is recorded as its atomic weight.

Constancy of Atomic Weights.— That the atomic weights are constant in different compounds is shown by the analysis of many pure substances containing the same element and also by H. Landolt's experiments (1907), which proved that there is no loss or gain of gravitational effect in ordinary chemical reactions within one part in ten million. Moreover, specimens of various elementary substances (*e.g.*, sodium, calcium, copper, silver, iron, nickel, cobalt, etc.) found in different parts of the earth or even in meteorites, have been found by careful research to have constant atomic weights independent of geographical occurrence. All the samples of terrestrial lead even, except those found in uranium or thorium minerals, show similar uniformity. That each native terrestrial mixture of isotopes is thus unvarying seems to show that each was commingled when the earth was still fluid, or else that some unknown law determines the proportion in which the isotopes are formed. If it were not for the consistency indicated in this paragraph, the table of atomic weights would be much less useful than it is. The atomic weights are precisely consistent also with the electro-chemical equivalents indicated by Faraday's Law (Faraday, Rayleigh, Richards), affording thus further evidence of their fundamental nature.

Hydrogen and Other Elements.— The hypothesis of Prout (1815) that all elements are aggregates of hydrogen has been greatly strengthened by the discovery of isotopes; for it appears that the fractions in the table above are due chiefly to isotopic' mixtures, in which each isotope taken separately has nearly a whole number for its individual atomic weight. The atomic weights of uranium, radium, thorium, the isotopes of lead, and helium furnish an argument in favour of the theory of the atomic disintegration in which they are concerned, and therefore support the postulate maintaining the composite nature of the elements. Nevertheless, all the simple elements and individual isotopes have atomic weights somewhat less than the appropriate multiples of that of hydrogen, as has been shown in the case of oxygen. Many theorists believe that this common deficiency is due to the actual loss of mass during the atomic coalescence of hydrogen nuclei, the expelled mass being transformed into energy. If this is true, the exact values of the simple atomic weights (and those of individual isotopes) even to the third decimal place, possess great theoretical interest, since they must furnish an essential clue to the amount of energy expended. Modern hypotheses concerning the structure of the atom (Sir E. Rutherford, Sir J. J. Thomson, N. Bohr, G. N. Lewis, I. Langmuir) assume that practically all the weight and mass of the atom (fixing, of course, its atomic weight) are concentrated in an exceedingly small nucleus in its centre.

Concord with Atomic Numbers.— For 50 years the atomic weights decided the arrangement of the periodic system of the elements. Recently x-ray spectra have more certainly evaluated the atomic numbers which place the elements in this system (Moseley); but the agreement between the two methods is close enough to indicate a fundamental if sometimes complex relation between them.

Atomic Weights and Cosmogony.— The sun and stars appear spectroscopically to be made largely of the elements existing on earth. It is therefore no mere flight of fancy to infer that the vast gravitational forces which regulate the motions of the heavenly bodies are due to the collective action of countless myriads of atoms, whose individual shares in the process are recorded in the table of atomic weights. The foregoing considerations concerning atomic weights suggest many other cosmological inferences, which are, however, beyond the scope of this article (see "Atomic Weights and Isotopes," *Chemical* Review, **I.** I., [1924]). It is not too much to say that these unique numbers, the atomic weights, probably bear a very close relation to the unknown fundamental processes which determined the nature and evolution of the universe. (T. W. R.)

ATOMIZATION, ELECTRICAL, a process for the production of stable colloidal solutions of metals. An electric arc is passed between electrodes of pure metal in distilled water contained in a vessel made of practically insoluble material. Faraday probably was the first to employ the electric arc to produce finely dispersed gold, but Bredig developed the method here described. Svedberg used the oscillating discharge from an induction coil and greatly reduced the current density, producing some hydrosols and olganosols. (See COLLOIDS.)

ATONALITY, a modern musical term which has been adopted in connection with that class of composition which is not written in any definite key and hence has no defined tonality (See HARMONY.)

ATONEMENT. To "atone" is to make "at one," and this is the actual derivation of the word. A doctrine of atonement makes the following assumptions. (a) There is a natural relation of communion between man and God. (b) This communion has been broken through man's fault. Early conceptions of this breach as due to the non-observance of taboos and rituals become, in the higher religions, a sense of sin, as an ethical offence against God's holiness and love. (c) Communion can be restored, *i.e.*, sin can be forgiven.

The Religious Doctrine.— Atonement is the means or condition of the restoration of communion between man and God. This has been variously found (a) in the endurance of punishment; (b) in the payment of compensation for wrong done, in the form of sacrifices or other offerings; (c) in the performance of some special ritual, the efficacy of which consists in its being pleasing to or appointed by God, or even in its having a coercive power over God; (d) in repentance and amendment of life. In most theories two or more of these are combined. Some or all of the conditions of atonement may be fulfilled, according to various views, either by the sinner or vicariously on his behalf by some kinsman; or by his family, clan or nation; or by someone else.

Old Testament.— In the Old Testament to "atone" represents the Heb. Kipper, a word originally meaning to "cover" or "wipe out," but probably used simply as a technical term. There is no harmonious system of teaching on the subject. In some cases there is no suggestion of forgiveness; sinners are "cut off" from the chosen people (Josh. vii. 24), nations perish in their iniquity (Jer. li. 62). Some passages make punishment the condition of pardon (II. Sam. xii. 13, 14; Is. xl. 2), though here repentance is assumed as following the punishment. Sometimes penitence and amendment are the sole conditions (Ezek. xviii.; Mic. vi.).

Sacrifice and other rites are also spoken of in this connection. The Priestly Code (Leviticus and allied passages) seems to confine the efficacy of sacrifice to ritual, venial and involuntary sins (Lev. iv. 2), and requires that the sacrifices should be offered at Jerusalem by the Aaronic priests; but these limitations did not belong to the older religion. Some writers (Ps. li.; Mic. vi. 6–8; Is. i. 11) protest against the ascription of great importance to sacrifice. The Old Testament has no theory of sacrifice; in connection with sin the sacrifice was popularly regarded as payment of penalty or compensation and this is specially connected with the offering of the blood (Lev. xvii. 11).

Jewish Day of Atonement.— The atoning ritual reached its climax on the Day of Atonement (in the Mishna simply "the Day" *Yōmā*), observed annually on the 10th day of the 7th month (Tisri), shortly before the Feast of Tabernacles or vintage festival. The laws of the Day of Atonement belong to the Priestly Code. There is no trace of this function before the exile (see Ezek. xlv. 18–20 LXX.) but the ritual of the '(scapegoat" was

doubtless derived from earlier times. The object of the observances was to cleanse the sanctuary, the priesthood and the people from all their sins and to renew and maintain favourable relations between Yahweh and Israel. The ritual includes certain unique acts. The Day of Atonement is the only fast provided in the Law; it is only on this occasion that (a) the Jews are required to "afflict their souls"; (b) the High Priest enters the Holy of Holies; (c) the High Priest offers incense before the mercy seat and sprinkles it with blood; and (d) the scapegoat or goat for Azazel is sent away into the wilderness, bearing upon him all the iniquities of the people. In later Judaism, especially from about 100 B.C., great stress was laid on the Day of Atonement, and it is now the most important religious function of the Jews.

The idea of vicarious atonement appears in the Old Testament in different forms. The nation suffers for the sin of the individual (Josh. vii., 10–15); and the individual for the sin of his kinsfolk (2 Sam. xxi., 1–9; Deut. v. g, 10); or of the nation (Ezek. xxxi. 3, 4). Above all the Servant of Yahweh appears as atoning for sinners by his sufferings and death (Is. liii.). But the Servant is nowhere identified with the Messiah.

New Testament. — In the New Testament, the English version uses "atonement" once, Rom. v. 11, for καταλλαγή (R.V. here and elsewhere "reconciliation"). This Greek word corresponds to the idea suggested by the etymology of at-one-ment, the reuniting in amity of those at variance, a sense which the word had in the 17th century but has since lost. But the idea which has usually been expressed by "atonement" is rather represented in the New Testament by ἱλασμός and its cognates, *e.g.*, I. John ii. 2, R.V., "He (Jesus) is the propitiation (ἱλασμός) for our sins." But these words are rare, and we read more often of "salvation" σωτηρία) and "being saved," which includes or involves restoration to communion with God. The leading varieties of teaching, the sayings of Jesus, St. Paul, the Johannine writings, the Epistle to the Hebrews, connect the Atonement with Christ especially with His death, and associate it with faith in Him and with repentance and amendment of life. It is quite clear that such teaching goes back to Jesus Himself. Attempts to dispute the authenticity of Mark x. 45 ("to give His life a ransom for many") and xiv. 24 (This is My blood of the covenant which is shed for many") have not been successful.

These ideas are also common to Christian teaching generally. The New Testament, however, does not indicate that its writers were agreed as to any formal dogma of the atonement, but various suggestions are made. St. Paul's teaching connects with the doctrine of Is. liii., and less directly with the ritual sacrifices (I. Cor. v. 7). It is developed mainly on legalistic lines. (Christ's righteousness makes possible the acquittal [δικαίωσις] of the sinner who has identified himself with Christ by faith [Rom. vi. 3–9, etc.]. His work is an expression of God's love to man (Rorn, v. 8). The redeeming power of Christ's death is also explained by his solidarity with humanity as the second Adam — the redeemed sinner has "died with Christ" (Rom. v. 15–19; vi. 8). Some atoning virtue seems also attributed to the Resurrection (Rom. iv. 25). In I. John, Christ is a "propitiation" (ἱλασμός) provided by the love of God that man may be cleansed from sin; He is also their advocate (Παράκλητος) with God that they may be forgiven, for His name's sake. Hebrews speaks of Christ as transcending the rites and officials of the law; He accomplishes the realities which they could only foreshadow; in relation to the perfect sacrifice which has atoned for sin, He is both priest and victim (Heb. ii. 17; ix. 14).

Later Interpretation. — The subsequent development of the Christian doctrine has chiefly shaped itself according to the Pauline formulae; the demands of divine righteousness were met on man's behalf, or in man's stead, by Christ, a formula, however, which left much room for controversy. The creeds and confessions are usually vague. Thus the Apostles' Creed, "I believe in the forgiveness of sins"; the Nicene Creed, "I believe in one Lord Jesus Christ . . . who for us men and for our salvation came down from heaven . . . I acknowledge one baptism for the remission of sins"; the Athanasian Creed, "Who (Christ) suffered for our salvation." In the Thirty-nine Articles of the Church of England we have (ii.) "Christ suffered . . . to reconcile His Father to us, and to be a sacrifice. not only for original guilt, but also for all actual sins of men" (so, verbally, the Augsburg Confession); and (xxxi.) "The offering of Christ once made is that perfect redemption, propitiation and satisfaction, for all the sins of the whole world." The Council of Trent declared that "*Christus . . . nobis sua sanctissima passione ligno crucis justificationem meruit et pro nobis deo patri satisfecit,*" "Christ earned our justification by His most holy passion and satisfied God the Father for us." The Westminster Confession declares: "The Lord Jesus Christ, by His perfect obedience and sacrifice of Himself, which He through the Eternal Spirit once offered up to God, hath fully satisfied the justice of His Father, and purchased not only reconciliation but an everlasting inheritance in the kingdom of heaven, for all those whom the Father hath given unto Him."

Individual theologians have sought to define more exactly the points on which the standards are vague. For instance, how was justice satisfied by Christ? The early Fathers, from the 3rd to the 11th century held, *inter alia,* that Christ paid a ransom to Satan to induce him to release men from his power. Anselm and the scholastics regarded the Atonement as a satisfaction to God's honour, rather than a ransom or a penalty, a satisfaction of such worth that the outrage of man's sin is made good. Hence this view is often called the *Satisfaction* Theory. The leading reformers emphasized the idea that Christ bore the punishment of sin, sufferings equivalent to the punishments deserved by men, a view especially characteristic of the later Calvinism, and known as the *Penal* Theory. But the intellectual activity of the Reformation also developed other views; the Socinians, with their humanitarian theory of the Person of Christ, taught that He died only to assure men of God's forgiving love and to afford them an example of obedience — "Forgiveness is granted upon the ground of repentance and obedience." Grotius put forward what has been called the *Governmental* Theory, viz., that the atonement took place not to satisfy the wrath of God, but in the practical interests of the divine government of the world, "The sufferings and death of the Son of God are an exemplary exhibition of God's hatred of moral evil, in connection with which it is safe and prudent to remit that penalty, which so far as God and the divine attributes are concerned, might have been remitted without it."

Modern Views. — The formal legal view continued to be widely held, though it was modified in many ways by various theologians. For instance, it has been held that Christ atoned for mankind not by enduring the penalty of sin, but by identifying Himself with the sinner in perfect sympathy, and feeling for him an "equivalent repentance" for his sin. Thus McLeod Campbell held that Christ atoned by offering up to God a perfect confession of the sins of mankind and an adequate repentance for them, with which divine justice is satisfied, and a full expiation is made for human guilt. A similar view was held by F. D. Maurice. Others hold that the effect of the atoning death of Christ is not to propitiate God, but to reconcile man to God; it manifests righteousness and thus reveals the heinousness of sin; it also reveals the love of God, and conveys the assurance of His willingness to forgive or receive the sinner; thus it moves men to repentance and faith, and effects their salvation; so substantially Ritschl. This view, which is found as early as Abélard, is commonly called the *Moral* Theory. In England much influence has been exerted by Dr. R. W. Dale's *Atonement,* the special point of which is that the death of Christ is not required by the personal demand of God to be propitiated, but by the necessity of honouring an ideal law of righteousness. This view, however, leads to a dilemma; if the law of righteousness is simply an expression of the divine will, satisfaction to law is equivalent to propitiation offered to God; if the law has an independent position, the view is inconsistent with pure monotheism.

Dale's attempt to restate the Penal Theory in a form free from objection on ethical grounds was followed on rather less definite lines by J. Denney in his *Death of Christ* and *Atonement and the Modern Mind.* The general trend of recent thought has been, however, in the direction (a) of much more strongly modified

transactional statements and (b) of a moral theory, stated as objectively as possible. Of the first of these types a good example is J. Scott Lidgett's *Spiritual Principle of the Atonement,* in which it is insisted that God should be regarded as a loving Father rather than a Judge, and the work of atonement is restated in the light of this principle. An even more influential book is R. C. Moberly's *Atonement and Personality.* Here an attempt is made to work out the implications of McLeod Campbell's suggestion that vicarious penitence, rather than vicarious suffering, is the key to atonement. Moberly retains the conception of an objective transaction, but interprets this along the lines of the Moral Theory, as an expression of love. This combination of views is made possible by emphasis upon the mystical self-identification of Christ with the sinner. More recently H. Rashdall (*The* Idea *of Atonement in Christian Theology*) has devoted a long and careful historical discussion to a defence of the Moral Theory in its simpler and less objective form, and his work has given a considerable impetus in Modernist circles to views of this type. There is, however, an undoubted reaction from such extreme treatments of the subject and both Rashdall's historical data and his reconstruction have been widely criticized. Meanwhile modified forms of Anselm's Satisfaction Theory, often expressed in terms of sacrifice, still hold the field in popular theology of a Catholic type and in devotional literature.

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AT OR BETTER, a term used in instructions to brokers in the securities or commodities markets which means, if it is in a selling order, to sell at the price specified or higher; or if it is in a purchase order, to buy at the price specified or lower.

ATOUTS, the 22 emblematic cards, numbered from 1 to 21, and including one unnumbered card, used in the ancient game of tarrochino or tarots. (*See* CARDS, PLAYING.) Atouts is also the regular modern French word for trumps at Auction and Contract Bridge.

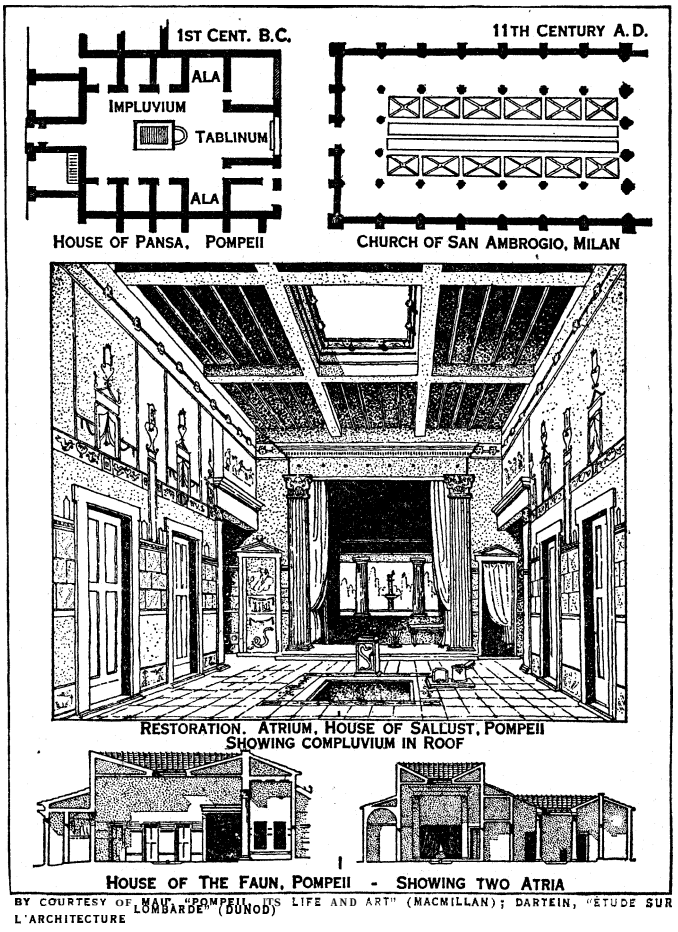
ATRATO, a river of western Colombia, South America, rising on the slopes of the Western Cordilleras, in 5° 36' N. lat., and flowing almost due north to the gulf of Uraba, or Darien, where it forms a large delta. Its length is about 400m., but owing to the heavy rainfall of this region it discharges no less than 175,000cu.ft. of water per second, together with a very large quantity of sediment, which is rapidly filling the gulf. The river is navigable to Quibdo (250m.), and for the greater part of its course for large vessels, but the bars at its mouth prevent the entrance of sea-going steamers. Flowing through the narrow valley between the Cordillera and coast range, it has only short tributaries, the principal ones being the Truando, Sucio and Murri. The gold and platinum mines of Choco were on some of its affluents, and the river sands are auriferous. The Atrato at one time attracted considerable attention as a feasible route for a trans-isthmian canal, which, it was estimated, could be excavated at a cost of £11,000,000.

ATREK, (ATRAK) a river which rises in lat. 37° 10′ N., long. 59° E., in the mountains of the north-east of the Persian province of Khorasan, and flows west along the borders of Persia and the Turkmen S.S.R. (*q.v.*). After a course of 350 mi., it enters the south-eastern corner of the Caspian sea, its mouth being in the Turkmen S.S.R., a little north-north-west of the Persian town of Astarabad.

ATREUS, in Greek legend, son of Pelops and Hippodameia, elder brother of Thyestes and king of Mycenae. His wife Aerope was seduced by Thyestes, who was driven from Mycenae. To avenge himself, Thyestes sent Pleisthenes (Atreus's son whom Thyestes had brought up as his own) to kill Atreus, but Pleisthenes was himself slain by his own father. After this Atreus, apparently reconciled to his brother, recalled him to Mycenae and set before him the flesh of his son whom Atreus had slain. Thyestes fled in horror. Subsequently Atreus married the daughter of Thyestes, Pelopia, mother of Aegisthus (*q.v.*). Thyestes was found by Agamemnon and Menelaus, the sons of Atreus, and imprisoned at Mycenae. Aegisthus being sent to murder Thyestes, mutual recognition took place, and Atreus was slain by the father and son, who seized the throne, and drove Agamemnon and Menelaus out of the country. Atreus is generally identified with the Attarissiyas of the Boghaz-Keui tablets.

ATRI, Abruzzi, Italy, province of Teramo, 18m. W. of Teramo station on the railway from Ancona to Foggia, and 18m. due E.S.E. of Teramo, on the site of the ancient Hadria (*q.v.*). Pop. (1936), 3,837 (town); 12,735 (commune). Its Romanesque-Gothic cathedral (1285–1305) is remarkably fine, though the interior was spoilt by restoration in 1657. The crypt was originally a Roman cistern. The palace of the Acquaviva family, dukes of Atri from the 14th century to 1775, stands on the principal square.

ATRIUM, originally the central room of a Roman house in which was placed the hearth. As this room had a hole in the roof to let out the smoke the atrium was in essence a small court, and when with the developing complexity of the Roman house the kitchen and hearth were removed to other positions the atrium remained as a court serving as a formal reception room and as the official centre of family life. By the end of the republic the addition of one or more colonnaded courts in the larger houses removed from the atrium the last vestiges of family life and in the empire it became practically the office of the owner of the



BY COURTESY OF MAU, "POMPEII, ITS LIFE AND ART" (MACMILLAN); DARTEIN, "ÉTUDE SUR L'ARCHITECTURE LOMBARDE" (DUNOD)

house. The atrium might be either with or without columns; it had. universally, a marble basin which was known as the *impluvium.* This was situated in the centre under the opening in the roof called the *compluvium.*

The term atrium is used in a generic sense (like the English "hall") as in the Atrium Vestae, the house of the vestal virgins. The word was later used for any open court, especially that around a temple or in front of a Christian church as in San Clemente at

Rome and San Ambrogio at Milan. Occasionally the word is incorrectly used for narthex (*q.v.*). (T. F. H.)

ATROPATENE or **MEDIA ATROPATEME,** anciently the district now occupied by the Azerbaijan republic and the Persian province of the same name. It formed part of the ancient Persian empire and the empire of Alexander, but in the confusion following the latter's death, secured for a considerable time the rank of an independent State. (See PERSIA: Ancient History, and PARTHIA.)

ATROPHY, a medical term implying wasting from some interference with healthy nutrition. Waste and repair are constant processes in the animal body; when they balance, the volume of the body and of its constituent parts remains constant; when repair is greater than waste there is growth or hypertrophy; when waste is greater than repair there is atrophy. The chief causes of atrophy are (1) disuse, (2) pressure, (3) interference with nervous supply. Thus the diminution in size of the pregnant uterus after child birth, the shrivelling of thymus and umbilical vessels in the infant, are atrophies from disuse; the disappearance of soft tissues and even bone in the neighbourhood of tumours, or an aneurysm, is an example of pressure-atrophy; the wasting of limbs in disease affecting the large motor ganglia of the ventral horns of the spinal cord, or the anterior nerve roots or efferent nerves, is atrophy from interference with nervous supply.

These causes may act singly or in conjunction, and may themselves be dependent upon antecedent conditions. A limb may atrophy from disuse because disease of bone, or of joint, renders movement painful, and pressure-atrophy depends upon interference of blood supply which the pressure induces. For interference with nervous supply to cause atrophy of muscle—other than disuse-atrophy—it is necessary for the efferent nerve to be disorganized in some part of its course. Hence in paralysis affecting the leg, when the lesion is in the brain, such atrophy as occurs is due to disuse, whereas in infantile paralysis and progressive muscular atrophy, the lesion is in the large multipolar cells of the ventral horns of the spinal cord, and the atrophy of muscle is truly of nervous origin and far more conspicuous. Interference with afferent or sensory nerves causes atrophy of skin and subcutaneous tissue. This is seen in certain injuries to nerves. Thus, severance of the radial nerve (or musculo-spinal from which it arises) occasions a glossy condition of the skin covering the thumb, index, middle and contiguous half of the ring finger, and the skin becomes as thin as paper.

The intimate structure of an atrophied part may be little or greatly altered. In the natural atrophy accompanying old age the microscope shows little difference from normal adult conditions. The biceps of a man aged 80 is visibly smaller than that of a pugilist aged 21, but the two could not easily be distinguished microscopically. The same is true of the muscle of an undersized and ill-developed factory worker. For this reason it is customary in pathology to distinguish between true atrophy and hypoplasia, the former signifying that the part regressed after having reached a normal size, the latter that it never reached the normal size. It is clear, too, that a part may be hypoplastic either because it is composed of fewer elements each of which is normal size, or because it contains a normal number of elements each of which is smaller than usual. Unknown factors of inheritance may control these two conditions.

In cases of true atrophy, particularly those moderately rapid in onset, the diminution in size is accompanied by other changes, such as fatty degeneration and fibrosis, which are recognizable microscopically. Even in the atrophy of muscle in the aged the muscle nuclei are packed more closely and appear somewhat shrivelled, but in the atrophy of muscle caused by pressure of an aneurysm these changes are well marked, and in the region where atrophy is greatest the muscle fibres contain numerous minute fat globules due to fatty degeneration of the protein substance. In the renal atrophy characteristic of chronic granular kidney, fatty changes and fibrosis co-exist with actual disappearance of true renal elements, but it is uncertain which is the primary change.

Sometimes these associated changes are so pronounced that their bulk more than counterbalances the diminished bulk due to atrophy itself, with the result that the part, though atrophied in respect of its essential elements, is actually larger than normal. Thus a fatty heart is atrophied so far as concerns its muscular elements, but may measure, and even weigh, more than the normal organ. In hypertrophic muscular paralysis, too, the muscles of calf and buttock are so large and firm that they give the impression of magnificent development, and yet they are totally inefficient for their function, and the microscope shows that their bulk is composed of fat and fibrous tissue almost to the exclusion of muscular fibres. In spite of appearances the condition is essentially atrophic. This disease does not come into the classes of atrophy mentioned above, for the cause is unknown; it seems to depend upon a hereditary factor and more than one member of a family may suffer from it.

Atrophy may be very rapid in onset. In acute yellow atrophy of the liver, and in allied conditions caused by some poisons, the organ may diminish in size to one-third or half within a few days. Under these circumstances the destructive changes are so intense that it may be impossible to recognize hepatic substance in the fatty, blood-impregnated and pigmented material revealed by the microscope. But as a rule atrophy is a gradual and slow process.

Since an atrophied part is abnormal and depends upon abnormal nutrition, it is sensitive to conditions which the normal part can resist. The small injuries and adverse circumstances of life produce disproportionately great results in the first instance, and reparative processes are correspondingly slow and unsatisfactory. Sometimes it becomes necessary to consider surgical removal of the affected part. In cases due to severance of a nerve, suture of the divided ends may effect great improvement or even a cure. In the case of muscles and skin suffering from disuse-atrophy, massage and surgical treatment of any underlying condition are indicated. But in many forms no treatment modifies the atrophy itself and treatment of symptoms as they arise alone is possible.

(W. S. L.-B.)

ATROPINE, a poisonous, crystalline alkaloid (see ALKALOIDS) widely used in medicine. It does not normally occur in nature, but is derived from laevo-hyoscyamine and laevo-hyoscine (see HYOSCYAMINE and HYOSCINE), found in various plants of the nightshade family, as belladonna (Atropa), henbane (*Hyoscyamus*), thorn-apple (Datura) and *Scopolia.* Pure atropine, $C_{17}H_{23}O_3N$, crystallizes from alcohol on addition of water in colourless prisms, which melt at 118° C It is readily soluble in alcohol or chloroform, less so in ether, and almost insoluble in water. When atropine was first prepared in 1833 the processes in use for the extraction of alkaloids were too crude to avoid racemization of laevo-hyoscyamine, and so the racemic isomeride, atropine, was obtained, and partially racemic mixtures were later on mistaken for new alkaloids, of which "daturine," "duboisine," etc., are examples. Atropine is now made by racemization, with small quantities of alkali, of crude *l*-hyoscyamine, the best source of which is Egyptian henbane (*Hyoscyamus* muticus). The alkaloid may be extracted by the process described in the article ALKALOIDS, and is generally purified after racemization by conversion into, and re-crystallization of, the neutral oxalate. Atropine forms a series of well-crystallized salts, of which the sulphate $(C_{17}H_{23}O_3N)_2,H_2SO_4,H_2O$ is that principally used in medicine. This salt crystallizes in long, slender, colourless needles (which break up on exposure to air to a crystalline powder) and melts at 194° C. Both atropine and hyoscyamine have been synthesized and are known to be respectively the racemic and laevo-tropic esters of tropine (*q.v.*) and many attempts have been made to improve on them. The most successful attempt of this kind is *homatropine,* which is a phenylglycollic ester of tropine, and is a powerful mydriatic, more rapid but also more transient in its action than atropine.

MEDICAL USES

Medicine — The official doses of atropine or its sulphate are from $\frac{1}{200}$ to $\frac{1}{100}$ grain. The most valuable preparations of this drug are the liquor atropinae *sulphatis,* which is a 1% solution, and the lamella—for insertion within the conjunctival sac—which contains $\frac{1}{5,000}$ grain of atropine.

Pharmacology.—When rubbed into the skin with such substances as alcohol or glycerine, which are absorbed, atropine paralyses the terminals of the pain-conducting sensory nerves. It acts similarly, though less markedly, upon the nerves governing the secretion of sweat and is therefore a local anaesthetic or anodyne and an anhidrotic. Being rapidly absorbed into the blood, it acts on nearly every part and function of the nervous system. Its most remarkable action is that upon the terminals of nearly all the secretory nerves in the body. Sweating and secretion of saliva and mucus in the mouth and throat are arrested. But certain nerve fibres from the sympathetic nervous system, which can also cause the secretion of a (specially viscous) saliva, are entirely unaffected by atropine. A curious parallel to this occurs in its action on the eye. The secretions of stomach, intestines, liver, pancreas and kidneys are reduced, though not arrested, as in the other cases. The secretion of mucus by the bronchi and trachea is greatly reduced and their muscular tissue is paralysed. The secretion of milk is much diminished or entirely arrested. Given internally, atropine does not exert any appreciable sedative action upon the sensory nerves.

The action of atropine on the motor nerves is equally important. Those that go to the voluntary muscles are depressed only by very large and dangerous doses. But moderate doses of atropine paralyse the terminals of the nerves of involuntary muscles, whether motor or inhibitory. In the intestine, for instance, are layers of muscle-fibre which are constantly being inhibited by the splanchnic nerves. These are paralysed by atropine, and intestinal peristalsis becomes more active, the muscles being released from nervous control. The motor nerves of the arteries, of the bladder and rectal sphincters, and of the bronchi, are also paralysed by atropine. The action upon the vaso-motor system is fairly clear. Whether affected entirely by action on the nerve terminals, or by an additional influence upon the vaso-motor centre in the medulla oblongata, atropine causes extreme dilatation of the blood-vessels, the skin becomes flushed and there may appear, after large doses, an erythematous rash, which must be carefully distinguished, in cases of supposed belladonna poisoning, from that of scarlet fever: especially as the temperature may be raised and the pulse is very rapid in both conditions. But the first action of atropine is to stimulate the vaso-motor centre — thereby causing temporary contraction of the vessels — and to increase the rapidity of the heart's action, so that the blood-pressure rapidly rises. Though transient, this action is so certain, marked and rapid, as to make the subcutaneous injection of atropine invaluable in certain conditions. Since the respiratory centre is similarly stimulated, atropine must be regarded as a temporary but efficient respiratory and cardiac stimulant.

Toxic doses of atropine — and therefore of belladonna — raise the temperature several degrees. The action is probably nervous. In small therapeutic and in small toxic doses it stimulates the motor apparatus of the spinal cord, just as it stimulates the centres in the medulla oblongata. In large toxic and in lethal doses the activity of the spinal cord is lowered.

No less important than any of the above is the action of atropine on the cerebrum, a state closely resembling that of delirium tremens being induced. In cases of poisoning the delirium may last for many hours or even days. Thereafter a more or less sleepy state supervenes due to exhaustion after the long period of cerebral excitement. It is to be noted that children who are particularly susceptible to the influence of certain of the other potent alkaloids, such as morphine and strychnine, will take relatively large doses of atropine without ill-effect.

The action of atropine on the eye is of high theoretical dnd practical importance. The drug affects only the involuntary muscles of the eye, just as it affects only the involuntary or non-striated portion of the oesophagus. The result of its instillation into the eye — and the same occurs when the atropine has been absorbed elsewhere — is rapidly to cause wide dilatation of the pupil. As a result, the tension of the eyeball is greatly raised. The sight of many an eye has been destroyed by the use of atropine — in ignorance of this action on the intra-ocular tension — in cases of incipient glaucoma. The use of atropine is absolutely contra-indicated in any case where the intra-ocular tension already is, or threatens to become, unduly high. The fourth ocular effect of atropine is the production of a slight but definite degree of local anaesthesia of the eyeball. It follows from the above that a patient who is definitely under the influence of atropine will display rapid pulse, dilated pupils, a dry skin and a sense of discomfort, due to dryness of the mouth and throat.

Therapeutics. — The external uses of the drug are mainly analgesic. The liniment or plaster of belladonna will relieve many forms of local pain; but totally to be reprobated is the use, in order to relieve pain, of belladonna or any other application which affects the skin, in cases where the surgeon may later be required to operate. In such cases, it is necessary to use such anodyne measures as will not interfere with the subsequent demands that may be made of the skin, *i.e.*, that it be aseptic and in a condition so sound that it is able to undertake the process of healing itself after the operation has been performed. Atropine is universally and constantly used in ophthalmic practice in order to dilate the pupil for examination of the retina by the ophthalmoscope, or in cases where the inflamed iris threatens to form adhesions to neighbouring parts. The drug is often replaced in ophthalmology by homatropine (*vide* supra). The anhidrotic action of atropine is largely employed in controlling the night-sweats characteristic of pulmonary tuberculosis.

Atropine, used as a plaster or internally, often relieves cardiac pain. Professor Schäfer recommended the use of atropine prior to the administration of a general anaesthetic, in cases where the action of the vagus nerve upon the heart is to be dreaded. It is of value as an antidote in poisoning by pilocarpine, muscarine (mushroom poisoning), etc.

In cases of whooping-cough or any other condition in which there is spasmodic action of the muscular fibre in the bronchi — a definition which includes nearly every form of asthma and many cases of bronchitis — atropine is an almost invaluable drug. Not only does it relieve the spasm, but it lessens the amount of secretion — often dangerously excessive — which is often associated with it. The relief of symptoms in whooping-cough is sharply to be distinguished from any influence on the course of the disease, since the drug does not abbreviate its duration by a single day. In treating an actual and present attack of asthma, it is advisable to give the standardized tincture of belladonna — unless expense is no consideration, in which case atropine may itself be used — in doses of twenty minims every quarter of an hour as long as no evil effects appear. The nocturnal urinary incontinence of children and of adults is frequently relieved by this drug.

Toxicology. — The symptoms of poisoning by belladonna or atropine are dealt with above. The essential point here to be added is that death takes place from combined cardiac and respiratory failure. This fact, is, of course, the key to treatment. This consists in the use of emetics or the stomach-pump, with lime-water, which decomposes the alkaloid. These measures are, however, usually rendered nugatory by the very rapid absorption of the alkaloid. Death is to be averted by such measures as will keep the heart and lungs in action until the drug has been excreted by the kidneys. Inject stimulants subcutaneously; give coffee — hot and strong — by the mouth and rectum, or use large doses of caffeine citrate; and employ artificial respiration. Do not employ such physiological antagonists as pilocarpine or morphine, for the lethal actions of all these drugs exhibit not mutual antagonism but coincidence.

ATROPOS, in Greek mythology, the eldest of the three Fates. Her name, the "Unalterable," indicates her function, that of rendering the decisions of her sisters irreversible or immutable. Atropos is most frequently represented with scales, a sun-dial or a cutting instrument, the "abhorred shears" with which she "slits the thin-spun life." Of the two other Fates (Moirai), Clotho is she who spins the thread of life, represented with a spindle, and Lachesis, she who casts lots as to its length, drawing a lot or pointing to the globe (see also FATE).

ATROSCINE: see HYOSCINE.

AT SIGHT, a term used on bills of exchange and drafts meaning that they are payable upon presentation or demand. Such

instruments are ordinarily known as sight drafts (*q.v.*), or sight bills of exchange (*q.v.*).

ATTA, TITUS QUINTIUS (QUINTICIUS) (d. 77 B.C.), Roman comedy writer, was distinguished as a writer of national comedies.

See Aulus Gellius vii. 9; Ribbeck, Comicorum Latinorum *reliquiae* (1855).

ATTACHMENT, in law, a process from a court of record, awarded by the justices at their discretion, on a bare suggestion, or on their own knowledge, and properly grantable in cases of contempt. It differs from arrest (*q.v.*), in that he who arrests a man carries him to a person of higher power to be forthwith disposed of; but he that attaches keeps the party attached, and presents him in court at the day assigned, as appears by the words of the writ. Another difference is, that arrest is only upon the body of a man, whereas an attachment is often upon his goods. It is distinguished from distress in not extending to lands, as the latter does; nor does a distress touch the body, as an attachment does. See PRACTICE AND PROCEDURE.

ATTACK is a word used in various senses in musical terminology. Thus in the form attncca (Ital.) it is a direction to proceed without pause to the next movement or section of a composition. "Good attack" applied to a performance signifies a performance characterized by spirit, decision and good ensemble; a use of the term allied with the French chef *d'attaque* as a designation for the leader of an orchestra. Attacco (Ital.), in turn, is a term applied to a short phrase or episodic subject in a fugue.

ATTAINDER, in English law, was the immediate and inseparable consequence from the common law upon the sentence of death. When it was clear beyond all dispute that the criminal was no longer fit to live he was called *attaint,* and could not, before the Evidence Act 1843, be a witness in any court. This attainder took place after judgment of death, or upon such circumstances as were equivalent to judgment of death, such as judgment of outlawry on a capital crime, pronounced for absconding from justice. Conviction without judgment was not followed by attainder. The consequences of attainder were (1) forfeiture, (2) corruption of blood. On attainder for treason, the criminal forfeited to the Crown his lands, rights of entry on lands, and any interest he might have in lands for his own life or a term of years. For murder, the offender forfeited to the Crown the profit of his freeholds during life, and in the case of lands held in fee-simple, the lands themselves for a year and a day; subject to this, the lands escheated to the lord of the fee. These forfeitures related back to the time of the offence committed. Forfeitures of goods and chattels ensued not only on attainder, but on conviction for a felony of any kind, or on flight from justice, and had no relation backwards to the time of the offence committed. By *corruption* of blood, "both upwards and downwards," the attainted person could neither inherit nor transmit lands. The lands escheated to the lord of the fee, subject to the Crown's right of forfeiture. The doctrine of attainder has, however, ceased to be of much importance. The Forfeiture Act 1870 enacted that henceforth no confession, verdict, inquest, conviction or judgment of or for any treason or felony, or *felo* de se, should cause any attainder or corruption of blood, or any forfeiture or escheat.

Bills of Attainder, in English legal procedure, were formerly a parliamentary method of exercising judicial authority. They were ordinarily initiated in the House of Lords and the proceedings were the same as on other bills, but the parties against whom they were brought might appear by counsel and produce witnesses in both Houses. In the case of an impeachment (*q.v.*), the House of Commons was prosecutor and the House of Lords judge; but such bills being legislative in form, the consent of Crown, lords, and commons was necessary to pass them. Bishops, who do not exercise but who claim the right to vote in cases of impeachment (*q.v.*), have a right to vote upon bills of attainder, but their vote is not conclusive in passing judgment upon the accused. First passed in 1459, such bills were employed, more particularly during the reigns of the Tudor kings, as a species of extrajudicial procedure, for the direct punishment of political offences. Dispensing with the ordinary judicial forms and precedents, they took away from the accused whatever advantages he might have gained in the courts of law; such evidence only was admitted as might be necessary to secure conviction; indeed, in many cases bills of attainder were passed without any evidence being produced at all. In the reign of Henry VIII. they were much used, through a subservient parliament, to punish those who had incurred the king's displeasure; many distinguished victims who could not have been charged with any offence under the existing laws being by this means disposed of. In the 17th century, during the disputes with Charles I., the Long Parliament made effective use of the same procedure, forcing the sovereign to give his consent. The most famous cases were those of Strafford and Laud. After the Restoration it became less frequent, though the Jacobite movement in Scotland produced several instances of attainder, without, however, the infliction of the extreme penalty of death. The last bill of attainder passed in England was in the case of Lord Edward Fitzgerald, one of the Irish rebel leaders of 1798.

A bill for reversing attainder takes a form contrary to the usual rule. It is first signed by the Sovereign and presented by a peer to the House of Lords by command of the Crown, or, in other words, it is entirely within the Crown's grace and favour. Such bills for reversal are not obsolete as they are the first step necessary by a claimant to a peerage which has fallen into abeyance (see PEERAGE) when the ancestor was attainted. The House of Lords has recently (1928) adopted a report recommending that such attainders be not reversed "where the attainder has been in existence for several centuries."

The Constitution of the United States forbids Congress to pass any bill of attainder or ex post facto law. Most of the State constitutions contain similar prohibitions.

ATTAINT, WRIT OF, an obsolete method of procedure in English law, for inquiring by a jury of 24 whether a false verdict had been given in a trial before an ordinary jury of 12. It originated in the days when jurors were regarded as witnesses as well as judges and a false verdict was regarded as perjury. If it were found that an erroneous judgment had been given, the wrong was redressed and the original jury incurred infamy, with imprisonment and forfeiture of their goods, which punishments were, however, commuted later for a pecuniary penalty. In criminal cases a writ of attaint was issued at suit of the king, and in civil cases at the suit of either party. In criminal cases it appears to have become obsolete by the end of the 15th century, although juries were sometimes fined by the Star Chamber for acquittal. Procedure by attaint in civil cases had also been gradually giving place to the practice of granting new trials, and after the decision in Bushell's case in 1670 (see PRACTICE AND PROCEDURE) it became obsolete, and was finally abolished by the Juries Act 1825, except as regards jurors guilty of embracery (*q.v.*).

ATTALEIA, an ancient city of Pamphylia, which derived its name from Attalus II., king of Pergamum; the modern Adalia (*q.v.*). It was important as the nearest seaport to the rich districts of south-west Phrygia. A much-frequented "half-sea" route led through it to the Lycus and Meander valleys, and so to Ephesus and Smyrna. This was the natural way from any part of central Asia Minor to Syria and Egypt, and accordingly we hear of Paul and Barnabas taking ship at Attaleia for Antioch. Originally the port of Perga, Attaleia eclipsed the old Pamphylian capital in early Christian times and became the metropolis. There are extensive remains of the ancient walls. The most conspicuous monument is the triple Gate of Hadrian, flanked by a tower built by the empress Julia.

ATTALUS, the name of three kings of ancient Pergamum.

Attalus I., Soter, king of Pergamum, succeeded Eumenes I. at Pergamum in 241 B.C. Soon after his accession (perhaps 235) he defeated the Galatians in a great battle, as a result of which he took the title of king, and by defeating Antiochus Hierax extended his boundaries over a large area in Asia Minor. Most of the rest of his life was occupied with wars against Philip V. of Macedon. He fought with Rome and the Aetolians against Philip and the Achaeans in 211, and joined in the general peace made in 204. In 201 war again broke out between Philip and Rhodes,

and Attalus joined the Rhodians. He died at Pergamum in 197. During his reign the court of Pergamum was one of the centres of Hellenistic culture. A Pergamese school of sculpture arose, stimulated by the dedication of votive figures to the great shrines after the victory over the Galatians, of which the so-called "Dying Gladiator" is one. There was equal activity on the literary side; there were a great library and a Stoic Academy.

Attalus II., king of Pergamum, was born in 200 B.C. He served as a general under his brother Eumenes II. and commanded the Pergamene contingent that served the Romans in their expeditions in Galatia (189) and Greece (171). He visited Rome frequently as an ambassador, and succeeded his brother in 159. Secure in his alliance with Rome, he played a successful part in the wars and diplomacy of the East, though Rome had to intervene actively when he was besieged in his capital by Prusias II. of Bithynia in 154. Under Attalus II. Pergamum retained its rank as a centre of Hellenistic culture, and is especially notable for Crates, the Homeric critic. He died in 138.

Attalus III., Philometor, succeeded his uncle Attalus II. in 138 B.C. A very different type of ruler from his predecessors, he introduced the Pergamese to the methods of Asiatic tyranny, from which they had previously been secure. After pursuing an eccentric career, largely devoted to gardening and sculpture, he died in 133. The sole importance of his reign lies in his will. As the last of the Attalic house he could dispose of the sovereignty, and he bequeathed it to Rome. Rome accepted it and became involved in a struggle with the pretender Aristonicus (*q.v.*).

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ATTAR OF ROSES, a perfume prepared by macerating or distilling roses, mainly the Rosa damascena. The essential oil obtained is a beautiful, precious and very costly material, costing as much as £50 a pound. Some 250 lbs. of roses are needed to make a single ounce of the attar, which means that several ac. of land yield only that small quantity of the perfume. The word attar, sometimes corrupted as "otto," is from the Persian 'attar, essence. The manufacture is chiefly oriental, in India and Persia, but it is also carried on in France and the Balkans.

ATTEMPT, in law, an act done with intent to commit a crime, and forming one of a series of acts which would constitute its actual commission if it were not interrupted. Mere intention to commit a crime is not sufficient, and an attempt must proceed to an overt act, but at the same time it must fall short of the ultimate purpose in any part of it. A person may be guilty of an attempt to commit a crime, even if its commission in the manner proposed was impossible. Every attempt to commit a felony or misdemeanour is in itself a common law misdemeanour, punishable by fine or imprisonment, unless the attempt to commit is specifically punishable by statute as a felony, as in the case of attempted murder, or in a defined manner as a misdemeanour; and a person who has been indicted for a felony or misdemeanour may, if the evidence so warrants, be found guilty only of the attempt.

ATTENTION. The term is employed in psychology sometimes in a wider, and sometimes in a narrower sense. In the narrower sense, which coincides more or less with the popular use of the term, attention means that mental process by which some object comes to be apprehended more clearly or distinctly than before it was attended to, or by which one object occupies the focus of consciousness while others (to which attention is not directed) are in the margin or periphery of consciousness. In the wider sense of the term attention denotes the mental process in virtue of which anything becomes an object of consciousness at all, as compared with the multitude of stimuli which never find entry into consciousness, although they are within reach of the observer. The wider sense is the more convenient, provided it is recognized that there are many degrees of attention varying from what is commonly called inattention (that is, a very low degree of attention) to the highest concentration. Attention in all its forms, and especially in its higher forms, is a process of selection, a form of preferential treatment — some things are admitted into consciousness whereas others are not, or some are placed in the very centre of consciousness whereas others are relegated to the margin. It is largely by the exercise and distribution of attention that the human mind may be said to assert itself against becoming the passive target of external stimulations.

The general effect of attention is that a certain object is admitted into consciousness while others are excluded, or that an object which receives more attention is apprehended more clearly. The resulting difference is not a difference in intensity but a difference in clearness. When, *e.g.,* special attention is concentrated on the first violin in a trio its notes do not become louder but clearer. One rarely mistakes an increase in clearness for an increase in intensity. Only some people confuse the two merely because both changes have the same kind of effectin so far as the object in question is helped to occupy a more central place in consciousness. For, as will be pointed out presently, the intensity of a stimulus, and therefore an increase in intensity, is one of the conditions which help to determine attention or to attract attention to the stimulus, and so give it a prominent place in consciousness. A negative result of attention directed to any object is that other objects receive either no attention or less attention than they would otherwise receive, that is to say they are either excluded from the field of consciousness or are relegated to a back place.

The conditions which influence the direction of attention to some objects rather than to others are of two principal kinds. The direction of attention is determined partly by the nature of the objects claiming attention, and partly by the disposition and character of the individual mind or subject exercising attention. The two sets of conditions may accordingly be described as the objective and the subjective conditions respectively.

Objective Conditions. — The objective conditions of attention are to be sought mainly in the intensity, volume, duration, and novelty of the objective stimulus claiming attention. A brilliant light or a shrill noise is more likely to attract attention than a feeble light or a soft sound. Again, within certain limits, a stimulus of longer duration is more likely to attract attention than a momentary one. Similarly a large object is more likely to be noticed than a small one. But most important of all the objective conditions is novelty, or change from preceding stimulation. Though the duration of a stimulus is favourable to its being noticed, yet a point is soon reached when its very sameness leads to its being ignored in favour of some new stimulus or some change in an existing stimulus. Change as such tends to attract attention. The sudden cessation in the motion of a mill or in the ticking of a clock will be noticed when the preceding uniform sound of either has ceased to attract attention. The importance of change of stimulus (including movement or apparent movement) in attracting attention is realized and exploited by the purveyors of luminous advertisements.

Subjective Conditions. — The subjective conditions of attention turn mainly on the momentary pre-occupations or the permanent interests of the individual mind. We may distinguish several forms in which such pre-occupations or interests may influence the direction of attention. First, there is the influence of the idea or experience which happens to occupy our attention at the moment, or did so shortly before. If we happen to be thinking of an object, it will attract our attention even under conditions in which it would otherwise have escaped our notice. Similarly a distant aeroplane though difficult to locate at first may be easily followed once it has been observed or spotted. Secondly, there is the mental *attitude* of the individual at the moment. A mental attitude is a kind of limited orientation. It favours whatever appears relevant to it, and resists everything else. In its simplest and most obvious form the general nature of a mental attitude is exemplified when a question occurs to one spontaneously, or is put to us by somebody else. The effect is a certain kind of expectancy and preparedness for anything that may help to answer the question or to solve the problem. If one is asked, or asks himself, about the architectural character of a clock-tower in front of him, he will attend to its architectural character, and

probably fail to note the time indicated by the clock; if he is asked the time, he will note this, and probably fail to observe the architectural form of the tower, or even the character of the numerals on the face of the clock, until he is asked whether they are Roman or Arabic, etc. On the whole it is remarkable how little most people really notice for which their mental attitude is not set. This is not altogether to be regretted, for it means a certain economy of mental effort. Lastly, there is the influence of one's entire previous training, that is, one's general mental outlook or orientation, or his dominant disposition or permanent interests, as determined by his whole previous education, in the widest sense of the term. In a miscellaneous exhibition different people will direct their attention to different exhibits according to their knowledge of the different fields of interest to which the objects belong. Of the miscellaneous contents of a newspaper different parts will similarly attract the attention of different people according to their previous training. Even if they all read the major portion of the newspaper, they will read the several parts each in a different order.

Various Kinds of Attention. — Psychologists usually distinguish various kinds of attention, and the classification is based on various grounds. Sometimes the classification is based on the differences in the kind of objects to which attention is directed. In this case we get the distinction between *sensorial attention* and *ideational attention,* according as the object attended to is a sensible object or an idea. More important are the distinctions based on the effort exerted. This distinction, however, is intimately bound up with that of interest. And the otherwise laudable attempt to combine both these bases in one scheme of classification has led to a somewhat inconsistent use of terms in this connection, the trouble being mainly due to the ambiguity of the epithet "voluntary," which is sometimes used in the sense of "involving volition" or effort, and sometimes in the sense of "free" or "willing" or "spontaneous," "not constrained." The most important distinctions may be indicated as follows: It is a familiar experience that we sometimes pay attention to something because it interests us, whereas at other times we attend to things by an effort of will. The former is called *attention from interest,* the latter is called *attention from effort.* The former is usually spontaneous and easy, the latter is often unpleasant and a strain. The former, again, is frequently called *spontaneous attention,* the latter *volitional or voluntary attention.* Again, attention is sometimes attracted by the mere intensity of some external stimulus such as a loud noise or a flash of light. The attention in this case involves no effort at all, and the object may or may not prove interesting. Such attention is often called *involuntary attention,* because it is often exercised in spite of our wish to attend to something else.

The Duration of Attention. — The concentration of attention upon some object or thought may continue for a considerable time among normal people. But what is commonly called an object or a thought is something very complex having many parts or aspects, and our attention really passes from part to part, backwards and forwards all the time. Our attention to what can be seriously called a single thing, affording no opportunities for the movement of attention from part to part, say a small patch of colour, cannot be held for more than about a second without serious risk of falling into a hypnotic trance or some similar pathological condition.

The Span of Attention. — How many objects can be attended to at one time? Many people have the impression that they can attend to a number of things at the same time. What really happens in such cases is that their attention alternates from one object to another, so that they really do attend to a multiplicity of things within a given time, only successively. But if the expression "at one time" is taken strictly, then it seems very doubtful whether more than one object (or at most a group of four or five things forming one object) can be attended to at once. When, in experiments on attention, objects are exposed for a small fraction of a second, then as a rule only one object is apprehended. Even when with somewhat longer exposures four or five objects appear to be apprehended by the subject there is some ground for supposing that most of them are really observed in the form of after-images rather than as direct percepts.

Abnormalities of Attention. — In normal life one does not always concentrate one's attention on anything special, but scatters it somewhat diffusely over a number of objects, passing more or less rapidly from one thing to another. This is healthy up to a point — it is a form of mental relaxation. But when such a state of comparative inattention becomes chronic, it is a symptom of a pathological mental condition. There are so-called "scatter-brained" people who are constitutionally incapable of concentrating attention on anything for long. If they enquire about anything their interest in it seems exhausted by the time they have put the question, and they proceed to put another question before the first has been answered. This condition is sometimes a passing phase with children, but chronic with the feeble-minded, or the mentally unstable. The opposite abnormality to such instability of attention is seen in people suffering from "fixed ideas." Even in normal life people sometimes concentrate attention on some one object or problem to such an extent that, for the time being, they are absorbed in it, and oblivious of everything else. This state of mind often betrays itself in what is called absent-mindedness, that is, inattention to most things because of special concentration on others. Up to a point this state, too, is healthy and effective. But when it becomes chronic and excessive it ends in a variety of abnormalities ranging from the harmless crank, to the fanatic, and the person suffering from fixed ideas and illusions from which he cannot divert his attention.

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ATTENUATION, in radio communication, is the reduction in power of a wave or a current with increasing distance from the source of transmission. Attenuation of an electric current or wave is ordinarily the result of the absorption or loss of power in certain elements of the circuit or transmission path. In some electrical circuits, particularly for currents of audio-frequencies, it is possible to make substantially equal the total attenuation for all frequencies within a certain range. A device used for this purpose is called an attenuation equalizer.

ATTERBOM, PER DANIEL AMADEUS (1790–1855), Swedish poet, son of a country parson, was born in the province of Östergötland. He studied in the university of Uppsala (1805–15) and became professor of philosophy there in 1828, and of aesthetics and literature in 1835. He was the first great poet of the romantic movement which was to revolutionize Swedish literature.

In 1807 he founded at Uppsala an artistic society, the Aurora League, whose first newspaper, *Polyfem,* was a crude effort, soon abandoned; but in 1810 there began to appear a journal, *Fosforos,* edited by Atterbom, which lasted for three years and found a place in classic Swedish literature. It consisted of poetry and aesthetico-polemical essays; it introduced the study of the new Romantic school of Germany, and formed a vehicle for the early works, not of Atterbom only, but of Hammerskold, Dahlgren, Palmblad and others. Later, the members of the Aurora League established the *Poetisk Kalender* (1812–22), in which their poems appeared, and a new critical organ, *Svensk Litteraturtidning* (1813–24).

Of Atterbom's independent works, the most celebrated is *Lycksalighetens O (The Fortunate Island),* a romantic drama published in 1824. Previously he had published a cycle of lyrics, *Blommorna (The Flowers),* of a mystical character somewhat in the manner of Novalis. Of a dramatized fairy tale, *Fagel bla (The Blue Bird),* only a fragment, which is among the most exquisite of his writings, is preserved. His *Svenska Siare och skalder* (1841–55, supplement, 1864), a series of biographies of Swedish poets and men of letters, forms a history of Swedish letters down to the end of the "classical" period. Atterbom's works were collected (13 vols., Örebro) in 1854–70.

ATTERBURY, FRANCIS (1662–1732), English man of letters, politician and bishop, was born at Milton, Bucks, the son of a clergyman. Educated at Westminster School and Christ Church, Oxford, he became a tutor of his college. He took holy orders in 1687, and was appointed one of the royal chaplains, but most of his time was spent in Oxford, where he was the chief

adviser of Dean Aldrich under whom Christ Church had become a centre of Toryism. He stood behind Charles Boyle in his attack on Richard Bentley, and in the *Rattle of the Books* S ift calls him the Apollo who directed the fight. In the high and low church controversy he was a witty and audacious champion of the high church clergy against what they regarded as the oligarchy of Erastian prelates. He was rewarded by the archdeaconry of Totnes, a prebend in Exeter Cathedral, and, after Queen Anne's accession, the deanery of Carlisle. In 1710 the prosecution of Sacheverell gave Atterbury another opportunity for the use of his powers of sarcasm and invective. He helped to frame the brilliant speech which the accused delivered at the bar of the House of Lords. With the fall of the Whigs his triumph came.

As prolocutor of the lower house of convocation, he drew up in 1711 the famous *Representation of the State of Religion,* and in August of that year Queen Anne, who had come to rely on Atterbury for advice in ecclesiastical matters, appointed him dean of Christ Church. He was not a good college administrator, and in 1713 was removed from Oxford to be bishop of Rochester.

Probably Atterbury was one of those who hoped to arrange matters so that at Queen Anne's death the act of succession could be easily set aside in favour of James Stuart, but on the accession of George I. he took the oath of allegiance and sought to ingratiate himself with the new court, though without success. He then violently opposed the new Government by his brilliant speeches in the House, and anonymously by pamphlets against the Hanoverians. When the rebellion of 1715 broke out in favour of the Pretender he refused to sign the address in which the bishops of the Province of Canterbury declared their attachment to the royal house, and in 1717 he began to correspond directly with the Pretender.

Atterbury was implicated in a plot in 1721 for the restoration of the Stuarts, and spent some months in the Tower in 1722. The evidence against him was insufficient for legal conviction, and recourse was had to a special bill in Parliament by which he was deprived of his ecclesiastical dignities and banished for life. For some years he was principal adviser to James, but, finding that his counsels were disregarded, he retired to Montpelier. For a brief period before his death on Feb. 22 1732, he was again in the Pretender's service. His remains were brought to England and secretly buried in Westminster Abbey.

In private life Atterbury was gentle and forbearing, and showed none of the acerbity and violence of the pamphleteer. Between him and his daughter, Mrs. Morice, there was tender affection; when he was ill in France she went over at the risk of her life to see him, and died immediately on her arrival. He was a close friend of Addison, and was on excellent terms with Pope, Swift, Arbuthnot and Gay.

See F. Williams, *Memoirs and Correspondence of Atterbury witlz Notes,* etc. (1869); *Stuart Papers,* vol. i.: *Letters of Atterbury to the Chevalier St. George,* etc. (1847); J. Nichols, *Epistolary Correspondence,* etc. (1783–96); and H. C. Beechmg, *Francis Atterbury* (1909).

ATTESTATION, the verification of a deed, will, or other instrument by the signature to it of a witness or witnesses, who subscribe to a memorandum, to the effect that it was signed or executed in their presence, showing that at the execution of the document there was present some disinterested person capable of giving evidence as to what took place. In Scots law, the corresponding clause is called the tecting-clause [*see* DEED; WILL (TESTAMENT); WITNESS].

AT THE MARKET, a term used in instructions to brokers in securities or commodities authorizing them to buy or sell at the most favourable price as promptly as possible after the order is given. Brokers receiving orders on such terms convey them to the exchange floor at once, where the floor trader will attempt to put through the trade upon the best possible terms for his customer. While no price is named and no price limit is set, the broker is expected to make the purchase or sale within a fraction of the price set by the last transaction in the same security or commodity.

ATTHIS (an adjective meaning "Attic"), the name given to a monograph or special treatise on the religious and political history, antiquities and topography of Attica and Athens. During the 4th and 3rd centuries B.C., a class of writers arose, who, making these subjects their particular study, were called atthidographi, or compilers of atthides. The first of these was Clidemus or Clitodemus (about 378 B.C.); the last, Ister of Cyrcne (d. 212 B.C.); the most important was Philochorus (first half of the 3rd century B.C.), of whose work considerable fragments have been preserved.

Fragments in Müller, *Fragmenta Historicorum Graecorum,* i.

ATTIC, in architecture, any portion of wall raised above the main cornice, utilized by the Romans principally for decorative purposes, inscriptions, etc., as in triumphal arches. It was developed in the Renaissance as an important part of a façade, frequently enclosing an additional storey, the windows of which were treated as part of the decoration. In modern usage the word is also employed to designate a storey immediately under the roof, especially when the roof is of steep pitch.

ATTICA, a triangular district of ancient Greece, with the chain of Mts. Cithaeron and Parnes as its base and Sunium as its apex. It is washed on two sides by the Aegean sea, and the coast is broken up into small bays and harbours, exposed to the south wind. Attica is very mountainous, and between the mountain chains lie several small plains open to the sea. On the west its natural boundary is the Corinthian gulf, so that it would include Megaris; indeed, before the Dorian invasion, which resulted in the foundation of Megara, the whole country was politically one, in the hands of the Ionian race. This is proved by the column which, as we learn from Strabo, once stood on the Isthmus of Corinth, bearing on one side in Greek the inscription, "This land is Peloponnesus, not Ionia," and on the other, "This land is not Peloponnesus, but Ionia."

Mountains.—The mountains of Attica continue the chain from Tymphrestus at the south end of Pindus, through Phocis and Boeotia (Parnassus and Helicon); from this proceeds the range which, as Cithaeron (4,600ft.) in the west and Parnes

FROM MURRAY, HANDY CLASSICAL MAPS

MAP OF ANCIENT ATTICA AND SOME OF ITS COASTAL ISLANDS. INCLUDING AEGINA

(4,600ft.) in the east, separates Attica from Boeotia, throwing off spurs southward towards the Saronic gulf in Aegaleos (1,534ft.) and Hymettus (3,370ft.), which bound the plain of Athens. The east end of Parnes is joined by another line of hills, which, separating from Mt. Oeta, skirts the Euboic gulf, and, after entering Attica, throws up the lofty pyramid of Pentelicus (3,635ft.), overlooking the plain of Marathon, and then sinks towards the sea at Sunium to rise once more in the outlying islands, Finally, in the extreme west, Cithaeron bends round at

right angles in the direction of the isthmus, at the northern approach to which it abuts against the mighty mass of Mt. Geraneia, between the Corinthian and the Saronic gulf.

Soil.—The soil is light and thin, and requires very careiul agriculture on the rocky mountain sides and in the maritime plains. This enforced industrious habits on the inhabitants and encouraged seafaring. The level ground was sufficiently fertile to form a marked contrast to the rest of the district. Thucydides attributes to the unattractive nature of the soil (i. 2 τὸ λεπτόγεων), the permanence of the same inhabitants in the country, whence arose the claim to indigenousness on which the Athenians prided themselves; while at the same time the richer ground fostered that fondness for country life spoken of by Aristophanes. The fact that out of the 182 demes (*see* CLEISTHENES) into which Attica was divided, one-tenth were named from trees or plants points to less aridity in ancient times.

Climate.—In approaching Attica from Boeotia a change of temperature is felt as soon as a person descends from Cithaeron or Parnes, and the sea breeze moderates the heat in summer. So Euripides describes the inhabitants as "ever walking gracefully through the most luminous ether" (*Med.* 829).

Again Xenophon says "one would not err in thinking that this city is placed near the centre of Greece—nay, of the civilized world—because, the farther removed persons are from it, the severer is the cold or heat they meet with" (Vectigal. 1. 6). The air is so clear that one can see from the Acropolis the lines of white marble that streak the sides of Pentelicus. The brilliant colouring of the Athenian sunsets is due to the same cause. The epithet "violet-crowned," used of Athens by Pindar, is due either to the blue haze on the surrounding hills, or to the use of violets (or irises) for festal wreaths. The prevalence of the north wind is expressed on the Horologium of Andronicus Cyrrhestes, called the Temple or Tower of the Winds, at Athens.

Vegetation.—Sophocles (Oed. Col. 700) shows that the olive flourished specially in Attica (see also Herodotus v. 82). In the legend of the struggle between Poseidon and Athena, for the patronage of the country, the sea-god is represented as having to retire vanquished before the giver of the olive; and the evidences of this contention were an ancient olive tree in the Acropolis, together with three holes in the rock, said to have been made by the trident of Poseidon. The fig also throve and Demeter was said to have bestowed it as a gift on the Eleusinian Phytalus, *i.e.*, "the gardener." Cithaeron and Parnes were formerly wooded; for on the former are laid the picturesque sylvan scenes in the Bacchae of Euripides, and it was from the latter that the wood came which caused the neighbouring deme of Acharnae to be famous for its charcoal—the ἄνθρακες Παρνήσιοι of the *Acharnians* of Aristophanes (348). From the thymy slopes of Hymettus came the famous Hymettian honey.

Minerals.—The pure white marble of Pentelicus used for the Athenian temples, and the blue marble of Hymettus—the trabes *Hymettiae* of Horace, used for Roman palaces, were famous. The silver mines of Laurium rendered silver the principal medium of exchange in Greece, so that "a silver piece (ἀργύριον) was the Greek name for money. Aeschylus speaks of the Athenians as possessing a "fountain of silver" (Pers. 235), and Aristophanes makes his chorus of birds promise the audience that, if they show him favour, owls from Laurium (*i.e.*, silver pieces with the emblem of Athens) shall never fail them (Birds, 1106). The purity and accurate weight of the Laurium coins gave them a wide circulation. (See further NUMISMATICS: Greek, § Athens.) In Strabo's time the mines had almost ceased to yield, but silver was obtained from the scoriae; and at the present day lead is got in the same way, chiefly by two companies, one of which is French and the other Greek. Two thousand shafts and galleries of the ancient mines remain.

Plain of **Megara.**—The plain of Megara was geographically linked with Attica. It commanded the three passes into the Peloponnese, one a long detour along the shores of the Corinthian gulf; the other two starting from Megara, and passing, the one over the ridge of Geraneia, the other along the Saronic gulf, under the dangerous precipices of the Scironian rocks.

Plain of **Eleusis.**—To the east of Megara lies Eleusis, bounded on the one side by the chain of Kerata, and on the other by that of Aegaleos, through a depression in which was the line of the sacred way, where the torchlight processions from Athens used to descend to the coast, the "brightly gleaming shores" (λαμπάδες ἀκταί) of Sophocles (Oed. Col. 1,049). The deep bay which here runs into the land is bounded on its southern side by the rocky island of Salamis. The winding channel which separates that island from the mainland in the direction of the Peiraeeus was the scene of the battle of Salamis. The east of the plain of Eleusis was called the Thriasian plain, and the city itself was situated in the recesses of the bay just mentioned.

Plain of Athens.—Next in order to the plain of Eleusis came that of Athens, the most extensive, reaching from the foot of Parnes to the sea, and bounded on the west by Aegaleos, and on the east by Hymettus. Its most conspicuous feature is the broad line of dark green along its western side, formed by the olive-groves of Colonus and the gardens of the Academy, watered by the Cephisus. This river, unlike the other rivers of Attica, has a constant supply of water, from its sources on Mt. Parnes, which was diverted in classical times, as it still is, into the neighbouring plantations (cf. Sophocles, Oed. *Col.* 685). The two bare knolls of light-coloured earth caused the poet in the same chorus to apply the epithet "white" (ἀργῆτα) to Colonus. The Ilissus river, rising in Mt. Hymettus and skirting the east of Athens, is a mere brook, which disappears in summer. Three roads lead to Athens from the Boeotian frontier over the mountain barrier—the easternmost over Parnes, from Delium and Oropus by Decelea, the usual route of the invading Lacedaemonians during the Peloponnesian war; the westernmost over Cithaeron, by the pass of Dryocephalae, or the "Oakheads," from Thebes by Plataea to Eleusis, and so to Athens, along which the Plataeans escaped during the siege of Plataea in the Peloponnesian war. The third, midway between the two, by the pass of Phyle, near the summit of which, overlooking the Athenian plain, is the fort occupied by Thrasybulus in the days of the Thirty Tyrants. On the sea-coast to the south-west of Athens rises the hill of Munychia, a mass of rocky ground, forming the acropolis of the town of Peiraeeus. The ground which joins it to the mainland is low and swampy, alluvial soil brought down by the Cephisus and according to Strabo was at one time an island. On one side of this, towards Hymettus, lay the open roadstead of Phalerum, on the other the harbour of Peiraeeus, a completely land-locked inlet, safe, deep and spacious, the approach to which was still further narrowed by moles. On the east are the small harbours of Zea and Munychia.

Eastern Attics.-The north-eastern boundary of the plain of Athens is formed by the graceful pyramid of Pentelicus, commonly known as Brilessus in ancient times. Between it and Hymettus intervenes a level space of ground zm. wide, which formed the entrance to the Mesogaea, an elevated undulating plain in the midst of the mountains, reaching nearly to Sunium. At the extremity of Hymettus, where it projects into the Saronic gulf, was the promontory of Zoster ("the Girdle"), so called because it girdles and protects the neighbouring harbour. From this promontory to Sunium there runs a lower line of mountains, and between these and the sea is the fertile strip of land called the Paralia. Beyond Sunium, on the eastern coast, were two safe ports, Thoricus, defended by the island of Helene, forming a natural breakwater in front of it, and Prasiae, now called Porto Raphti ("the Tailor"), from a statue at the entrance. In the north-east corner between Parnes, Pentelicus and the sea is the little plain of Marathon (*q.v.*), the scene of the battle against the Persians (490 B.C.). The bay in front is sheltered by Euboea, and on the north by a projecting tongue of land, called Cynosura.

One district of Attica, the territory of Oropus, belonged to Boeotia, as it was situated to the north of Parnes; but the Athenians always endeavoured to retain it, because it facilitated their communications with Euboea, which was of the utmost importance to them; for, if Aegina should rightly be called "the eyesore of the Peiraeeus," Euboea was quite as truly a thorn in the side of Attica; Demosthenes (De *Cor.*, p. 307) records the ravages of the Euboean pirates.

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ATTIC BASE, the term given in architecture to any column base (*q.v.*) consisting of an upper and lower torus separated by a scotia. Used first by the Greeks in connection with the Ionic order, it became the favourite base of the Romans and is common in Byzantine, Romanesque and early Gothic work.

ATTICISM. (1) Taking the side of Athens in the Peloponnesian war, a word formed similarly to *medism* (taking the side of Persia in the Persian war); (2) the artificial imitation of Attic Greek in Hellenistic literature. (*See* GREEK LITERATURE.)

ATTICUS, TITUS POMPONIUS (109–32 B.C.), Roman patron of letters, was born at Rome three years before Cicero, with whom he was educated. His name was Titus Pomponius, that of Atticus being given him afterwards from his long residence in Athens (86–65) and his intimate acquaintance with the Greek literature and language. When Pomponius was still a young man his father died, and he prudently transferred himself and his fortune to Athens, in order to escape the civil war, in which he might have been involved through his connection with the murdered tribune, Sulpicius Rufus. Here he lived in retirement, devoting himself entirely to study. On his return to Rome, he assumed the name of Quintus Caecilius Pomponianus. From this time he kept aloof from political strife, attaching himself to no particular party, and continuing on intimate terms with men so opposed as Caesar and Pompey, Antony and Octavian. His most intimate friend, however, was Cicero, whose correspondence with him extended over many years. His private life was tranquil and happy. He did not marry till he was 53 years of age, and his only child became the wife of Marcus Vipsanius Agrippa, the distinguished minister of Augustus. In 32, being seized with an illness believed to be incurable, he starved himself to death. Of his writings none is extant, but mention is made of two: a Greek history of Cicero's consulship, and some annals forming an epitome of Roman history down to the year 54. His most important work was his edition of the letters addressed to him by Cicero. He formed a large library at Athens, and engaged a staff of slaves to make copies of valuable works.

See Life by Cornelius Nepos; Berwick, *Lives of Messalla Corvinus and T.P.A.* (1813); Fialon, *Thesis in T.P.A.* (1861); Boissier, *Cicéron et ses amis* (1888; Eng. trans. A. D. Jones, 1897); W. H. How, *Cicero: Select Letters* (Oxford, 1926) vol. ii. Appendix ii. A translation of Cicero's Letters to Atticus by E. O. Winstadt is published in the Loeb Classical Library (1912).

ATTICUS HERODES, TIBERIUS CLAUDIUS (*c.* A.D. 101–177), Greek rhetorician, celebrated among his contemporaries. In 125 Hadrian appointed him prefect of the free towns of Asia, and in 140 he was summoned by Antoninus Pius to undertake the education of Marcus Aurelius and Lucius Verus, and received many marks of favour, amongst them the consulship (143). He is principally celebrated, however, for the vast sums he expended on public purposes. He built at Athens a race-course of Pentelic marble, and a music theatre, called the Odeum, which still exists. At Corinth he built a theatre, at Delphi a stadium, at Thermopylae hot baths, at Canusium, in Italy, an aqueduct. He even contemplated cutting a canal through the Isthmus of Corinth. Many of the partially ruined cities of Greece were restored by Atticus, and numerous inscriptions testify their gratitude. Of his many works, the only one extant is a speech "On the Constitution" (ed. Hass, 1880).

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ATTILA (d. 453), king of the Huns, became king in 433 on the death of his uncle Roua. In the first eight years of his reign Attila was chiefly occupied in the wars with other barbarian tribes, by which he made himself virtually supreme in Central Europe. His own special kingdom comprised the countries which are now called Hungary and Transylvania, his capital being possibly near the modern city of Buda-Pest; but having made the Ostrogoths, the Gepidae and many other Teutonic tribes his subject-allies, and having also sent his invading armies into Media, he seems for nearly 20 years to have ruled practically without a rival from the Caspian to the Rhine.

Early in his reign, Honoria, grand-daughter of the Emperor Theodosius II., being subjected to severe restraint on account of an amorous intrigue with one of the chamberlains of the palace, sent her ring to the king of the Huns, and called on him to be her husband and her deliverer. Nothing came of the proposed engagement, but the wrongs of Honoria, his affianced wife, served as a pretext for some of the constantly recurring embassies with which Attila worried the two courts of Constantinople and Ravenna.

One of the return embassies from Constantinople (448) had the advantage of being accompanied by a rhetorician named Priscus, whose minute account of the negotiations, including a vivid picture of the great Hun in his banquet-hall, is by far the most valuable source of information as to Attila's court and camp. In the ambassador's suite there was an interpreter named Vigilas, who for 50 pounds of gold had promised to assassinate Attila. This design was discovered by the Hunnish king, but had not been revealed to the head of the embassy or to his secretary.

The new Emperor Marcian answered the insulting message of Attila in a manlier tone than his predecessor. Accordingly the Hun now turned upon Valentinian III., the trembling emperor of the west, and demanded redress for the wrongs of Honoria, and one-half of Valentinian's dominions as her dowry. Allying himself with the Franks and Vandals, he led his vast many-nationed army to the Rhine in the spring of 451, crossed that river, and sacked, apparently, most of the cities of Belgic Gaul, finally reached the Loire and laid siege to the strong city of Orléans. The citizens, under the leadership of their bishop, Anianus, made a heroic defence, but the place was on the point of being taken when, on June 24, the allied Romano-Gothic army of Aëtius and Theodoric, king of the Visigoths, was seen on the horizon. Attila turned again to the north-east, halted near Troyes, in the Catalaunian plains, and offered battle to his pursuers.

The battle (Chalons) which followed—one of the decisive battles of the world—has been well described by the Gothic historian, Jordanes, as "ruthless, manifold, immense, obstinate." It lasted for the whole day, and the carnage was terrible. The Visigothic king was slain, but the victory, though hardly earned, remained with his people and his allies. Attila retreated, apparently in good order, on the Rhine, recrossed that river and returned to his Pannonian home. Thence in the spring of 452 he again set forth to ravage or to conquer Italy. After a stubborn contest, he took and utterly destroyed Aquileia, the chief city of Venetia, and burned the cities at the head of the Adriatic, Concordia, Altinum and Patavium (Padua). The fugitives, seeking shelter in the lagoons of the Adriatic, laid the foundations of the future city of Venice. Upon Milan and the cities of western Lombardy the hand of Attila seems to have weighed more lightly, plundering rather than utterly destroying; and he yielded to the entreaty of Pope Leo I. and consented to cross the Alps, with a menace, however, of future return, should the wrongs of Honoria remain unredressed. But no further expeditions to Italy were undertaken by Attila, who died suddenly in 453, in the night following a great banquet which celebrated his marriage with a damsel named Ildico.

Under his name Etzel, Attila plays a great part in Teutonic legend (see NIBELUNGENLIED) and under that of Atli in Scandinavian Saga, but his historic lineaments are greatly obscured in both. He was short of stature, swarthy and broad-chested, with a large head and hair which early turned grey, snub nose and deep-set eyes. He walked with a proud step, darting a haughty glance this way and that as if he felt himself lord of all.

See Priscus, Jordanes, the *Historia Miscella,* Apollonius Sidonius and Gregory of Tours, who are the chief authorities for Attila's life.

ATTIS or **ATYS,** a deity worshipped in Phrygia, and later throughout the Roman empire, in conjunction with the Great Mother of the Gods. Their worship included the celebration of

mysteries annually on the return of the spring season. Attis was confused with Pan, Sabazius (*q.v.*), Mēn and Adonis, and there were resemblances between the orgiastic features of his worship and that of Dionysus. His resemblance to Adonis has led to the theory that the names of the two are identical, and that Attis is only the Semitic companion of Syrian Aphrodite grafted on to the Phrygian Great Mother worship. It is likely, however, that Attis, like the Great Mother, was indigenous to Asia Minor, adopted by the invading Phrygians, and blended by them with a deity of their own.

Legends.—According to Pausanias (vii. 17), Attis was a beautiful youth born of the daughter of the river Sangarius, who was descended from the hermaphroditic Agdistis, a monster sprung from the earth by the seed of Zeus. Having become enamoured of Attis, Agdistis struck him with frenzy as he was about to wed the king's daughter, with the result that he deprived himself of manhood and died. Agdistis in repentance prevailed upon Zeus to grant that the body of the youth should never decay or waste. In Arnobius (v. 5–8) Attis emasculates himself under a pine tree, at the foot of which violets sprang from his blood, like the flower called after him from that of Hyacinthus (*q.v.*). The Great Mother and Agdistis carry the pine-tree to her cave, where they wildly lament the death of the youth. Zeus grants the petition as in the version of Pausanias, but permits the hair of Attis to grow, and his little finger (which has been interpreted as the phallus) to move. In Diodorus (iii. 58–59) the Mother is the carnal lover of Attis, and when her father the king discovers her fault and kills her lover, roams the earth in wild grief. In Ovid, (*Fasti,* iv. 223 *et seq.)* she is inspired with chaste love for him, which he pledges himself to reciprocate. On his proving unfaithful, the Great Mother slays the nymph with whom he has sinned, whereupon in madness he mutilates himself as a penalty. Another form of the legend (Paus. vii. 17), showing the influence of the Aphrodite-Adonis myth, relates that Attis, the impotent son of the Phrygian Caläus, went into Lydia to institute the worship of the Great Mother, and was there slain by a boar sent by Zeus.

Attis was originally a god of vegetation, or tree-spirit, as is indicated by his association with the pine-tree, into which he was said to have been afterwards changed. In his self-mutilation, death and resurrection he represents the fruits of the earth, which die in winter only to rise again in spring.

See GREAT MOTHER OF THE GODS; J. G. Frazer, *Adonis, Attis, Osiris* (1906) and *The Golden Bough* (abridged edition, 1922).

(G. S.)

ATTITUDE. The term is mostly used in psychology to denote a certain disposition or preparedness to attend to certain objects or certain parts of objects rather than others. This is one of the most important subjective conditions of attention (*q.v.*) Its influence manifests itself not only in waking life but even in sleep. A mother's attitude is "set" for her child, and she will hear the child's movements though deaf to other, louder noises. The term is also used sometimes in a physical or physiological sense to denote a certain condition of partial stimulation or nascent excitation of nerve centres, which may help to explain the phenomena of habit (*q.v.*).

ATTLEBORO, a city of Bristol county in southeast Massachusetts, U.S.A., 12 mi. N.E. of Providence. It is served by the New York, New Haven and Hartford railroad. The area is 28 sq. miles. The population was 21,769 in 1930, of whom 4,765 were foreign born; and 22,071 in 1940.

There were 708 employed in retail selling, and retail sales were $7,551,000 in 1939. The 121 manufacturing establishments, with 6,732 employees, produced goods valued at $35,108,952 in 1939. Attleboro manufactures mainly jewellery and silverware but also makes optical goods, wrenches, tools, building paper, cotton goods and boxes, and has a large dyeing and bleaching plant. The jewellery industry was established there in 1780.

The first settlement within the present bounds of the city was made in 1669 by John Woodcock. The name commemorates the market town of Attleborough, Norfolk, England, the home of some of the early settlers. There is a glacial rock ledge in fine preservation in Attleboro; and an old powder house where ammunition was stored in the days of the Revolution. Some old houses are still standing in the city. The Angle Tree monument was erected in 1790. The town was incorporated in 1694. In 1887 it was divided by the creation of the township of North Attleborough, which is also a manufacturing centre, and which had a population of 10,359 in 1940. The city mas incorporatedin 1914.

See J. Dagget, *A Sketch of History of Attleborough to 1887* (Boston, *1894).*

ATTOCK, a town and fort in British India, in the Punjab, 47m. by rail from Peshawar, and on the east bank of the Indus. The Indus is here crossed by the military and trade route through the Khyber Pass into Afghanistan. The river runs past Attock in a deep, rapid channel about 200yd. broad. The rocky gorges through which it flows, with a distant view of the Hindu Kush, form some of the finest scenery in the world. Since 1883 an iron girder bridge of five spans carries the North-Western railway to Peshawar, and has also a subway for wheeled traffic and foot passengers. The fort of Attock was built by the emperor Akbar in 1581, on a low hillock beside the river.

ATTORNEY, in English law, in its widest sense, any substitute or agent appointed to act in "the turn, stead or place of another." Attorneys are of two kinds, attorneys-in-fact and attorneys-at-law. The former is simply an agent, the extent of whose capacity to act is bounded only by the powers embodied in his authority, his power of attorney. The latter was a public officer, conducting legal proceedings on behalf of others, known as his clients, and attached to the supreme courts of common law at Restminster. Attorneys-at-law corresponded to the solicitors of the courts of chancery and the proctors of the admiralty, ecclesiastical, probate and divorce courts. Since the passing of the Judicature Act of 1873, however, the designation "attorney" has become obsolete in England, all persons admitted as solicitors, attorneys or proctors of an English court being henceforth called "solicitors of the supreme court" *(see* SOLICITOR).

In the United States an attorney-at-law exercises all the functions distributed in England between barristers, attorneys and solicitors, and his full title is "attorney and counsellor-at-law." When acting in a court of admiralty he is styled "proctor" or "advocate." In courts of equity or chancery in many States he is styled "solicitor." Formerly, in some States, there existed a grade among lawyers of attorneys-at-law, which was inferior to that of counsellor-at-law, and in colonial times New Jersey established a higher rank still—that of sergeant-at-law. Now the term of attorney-at-law is precisely equivalent to that of lawyer, yet many consider a lawyer to be an attorney, particularly proficient in his profession. Attorneys are licensed to practice as the result of acts of the State legislatures, or by the rules of the highest court of the state. This is done ordinarily by examination by state or local boards, named by the court. In all States but Indiana, a preliminary education in a law school or under the direction of a practising attorney, or both, is required. In most States a preliminary high school education is required, and in a few of the States, part or all of a college education is required. New Jersey has a later separate examination for counsellor. Attorneys from other States may do a limited practice under comity in most States, and similarly one may be admitted to practice in most States if he has previously practiced for a required number of years in another State under what is known as "comity." In the courts of the United States, admission is governed by particular rules, the Supreme Court of the United States requiring practice of three years in a State, and admission for the same length of time at the bar of the highest court of that State. In almost all States aliens are not admitted, most requiring actual residence in the State as well as American citizenship. Women may practise in the United States Supreme Court, having been given this privilege in 1879, and in substantially all of the State courts.

An attorney is an officer of the court which admits him to practice, and he is subject to its discipline. He is liable to his client in damages for failure to exercise ordinary care and skill, and he can bring action for the value of his services. He has a lien on

his client's papers, and usually on any judgment in favour of his client to secure the payment of his fees. (See BAR.)

ATTORNEY-GENERAL, in England, the chief law officer appointed to manage all the legal affairs and suits in which the Crown is interested. He is appointed by letters-patent authorizing him to hold office during the sovereign's pleasure. He is ex *officio* the leader of the bar. Although we do not meet with the title *attornatus regis* until 1253, we may be sure that the office had already been long in existence. We are told by Bracton that the king had his serjeants-at-law in every county to prosecute pleas of the Crown in his name. These king's serjeants may be identified with the attornati *regis,* the number of whom varied from time to time. Eventually, in 1472, William Husee was appointed attorney-general of England with power to appoint deputies to act for him in any court of record. Henceforth the office is held singly. He has precedence in all the courts, and in the House of Lords he has precedence of the lord advocate, even in Scottish appeals. He is a necessary party to all proceedings affecting the Crown. The attorney-general and the solicitor-general (*q.v.*) are always members of the House of Commons (except for temporary difficulties in obtaining a seat) and of the Ministry, being selected from the Party in power, and their advice is at the disposal of the Government, and of each department of the Government, while in the House of Commons they defend the legality of ministerial action if it is called in question. Prior to 1895 no restriction was placed on the private practice of the law officers, but since that date this privilege has been withdrawn, and the salary of the attorney-general fixed at £7,000 a year with such fees as he may receive for litigious business on behalf of the Crown. During recent administrations he has had a seat in the cabinet and been made a privy councillor. The Crown has also as a legal adviser an attorney-general in Northern Ireland. In Scotland he is called lord advocate (*q.v.*). There are attorneys-general for the duchies of Cornwall and Lancaster. There is also an attorney-general or his equivalent in almost all the British colonies, and his duties are very similar to those of the same officer in England. In the self-governing colonies he is appointed by the administration of the colony, and in the Crown colonies by royal warrant under the signet and sign-manual.

The functions of the attorney-general are to-day of great constitutional importance and a number of recent statutes, casting upon him new duties, have invested his office with a continually increasing responsibility. He is not only the legal representative of the Crown in the courts but the *parens patriae* or guardian of public interests. In English law "the public" as a juristic conception does not exist, the Government of the country is not a corporation, the term "State" is merely a political expression, and even the term "Crown" is only a convenient impersonal expression for the king. The rights of the public in general are therefore protected by the attorney-general as the representative of the king in whom the "public" rights are vested. The result is that whenever acts are done tending to the injury of the public in general, and to the injury of no one in particular, the only person who can set the law in motion is the attorney-general. If a plaintiff wishes to put in suit a public wrong, he can only do so at the instance of the attorney-general. Our law here goes on the principle that "what is everybody's business is nobody's business" —it is the business only of the attorney-general. A plaintiff can only sue by himself in respect of a public tort where the interference with the public is such that some private right of his is, at the same time, interfered with, *e.g.,* where the obstruction of a highway by a local authority is such that the owner of premises abutting upon the highway is specially affected by the interference with his private right of access. But so far as the public is wronged by such obstruction of the highway, the wrong can only be redressed at the instance of the attorney-general who in such a case would apply for an injunction. The attorney-general has an absolute discretion as to whether he will intervene or not (see *L.C.C.* v. *Attorney-General,* 1902, A C. 165, which may be regarded as the leading case on the subject). On the other hand, the attorney-general, once he intervenes, is just as much subject to the control of the courts as every other suitor (R. v. *Prosser* 18 L. J. Ch. 35) and the courts are not bound to grant what he asks; they can prevent him from prosecuting a proceeding which is simply vexatious and has no legal object. He enjoys prerogatives as the representative of the Crown when he appears in the courts, such as the right to reply, trial at bar, change of venue (see PREROGATIVE, also PETITION OF RIGHT), but it is characteristic of the independence of the British courts towards the Executive that a law officer's opinion has no more force than the opinion of any other counsel.

Just as a public wrong, affecting no one in particular, can only be restrained at the instance of the attorney-general, so a public duty, the performance of which affects no one in particular, can only be enforced at the instance of the attorney-general, who in such cases is the proper party to apply for a writ of mandamus. Proceedings by criminal information, opposed as they are to the usual criminal procedure of indictment, are reserved for cases of public importance and are therefore regarded as at the suit of the attorney-general, even when the initiative is taken by a private individual, *i.e.,* a "relator" or "informer." The most familiar example of such proceedings is the publication of a seditious libel; in such a case the attorney-general himself files an *ex officio* information. So also, in the case of charities of a public character, the attorney-general represents all the persons who are an object of the charity, and they are thus plaintiffs through him.

In all civil proceedings by or against the Crown the attorney-general, or the solicitor-general, is the proper legal representative of the Crown in court. In actions for the recovery of any debt due to the Crown, whether by way of penalty or of tax, the attorney-general proceeds by information of debt. In proceedings against the Crown (see PETITION OF RIGHT) the Crown itself is the nominal defendant, but one or other of the law officers represents it. Furthermore, although it rests nominally with the Home Secretary, under the Petition of Right Act, to decide whether a suppliant shall be allowed to sue the Crown, in practice the Home Secretary always refers the petition to the attorney-general for his decision whether his leave ("fiat") shall be granted, and this discretion is absolute and cannot be questioned by the suppliant. In such cases the interests of the Crown are, of course, directly concerned. Where they are only indirectly concerned, the attorney-general himself is, and must be, made a defendant in order that the interests of the Crown may be protected. In a recent case of considerable constitutional importance (*Esquimault* Railway v. Wilson, 1925, A.C. 358) the power of the courts to insist on the attorney-general being joined as a defendant was based on wider ground, namely the right of a subject, when plaintiff in such an action, to claim that the attorney-general be made a party. This decision was a natural sequel to the great case of Dyson v. the Attorney-General, 1911, 1 K. B., 410, where the courts held, following ancient Exchequer precedents, that a subject might sue the attorney-general, as representative of the Crown. directly in an action for a declaration as to the subject's rights (see PETITION OF RIGHT).

To enumerate all the cases—such as peerage claims, lunacy proceedings, legitimacy declarations—in which the attorney-general may or must be a party would be beyond the limits of this article. It is enough to say that in all such cases the explanation of his participation is the same: the Crown is regarded as an interested party.

Of late years duties of great public importance have been cast upon the attorney-general by statute. The most recent example, and in some ways the most important, is the Trade Disputes and Trade Unions Act of 1927, by s. 7 of which the attorney-general is empowered to apply for an injunction to restrain the application of trade union funds in contravention of that section of the act which declares a "general strike" illegal. This, in effect, is to enable the attorney-general to interfere in such a case for the protection of the State. Certain Acts—such as the Official Secrets Act of 1911 (see SECRET)—provide that no prosecution for offences thereunder shall be initiated except by or with the consent of the attorney-general. Such provisions may be regarded as interposing the shield of the attorney-general between the police authorities and persons against whom they might institute

proceedings, and it is regrettable that the protection thus afforded by the Act of 1911 has been cut down by the Official Secrets Act of 1920 which only requires the consent of the attorney-general to proceedings in cases under the Act where they are dealt with "summarily," in other words without a jury. The consent of the attorney-general is also required before an appellant whose conviction and sentence has been affirmed by the court of criminal appeal (*q.v.*) can appeal further to the House of Lords, and such consent will only be granted where some important point of law is involved. Here also the attorney-general has an absolute discretion in the grant, or refusal, of his certificate.

The office of attorney-general is therefore unique in character. He is a minister of the Crown but he also exercises, particularly in the consideration of Petitions of Right, a judicial discretion. He is the representative of the interests of the Crown and at the same time the guardian of the rights of the public, and the two may not always coincide. It is easy to conceive a conflict of duties and on this ground it has been contended that the recent innovation of giving him cabinet rank is a bad one as calculated to impair his independence as the guardian of the public rights.

See Holdsworth, *Hist. Eng. Law* vi. 457; J. H. Morgan, "Remedies v. the Crown"; Bellot, "The Origin of the Attorney-General," *Law Quarterly Review* xxviii. p. 400. There is an admirable exposition of the attorney-general's duties by Sir Douglas Hogg, now Lord Hailsham, in Hansard's *Parliamentary Debates (Commons)* vol. 207 (No. 75) cols. 427–434. (J. H. Mo.)

UNITED STATES

The attorney-general of the United States is the chief law officer of the Government and head of the Department of Justice, one of the executive departments. He is appointed by the president, and, like the heads of the other executive departments, is a member of the cabinet. Since 1886, in case of death, resignation, removal or disability of both the president and the vice-president, he is in line of succession to the Presidency, after the secretary of State, secretary of the Treasury and secretary of War.

The office of attorney-general has existed since 1789, when the Government, under the Constitution, was organized. It was created by the Judiciary Act of 1789. That Act divided the United States into 13 judicial districts, established courts therein, defined their jurisdiction, and also the appellate jurisdiction of the Supreme Court. It provided that in each district there should be an attorney for the United States, who should have charge of civil and criminal actions in his district, and finally that there should be appointed an attorney-general of the United States who was to be "a meet person learned in the law," whose duty it should be to represent the United States in the Supreme Court and who should be the legal adviser of the president and of the heads of the departments "touching any matters that may concern their Departments." The attorney-general, under that act, was not an executive officer of the Government. His duties, as defined by the statute, made him merely an adviser of the executive branch and an advocate in the Supreme Court, and the measure of his compensation, $1,500 a year, was based upon the belief that his duties would take but little of his time, leaving him free to enjoy the professional emoluments which it was thought the prestige of his position would bring him. Until about the year 1814, the attorney-general did not reside at the seat of Government. In that year, Attorney-General Pinckney, one of the great lawyers of his day, resigned because President Madison insisted that he take up his residence in Washington. From the beginning, however, the office was regarded as one of great dignity and importance, and with the growth of the United States and the development of its governmental functions statutes were enacted from time to time which increased its duties and responsibilities, and gradually brought it to a parity with the heads of the executive departments. In 1870 it was organized by law as the Department of Justice.

The Department of Justice is an executive department and the attorney-general as its head has plenary control over the law business of the Government, all its other law officers being responsible to him, though some of the bureaux and commissions, such as the Bureau of Internal Revenue, the Federal Trade Commission and the Interstate Commerce Commission have lawyers on their staffs who are not officers or employés of the Department of Justice and who, in the performance of their duties within their respective departments, are not under the direction of the attorney-general. In the language of the U.S. Supreme Court he "has charge of the institution and conduct of the pleas of the United States and of the litigation which is necessary to establish the rights of the Government." The duties of the attorney-general are primarily those of a lawyer, but as head of the department much of his time and energy must now be devoted to administration. The personnel of his immediate staff at the seat of Government numbers between 700 and 800. His chief assistant is the solicitor-general, who by law exercises the powers of the attorney-general in the latter's absence and to whom is assigned charge of the Government's litigation in the Supreme Court, being about one-third of the entire business of that court. The solicitor-general also decides whether review in the higher courts shall be sought in cases which the Government has lost in courts below. This duty of passing upon questions of appeal and therein seeing to it that the Government's interests are protected, and all reasonable effort made to procure a correct construction of the law, at the same time avoiding imposing unwarranted burdens upon the appellate courts and unnecessary expense to litigants, is one of grave responsibility, calling for the exercise of sound, discriminating judgment.

There are an assistant to the attorney-general and seven assistant attorneys-general, among whom supervision of the work of the department is apportioned; one assistant, in charge of cases arising under the customs laws, has his office in the city of New York. There are several departmental solicitors who, as members of the attorney-general's staff, deal with legal matters arising in their respective departments. The Federal district attorneys, appointed by the executive for the ninety-one United States district courts, are in effect deputies of the attorney-general.

Through the superintendent of prisons the attorney-general controls all Federal prisons and prisoners. The number of such prisoners in Federal and State prisons in 1928 was about 16,000

The judicial districts have increased from the original 13 to 91 with 91 U.S. district courts and 136 U.S. district judges. There are nine judicial circuits with nine circuit courts of appeals and 34 U.S. circuit judges. There is a court of general jurisdiction and a court of appeals in the District of Columbia. In 1855 there was established a court of claims, a tribunal in which claims against the United States could be judicially heard and determined. It would not be within the scope of this article to set forth this jurisdiction in detail, but it may be said to include all causes of action based upon contract, express or implied, with the Government. As a result of the World War the number of cases of this kind has greatly increased and one of the heavy duties of the attorney-general and his staff is the defence of these suits. At the present time there are pending in that court over 2,200 suits involving claims against the Government in amount exceeding $1,800,000,000. At the close of the last fiscal year there were pending in the district courts over 16,000 civil suits in which the U.S. Government was directly interested and more than 35,000 criminal prosecutions, although during that year more than 19,000 civil suits and 67,000 criminal cases had been terminated.

The administrative control and supervision of the offices of U.S. marshals, and in some respects, of the offices of clerks of U.S. courts, is in the attorney-general. The entire personnel of the Department of Justice is about 5,100. All petitions to the president for pardon, commutation of sentence, or other form of executive clemency are investigated by an official of the department called the pardon attorney and the facts relating to each application are ascertained for the guidance of the attorney-general in making his recommendation to the president. About 1,200 petitions of this kind are considered each year. All petitions of Federal prisoners for release on parole are considered and approved or disapproved by the attorney-general. About 4,300 applications of this kind are considered each year. The attorney-general also makes recommendations to the president respecting appointments to all Federal judicial positions including the U S. Supreme Court.

As already pointed out, from the beginning the attorney-general has been the legal adviser of the president and of the heads of the

executive departments with respect to the questions arising in the administration of their departments. For many years pursuant to statute his formal opinions have been published from time to time in book-form, and are now contained in 34 volumes. They are binding upon and control the action of the executive officers of the Government, are frequently cited by the courts, and regarded as of high authority. Prepared under statutory sanction by the chief law officer of the Government for the guidance of the heads of departments charged with the administration of the statutes enacted by Congress, they have the status of important State papers entitled to the highest respect upon all questions of the powers and duties of the executive branch of the Government.

There is also under each State Government an officer usually called the attorney-general, whose relation to the Government of his State is similar to that of the U.S. attorney-general to the Federal Government. He is usually elected by the people at the same time and for the same term as the governor. For an accurate description of the duties of the attorney-general of any particular State an examination of the Constitution and laws of that State is necessary. (J. G. S.)

ATTORNMENT, in English real property law, the acknowledgment of a new lord by the tenant on the alienation of land. Under the feudal system it was always considered unreasonable to the tenant to subject him to a new lord without his own approval, and it thus came about that alienation could not take place without the consent of the tenant. Attornment was also extended to all cases of lessees for life or for years. The necessity for attornment was abolished by an act of 1705 (*see* now s. 151 of the Law of Property Act 1925). The term is now used to indicate an acknowledgment of the existence of the relationship of landlord and tenant. An attornment-clause, in mortgages, is a clause whereby the mortgagor attorns tenant to the mortgagee, thus giving the mortgagee the right to distrain, as an additional security.

ATTRIBUTES: *see* CATEGORY; SPINOZA; SUBSTANCE.

ATTRITION, a rubbing away; a term used in pathology and geology (Lat. *attritio,* from *attero,* "rub away"). Theologians have also distinguished "attrition" from "contrition" in the matter of sin, as an imperfect stage in the process of repentance; attrition being due to servile fear of the consequences of sin, contrition to filial fear of God and hatred of sin for His sake.

ATTWOOD, THOMAS (1765–1838), English composer, was a chorister of the Chapel Royal and a pupil of Mozart in Vienna. In 1796 he became organist of St. Paul's. One or two of his songs, such as "The Soldier's Dream," and of his glees such as "In peace love tunes the shepherd's reed" and "To all that breathe the air of Heaven," are still occasionally heard.

ATTWOOD, THOMAS (1783–1856), English political reformer, was born at Halesowen, Worcestershire, Oct. 6 1783. He was one of the founders, in Jan. 1830, of the Political Union, formed to agitate for a reform of the franchise. Under his leadership vast crowds of working men met periodically in the neighbourhood of Birmingham to demonstrate in favour of reform of the franchise, and Attwood used his power to prevent illegal methods of agitation. After the passing of the Reform act in 1832 he was elected one of the members for the new borough of Birmingham, for which he sat till 1839.

In the House of Commons he was persistent in advocating his monetary theory, that the existing currency should be rectified in favour of State-regulated and inconvertible paper money and the adoption of a system for altering the standard of value as prices fluctuated. He retired from Parliament in 1837, and died at Great Malvern, March 6 1856.

His grandson, C. M. Wakefield, wrote his life "for private circulation" (there is a copy in the British Museum), and his economic theories are set forth in a little book, *Gemini,* by T. *B.* Wright and J. Harlow, published in *1844.*

ATWOOD, GEORGE (1746–1807), English mathematician, was educated at Westminster school and Trinity college, Cambridge. He received from William Pitt an office in the customs which was practically a sinecure and left him leisure for his studies. He was the inventor of Atwood's machine.

Atwood's most important works are: *Treatise on the Rectilinear Motion and Rotation of Bodies* (1784), which describes the machine, since called by Atwood's name, for verifying experimentally the laws of simple acceleration of motion and *Dissertation on the Construction and Properties of Arches* (1801–04).

ATWOOD, WALLACE WALTER (1872–), American geographer and geologist, was born in Chicago, Ill., on Oct. 1, 1872. He graduated in 1897 and received the degree of doctor of philosophy in 1903 from the University of Chicago, in which from 1903 to 1913 he was successively instructor, assistant professor, associate professor and professor of physiography and general geology. He was professor of physiography at Harvard university from 1913 until 1920 when he became president of Clark university. In 1901–09 he was assistant geologist with the U.S. Geological Survey and in 1904 became geologist of the Illinois Geological Survey. He made extensive field researches in structural and economic geology, notably on the coal resources of Alaska. He also made studies of glaciation, especially in the Rocky mountains, and of the physical geography of various parts of the United States. In 1925 he founded and became editor of *Economic Geology.*

Besides numerous scientific and educational papers, he published *Physical Geography of the Devils Lake Region* (1899), *Physical Geography of the Evanston-Waukegan Region of Illinois* (1908), *Interpretation of Topographical Maps* (1908), *Glaciation of the Uinta and Wasatch Mountains* (1909), *Mineral Resources of South-western Alaska* (1910), *Geology and Mineral Resources of the Alaska Peninsula* (1911) and *New Geography, Book II.* (1920).

ATYPICAL CHILDREN. Atypical means irregular, or not conformable to type. Applied to children, it usually indicates those who are below normal mentally, or who are suffering from more or less abnormal conditions of the mind. (*See* MENTAL DEFICIENCY.) "Atypical schools" are maintained in Washington, D.C., and other American cities, for children of this class. No attempt is made to maintain the ordinary school curriculum. The atypical children are taught as individual peculiarities require. They are not able, usually, to profit by any considerable amount of mental training, but frequently receive much benefit from various sorts of manual training, rug and basket weaving and other types of physical work.

AUBADE (a French word from *aube,* the dawn), the dawn-song of the troubadours of Provence, developed by the Minnesingers (*q.v.*) of Germany into the *Tagelied,* the song of the parting at dawn of lovers at the warning of the watchman, and now applied, analogously with its counterpart "serenade," to musical compositions in general of a suitable type. In France the term is applied also to the performance of a military band in the early morning in honour of some distinguished person.

AUBAGNE, a town of south-eastern France, in the department of Bouches-du-Rhône, 11 mi. E. of Marseille on the river Huveaune. Pop. (1936), 7,294. The railway to Toulon here turns south and reaches the coast through two tunnels. Earthenware is made and fruit and vines are cultivated. A fountain commemorates the statesman The Marquis de Barthélemy (1750[?]–1830).

AUBE, department, France, S.E. of Paris, including the courses of the Seine and Aube from near the edge of the Jurassic rocks of Côte d'Or to the lowland in which Aube, Seine, Yonne and Loing unite. Area 2,327 sq.mi.; pop. (1936) 239.563. Its north boundary is an old frontier zone, *e.g.,* between Remi and Senones of early Gallo-Roman times, between the archbishoprics of Sens and Reims, between France and Burgundy till the days of Hugh Capet. The two main rivers traverse the *Champagne Humide* and the *Champagne Pouilleuse,* the clay and the chalk, in succession. Much of the department is a sterile plain with habitations near the *Sommes* or springs coming from the chalk, but a large outlier of Tertiary rocks covering the chalk in the south-west, the Forêt d'Othe, is shared between Aube and Yonne. On the Jurassic rocks in the south-east a height of 1,200ft. is reached and thence the general slope is down to the north-west. As an unforested region of early times it seems to have had some prehistoric importance, and as the unforested lowland north-east of the highland ways through CBte d'Or to Paris it was long a traders' route and had great fairs at Troyes and Arcis-sur-Aube. The transition in the north-west from chalk to Tertiary deposits gives a broken sur-

face. The climate is fairly mild and the rainfall mostly between 600 and 700 mm. per annum, but greater along the edge of the highland in the south-east, where porous Jurassic rocks give slopes useful for the vine. The river zones have good natural pasture and are famed for cattle and cheese, helped by good forage crops.

The capital of the department is Troyes, and that city, Bar-sur-Aube, and Nogent-sur-Seine give their names to arrondissements. The department is in the military circumscription of the XXth Army Corps, its courts refer to the Court of Appeal at Paris, its educational area *(acade'mie)* is that of Dijon. The archbishopric of Sens includes a bishopric of Troyes, and that cathedral's famed collection of painted (16th century) glass is the crowning example of a remarkable feature of the churches of the department. Within the department is the historic abbey of Clairvaux.

AUBENAS, south-east France, department of Ardèche, 19 mi. S.W. of Privas by road. Pop. (1936) 5,338 Situated on the slope of a hill, on the right bank of the Ardeche, its streets are crooked and narrow. It has a castle of the 13th and 16th centuries. Institutions include a tribunal and chamber of commerce, and a conditioning-house for silk. Iron and coal mines are worked in the vicinity. Aubenas is an important silk depôt and has a large silk-spinning and weaving industry. The district is rich in plantations of mulberries and olives.

AUBER, DANIEL FRANCOIS ESPRIT (1782–1871), French musical composer, the son of a Paris printseller, was born at Caen in Normandy. He learnt to play at an early age on several instruments, his first teacher being the Tirolean composer, I. A. Ladurner. Eventually he studied under Cherubini, and in 1813 made his début as a composer with a one-act opera, the *Séjour militaire,* which was a failure. In 1822 began his long association with **A.** E. Scribe, who shared with him, as librettist, the success and growing popularity of his compositions. The opera *Leicester,* in which they first worked together (1823) showed evidences of the influence of Rossini. But in general his style was wholly individual being marked by all the lightness and facility, sparkling vivacity, grace, elegance, and clear and piquant melody characteristic of the French School. *La Muette de Portici* familiarly known as *Masaniello* (1828), became a European favourite, and its overture, songs and choruses were everywhere heard. The duet, "Amour sacré de la patrie," was welcomed like a new "Marseillaise," and sung by Nourrit at Brussels in 1830, it became the signal for the revolution. Of Auber's remaining operas (about 50 in all) the more important are: *Le Maçon* (1825), *La Fiancée* (1829), *Fra Diavolo* (1830), *Lestocq* (1834), *Le Cheval de bronze* (1835), *L'Ambassadrice* (1836), *Le Domino noir* (1837), *Le Lac des fées* (1839), *Les Diamants de la couronne* (1841), *Hayde'e* (1847), *Marco Spada* (1853), *Manon Lescaut* (1856), and *La Fiancée du roi des Garbes* (1864).

In 1829 Auber was elected member of the Institute, in 1830 he was named director of the court concerts, and in 1842, at the wish of Louis Phillippe, he succeeded Cherubini as director at the Conservatoire. Napoleon III. made Auber his Imperial Maître de Chapelle in 1857. Auber's attractive manners, his witty sayings, and his ever-ready kindness won for him a secure place in the respect and love of his fellow-citizens. He remained in his old home during the German siege of Paris, 1870–71, but the miseries of the Commune profoundly affected him and probably hastened his death.

BIBLIOGRAPHY.—Adolph Kohut, *Auber,* vol. xvii. of *Musiker Biographien* (1895); Charles Malherbe, *Auber;* Lionel Dauriac, *La Psychologie dans l'opéra française.*

AUBERGINE: *see* EGG-PLANT.

AUBERLEN, KARL AUGUST (1824–1864), German Protestant theologian, was born at Fellbach, Germany, Nov. 19, 1824. He was educated at Tiibingen, and in 1851 was made professor of theology at Basel, where he soon earned attention by his success both as a teacher and as an author. As a young man he was influenced by the ideas of Hegel, Goethe and Baur; but as he grew older, he became more conservative. He was the author of a number of theological works, including *Der Prophet Daniel und die Offenbarung Johannis* and *Die gottliche Offenbarung,* both of which were translated into English. He died at Basel in 1864

AUBERVILLIERS, town of northern France, in the department of Seine, on the canal St. Denis, 2m. from the right bank of the Seine and 1m. north of the fortifications of Paris. Pop. (1936) 55,871. It manufactures cardboard, colours, chemical products, perfumery, etc. During the middle ages and till modern times Aubervilliers was the resort of numerous pilgrims to *Notre Dame des Vertus.*

AUBIGNAC, FRANCOIS HEDELIN, ABBÉ D' (1604–1676), French author, was born in Paris. His father practised at the Paris bar, and his mother was a daughter of the great surgeon Ambroise Paré. François Hédelin took holy orders, was appointed tutor to one of Richelieu's nephews, and received through his pupil's influence the abbeys of Aubignac and of Mainac. In 1646 he retired to Nemours, occupying himself with literature till his death. He took an energetic share in the literary controversies of his time. Against Gilles Ménage he wrote a *Térence justifié* (1656); he laid claim to having originated the idea of the "Carte de tendre" of Mlle. de Scudéry's *Clélie;* and after being a professed admirer of Corneille he turned against him because he had neglected to mention the abbé in his *Discours sur le poème dramatique.* He was the author of four mediocre tragedies: *La Cyminde* (1642), *La Pucelle d'Orléans* (1642), *Zénobie* (1647) and *Le Martyre de Sainte Catherine* (1650). *Zénobie* was written with the intention of affording a model in which the strict rules of the drama, as understood by the theorists, were observed. In the choice of subjects for his plays, he seems to have been guided by a desire to illustrate the various kinds of tragedy — patriotic, antique and religious. It is as a theorist that d'Aubignac still arrests attention. Jean Chapelain was the first to establish the convention of the unities ihat plays so large a part in the history of the French stage; but the laws of dramatic method and construction generally were codified by d'Aubignac in his *Pratique du théâtre.* The book was only published in 1657, but had been begun at the desire of Richelieu as early as 1640. His *Conjectures académiques sur l'Iliade d'Homère,* published nearly forty years after his death, threw doubts on the existence of Homer, and anticipated to some extent the conclusions of Friedrich August Wolf in his *Prolegomena ad Homerum* (1795).

BIBLIOGRAPHY.—See G. Saintsbury, *Hist. of Criticism,* bk. v., and H. Rigault, *Hist. de la querelle des anciens et modernes* (1859). The contents of the *Pratique du Théâtre* are summarized by F. Brunetière in his notice of Aubignac in the *Grande Encyclopédie.*

AUBIGNE, CONSTANT D' (BARON DE SURINEAU) (*c.* 1584–1647), French adventurer, was the son of Théodore Agrippa d'Aubigné, and the father of Madame de Maintenon. Born a Protestant, he became in turn Catholic or Protestant as it suited his interests. He betrayed the Protestants in 1626, revealing to the court, after a voyage to England, the projects of the English upon La Rochelle. He was renounced by his father; then imprisoned by Richelieu's orders at Niort, where he was detained ten years. After having tried his fortunes in the Antilles, he died in Provence. He had two children, Charles, father of the duchess of Noailles, and Françoise, known in history as Madame de Maintenon.

See T. Lavallée, *La Famille d'Aubigné et l'enfance de Madame de Maintenon* (Paris, 1863).

AUBIGNE, JEAN HENRI MERLE D' (1794–1872), Swiss Protestant divine and historian of the Reformation, was born on Aug. 6, 1794, at Eaux Vives, Geneva. The ancestors of his father, Aimé Robert Merle d'Aubigné (1751–1799), were French Protestant refugees. Educated in Germany, he was pastor of the French Protestant Church in Hamburg for some years, and in 1823 a pastor in Brussels. He was at this time president of the consistory of French Protestant Churches, and subsequently professor of Church history in a Swiss institution maintained by the Evangelical Alliance. He died in Switzerland in 1872.

His principal works *are:* — *Discours sur l'étude de l'histoire de Christianisme* (Geneva, 1832); *Le Luthéranisme et la Réforme* (Paris, 1844); *Germany, England and Scotland, or Recollections of a Swiss Pastor* (London, 1848); *Trois siècles de lutte en Écosse, ou deux rois et deux royaumes* (1850); *Le Protecteur ou la répu-*

blique d'Angleterre aux jours de Cromwell (Paris, 1848); *Le Concile et l'infaillibilité* (1870); *Histoire de la Re'formation aux XVI^ième siècle* (Paris, 1835–53; new ed. 1861–62, in 5 vols.); and *Histoire de la Re'formation en Europe au temps de Calvin* (8 vols. 1862–77).

The first portion of his *Histoire de la Re'formation,* which was devoted to the earlier period of the movement in Germany, was translated into most European languages. The second portion, dealing with reform in the time of Calvin, dealt with a subject hitherto less exhaustively treated, but it did not meet with the same success. This part was all but completed at the time of his death. Among his minor treatises, the most important are the vindication of the character and aims of Oliver Cromwell, and a sketch of the struggles in the Church of Scotland.

Aubigné had amassed a wealth of well-documented information; but his desire to give in all cases a full and graphic picture, assisted by a vivid imagination, betrayed him now and then into filling up a narrative by inference from later conditions. Moreover, in his profound sympathy with the Reformers, he is often an apologist rather than an impartial historian. But his work is a monument of painstaking sincerity, and brings us into direct contact with the spirit of the period.

AUBIGNÉ, THEODORE AGRIBPA D' (1552–1630), French poet and historian of his own time, was born at St. Maury, Saintonge, the son of a Huguenot gentleman, one of the conspirators of Amboise. He was sent, at the age of 14, to Geneva, but in a year's time had joined the Huguenot army in France. He served Henry IV. both in the field and in the council chamber, though his rough manners and habit of outspoken criticism made his career at court rather a chequered one. In 1620 he was compelled to leave France in consequence of the publication of his *Histoire universelle depuis 1550 jusqu'à l'an 1601.* The first two volumes appeared in 1616 and 1618, and the third, which was ordered to be burned by the common hangman, in 1619. The book is a lively account of the camp and court life of the time, valuable because of the author's first-hand knowledge of the events described. Aubigné found a secure retreat at Geneva for the last ten years of his life.

BIBLIOGRAPHY.—A complete edition of Aubignk's works according to the original mss. was begun by E. Réaume and F. de Caussade (1879). It contains all the literary works, the *Aventures du baron de Faeneste* (1617), and the *Mémoires* (1873–92). The best edition of the *Histoire universelle* is by A. de Ruble. The *Mémoires* were edited by L. Lalanne (1854).

AUBM, a town of southern France, in the department of Aveyron on the Enne, 30 mi. N.W. of Rodez Pop. (1936) 3,961. Aubin is the centre of important coal mines worked in the middle ages. and also has iron-mines and marble quarries. Sheep breeding is important in the vicinity.

AUBREY, JOHN (1626–1697), English antiquary, was born at Easton Pierse or Percy, near Malmesbury, Wiltshire. his father being a country gentleman. In 1667 he made the acquaintance of Anthony à Wood at Oxford, and when Wood began to gather materials for his invaluable *Athenae Oxonienses,* Aubrey offered to collect information for him. From time to time he forwarded memoranda to him, and in 1680 he began the "Minutes for Lives," which Wood was to use at his discretion. He left the task of verification largely to Wood. As a hanger-on in great houses he had little time for systematic work, and he wrote the "Lives" in the early morning while his hosts were sleeping off the effects of the dissipation of the night before. The principal charm of his "Minutes" lies in the amusing details he has to recount about his personages, and in the truthfulness that he permits himself in face of established reputations. In 1692 he complained bitterly that Wood had destroyed 40 pages of his ms., probably because of the dangerous freedom of Aubrey's pen. Wood was prosecuted eventually for insinuations against the judicial integrity of the earl of Clarendon. One of the two statements called in question was certainly founded on information provided by Aubrey. This perhaps explains the estrangement between the two antiquaries and the ungrateful account that Wood gives of the elder man's character. "He was a shiftless person, roving and magotie-headed, and sometimes little better than crased. And being exceedingly credulous, would stuff his many letters sent to A. W. with follies and misinformations, which sometimes would guide him into the paths of errour."[1]

In 1673 Aubrey began his "Perambulation" or "Survey" of the county of Surrey, and a "History of his Native District of Northern Wiltshire." In the next year he published his only completed, though certainly not his most valuable work, the *Miscellanies,* a collection of stories on ghosts and dreams. He died at Oxford and was buried in the church of St. Mary Magdalene.

Beside the works already mentioned, his papers included: "Architectonics Sacra," notes on ecclesiastical antiquities; and "Life of Thomas Hobbes of Malmesbury," which served as the basis of Dr. Blackburn's Latin Life, and also of Wood's account. His survey of Surrey was incorporated in R. Rawlinson's *Natural History and Antiquities of Surrey* (1719); his antiquarian notes on Wiltshire were printed in *Wiltshire; the Topographical Collections of John Aubrey,* corrected and enlarged by J. E. Jackson (Devizes, 1862); part of another ms. on "The Natural History of Wiltshire" was printed by John Britton in 1847 for the Wiltshire Topographical Scciety; the *Miscellanies* were edited in 1890 for the *Library of Old Authors;* the "Minutes for Lives" were partially edited in 1813. A complete transcript, *Brief Lives chiefly of Contemporaries set down by John Aubrey between the Years 1669 and 1696,* was edited for the Clarendon Press in 1898 by the Rev. Andrew Clark from the mss. in the Bodleian library, Oxford.

See also John Britton, *Memoir of John Aubrey* (1845); David Masson, in the *British Quarterly Review* (July 1856); Émile Montégut, *Heures de lecture d'un critique* (1891); and a catalogue of Aubrey's collections in *The Life and Times of Anthony Wood . . .,* by Andrew Clark (1891–1900, vol. iv. pp. 191–193), which contains many other references to Aubrey.

AUBRIETIA, a genus of small perennial herbs of the family Cruciferae, *A. deltoides,* the purple rock-cress, is frequently cultivated in rock-gardens. The flowers are purple or violet. They are natives of the mountainous regions of Greece, Italy, etc.

AUBURN, a city of northeastern Indiana, U.S.A., on federal highway 27 and state roads 427 and 8, 23 mi. N. by E. of Ft. Wayne; the county seat of DeKalb county and the centre of a great variety of manufacturing industries. It is served by the Baltimore and Ohio, the Indiana Service corporation, the New York Central and the Pennsylvania railways.

The population of Auburn in 1930 was 5,088 and 5,415 in 1940. Auburn was settled about 1800 and was selected as the county seat in 1836.

AUBURN, a city in the southwest part of Maine, U.S.A., on the Androscoggin river, opposite Lewiston, 32 mi. N. by E. of Portland; the shire town of Androscoggin county. It is on federal highway 202 and is served by the Grand Trunk and the Maine Central railways and by bus line to Portland. The population was 16,985 in 1920; 18,571 in 1930 (14·3% foreign-born white); and 19,817 in 1940 by federal census. With its neighbouring city across the river, Auburn forms an important industrial centre, favoured by abundant water power. A hydroelectric development, providing 27,000 h.p., is at Gulf island, four miles above the cities. Within the boundaries of Auburn there were 60 manufacturing establishments in 1937, which had an output valued at $14,551,370. The assessed valuation of property in 1938 was $17,044,570. There are two city parks covering about 200 ac. Auburn was settled in 1783; incorporated in 1842: rechartered in 1869; and adopted a commission-manager form of government in 1917.

AUBURN, the county seat and the only city of Cayuga county (N.Y.), U.S.A., 2j mi. S.W. of Syracuse, on an outlet of Owasco lake, which lies two miles to the southeast. It is on the Yellowstone trail, and is served by the Lehigh Valley and the New York Central railways. Its area is 8·4 sq.mi. The population was 36,652 in 1930 (about 20% foreign-born, chiefly from Italy, Poland and Russia); 35,753 in 1940 by the federal census.

The city occupies an undulating site. over 700 ft. above sea level, in the heart of the Finger Lakes district. The wide streets are shaded with arching elms and other beautiful trees. The fertile surrounding country produces milk, corn, oats, barley, buckwheat,

[1] "Life of Anthony à Wood written by Himself" (*Athen. Oxon.,* ed. Bliss).

potatoes, hay and fine fruits; and there are quarries of water lime, quicklime, gypsum and sandstone along the shores of Lake Cayuga. Auburn has 20 to 2j wholesale houses and over 700 retail stores. The principal manufactures are cordage and twine, agricultural implements and wagons, shoes and shoe patterns and shoe racks, shoe forms, fishhooks and lures, carpets and rugs, rubber stamps and inking pads, diesel engines and oiling devices, forgings and castings, caps and hats, buttons and surgical instruments. Printing is also an important industry. It has 24 classifications of industry with more than $32,000,000 in products turned out annually. The assessed valuation of property in 1940 was $51,222,33j.

On the summit of Fort Hill, in the southwestern part of the city, is a grass-grown earthwork which was an ancient stronghold of the Cayugas; and in its centre stands a monument to the Cayuga chief Logan (b. 1725) who was an unswerving friend of the early settlers of this region. The home of William H. Seward, Lincoln's secretary of state, still stands in the heart of the city. The Auburn theological seminary merged with Union theological seminary at New York city. A NYA resident centre is now housed in the seminary buildings. The Seymour (public) library of 50,539 volumes is housed in the beautiful Case Memorial building. The Auburn state prison, when it was built in 1816, embodied advanced ideas of prison construction, and the "Auburn system" (solitary confinement by night, combined with work in association during the day) received much attention from the penologists of Europe and America.

Auburn was founded in 1793 by Capt. John L. Hardenburgh, on the site of a Cayuga village called Wasco, near the place where the Genesee trail crossed the outlet of the lake, and at first it was called Hardenburgh Corners. In 1805 it was chosen as the county seat, and in 1815 it was incorporated. It was chartered as a city in 1848, and since 1920 has had the commission-manager form of government.

AUBURN, ruddy-brown; the meaning has changed from the original one of brownish-white or light yellow (Low Lat. *alburnus,* whitish, light-coloured), probably through the intensification of the idea of brown caused by the early spelling "abron" or "abrown."

AUBUSSON, PIERRE D' (1423–1503), grand master of the order of St. John of Jerusalem, was a scion of a noble French family, and was in early life a soldier of fortune under the emperor Sigismund. On his return to France he fought with the Armagnacs against the Swiss, distinguishing himself at the battle of St. Jacob (1444). He then joined the order of the Knights Hospitallers of St. John of Jerusalem, becoming grand master in 1476. The defence of Rhodes against the fleet of the sultan Mohammed II. in 1479 made Aubusson famous throughout Europe. His treacherous conduct toward Jem, brother of Mohammed's successor, the sultan Bayezid, is a stain on Aubusson's memory. After Jem's defeat by his brother he took refuge at Rhodes under a safe-conduct from the grand master; Aubusson nevertheless accepted a bribe from Bayezid, and after six years' imprisonment Jem was handed over to Pope Innocent VIII. Aubusson's reward was a cardinal's hat (1489), and the power to confer all benefices connected with the order without the sanction of the papacy; the order of St. John received the wealth of the suppressed orders of the Holy Sepulchre and St. Lazarus. The remaining years of his life Aubusson spent in the attempt to restore discipline and zeal in his order, and to organize a grand international crusade against the Turks. The death of Jem in 1495 had removed the most formidable weapon available against the sultan; and when in 1501 Aubusson led an expedition against Mytilene, dissensions among his motley host rendered it abortive. The old man's last years were embittered by chagrin at his failure, which was hardly compensated by his success in extirpating Judaism in Rhodes by expelling all adult Jews and forcibly baptizing their children.

See P. Bouhours, *Hist. de Pierre d'Aubusson* (Paris, 1676; Hague, 1793; abridged ed. Bruges, 1887); G. E. Streck, *Pierre d'Aubusson, Grossnzeister,* etc. (1873); J. B. Bury in *Cambridge Mod. Hist.* vol. i., p. 85, etc. (for relations with Jem).

AUBUSSON, a town of France, capital of an arrondissement in the department of Creuse, on the river Creuse, 24 mi. S E. of Guéret by rail. Pop. (1936) 5.464. It has celebrated manufactories of carpets, etc., employing over 2,000 workmen, the artistic standard of which is maintained by a national school of decorative arts, founded in 1869. The industry goes back at least as far as 1531. Beauvais tapestries and Gobelins are still made on hand-looms. From the 10th to the 13th century Aubusson was the centre of a viscounty. It was then incorporated in the countship of La Marche and shared in its fortunes. From the family of the old viscounts was descended Pierre d'Aubusson (*q.v.*).

AUCASSIN AND NICOLETTE, now considered the most charming of all mediaeval love romances, was not popular in its own day and has survived in a single manuscript in the Bibliothèque Nationale at Paris. The story resembles that of the far more popular *Floire et Blanchefleur* and, like it. was probably based on a Moorish original, though the scene is laid in Provence. Aucassin, son of the count of Beaucaire, is enamoured of a lovely slave-girl, Nicolette, daughter of the Saracen king of Carthage. To keep them apart both are imprisoned, but she escapes to the forest, where she is found by her lover. After spending three years together in the kingdom of Torelore (a name given to the barren district of Aiguesmortes), they are captured by Saracens. The ship in which Aucassin is carried off is wrecked at Beaucaire, where he is joyfully received as count, his parents being dead. The other ship brings Nicolette to Carthage, where she is recognized by her father, the king; but as he wishes her to marry a paynim lord, she escapes in the disguise of a minstrel and makes her way to Beaucaire, where all ends happily.

Not only is Aucassin the Arabic name Alcazin or al-Kâsim, and Carthage evidently Carthagena, but the form in which the tale is told is oriental; it is a chante-fable, told in alternating sections of prose and verse, or rather song, for the verses were unquestionably chanted. But, in spite of its Arabic origin and Provençal setting, it was composed in northern France in the 12th century by a skilful but unknown poet.

The unique ms. of *Aucassin and Nicolette* was first published by Méon in 1808. The best edition is that by F. W. Bourdillon (Manchester University Press, 1919), which includes a bibliography. The first translation, into modern French, was that by M. de Sainte-Palaye in 1752, and it has been translated into English by Andrew Lang, Laurence Housman and many others. (L. F. S.)

AUCH, south-west France, capital of the department of Gers, on the Southern railway, south of Agen. Pop. (1936) 11,850. It consists of a lower and upper quarter united by several flights of steps. The streets are steep and narrow, but there is an 18th century promenade in the upper town. Three bridges cross the Gers to the suburb of Patte d'Oie.

Auch (*Elimberris*) was the capital of a Celtiberian tribe, the Ausci, and became one of the most important cities of Roman Gaul. In the 4th century its bishopric was founded and after the destruction of Eauze it became the metropolis of Novempopulana. Till 732, Auch stood on the right bank of the Gers, but in that year the Saracen ravages drove the inhabitants to the left bank. The Benedictine abbey of St. Orrens was founded by Count Bernard of Armagnac in the 10th century. The city was the capital of Armagnac in the middle ages. Its importance may be related to the use of the valley-road through a rather difficult region of deeply-cut streams — the Plateau de Gers. During the Religious Wars of the 16th century Auch remained Catholic, except for a short occupation in 1569 by Huguenots under Gabriel, count of Montgomery. In the 18th century it was the capital of Gascony and the seat of a generality. Antoine Mégret d'Étigny, *intendant* from 1751 to 1767, did much to improve the city and its commerce. The most interesting part of the town is the old quarter around the Place Salinis, a spacious terrace with an extensive view. On its north side rises the cathedral of Sainte-Marie, built from 1489–1662. It is one of the finest Gothic buildings in south France. The Greco-Roman façade, however, dates from the 17th century. The chief treasures of the cathedral are the magnificent Renaissance stained-glass windows and the 113 choir-stalls of carved oak, also of Renaissance workmanship. The archbishop's palace, an 18th century building with a Romanesque

hall and tower (14th century), adjoins the cathedral. Little remains of the abbey of St. Orrens. The ecclesiastical seminary contains an important library with a collection of manuscripts. The former palace of the intendants of Gascony is now the prefecture. Auch is the seat of an archbishop, a prefect, and a court of assizes, and has tribunals of first instance and of commerce and a chamber of commerce. Trade is in Armagnac brandy, wine, cereals, poultry, and "pâté de foie." Other industries are the making of hosiery, horse-rearing, brick-making, flour-milling, and tanning.

AUCHMUTY, SIR SAMUEL (1756–1822), British general, was born in New York, and served in the American War of Independence. At the conclusion of peace he exchanged into a regiment going to India. He served in the campaign against Tippoo Sahib, returning to England in 1797. Auchmuty became adjutant-general to Sir David Baird in Egypt in 1801; he was one of the few officers who came out with distinction from the Buenos Ayres expedition of 1806–07.

In 1810 he was sent out to India as commander-in-chief in Madras, and in the following year commanded the expedition to Java. The storming of the fortified position of Meester Cornelis (Aug. 28 1811), stubbornly defended by General Janssens, practically achieved the conquest of the island, and after the action at Samarang (Sept. 8), Janssens surrendered. In 1822 Auchmuty, who had received a G.C.B. in 1815, became commander-in-chief in Ireland. He died Aug. 11 1822.

AUCHTERARDER, police burgh, Perthshire, Scotland, 13¾m. S.W. of Perth by the L.M.S. Railway, on Ruthven water, a right-hand tributary of the Earn. Pop. (1931) 2,254 The chief manufactures are those of tartans and other woollens. It obtained a charter from the earl of Strathearn (early 13th century), afterwards became a royal burgh for a period, and was represented in the Scottish parliament. Its castle, now ruinous, was built as a hunting-lodge for Malcolm Canmore, but of the abbey it possessed as early as the reign of Alexander II. (1198–1249) no remains exist. The Norman church of St. Mungo is in ruins. The town was almost entirely burned down by the earl of Mar in 1716 during the abortive Jacobite rising. It was here that the dispute arose which led to the disruption in the Church of Scotland in 1843. The estate of Kincardine, 1m. S., gives the title of earl of Kincardine to the duke of Montrose. The castle was dismantled in 1645 by the marquis of Argyll in retaliation for the destruction of Castle Campbell in Dollar Glen south of the Ochils. The ruined castle of Tullibardine, 2m. W. of the burgh, once belonged to the Murrays of Tullibardine, ancestors of the duke of Atholl, who derives the title of marquis of Tullibardine from the estate.

AUCHTERMUCHTY, royal and municipal burgh and market town of Fifeshire, Scotland, about 9m. W. by S. of Cupar. Pop. (1931), 1,253. (*See* also FIFE.)

AUCKLAND, GEORGE EDEN, EARL OF (1784–1849) a governor-general of India, was second son of the first Baron Auckland. He was educated at Oxford, succeeding to the peerage in 1814. He was a consistent supporter of the Whigs and was selected by Lord Grey as president of the Board of Trade and master of the Mint in the famous Reform ministry of 1830. He occupied these two posts until Lord Grey's retirement in 1834, when Lord Melbourne made him first lord of the Admiralty, a post which he lost on the fall of the ministry the same year. On his return to office in 1835, Lord Melbourne sent Auckland out as governor-general to India. He devoted his attention to the improvement of native schools, to the economic development of India and especially to construction of famine relief works in the north-west; and he would no doubt have been remembered only as a painstaking and successful administrator but for his appalling error in interfering in the affairs of Afghanistan. Yielding to unwise advice, he proclaimed in Oct. 1838 the dethronement of the Afghan usurper, Dost Mohammed, and sent an expedition to Kabul under Sir John Keane, who victoriously entered the city and placed the rival Shah Shuja on the throne in Aug. 1839. For this victory he was created Lord Eden of Norwood and Earl of Auckland. But at the end of 1841 the insufficient garrison left in Kabul was surprised and defeated by a native insurrection. A series of disasters followed, as a result of which very few of the white troops reached India alive. Lord Auckland left India, recalled by Peel, in Feb. 1842, when affairs were at their worst. He re-entered politics and was again made first lord of the Admiralty in 1846 by Lord John Russell. He died suddenly on Jan. 1, 1840.

See Forbes, The *Afghan* Wars (1892); S. J. Trotter, *The* Earl of *Auckland* (1893).

AUCKLAND, WILLIAM EDEN, 1ST BARON, cr. 1793 (1745–1814), English statesman, was educated at Eton and at Christ Church, Oxford, and was called to the bar in 1768. He was under secretary of State (1772), commissioner of the board of trade (1776), commissioner to North America in connexion with the dispute with the American colonists (1778), and chief secretary for Ireland (1780). He resigned the chief-secretaryship in 1782, but next year took office as vice treasurer of Ireland under the coalition ministry, resigning with the Government in December. He opposed strongly Pitt's propositions for free trade between England and Ireland in 1785, but took office with Pitt as a member of the committee on trade and plantations, and negotiated in 1786 and 1787 Pitt's important commercial treaty with France, and agreements concerning the East India companies and Holland. In 1788 he was sent as ambassador to Spain. The same year he was sent on a mission to Holland, and represented English interests there with great zeal and prudence during the critical years of 1790 to 1793, obtaining the assistance of the Dutch fleet in 1790 on the menace of a war with Spain, signing the convention relating to the Netherlands the same year, and in 1793 attending the congress at Antwerp. He did not again hold office until 1798, when he joined Pitt's Government as joint postmaster general. He severely criticized Pitt's resignation in 1801, from which he had endeavoured to dissuade him, and retained office under Addington. This terminated his friendship with Pitt, who excluded him from his Administration in 1804 though he increased his pension. Auckland was included in Granville's ministry of "All the Talents" as president of the board of trade in 1806. He held the appointments of auditor and director of Greenwich hospital, recorder of Grantham, and chancellor of the Marischal College in Aberdeen. He died on May 28 1814.

He had married in 1776 Eleanor, sister of the first Lord Minto, and had a large family. Emily Eden (1797–1869), the novelist, was one of his daughters. On the death of his son George, 2nd baron and earl of Auckland (*q.v.*), the barony passed to the 1st baron's younger son Robert John (1799–1870), bishop of Bath and Wells, from whom the later barons were descended, and who was also the father of Sir Ashley Eden (1831–87), lieutenant governor of Bengal.

Lord Auckland's *Journal* and Correspondence (published 1861–62) throws much light on the political history of the time.

AUCKLAND, the largest city of New Zealand, and a thriving sea-port, on the east coast of New Zealand; capital of the province of its name. Population (1927) 202,400. It is beautifully situated at the mouth of an arm of Hauraki Gulf, the Waitemata harbour, and only 6m. from the Manukau harbour on the western coast. Auckland harbour, one of the best in New Zealand, is approached by great vessels at the lowest tides, and has large up-to-date concrete wharves. In 1926 the cargo handled totalled 1,948,079 tons. The Calliope graving dock provides ample accommodation for all kinds of shipping. Queen street, the principal thoroughfare, leads directly inland from the central wharves, and contains the majority of the public buildings. The city has a university, an art gallery and free library containing excellent pictures, and valuable mss., including a collection by Sir G. Grey, and a museum containing fine collections of Maori art. There are many magnificent parks and public reserves, covering in all 9,509 acres, although a considerable proportion of this area is outside the actual city confines. The Zoo, which occupies 29 acres, is justly famous. Of the suburbs, Newton, Parnell and Newmarket are outlying parts of the city itself; Devonport, Birkenhead and Northcote are beautifully situated on the north shore of the harbour and are served

by steam ferries; other residential suburbs lie among the hills on the mainland, such as Mount Albert, Mount Eden and Epsom. Onehunga is a port on the Manukau harbour. Auckland's population increase has been greater in ratio in recent years than that of any other New Zealand city, owing to the rapid settlement of the magnificent dairying lands to the north and south, and to its growing popularity as a residential city. Auckland was founded as the original capital of New Zealand in 1840 by Governor Hobson, but the seat of government was removed in 1865 to Wellington. There are regular steamships to other parts of the dominion, the Pacific Islands, Australia, Vancouver and Eastern ports.

AUCKLAND ISLANDS, a group of islands in the southern Pacific Ocean in 50° 24' S., 166° 7 E., discovered in 1806 by Capt. Briscoe. The islands are of volcanic origin, with fertile soil and are forest clad. They were granted to a private company by the British Government as a whaling station, but the establishment was abandoned in 1852. The islands belong politically to New Zealand, which maintains there a depôt of food and clothing for shipwrecked sailors. They are uninhabited. Area of the largest about 330sq. miles.

AUCTION BRIDGE, this originated in India. Three members of the Indian civil service, Mr. F. Roe ("John Doe"), Mr. Hudson, and another, all keen bridge players, were staying at a far-away hill station, where it was quite impossible to find a fourth. They played "Cut Throat" for a time, but they soon got tired of that, and then they set their wits to work to invent some better three-handed form of bridge. They tried all sorts of variations, without success, until one of them hit on the idea (probably borrowed from Vint) of bidding for the declaration, and it caught on at once. On that basis a new game was formulated, and it was, then and there, christened "Auction Bridge." The exact date of its birth is uncertain. The first record which we have of it is a letter from the late Mr. Oswald Crawfurd, which appeared in the *Times* of Jan. 16, 1903. This letter gave a brief outline of the game, and described it as "the new game of Auction Bridge for three players." Mr. Crawfurd had just returned from India, and had, no doubt, seen the game played in that country.

The next thing that happened was the publication of a short treatise by "John Doe," entitled "Auction Bridge," which was published by the Pioneer Press at Allahabad in 1904. The game was still confined to three players, but it had grown considerably. A further, and much fuller, description of it appeared in the *Daily Mail* of April 24, 1906, again by Mr. Oswald Crawfurd who seems to have been the real pioneer of the game in Britain, but it was the card-playing members of the Bath club who converted it from a three-handed game into a four-handed one, and who put it on a sound basis. The Bath club was the original home of the game in Britain, and for some considerable time it spread no further. Then, in 1907, the Portland club took it up, and after that its circle widened very rapidly, so much so that in about a year's time ordinary bridge was a thing of the past. Whist still clung on, and still does in some few places, but straight bridge is practically dead.

Auction bridge is played on the same lines as ordinary bridge with one or two important variations. The point where auction bridge diverges most widely from its parent game is in the declaration, which is no longer confined to the dealer and his partner, but every player in turn has the right of making a declaration, or as it is now termed "a bid," by overcalling any previous bid which has been made. Another notable point of difference is that when the declarer fails to fulfil his contract, his adversaries do not score below the line as at ordinary bridge, but they score a penalty of 50 points, or 100 if doubled, above the line for each under-trick, whatever the call may have been. Under no circumstances can the adversaries of the declarer score anything towards game. Doubling may take place as in straight bridge, but no bid that has been redoubled may again be doubled.

When auction bridge was first introduced the old bridge values were used, but it was soon recognized that the game was spoilt by the overwhelming value of the no truinp call. The Americans introduced a variation by inventing a new suit, "Royal Spades," or "Royals," which gave spades an alternative value of 2 or 9 per trick. This was tried in Britain for a while, but it was so obviously bad that, when the laws were revised in 1914, the lower value of the spade was done away with altogether, leaving it at 9, and the suits were all brought closer together—clubs 6, diamonds 7, hearts 8, spades 9, no trumps 10. These are the values at the present time. The great advantage of this scale over the old one is that it is possible to win the game on any call. "Five clubs" will do it as effectively as "three no trumps." "No trumps" is still the most valuable call, but its power is not overwhelming.

The scoring at auction bridge runs much higher than at ordinary bridge, owing principally to the amounts scored above the line for penalties; also the bonus for winning the rubber is increased from 100 to 250 points. The average value of a rubber at ordinary bridge is 170 points, at auction bridge it is nearer 400.

The original laws of auction bridge were drawn up by a joint committee of the Portland and Bath clubs in 1909, and were revised in 1914 by a special committee consisting of members of the Portland, Bath, Turf, St. James's, Baldwin, and White's clubs. These laws governed the game in Britain for ten years, but after a time, and after further experience, a demand arose for fresh revisions, and the Portland club, in 1924, drew up a new code of laws for the use of its own members. The code was accepted and adopted by all the other clubs. In the meantime, the Americans, who had adopted the English laws in *toto* at first, began to make alterations here and there, until, in 1925, the Whist club of New York, in conjunction with the Whist League of America, drew up an entirely new code of their own.

The principal difference between the two systems is in the bidding. In Britain, the bidding is governed by value. A bid of two no trumps, counting 20 points, takes precedence of a bid of three clubs, counting only 18, and a bid of four spades, counting 36, is higher than five diamonds counting 35. In America a bid of a greater number of tricks takes precedence of a less number, irrespective of the value. Thus, three clubs is higher than two no trumps, and five diamonds beats four spades. This American system is known as "Majority calling." It is adopted almost universally on the Continent, and some British players were so strongly in favour of it that in the summer of 1927 a conference of representatives of all the principal card-playing clubs in London was called together to consider it. Such a wide difference of opinion was expressed, that, in order to ascertain the general feeling in the country, all British bridge players, both in London and in the provinces, were asked to give the majority calling four months' trial and to report to the conference at the end of that period. The conference met again on Nov. 7, 1927, the clubs represented being Almack's, Baldwin, Bath, Carlton, Conservative, Devonshire, National Liberal, Portland, St. James's, St. Stephen's, Turf, and White's. The reports received were fairly evenly divided. In London clubs there was a strong feeling against making any change, but a small balance of country clubs were in favour of majority calling. As there was no strong mandate for any change, the conference decided by 9 votes to 3, voting by clubs, to retain our old system of value caliing in the revised laws, but to describe the principles of majority calling in an appendix, so that anyone who liked could use it. The card committee of the Portland club had in the meantime carefully revised the laws, which were submitted to the conference, and passed with a few minor alterations, and they became law on March 1, 1928.

Apart from questions of law, auction bridge has been considerably influenced by American principles and American conventions. British players, as a rule, like a plain straightforward game, with as few conventions as possible. Americans, on the contrary, love conventions and are constantly inventing new ones, some of which have found their way to England. The most notable one is the "Informatory Double." When a player doubles an adverse bid of one no trump, his partner is bound to take the double out by bidding "Two" of his best suit, however, weak it may be, giving preference to the major suits over the minor ones. In the same way, if a player doubles a suit bid of "One" or "Two," it does not mean that he is strong in that suit, but just the opposite; it means that he is strong in the other three suits, but too weak in the suit declared to bid no trumps. His partner must make a bid in his own best suit, or bid no trumps if he has the declared suit stopped twice.

This convention met with strong opposition for many years in England, but it gradually crept in, and in 1925 became general.

On the completion of the deal, the dealer has first call. He can either pass or make a bid of some kind. If he elects to pass it is better to sny, "No bid" than "Pass," as the latter call is apt to be mistaken for "Hearts." Then each player in turn, commencing with the one on the dealer's left, can either pass or can overcall any previous bid that has been made either by the adversaries or by his own partner. When a bid has been passed by three players it becomes the declaration, and the player who made it, or in the case of the same suit having been bid by both partners, the player who made the first of such bids, plays the combined hands, and is termed "the declarer," his partner becoming "dummy."

When the declarer fulfils his contract, he scores, below the line, the value of as many odd tricks as he makes. When he fails to fulfil his contract his adversaries score 50 above the line, or 100 if doubled, for every under-trick. Honours are scored above the line by either side which holds them. A game consists of 30 points scored by tricks alone, that is, below the line. When either side has won two games, the total scores are added up, including scores for tricks, honours, and penalties, and the difference between the two scores is the amount won and lost.

The principle of bidding has undergone a considerable change since auction bridge was first introduced. In the early days players followed the lines of ordinary bridge and made their bids on numerical strength without top honours, but this has been entirely superseded. Players have learnt by experience that it is aces and kings that matter and that win games. An original bid, that is the first bid made on a hand, can always be depended upon to have top honours at the head of it, when it is made by a responsible player. Top honours mean ace, king; or ace, queen, knave; or king, queen, at least. Subsequent bids after the first original one are made on numerical strength with outside support to back them up, or an original bid of a partner can be supported on numerical strength, but the one outstanding principle of modern declaring is that an original suit bid must have top honours at the head of it. At ordinary bridge the dealer would always call "Hearts" on king, ten, to five or six, with little else in his hand, but no sound auction bridge player would call "one heart" on that hand as an original call. He might call "two hearts" on it on the second round, but that is quite a different thing from calling it originally.

There are two entirely diiferent departments of auction bridge—the declaration and the play of the cards. There is considerable difference of opinion as to the relative value of these two. Some players estimate the value of clever declaring as high as 80%, others, including Lenz of New Ycrk, think that they are nearly, if not quite, equal, and that scientific play of the cards is as important as clever declaring. Eoth are important, but correct declaring is easier to acquire. It is not given to everybody to have the card sense and to be able to play the cards well, but anyone of ordinary intelligence can be taught to declare correctly. The most valuable declaration which can be made is no trumps, because three by cards will win the game from a love score at no trumps, but it takes four or five by cards to win the game on a suit declaration, but nevertheless a really strong major suit call, that is spades or hearts, is safer and better than no trumps. Some players are so obsessed with the glamour of the no trump call, that they seem to think it is the only road to success at the bridge table, and they call it on every possible occasion, and sometimes on very inadequate material. This is a great mistake. A genuine no trump hand should be well guarded in at least three suits, and should have a queen over the average—nothing weaker than this is justifiable at the score of love. (See also BRIDGE; CONTRACT BRIDGE)

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UNITED STATES

Auction bridge may be designated as the offspring of bridge, the grandchild of whist and the father of contract. The history of whist, bridge, auction bridge and contract bridge in America—meaning, in this instance, the United States and Canada—is a record of European importations and domestic modifications. "Contract" appears to have been derived directly from France; but the other three, whatever their original place of birth, undoubtedly came to America from England. To-day (1928) auction bridge is the prevailing game, with contract widely played and growing rapidly in popularity; bridge is virtually abandoned, and whist played enthusiastically at the annual sessions of the American Whist League, but rarely elsewhere.

The Whist Club (New York) promulgated the first American code of auction bridge laws in 1910; these laws were immediately adopted by all American players and since then that club has been recognized as the supreme legislative authority for auction bridge in America. The 1910 code was amended in 1911, and revised and rewritten in 1912. In 1911, the Racquet Club of Philadelphia adopted for its own use the count of 6 points per trick for the club suit, 7 for diamonds, 8 for hearts, 9 for "royal" spades and 10 for no trump; the count of 2 being retained for spades used defensively. This was the first change from the old bridge count of 12 for no trump, 8 for hearts, 6 for diamonds, 4 for clubs and 2 for spades. Early in 1912 the Whist Club adopted the Racquet Club count for club play, and in Nov. 1912, embodied that count in its official code.

In 1913 the American code was entirely rewritten. This code eliminated chicane, created new privileges for dummy and reduced the revoke penalty to 100 points. In 1915 another new code was issued; it increased the values of slams and abolished the dual value of spades, thus giving the single value of 9 to the spade suit. More radical than either of these was the substitution of "numerical overcalling" in place of the system under which the values of tricks determined the rank of a bid. Since this revision, a larger number of tricks bid for always overcalls a smaller number (e g., four clubs overcalls three no trumps); the declarations assuming rank only when an equal number of tricks is bid for—no trump highest and clubs lowest. This change proved popular.

Further revisions were made in 1917 and 1920, involving no radical changes; but in 1925–26, an exhaustive study was made by The Whist Club in collaboration with Knickerbocker Whist Club (New York) and the American Whist League. This resulted in March, 1926, in the promulgation, by the Whist Club, of the present (1928) American auction bridge code. Three features of this final code are radical departures from all that has gone before: (1) The rank of cards from ace down to deuce is made uniform for all purposes (formerly ace was low in drawing for deal and seats, and low won; now ace is high and high wins); (2) honour-values are made multiples of ten instead of being based on trick-values; (3) revoke penalties are payable in tricks, which are utilized and scored exactly as if they had been won in play.

The outstanding differences between the American and English games of auction bridge lie: first, in the laws relating to rank of cards in drawing for deal and choice of seats, rank of bids in overcalling, method of counting honours, and the revoke penalty; second, in the greater readiness in America to try and adopt new "conventions"; and third, in the greater popularity in America of duplicate contests, which tend to reduce the element of luck and make skill the important factor. Most of the special and conventional tactics of bidding and play, prominently the "informatory double," are of American origin; many of these conventions have been adopted in England.

The popularity of auction bridge in America has grown until it is played by all classes of intelligent people; the number of its devotees is impossible to estimate; but the demand for playing cards, score pads, text-books and all kinds of bridge literature proves it to be enormous.

Over 40 years ago the teaching of whist was inaugurated by Miss Kate Wheelock. She was successful but not until auction bridge becdme a popular fad did the demand for instruction become wide-spread. Of late. however, bridge players have furnished conclusive evidence of their desire to learn how to play scientifically; in 1928 there were over one thousand American teachers, many of whom were unable to meet the demands made upon them for lessons.

Bridge by radio was introduced in Nov. 1925 and continued weekly during the winter seasons of 1926–27 and 1927–28 (November to March inclusive). A bridge hand is widely advertised in advance and the correct bidding and play are described with expert comment from approximately one hundred broadcasting stations at a designated hour. It is estimated that ten million players listen in each week, in most cases actually playing the hand in concert with the announcement as it comes to them through the air.

The American Auction Bridge League was formed in 1927 with R. R. Richards of Detroit as its first president. It manages largely attended duplicate contests and awards national championships.

The *Auction* Bridge magazine, a monthly publication, which started its career in 1922 has steadily increased the number of its subscribers; it has a large and representative editorial board.

(M. C. W.)

AUCTION PITCH, a card game (a variation of All Fours, *q.v.*) for from four to seven players. A complete pack is used. All the players cut for deal, the highest winning. Ace is the highest card, deuce the lowest. The dealer shuffles, and his opponent at the right cuts. The deal passes to the left. The cards are dealt in rotation, three at a time, to the players, beginning at the dealer's left. Six cards are dealt to each player. If an exposed card or a wrong number be dealt to a player there must be a new deal. The choice of trump is auctioned. Each player has one chance to bid. The player at the dealer's left has the first chance; he may pass or bid from one to four. Each succeeding player must pass or exceed the preceding bid; in addition, the dealer may refuse to sell for four, by bidding four. The winner of the auction pitches *the* trump by leading a card; the suit of the card led becomes trump. If no bid is offered, the player at the dealer's left pitches the trump, without the obligation to fulfil any contract. The winner of one trick leads for the next. Each player who is able must follow suit or trump. A player unable to follow lead to a plain (non-trump) suit may discard or trump. A revoke penalizes the offender the amount bid. Other players score what they make. In addition, *the* pitcher cannot be penalized for failure to fulfil contract when another player revokes.

The highest card of the suit led or the highest trump played wins the trick. One point is scored by the player dealt the highest trump out; one point is scored by the player dealt the lowest trump out. The player of a trump may ask if it is high or low. Jack (Knave) counts one point for the player winning the trick containing the Jack of trumps. Cards count one point for the player scoring most, each 10 scoring 10, each Ace 4, each King 3, each Queen 2, and each Jack found in the tricks won by him scoring 1. The claimant of cards turns his tricks face up, so that all may count his score. A tie for cards is won by the non-pitcher of trumps; a tie between two other players cannot be scored. Should two players be able to score game, the pitcher has precedence; between two non-pitchers able to score game precedence is given; first, to the holder of *high,* second to low, third to Jack, last to cards. If the pitcher of trumps fails to fulfil his contract, the amount of his bid is deducted from his score. A minus score puts him "in the hole," his shortage being indicated by a circle about his score. Game is 7 or 10 points, as agreed. (E. V. S.)

AUCTIONS AND AUCTIONEERS. An auction (Lat. *auctio,* increase) is a proceeding at which people are invited to compete for the purchase of property by successive offers of advancing sums. The advantages of conducting a sale in this way are obvious, and we naturally find that auctions are of great antiquity. Herodotus describes a custom which prevailed in Babylonian villages of disposing of the maidens in marriage by delivering them to the highest bidders in an assembly annually held for the purpose (Book i. 196). So also among the Romans the quaestor sold military booty and captives in war by auction—sub *hasta*—the spear being the symbol of quiritarian ownership. The familiarity of such proceedings is forcibly suggested by the conduct of the Praetorian Guard when Sulpicianus was treating for the imperial dignity after the murder of Pertinax. Apprehending that they would not obtain a sufficient price by private contract, the Praetorians proclaimed from their ramparts that the Roman world was to be disposed of by public auction to the best bidder. Thereupon Julian proceeded to the foot of the ramparts and outbid his competitor (Gibbon, vol. i. ch. v.). Though, however, auctions were undoubtedly common among the Romans both in public and private transactions, the rules whereby they were governed are by no means clearly enunciated in the Corpus *Iuris Civilis.*

In England the method of conducting auctions has varied. In some places it has been usual to set up an inch of lighted candle, the person making the last bid before the fall of the wick becoming the purchaser. By an act of William III. (1698), this method of sale was prescribed for goods and merchandise imported from the East Indies. Lord Eldon speaks of "candle-stick biddings," where the several bidders did not know what the others had offered. A "dumb bidding" was the name given to a proceeding at which a price was put by the owner under a candlestick with a stipulation that no bidding should avail if not equal to it. In a "Dutch auction" property is offered at a certain price and then successively at lower prices until one is accepted.

According to the practice now usual in England, a proposed auction is duly advertised, and a printed catalogue in the case of chattels, or particulars of sale in the case of land, together with conditions of sale, are circulated, Sometimes, in sales of goods, the conditions are merely suspended in the auction room. At the appointed time and place, the auctioneer, standing on a desk or rostrum, "puts up" the several lots in turn by inviting biddings from the company present. He announces the acceptance of the last bid by a tap with his hammer and so "knocks down" the lot to the person who has made it. Sometimes property is offered on lease to the highest bidder. "Roup" is the Scottish term for an auction. A bid in itself is only an offer, and may accordingly be retracted at any time before its acceptance by the fall of the hammer or otherwise. Puffing is unlawful. Unless a right to bid is expressly reserved on behalf of the vendor, he must neither bid himself nor employ anyone else to bid. When a right to bid has been expressly reserved, the seller or any one person (but no more) on his behalf may bid at the auction. If it is simply announced that the sale is to be subject to a reserved or upset price, no bidding by or on behalf of the seller is permissible: it is only lawful to declare by some appropriate terms that the property is withdrawn. Where a sale is expressed to be without reserve, or where an upset price has been reached, the auctioneer must, after the lapse of a reasonable interval, accept the bid of the highest bona fide bidder. By not doing so he would render the vendor liable in damages. The auctioneer must not make a pretence of receiving bids which are not in fact made, as it would be fraudulent to run up the price by such an artifice. A "knock-out" is a combination of persons to prevent competition between themselves at an auction by an arrangement that only one of their number shall bid, and that anything obtained by him shall be afterwards disposed of privately among themselves. With a view to the suppression of such "rings," the Auctions (Bidding Agreements) act, 1927, was passed by the British parliament.

A "mock auction" is a proceeding at which persons conspire by artifice to make it appear, contrary to the fact, that a *bona* fide sale is being conducted, and so attempt to induce the public to purchase articles at prices far above their value. Those who invite the public to enter the room where the supposed auction is proceeding, or otherwise endeavour to attract bidders, are called "barkers." A conspiracy to defraud in this way is an indictable offence.

The Auctioneer's Licence.—By a charter of Henry VII., confirmed by Charles I., the business of selling by auction was confined to an officer called an *outroper,* and all other persons were prohibited from selling goods or merchandise by public claim or outcry (see Henry Blackstone's Reports, vol. ii. p. 557). The only qualification now required by an auctioneer is a licence on which a duty of £10 has to be paid, and which must be renewed before the 5th of July in each year. A liability to a penalty of £100 is incurred by acting as an auctioneer without being duly licensed. An auctioneer is bound under a penalty oi £20 to see that his full name and address, together with a copy of the

Auctions (Bidding Agreements) act, 1927, are displayed before the commencement of an auction and during its continuance in the place where he conducts it. He is the agent of the vendor only, except in so far that, after he has knocked down a lot to the highest bidder, he has authority to affix the name of the latter to a memorandum of the transaction. so as to render the contract of sale enforceable where written evidence is necessary. An auctioneer does not by merely announcing that a sale of certain articles will take place, render himself liable to those who, in consequence, attend at the time and place advertised, if the sale is not in fact proceeded with, provided he acts in good faith. One of the chief risks run by an auctioneer is that of being held liable for the conversion of goods which he has sold upon the instructions of a person whom he believed to be the owner, but who in fact had no right to dispose of them.

The number of auctioneers' licences issued during the year ended March 31, 1937 was 7,033. A central organization with headquarters in Lincoln's Inn Fields, London, the Auctioneers' and Estate Agents' Institute of the United Kingdom, was founded in 1886. The Incorporated Society of Auctioneers and Landed Property Agents was founded later. (H. H.)

In the United States the same general principles underlie the control of auctions as in Great Britain. Specifically, they are regulated by states. A survey conducted by the Better Business Bureau of Milwaukee, Wis. (1924) in 52 principal cities illustrates this. Eleven did not permit auctions after 6 P.M., the rest closed them from 6 to 12 P.M.; some required no license fee, a few demanded a percentage, others a fixed amount for a specified time, *i.e.,* Tacoma, Wash., $1,000 a year, $50 a day. A majority permitted more than one jewelry auction in a given store the same year, and allowed auctions to run any number of successive days; a few fixed 30, Pittsburgh, Pa., 7–10 days as the limit. About 50% demanded from short, indefinite periods to 1 year of residence from merchants of jewelry auctions. Control of fraud and switching varied from requiring bonds or stock permits, imposing fines or revoking licenses to applying false pretences laws or merely "watching." Several cities demanded $2,500 bonds to ensure auctioneer's good faith, some $100 annual license fee, others twice the amount sold. Street auctions are limited or barred entirely. Some cities enforce transient merchant laws; others have drafted ordinances The Mastick-Goodrich law of New York was passed in 1927 to regulate auctions. Efforts against fraud have centred especially on jewellery sales, the greatest breeders of fake and mock auctions.

AUCUBA, a small genus of the dogwood family (Cornaceae) containing the familiar Japanese laurel (*Aucuba japonica*), grown in frost-free places or in the cool greenhouse. It bears male and female flowers on distinct plants; the red berries often last till the next season's flowers appear. A variegated form is the gold-dust tree.

AUDAEUS or AUDIUS, a church reformer of the 4th century, by birth a Mesopotamian. He was banished into Scythia, where he worked successfully among the Goths. The Audaeans celebrated the feast of Easter on the same day as the Jewish Passover, and they were also charged with attributing to the Deity a human shape, an opinion which they appear to have founded on Genesis i. 26. Theodoret accuses them of Manichean tendencies.

The main source of information is Epiphanius (Haer. 70).

AUDE, department of south France formed in 1790 from part of the old province of Languedoc. Area 2,448 sq.mi. Pop. (1936) 285,115. It consists of the east side of the Carcassonne gap between the Montagne Noire as an outer rampart of the Plateau Central and the outer ramparts of the Pyrenees, and it includes portions of both as well as the north-eastward projection of the latter in the Corbières between the valley of the Aude and that of the much smaller Berre, the department's two chief rivers. Aude is bounded on the north-east by Hérault, north-west by Tarn, west by Haute-Garonne, south-west by Ariège, south by Pyrénées-Orientales and east by the Mediterranean, and it is formed mainly by the basin of the Aude which runs out at its north-east corner. The coast, like that of Hérault, has large lagoons (Bages et Sigean, Gruissan, Lapalme and Leucate) separated from the sea by spits. Climate and vegetation are Mediterranean, the average winter temperature 44°–45°, and summer temperature 70°–71°, the rainfall is less than 24in. save on the hills. The department is agricultural, growing maize and other grains, while, with Hérault, it produces most of the cheapest wines of France, though those of Limoux and Narbonne are highly esteemed. The olive and chestnut are also grown. There are salt-producing marshes, some mines of mispickel, iron and manganese, and stone quarries.

The Canal du Midi, coming from the west via the Carcassonne gap, follows the Fresquel tributary to the Aude and a branch, Canal de la Robine, passes out to sea through Narbonne. The Southern Railway (Midi) serves the department.

The three arrondissements are named from the chief towns, Carcassonne (capital of the department), Limoux and Narbonne, and they are divided into 31 cantons. Aude belongs to the 16th military region and to the *académie* (educational division) and court of appeal of Montpellier. It forms the diocese of Carcassonne under the archbishopric of Toulouse.

AUDE, river of south-west France, rising in the eastern Pyrenees near the P. Carlitte and flowing into the Gulf of Lions. The upper course, except near Axat, is through deep gorges. Below Carcassonne its course, from north, turns due east, skirting the Corbières, to enter the Mediterranean some 12m. E.N.E. of Narbonne. The Aude gap, between the Pyrenees and the Montagne Noire, is one of the great historic thoroughfares of western Europe. The Aude is 140 m. long, with a basin of 2,061 sq m.

AUDEBERT, JEAN BAPTISTE (1759–1800), French artist and naturalist, published in 1800 *L'Histoire* naturelle des singes, des makis et des *galéopithèques,* illustrated by 62 folio plates drawn and engraved by himself. Two posthumous works appeared in 1802 under the general title Oiseaux *dorés* ou *à reflets* me'talliques.

AUDEFROI LE BATARD, French *trouvère,* flourished at the beginning of the 13th century and was born at Arras. The seigneur de Nesles, to whom some of his songs are addressed, is probably the châtelain of Bruges who joined the crusade of 1200. Audefroi was the author of at least five lyric romances: Argentine, Belle Idoine, Belle Isabeau, Belle *Emmelos* and *Béatrix.* These romances are an attempt to put new life into the lyric romance which was already dying out.

See A. Jeanroy, *Les Origines* de *la poésie lyrique* en France *au* moyen *âge* (1889).

AUDIENCE. In a technical sense, the term is applied to the right of access to the sovereign enjoyed by the peers of the realm individually and by the House of Commons collectively. More particularly it means the ceremony of the admission of ambassadors, envoys, or others to an interview with a sovereign or an important official for the purpose of presenting their credentials. In France, azrdience is the term applied to the sitting of a law court for hearing actions. In Spain, azrdiencia is the name given to certain tribunals which try appeals from courts of first instance. The azidiencia *pretorial, i.e.,* of the praetor, was a court in Spanish America from which there was no appeal to the viceregent, but only to the council of the Indies in Spain.

In England the *Audience-court* was an ecclesiastical court, held by the archbishops of Canterbury and York, in which they once exercised a considerable part of their jurisdiction. It has been long disused and is now merged in the court of arches.

AUDIFFRET-PASQUIER, EDMÉ ARMAND GASTON, DUC D' (1823–1905), French statesman created duke in 1844, and became auditor at the council of State in 1846. After the revolution of 1848, he retired to private life. In Feb. 1871 he was elected to the National Assembly, and became president of the right centre in 1873.

After the fall of Thiers, he directed the negotiations between the different royalist parties to establish a king in France, but as he refused to give up the tricolour for the flag of the old régime, the project failed. Yet he retained the confidence of the chamber, and was its president in 1875 when the constitutional laws were being drawn up. He likewise was president of the senate from March 1876 until 1879, when his party lost the majority.

AUDIO FREQUENCIES, in radio communication, the frequencies corresponding to normally audible sound waves. The upper limit ordinarily lies between 10,000 and 20,000 cycles. The lower limit is about 16 cycles.

AUDIO-FREQUENCY TRANSFORMER, a transformer used with electric currents of audio-frequency. An example of such use is in the audio-frequency amplifier forming part of a radio receiving set.

AUDIT ALE, a special quality of strong ale brewed at certain colleges in the English universities of Oxford and Cambridge, so called because it was drunk at the feasts held on audit-day.

AUDIT AND AUDITOR. An audit is examination of the accounts kept by the financial officers of a state, public corporations and bodies, or private persons, and the certifying of their accuracy. In the British Isles the public accounts were audited from very early times, though until the reign of Queen Elizabeth in no very systematic way. Prior to 1559 this duty was carried out, sometimes by auditors specially appointed, at other times by the auditors of the land revenue, or by the auditor of the exchequer, an office established as early as 1314. But in 1559 an endeavour was made to systematize the auditing of the public accounts, by the appointment of two auditors of the imprests. These officers were paid by fee and did their work by deputy, but as the results were thoroughly unsatisfactory the offices were abolished in 1785. An audit board, consisting of five commissioners, was appointed in their place, but in order to concentrate under one authority the auditing of the accounts of the various departments, some of which had been audited separately, as the naval accounts, the Exchequer and Audit Act of 1866 was passed. This statute. which sets forth at length the duties of the audit office, empowered the sovereign to appoint a "comptroller and auditor-general," with the requisite staff to examine and verify the accounts prepared by the different departments of the public service. In examining accounts of the appropriation of the several supply grants, the comptroller and auditor-general "ascertains first whether the payments which the account department has charged to the grant are supported by vouchers or proofs of payments; and second, whether the money expended has been applied to the purpose or purposes for which such grant was intended to provide." The treasury may also submit certain other accounts to the audit of the comptroller-general. All public moneys payable to the exchequer (*q.v.*) are paid to the "account of His Majesty's exchequer" at the Bank of England, and daily returns of such payments are forwarded to the comptroller. Quarterly accounts of the income and charge of the consolidated fund are prepared and transmitted to him, and in case of any deficiency in the consolidated fund, he may certify to the bank to make advances.

In the United States the auditing of the federal accounts is in the charge of the office of the Comptroller General, who is the head of the General Accounting Office, an agency independent of the executive departments of the government and responsible directly to Congress. In the performance of this function, the Comptroller General operates through a technical unit or bureau called the Audit Division under which are the following subdivisions: (1) Contract Examining Unit; (2) Receiving and Computing Section; (3) Check Section; (4) Contract Voucher Section; (5) Miscellaneous Section; (6) Civil Pay and Travel Section; (7) Military Pay Section; (8) Receipts and Deposits Section; (9) Audit Review Section; (10) Accounting Section; (11) Indian Tribal Claims Section and (12) Veterans' Bureau Section. This covers all government activities except those of the Post Office which are audited by the Post Office Division, a co-ordinate bureau with the Audit Division under the Comptroller General.

Provision is made in all the state and local governments for the exercise of the audit function in some form.

In practically all European countries there is a department of the administration, charged with the auditing of the public accounts, as the *cour* des *comptes* in France, the *Rechnungshof* des *deutschen Reiches* in Germany, etc. All local boards, large cities, corporations and other bodies have official auditors for the purpose of examining and checking their accounts and looking after their expenditure. So far as regards the work which auditors discharge in connection with the accounts of joint-stock companies, building societies, friendly societies, industrial and provident societies, savings banks, etc, the word auditor is now almost synonymous with "skilled accountant," and his duties are discussed in the article ACCOUNTANCY AND ACCOUNTANTS.

In Scotland there is an "auditor" who is an official of the court of session, appointed to tax costs in litigation, and who corresponds to the English taxing-master. In France there are legal officers, called auditors, attached to the *Conseil d'État*, whose duties consist in drawing up briefs and preparing documents. On the continent of Europe, lawyers skilled in military law are called "auditors."

Auditores **Rotae.**—Auditor is also the designation of certain officials of the Roman curia. The auditores Rotae are the judges of the court of the Rota (so called, according to Hinschius, probably from the form of the panelling in the room where they originally met). These were originally ecclesiastics appointed to hear particular questions in dispute and report to the pope, who retained the decision in his own hands. In the Speculum *juris* of Durandus (published in 1272 and re-edited in 1287 and 1291) the auditores *palatii domini papae* are cited as permanent officials appointed to instruct the pope on questions as they arose. The court of the Rota appears for the first time under this name in the bull *Romani Pontificis* of Martin V. in 1422, and the auditores by this time had developed into a permanent tribunal to which the definite decision of certain disputes, hitherto relegated to a commission of cardinals or to the pope himself, was assigned. From this time the powers of the auditores increased until the reform of the curia by Sixtus V., when the creation of the congregations of cardinals for specific purposes tended gradually to withdraw from the Rota its most important functions. It still, however, ranks as the supreme court of justice in the papal curia, and, as members of it, the auditores enjoy special privileges. They are prelates, and, besides the rights enjoyed by these, have others conceded by successive popes, *e.g.,* that of holding benefices in plurality, of non-residence, etc. When the pope says mass pontifically the subdeacon is always an auditor. The auditores must be in priest's or deacon's orders, and have always been selected—nominally at least—after severe tests as to their moral and intellectual qualifications. They are 12 in number, and, by the constitution of Pius IV., four of them were to be foreigners: one French, one Spanish, one German and one Venetian; while the nomination of others was the privilege of certain cities. No bishop, unless in *partibus* (see BISHOP), may be an auditor. On the other hand, from the auditores, as the intellectual *élite* of the curia, the episcopate, the nunciature and the cardinalate are largely recruited. The auditor camerae (zrditore generale *della* reverenda camera apostolica) is an official formerly charged with important executive functions. In 1483, by a bull of Innocent VIII., he was given extensive jurisdiction over all civil and criminal causes arising in the curia, or appealed to it from the papal territories. In addition he received the function of watching over the execution of all sentences passed by the curia. This was extended later, by Pius IV., to a similar executive function in respect of all papal bulls and briefs, wherever no special executor was named. This right was confirmed by Gregory XVI. in 1834, and the auditor may still in principle issue letters monitory. In practice, however, this function was at all times but rarely exercised, and, since 1847, has fallen to a prelate *locum tenens,* who also took over the auditor's jurisdiction in the papal states (Hinschius, Kathol. *Kirchenrecht,* i. 409, etc.).

Auditores (listeners), in the early Church, was another name for catechumens (*q.v.*).

AUDIT BUREAU OF CIRCULATIONS, a co-operative organization of advertisers, advertising agencies, and publishers in the United States and Canada. Organized in 1914. Headquarters, Chicago, Illinois. The objects of the bureau are described in the by-laws as follows:

To issue standardized statements of the circulation of publisher members; to verify the figures shown in these statements by auditors' examinations of any and all records considered by the Bureau to be

necessary; and to disseminate circulation data only for the benefit of advertisers, advertising agencies and publishers.

Each Publisher's Statement and each Audit Report issued to members shall embrace figures and facts bearing on the quantity, quality, distribution of circulation and circulation methods; thereby enabling quality as well as quantity to be established. The figures in the Audit Report shall be those verified by Bureau auditors. Facts, without opinion, to be reported.

In 1939 the membership numbered over 2,000, including approximately 260 advertisers, 135 advertising agencies, 1,070 newspapers, 220 magazines, 60 farm papers, and 270 business papers.

Up to the time that the bureau was organized every publisher had his own conception of what constituted a paid subscriber so that one publisher who offered a circulation of 100,000 might have actually a very different total from another publisher who claimed the same figure. Advertisers recognized the need of a common denominator in measuring circulation and the need to have all publishers use the same standards of measurement. These needs have been supplied in the information that is contained in A.B.C. reports.

The operating procedure of the bureau is briefly as follows: Twice a year each publisher member submits to the bureau a statement answering questions that, in the group judgment of advertisers, have a bearing on circulation values. These reports, known as Publisher's Statements, are printed and distributed to members. Once a year trained auditors from the bureau make an audit of the circulation records of each publisher member. These official audits are also printed and distributed to members.

The cost of operating the bureau is largely covered by the dues of the publisher members. But it is controlled by the buyers of advertising — the advertising agency and advertiser members. The managing director of the bureau operates under the direction of a board of directors of 27 men elected by the members. The directors include the representatives of 12 advertisers, 3 advertising agencies, and 12 publishers.

These men meet frequently to hear the reports of the bureau's activities and to act as a court of review in cases where publishers have been found delinquent in meeting the requirements of the bureau or where any publisher has a complaint against the management's interpretation of the rules. The growth of publication advertising in the United States and Canada is due largely to the protection that advertisers are assured through the use of A B C. verified circulation (P. L. T.)

AUDITION, also known as auditory sensation, is the principle of the division of sensations of hearing, according to which two great groups are formed. The first is that of sensations of tone, which are musical and smooth; the second that of sensations of noise, which are abrupt, harsh and rough. The physical stimulus of audition is the vibration of some material body; this vibration is normally transmitted to the ear by a wave-movement of the air particles.

See ACOUSTICS OF BUILDINGS; Helmholtz. *On* the *Sensations* of Tone (Eng. trans. 1895); Titchener, Text-book of Psychology (1910).

AUDLEY or AUDELEY, **SIR JAMES** (c. 1316–1369), one of the original knights, or founders, of the Order of the Garter, was the eldest son of Sir James Audley of Stratton Audley in Oxfordshire. He served under the Black Prince in France, and was made governor of Aquitaine and great seneschal of Poitou.

BIBLIOGRAPHY.—*See* Jean Froissart, Chroniques, Tr. by T. Johnes (Hafod, 1810); G. F. Beltz, Memorials of the Most Noble Order of the Garter (1841).

AUDLEY, THOMAS AUDLEY, BARON (*c.* 1488–1544), lord chancellor of England, entered Parliament in 1523 for the county of Essex. In 1529 he was Speaker of the House of Commons, presiding over the famous Black Parliament which abolished papal jurisdiction in England. He supported Henry VIII. in seeking a divorce from Catherine of Aragon, and became lord chancellor on Jan. 26 1533. He presided at the trial of Bishop Fisher and Sir Thomas More in 1535, and in 1536 he tried Anne Boleyn. He was raised to the peerage in 1538, and received the garter in 1540. He presided at the trials of Henry Pole (Lord Montacute) and the marquess of Exeter, managed the attainder of Thomas Cromwell, and the dissolution of Henry's marriage with Anne of Cleves. He resigned the lord chancellorship on April 21 1544, and died on April 30. His subservience to Henry VIII. was rewarded by the gift of many monastic estates. He re-endowed Buckingham College, Cambridge, under the new name of St. Mary Magdalene.

AUDRAN, the name of a family of French artists and engravers. The first who devoted himself to the art of engraving was Claude Audran, born 1597, and the last was Benoit, Claude's great-grandson, who died in 1772. The two most distinguished members of the family are Gérard and Jean.

GÉRARD or GIRARD, AUDRAN, engraver, was the third son of Claude Audran, and was born at Lyons in 1640. He was taught the first principles of design and engraving by his father, and continued his studies in Paris. He there, in 1666, engraved for Le Brun "Constantine's Battle with Maxentius," his "Triumph" and the "Stoning of Stephen," which placed Audran in the very first rank of engravers at Paris. He spent the years 1667–70 in Rome, where he engraved several fine plates. J. B. Colbert was so struck with the beauty of Audran's works that he persuaded Louis XIV. to recall him to Paris. On his return he was appointed engraver to the king, from whom he received great encouragement. He died at Paris in 1703. His engravings of Le Brun's "Battles of Alexander" are regarded as the best of his numerous works.

JEAN AUDRAN, nephew of Gérard, was born at Lyons in 1667. He was 80 years of age before he quitted the graver, and nearly 90 when he died. The best prints of this artist are those in which the etching constitutes a great part; and he has finished them in a bold, rough style. The "Rape of the Sabines," after Poussin, is considered his masterpiece.

AUDRAN, EDMOND (1842–1901), French musical composer, was born at Lyons. He made his first appearance as a dramatic composer at Marseille with *L'Ours* et *le Pacha* (1862), a musical version of one of Scribe's vaudevilles. Later he made various attempts to win fame as a writer of sacred music but eventually became known almost entirely as a composer of the lighter kinds of opera. His first Parisian success was made with Les *Noces d'Olivette* (1879), a work which speedily found its way to London and (as *Olivette*) ran for more than a year at the Strand theatre (1880–81).

Later works from his fluent pen which enjoyed exceptional favour included Le Grand Mogol (Marseille, 1876; Paris, 1884; London, as *The Grand Mogul,* 1884), La Mascotte (Paris, 1880; London, as The Mascotte, 1881), Gillette de Narbonne (Paris, 1882; London, as Gillette, 1883), La Cigale et la *Fourmi* (Paris, 1886; London, as La Cigale, 1890), Miss *Hélyett* (Paris, 1890; London, as Miss Decima, 1891), La Poupde (Paris, 1896; London, 1897). Audran was one of the best of the successors of Offenbach. He had little of Offenbach's humour, but his music is distinguished by an elegance and a refinement of manner which lift it above the level of opéra bouffe to the confines of genuine opéra comique. He was a fertile if not a very original melodist, and his orchestration is full of variety, without being obtrusive or vulgar.

AUDREHEM, ARNOUL D' (c. 1305–70), French soldier, was born at Audrehem, in the present department of Pas de Calais, near St. Omer. In June 1351 he became marshal of France. In March 1352 he was appointed lieutenant for the King in the territory between the Loire and the Dordogne, in June 1353 in Normandy, and in 1355 in Artois, Picardy and the Boulonnais. At Poitiers he was one of those who advised King John to attack the English, and, charging in the front line of the French Army, was slightly wounded and taken prisoner. He took an active part in the negotiations for the treaty of Bretigny, recovering his liberty at the same time as King John.

In 1361, as the King's lieutenant in Languedoc, he prevented the free companies from seizing the castles, and negotiated the treaty with their chiefs under which they followed Henry, count of Trastamara (later Henry II. of Castile), into Spain. In 1365 he himself joined du Guesclin in the expedition to Spain, was taken prisoner with him by the Black Prince at the battle of Najera (1367), and was unable to pay his ransom until 1369. In 1368, on account of his age, he was relieved of the office of

marshal, but he was sent to Spain in 1370 by Charles V., to urge his friend du Guesclin to return to France, and in spite of his age he took part in the battle of Pontvallain (Dec. 1370).

See Émile Molinier, "Étude sur la vie d'Arnoul d'Audrehem, maréchal de France," in *Mémoires présentés par divers savants à l'académie des inscriptions et belles-lettres,* 2e série, iv. (1883).

AUDUBON, JOHN JAMES (1785–1851), American naturalist, was born at Les Cayes, Santo Domingo, now Haiti, April 26, 1785. By his father, Lieut. John Audubon, a French naval officer and planter, the boy was taken to the United States and then to France. Even in his petted boyhood he was fond of nature and began making collections. He attended a military school for a time, and for a brief period studied drawing in Paris. His chief preparation for his future work, however, came when he spent a year on his father's farm near Philadelphia, and some months after his return, in France, hunting and drawing birds. The loss of his father's property in the West Indies and the unsettled conditions in France caused Audubon to engage in business in the new world. After he had made various unsuccessful ventures in the west, his loyal wife, Lucy Bakewell Audubon, insisted that his avocation become a vocation and practically assumed the support of the family while Audubon devoted himself to his great work, *The Birds of America* (1827–38). This imposing series contained 435 hand-coloured plates with 1,065 life-sized figures of 489 supposedly distinct species of birds. In spite of the later criticisms of his drawing, Audubon's service in making known in so handsome a fashion the birds of the new world is of inestimable value. When his pictures were exhibited at the Royal Institution of Edinburgh, they became the talk of the town; and in many writers traces may be found of the deep influence the productions of the "American woodsman" exerted upon his contemporaries. Audubon was a pioneer in reproducing birds in their natural poses. His work, which was carried on by subscriptions, supplemented by his income from painting, teaching, etc., became in time a family affair, his son John assisting him in his collecting and drawing, and his son Victor taking charge of business affairs. While the volumes were going through the press, Audubon divided his time between England and America, gathering new specimens, making drawings, and supervising publication. After the publication of the descriptive matter, *Ornithological Biography* (1831–39), in which William Macgillivray assisted him, and of *A Synopsis of the Birds of North America* (1839), the naturalist returned permanently to his adopted country. Immediately after his settlement in New York he threw himself energetically into two new tasks—the revision in "miniature" or octavo form of *The Birds of America* (1840–44) and the production of *The Viviparous Quadrupeds of North America* on which he collaborated with his faithful friend, the Rev. John Bachman, the father-in-law of his two sons. The folio plates of the *Quadrupeds* appeared in parts from 1842 to 1846, but Audubon lived to see only one volume of the text finished. In spite of his wonderful vitality, both mind and health failed before his death, Jan. 27, 1851. The house which he built by the Hudson still stands in New York City, near Riverside Drive and 158th Street.

BIBLIOGRAPHY.—F. H. Herrick's *Audubon the Naturalist* (1917), contains a full bibliography. Robert Buchanan's *The Life and Adventures of John James Audubon, the Naturalist* (1868), published in Everyman's Library, although readable, is inaccurate. It is a condensation of Mrs. Audubon's manuscript. Unable to secure the return of this manuscript, she published in America (1869) the Buchanan life with some additions, omissions of objectionable passages, and a preface by J. G. Wilson. Although Audubon's facts are not always accurate, he gave some vivid pictures of the America of his day. For these see *Audubon and His Journals* (1897), edited by Maria R. Audubon and Elliott Coues; also *Delineations of American Scenery and Character* (1926), edited by F.H. Herrick. *See* also F. H. Herrick, *Audubonthe Naturalist* (1917); E.A. Muschamp, *Audacious Audubon* (1929).

AUDUBON, a residential borough of Camden county, New Jersey, U.S.A., 5 mi. S.E. of Camden, on federal highway 30. It is served by the Pennsylvania-Reading Seashore railway. The population was 4,740 in 1920 (90% native white); it was 8,904 in 1930 and 8,906 in 1940 by the federal census. Wire, cloth and concrete block are manufactured. The borough was incorporated in 1900.

AUE, town of Germany, in the *Land* of Saxony at the confluence of the Mulde and Schwarzwasser, 21 mi. S.W. of Chemnitz. Pop (1939) 25,512. It has the Erzgebirge in the background to the southward. It manufactures machinery and metal objects.

AUENBRUGGER, LEOPOLD (1722–1809), Viennese physician, was born at Graz, Steyermark, on Nov. 19, 1722. He studied at Vienna and was placed in charge of the Spanish military hospital and the hospital of the Holy Trinity. His *New Invention for Discovering Obscure Thoracic Diseases by Percussion of the Chest* (1762) first introduced percussion as a means of detecting chest diseases but his method was not taken up until after his death, being introduced largely by the influence of the physician Piorry (d. 1879).

See M. Neuburger, *Leopold Auenbrugger* (1922).

AUER, LEOPOLD (1845–1930), violinist and famous teacher, was born at Veszprim, Hungary, June 9, 1845. He was trained at the Vienna conservatoire and later studied with Joachim, making the acquaintance at the same period of Brahms and Liszt, with both of whom he played. His début he made at Leipzig at one of the Gewandhaus concerts. In London later he met Anton Rubinstein, who in 1862 had founded the Imperial Conservatoire of Music, St. Petersburg, and at his suggestion he succeeded Wienavski as professor of the violin there in 1868, becoming two years later solo violinist to the imperial court.

When the Russian Revolution occurred in 1917 he was in Scandinavia. At the age of 73, with two trunks, his Stradivarius violin and $1,000 as his total of possessions, he sought refuge in America in Feb. 1918. Among his more famous pupils are Jascha Heifetz, Efrem Zimbalist, Mischa Elman and Toscha Seidel, while the high esteem in which he is held was illustrated by a remarkable concert given in his honour at Carnegie Hall, New York, in 1925, in which Rachmaninoff, Josef Hofmann, Gabrilowitsch, Zimbalist and Heifetz all took part. He is the author of *Violin Playing as I teach it* (1921); *My Long Life in Music* (1923) and *Violin Master Works and their Interpretation* (1925).

AUERBACH, BERTHOLD (1812–1882), German novelist, whose fame rests on his tales of village life, was born on Feb. 28 1812, at Nordstetten in the Black forest, and died at Cannes on Feb. 8 1882. He was educated at Tiibingen, Munich and Heidelberg, and studied philosophy under Strauss and Schelling. His parents, who were Jews, intended him to enter the Jewish ministry, but he was estranged from Jewish orthodoxy by the study of Spinoza, and turned to literature. Spinoza's life formed the basis of his first novel, *Dichter und Kaufmann* followed in 1839, and a translation of Spinoza's works in 1841. In 1843 he published the *Schwarzwalder Dorfgeschichten,* stories of peasant life in the Black forest, and later on novels in the same genre, *Barfüssele* (1856), *Edelweiss* (1861), and others. These works found a wide public and many imitators. They are not realistic studies of rural life in the modern sense, and probably they owed some of their popularity to the philosophical reflections and romanticism which Auerbach lent to the subjects treated.

The first collected edition of Auerbach's *Schriften* appeared in 1863–64; the best edition is that of 1892–95. Auerbach's *Briefe an seinen Freund J. Auerbach* (preface by F. Spielhagen) were published in a vols. (1884). *See* E. Zabel, *B. Auerbach* (1882); *E.* Lasker, B. *Auerbach, ein Gedenkblutt* (1882).

AUERBACW, a town in the south-west of the *Land* of Saxony, lying 1,500 ft. above sea level under the Erzgebirge, east of Plauen. Pop. (1939) 18,226. It produces embroidery, carpets and textiles.

AUERSPERG, ANTON ALEXANDER, GRAF VON (1806–1876), Austrian poet, who wrote under the pseudonym of ANASTASIUS GRÜN, was born on April 11 1806 at Laibach, and died at Graz on Sept. 12, 1876, and was head of the Thurn-am-Hart branch of the Carniolan cadet line of the house of Auersperg. He studied law at Graz and Vienna. As a member of the estates of Carniola on the *Herrenbank* of the diet at Laibach, he was an outspoken critic of the Austrian Government, leading the opposition of the duchy to the exactions of the central power. After the revolution of 1848 at Vienna he represented for 2 short time the district of Laibach at the German national

assembly at Frankfurt, to which he tried in vain to persuade his Slovene compatriots to send representatives. In 1860 he was summoned to the remodelled reichsrat by the emperor, who next year nominated him a life member of the Austrian upper house (*Herrenhaus*).

Count Auersperg's first publication was a collection of lyrics, Blatter der *liebe* (1830). His second production, Der *letzte* Ritter (1830), celebrates the deeds and adventures of the Emperor Maximilian I. (1493–1519) in a cycle of poems written in the strophic form of the Nibelungenlied. But Auersperg's fame rests almost exclusively on his political poetry; two collections entitled *Spaziergänge* eines Wiener *Poeten* (1831) and *Schutt* (1836) created a sensation in Germany by their originality and bold liberalism. These two volumes of poems were the forerunners of the German "Freiheit" poetry of 1840–48. His Gedichte (1837), if anything, increased his reputation; his epics, Die *Nibelungen im* Frack (1843) and Der *Pfaff* vom *Kahlenberg* (1850), are characterized by a fine ironic humour. He also produced masterly translations of the popular Slovene songs current in Carniola (Volkslieder *aus* Krain, 1850), and of the English poems relating to "Robin Hood" (1864).

BIBLIOGRAPHY.—Anastasius Griin's Gesanzmelte Werke were published by L. A. Frankl (1877); his Briefwechsel *mit* L. *A. Frankl* (1897). A selection of his Politische *Reden* und Schriften has been published by S. Hock (1906). See P. von Radics, Anastasius *Grün* (2nd ed., Leipzig, 1879).

AUERSTADT, BATTLE OF, Oct. 13, 1806: see NAPOLEONIC CAMPAIGNS.

AUFFENBERG-KOMARÓW, MORITZ, RITTEW VON (1852–1928), Austrian general, was born May 22, 1852, at Troppau and died on May 18. 1928. A most able soldier, Auffenberg was one of the leaders of the Austrian military party which centred round the Archduke Franz Ferdinand. He was minister of war from Sept. 1911 until Dec. 1912. In the course of his reorganization of the army, especially of the supply department, he made many enemies who compelled his dismissal by the emperor. In 1914 he commanded the Austrian 4th Army and won a remarkable victory at Komarów, Aug. 26–Sept. 3, 1914.

After the victory Auffenberg succeeded in the difficult operation of completely changing the front of his entire army, with which he moved southward in time to take part in the second battle of Lemberg; but the superior strength of the Russians and the failure of his colleagues to maintain the front farther south made it impossible for him to avert defeat. He was then called on to resign his command, and in April 1915 was arrested for alleged irregularities during his tenure of the war ministry. There was no real evidence for the charges and he was acquitted; but he took no further part in public life. He wrote *Aus Oesterreichs* Hohe *und* Niedergang (1921); he also contributed to the Encyclopedia *Britannica* (12th ed.) an important article on the battles around Lemberg (Lwow) and some biographies.

AUFGESANG, a division of the verses or stanzas of the ancient German Minnelieder. The stanza was usually divided into three sections. The two first, which were similar in construction, formed the introduction or *Aufgesang*, and the third was known as the *Abgesang* or conclusion. The form is still in use for hymns.

AUFIDENA, ancient city of the Samnites Caraceni, just north of modern Alfedena, Italy, a station on the railway between Sulmona and Isernia, 37m. from the latter. Its remains are described by L. Mariani in *Monumenti* dei Lincei (1901), 225 seq.; *cf. Notizie* degli scavi (1901), 442 *seq.*; (1902), 516 seq. The ancient city occupied two hills, both over 3,800ft. above sea-level (in the valley between were found the supposed remains of the later forum), and the walls, of rough Cyclopean work, were over a mile in circuit. Fourteen hundred tombs have already been examined in the necropolis below the town, and this may be only a sixteenth of the whole. They are all inhumation burials, of the advanced iron age (7th to 4th century B.C), falling into three classes—those without coffin, those with a coffin formed of stone slabs, and those with a coffin formed of tiles. The objects discovered are preserved in a museum on the spot. Castel di Sangro, five miles to the north-east, was probably the post-station on the road between Sulmo and Aesernia in the Roman period.

AUGEAS, AUGEIAS or **AUGPAS,** in Greek legend, a son of Helios the sun-god, and king of the Epeians in Elis. He possessed an immense wealth of herds, including 12 white bulls, sacred to Helios. Eurystheus imposed upon Heracles the task of clearing out all his stalls unaided in one day. This Heracles did by turning the rivers Alpheus and Peneus through them. Augeas had promised him a tenth of the herd but refused this, alleging that Heracles had acted only in the service of Eurystheus. Heracles thereupon sent an army against him, and finally slew Augeas and his sons. (Pindar, *Olymp.*, xi. 24; Diodorus, iv. 13; Theocritus, Idyll, 25.)

AUGEREAU, PIERRE FRANÇOIS CHARLES, DUKE OF CASTIGLIONE (1757–1816), marshal of France, was born in Paris in a humble station of life. In his early manhood he was a soldier of fortune, serving in the Russian, Prussian, and Neapolitan armies; but the events of the French Revolution brought him back to his native land. He served against the Vendeans and then joined the troops opposing the Spaniards in the south. There he rose rapidly, becoming general of division on Dec. 23, 1793. His division distinguished itself in the Italian campaign, and under Bonaparte he had a share in the battle of Millesimo and in taking the castle of Cosseria and the camp of Ceva. At the battle of Lodi (May 10, 1796), the turning movement of Augereau and his division helped to decide the day, and at Castiglione he rendered signal services. Bonaparte thus summed up his military qualities: "Has plenty of character, courage, firmness, activity; is inured to war; is well liked by the soldiery; is fortunate in his operations"

In 1797 Bonaparte sent him to Paris to encourage the Directors, and it was Augereau and the troops led by him that coerced the "moderates" in the councils and carried through the coup *d'état* of 18 Fructidor (Sept. 4, 1797). He took no part in the coup *d'état* of Brumaire, 1799, and did not distinguish himself in the Rhenish campaign which ensued. Nevertheless, owing to his final adhesion to Bonaparte's fortunes, he received a marshal's baton at the beginning of the empire (May 19, 1804). In the campaign of 1805 he did good service around Constance and Bregenz, and at Jena (Oct. 14, 1806) his corps distinguished itself. Early in 1807 he fell ill of a fever, and at the battle of Eylau he had to be supported on his horse, but directed the movements of his corps with his wonted bravery. His corps was almost annihilated and the marshal himself received a wound from which he never quite recovered.

When transferred to Catalonia, he gained some successes but tarnished his name by cruelty. In the campaign of 1812 in Russia, and in the Saxon campaign of 1813, his conduct was little more than mediocre. Before the battle of Leipzig (Oct. 16 to 19, 1813), Napoleon reproached him with not being the Augereau of Castiglione, to which he replied, "Give me back the old soldiers of Italy, and I will show you that I am." In 1814 he had command of the army of Lyons, and his slackness exposed him to the charge of having come to an understanding with the Austrian invaders. Thereafter he served Louis XVIII., but after reviling Napoleon, went over to him during the Hundred Days. The emperor repulsed him and charged him with being a traitor to France in 1814. Louis XVIII., when restored to the throne, deprived him of his military title and pension. He died at his estate of La Houssaye on June 12 1816. In person he was tall and commanding, but his loud and vulgar behaviour frequently betrayed the soldier of fortune.

See Kock's *Mémoires* de *Masséna;* Bouvier, Bonaparte en *Italie;* Count A. F. Andréossi, La Campagne *sur le Mein, 1800–01;* Baron A. Ducasse, *Précis* de la *campagne* de *l'armée* de Lyon en 1814; and the Memoirs of Marbot.

AUGHRIM or **AGHRIM,** a small village in Co. Galway, Eire, 4 mi. W. by S. of Ballinasloe. It is rendered memorable by the decisive victory gained here on July 12, 1691, by the forces of William III under General Ginkel, over those of James II under the French general St. Ruth, who fell in the fight. The Irish, numbering 25,000 and strongly posted behind marshy ground, at first maintained a vigorous resistance; but Ginkel having penetrated their line of defense, and their general being

struck down by a cannon ball at this critical moment, they were at length overcome and routed with terrible slaughter. The loss of the English did not exceed 700 killed and 1,000 wounded; while the Irish, in their disastrous flight, lost about 7,000 men, besides the whole material of the army. This defeat rendered the adherents of James in Ireland incapable of further efforts, and was speedily followed by the complete submission of the country.

AUGIER, GUILLAUME VICTOR EMILE (1820–1889), French dramatist, was born at Valence, Drôme, on Sept. 17, 1820. He was the grandson of Pigault Lebrun, and belonged to the well-to-do *bourgeoisie* in principles and in thought as well as by actual birth. He received a good education and studied for the bar. In 1844 he wrote a play in two acts and in verse, *La Ciguë,* produced with considerable success at the Odéon. Thenceforward, at fairly regular intervals, either alone or in collaboration with other writers—Jules Sandeau, Eugène-Marie Labíche, Éd. Foussier—he produced plays which were in their way eventful His last comedy, *Les Fonrrchambault,* belongs to the year 1878. After that date he wrote no more, restrained by an honourable fear of producing inferior work. He died at Croissy on Oct. 25, 1889.

Augier, with Dumas *fils* and Sardou, may be said to have held the French stage during the Second Empire. The man respected himself and his art, and his art on its ethical side—for he did not disdain to be a teacher—has high qualities of rectitude and self-restraint. Uprightness of mind and of heart, generous honesty, as Jules Lemaitre well said, constituted the very soul of all his dramatic work. *L'Aventurière* (1848), in verse, the first of Augier's important worts, already shows a deviation from romantic models; and in the *Mariage d'Olympe* (185j) the courtesan is shown as she is, not glorified as in Dumas's *Dame aux Camélias.* In *Gabrielle* (1849), in verse, he declared war on romanticism; and in the comedies that followed he showed no sympathy for the nervous and melancholy types of character hitherto in favour. But it is difficult to comment on contemporary life in verse, and Augier found fuller expression for his criticism of the Paris of his day when he turned to prose-writing. *Le Gendre de M. Poirier* (1854), written in collaboration with Jules Sandeau, is still a classic. Others of his nine successful plays are *Le Fils de Giboyer* (1862), *Lions et renards* (1869), *Jean de Thommeray* (1874), *Madame Caverlet* (1876), and *Les Fourchambault* (1878). The two last-named are *pièces à thèse* on the strict Dumas model. Augier's first drama, *La Ciguë,* belongs to a time (1844) when the romantic drama was on the wane; and his almost exclusively domestic range of subject scarcely lends itself to lyric outbursts of pure poetry. His verse, if not that of a great poet, has excellent dramatic qualities, while the prose of his prose dramas is admirable for directness, alertness, sinew and a large and effective wit. René Doumic has said of his plays that in their ensemble they form the most complete expression of the bourgeois society of the time, and that they are one of the most important manifestations of the bourgeois spirit in the whole of French literature.

AUGITE, an important rock-forming mineral of the pyroxene (*q.v.*) group. The name is now applied to aluminous pyroxenes of the monoclinic series, which are dark-green, brown or black in colour. The habit of well-shaped crystals in lavas is simple and very characteristic, consisting of the forms a (100), b (010), *m* (110), and *s* (111). Twins with the orthopinacoid (100) as twin plane are common. Chemically, augite is an isomorphous mixture in which the compounds diopside ($CaMgSi_2O_6$) (*q.v.*) and hedenbergite ($CaFe'Si_2O_6$) preponderate, but containing also alumina and ferric oxide and variable amounts of the $(Mg,Fe'')SiO_3$ (clinoenstatite) molecule. The small amount of sodium usually present in the mineral occurs in solid solution as the acmite-jadeite molecule. The interpretation of augite analyses is not simple, and it is at present not possible to state the manner in which the sesquioxides $(Al,Fe''')_2O_3$ are disposed in the constitution of the mineral. According to G. Tschermak's view, these enter in the form of the hypothetical silicate $(Mg,Fe)O\,(Al,Fe)_2O_3SiO_2$ sometimes known as Tschermak silicate, but a study of superior analyses of augite shows that this view cannot be sustained. It is believed by some investigators that alumina and ferric oxide (above that needed for the acmite-jadeite molecules) enter as such in solid solution with diopside and hedenbergite. Thus interpreted an analysis of an augite from Hawaii and 6.82% Al_2O_3 and 3.36% Fe_2O_3, has the molecular composition as follows: $CaMgSi_2O_6$, 69·12%; $CaFeSi_2O_6$, 15·13%; $NaFeSi_2O_6$ (acmite), 5·08%; $MgSiO_3$, 1·90%; $FeSiO_3$, 0·40%; $(Al,Fe)_2O_3$,8·65%. Common augite is usually non-pleochroic, but varieties containing significant proportions of soda (aegirine-augite) or titania (titan-augite) are noticeably so, the former being characteristically green and the latter violet in thin section. Augite is a common mineral of igneous rocks of medium and low silicity such as porphyrites, gabbros and basalts while the varieties aegirine-augite and titan-augite are characteristic of alkaline igneous rocks, nepheline- and leucite-bearing lavas and intrusions, monchiquites, limburgites, etc. (C. E. T.)

AUGMENT, in Sanskrit and Greek grammar the vowel prefixed to indicate the past tenses of a verb; in Greek grammar it is called *syllabic,* when only the ε is prefixed; *temporal,* when it causes an initial vowel in the verb to become a diphthong or long vowel, (Lat. *augere,* to increase).

AUGMENTATION, or enlargement, a term in heraldry for an addition to a coat of arms; in biology, an addition to the normal number of parts; in Scots Law, an increase of a minister's stipend by an action called "Process of Augmentation." The "Court of Augmentation" in Henry VIII.'s time was established to try cases affecting the suppression of monasteries, and was dissolved in Mary's reign. In music, augmentation is a term signifying that the notes to which it applies are doubled in length, quavers becoming crotchets, crotchets minims, and so on.

AUGSBURG, a city and episcopal see, Bavaria, Germany, chief town of the district of Swabia. Pop. (1939) 185,704. Lying on a plateau 1,500ft. above sea, between the rivers Wertach and Lech, which unite below the city, it consists of an upper and a lower town, the old Jakob suburb and various modern suburbs.

Augsburg (*Augusta Vindelicorum*) is named after Augustus, who established a Roman colony here about 14 B.C. Sacked by the Huns in the 5th century it afterwards came under the power of the Frankish kings. It suffered in the war of Charlemagne against Tassilo III., duke of Bavaria; and later became part of the dukedom of Swabia, when it became important as a manufacturing and commercial town, becoming, after Niirnberg, the centre of the trade between Italy and North Europe; its merchant princes, the Fuggers and Welsers, rivalled the Medici of Florence; but with the discoveries of the 15th and 16th centuries trade declined. In 1276 it was made a free imperial city, until its annexation (1806) to the kingdom of Bavaria. It was besieged and taken by Gustavus Adolphus in 1632, and in 1635 surrendered to the imperial forces; in 1703 it was bombarded by the electoral prince of Bavaria, and also suffered severely in the war of 1803. The Augsburg confession (1530) and the Augsburg alliance (1686) were decided here. The Renaissance town hall (*1616–1620*) is one of the finest in Germany, and contains the "Golden Hall," 113 ft. long, 59 ft. broad and 53 ft. high. The cathedral, with two Romanesque towers, dates from the 10th century. The church of St. Ulrich is Late Gothic (1474–1500), finely proportioned, with a high tower (300 ft.). The newer buildings, in the west quarter of the city, include law courts, a theatre, and a municipal library. The "Fuggerei," built in 1519 by the brothers Fugger, is a miniature town, with six streets or alleys, three gates and a church, and consists of 106 small houses let to indigent Roman Catholic citizens.

Augsburg, the chief seat of the textile industry in south Germany, produces woollen, linen and cotton goods and has bleaching and dye works. Its production of agricultural and industrial machinery and its chemical works are important. Most important in World War II were the factories making Diesel engines for submarines and Messerschmitt planes. These factories were bombed by the British in Sept. 1940, and very heavily attacked from the air in April 1942 and in 1943

AUGSBURG, CONFESSION OF, the most important Protestant statement of belief drawn up at the Reformation,

presented in Latin and German to the emperor Charles V. at the Diet of Augsburg, June 25, 1530. It was compiled by Melanchthon, but based on articles previously drawn up by Luther, and in particular on those presented by him at the Marburg conference (see MARBURG, COLLOQUY OF); Melanchthon being in constant correspondence with Luther while compiling the Confession. It has become the classical statement of Lutheran doctrine, and is in effect the official creed of the Lutheran Churches. The 21 articles of its first part state the main doctrines held by Lutherans: (a) in common with Roman Catholicism, the doctrine of the creeds of the Catholic Church; (b) in common with Augustine and his followers, against Pelagianism and Donatism; (c) in opposition to Roman Catholicism, affirming justification by faith and the exclusive mediatorship of Christ; also on the Church, the ministry, and rites; (d) in opposition to Anabaptism, on the meaning and administration of sacraments, on confession, and on the millennium. The seven articles of the second part condemn what Luther and his followers believed to be the chief Roman abuses: (1) withholding the cup; (2) compulsory celibacy of the clergy; (3) the Mass a sacrifice; (4) compulsory confession; (5) festivals and fasts; (6) monastic vows; (7) secular authority exercised by bishops.

See Hastings, *Encyclopaedia of Religion and Ethics,* art. "Confessions," § 13, Confessions in the Lutheran Churches"; Lindsay, *History of the Reformation,* vol. i., bk. ii., ch. v.; Beard, *The Reformation in Relation to Modern Thought and Knowledge;* Herzog-Hauck, *Realencyklopadie,* art. "Augsburger Bekeantniss," with references to Continental writers. On the history of the text of the Coniession, *see* Müller, *Die symbolischen Bücher der evangelisch-lutherischen Kirche* (1907). The text presented at the Diet is known as the *Invariata,* and the edition revised by Melanchthon and issued in 1540 as the Variata—the former being authoritative for Lutheranism.

AUGSBURG, WAR OF THE LEAGUE OF (the name applied to the European War of 1688–97). The League of Augsburg was concluded on July 9, *1686,* by the emperor, the elector of Brandenburg and other princes, against the French. Spain, Sweden, England and other non-German states joined the league, and formed the Grand Alliance by the Treaty of Vienna (July 12, 1689). (*See* GRAND ALLIANCE, WAR OF THE.)

AUGURS, in ancient Rome, members of a religious college whose duty it was to observe and interpret the signs *(auspices)* of approval or disapproval sent by the gods in reference to any proposed undertaking. The *augures* were originally called *auspices,* but, while *auspex* fell into disuse and was replaced by *augur, auspicium* was retained as the scientific term for the observation of signs. *Auspex=avi-spex,* "observer of birds"; *augur* may perhaps=*avi-gur,* from *garrire,* to chatter (of birds), but is more probably to be referred to a lost verb *augo,* tell, so that the *augur* would be one who declares the will of the gods.

The early history of the college is obscure. Its institution has been attributed to Romulus or Numa. It probably consisted originally of three members, of whom the king himself was one. This number was doubled by Tarquinius Priscus, but in *300* B.C. it was only four, two places, according to Livy (x 6), being vacant. The Ogulnian law in the same year increased the number to nine, five plebeian being added to the four patrician members. In the time of Sulla the number was 1 j, which was increased to *16* by Julius Caesar. This number continued in imperial times; the college itself was certainly in existence as late as the 4th century A.D. The office of augur, which was bestowed only upon persons of distinguished merit and was much sought after by reason of its political importance, was held for life. Vacancies were originally filled by co-optation, but by the Domitian law (104) the selection was made, by 17 out of the 35 tribes chosen by lot, from candidates previously nominated by the college. The insignia of office were the *lituus,* a staff free from knots and bent at the top, and the *trabea,* a kind of toga with bright scarlet stripes and a purple border.

The science of augury was contained in various written works, including a manual of augural ritual, and a collection of answers given by the college to the senate. The natural region to look to for signs of the will of Jupiter was the sky, where lightning and the flight of birds seemed directed by him as counsel to men. It was the duty of the augur, before the auspices properly so called (those from the sky and from birds) were taken, to mark out with his staff the *templum* or consecrated space within which his observations were intended to be made. At midnight, when the sky was clear and there was an absence of wind, the augur, in the presence of a magistrate, took up his position on a hill which afforded a wide view. After prayer and sacrifice, he marked out the *templum* both in the sky and on the ground and dedicated it. Within its limit he then pitched a tent, in which he sat down with covered head, asked the gods for a sign, and waited for an answer. As the augur looked south he had the east, the lucky quarter, on his left, and therefore signs on the left side were considered favourable, those on the right unfavourable. The practice was the reverse in Greece; the observers of signs looked towards the north, so that signs on the right were regarded as the favourable ones, and this is frequently adopted in the Roman poets. The augur afterwards announced the result of his observations in a set form of words, by which the magistrate was bound.

Signs of the will of the gods were of two kinds, either in answer to a request (*auspicia impetrativa*), or incidental *(auspicia oblativa).* Of such signs there were five classes: (1) Signs in the sky *(caelestia auspicia),* consisting chiefly of thunder and lightning, but not excluding falling stars and other phenomena. Lightning from left to right was favourable, from right to left unfavourable; but on its mere appearance, in either direction, all business in the public assemblies was suspended for the day. Since the person charged to take the auspices for a certain day was constitutionally subject to no other authority who could test the truth or falsehood of his statement that he had observed lightning, this became a favourite device for putting off meetings of the public assembly. Restrictions were, however, imposed in later republican times. When a new consul, praetor or quaestor entered on his first day of office and prayed the gods for good omens, it was a matter of custom to report to him that lightning from the left had been seen. (2) Signs frorn birds *(signa ex avibus),* with reference to the direction of their flight, and also to their singing, or uttering other sounds. To the first class, called *alites,* belonged the eagle and the vulture; to the second, called *oscines,* the owl, the crow and the raven. The mere appearance of certain birds indicated good or ill luck, while others had a reference only to definite persons or events. In matters of ordinary life on which divine counsel was prayed for, it was usual to have recourse to this form of divination. For public affairs it was, by the time of Cicero, superseded by the fictitious observation of lightning. (3) Feeding of birds *(auspicia ex tripudiis),* which consisted in observing whether a bird—usually a fowl—on grain being thrown before it, let fall a particle from its mouth (*tripudium sollistimum*). If it did so, the will of the gods was in favour of the enterprise in question. The simplicity of this ceremony recommended it for very general use, particularly in the army when on service. (4) Signs from animals *(pedestria auspicia,* or *ex quadrupedibus), i.e.* observation of the course of, or sounds uttered by, quadrupeds and reptiles within a fixed space, corresponding to the observations of the flight of birds, but much less frequently employed. (5) Warnings *(signa ex diris),* consisting of all unusual phenomena, but chiefly such as boded ill. Such were various noises, the fall of a stick in a temple, the squeak of a mouse, stumbling, sneezing, or the seizure of anyone in the *comitia* by an epileptic fit (*morbus comitialis*). Being accidental in their occurrence, they belonged to the *auguria oblativa,* and their interpretation was rather a matter for the *pontifices* than for the augurs, when the incident wss not already provided for by a rule.

Among the other means of discovering the will of the gods were the casting of lots, oracles of Apollo (in the hands of the college *sacris faciundis*), but chiefly the examination of the entrails of animals slain for sacrifice. Anything abnormal found there was brought under the notice of the augurs, but usually the Etruscan *haruspices* (*q.v.*) were employed for this. The persons entitled to ask for an expression of the divine will on a public affair were the magistrates. To the highest offices, including all persons of consular and praetorian rank, belonged the right of taking *auspicia maxima;* to the inferior

offices of aedile and quaestor, the auspicia *minora;* the differences between these, however, must have been small. The subjects for which auspicia *publica* were always taken were the election of magistrates, their entering on office, the holding of a public assembly to pass decrees, the setting out of an army for war. They could only be taken in Rome itself; and in case of a commander having to renew his *auspicia,* he must either return to Rome or select a spot in the foreign country to represent the hearth of that city. The time for observing auspices was, as a rule, between midnight and dawn of the day fixed for any proposed undertaking. The founding of colonies, the beginning of a battle, the calling together of an army, sittings of the senate, decisions of peace or war, were frequently occasions for taking auspices. The place where the ceremony was performed was not fixed, but selected with a view to the matter in hand. A spot being selected, the official charged to make the observation pitched his tent there some days before. A matter postponed through adverse signs from the gods could on the following or some future day be again brought forward for the auspices. If an error (*vitium*) occurred in the auspices, the augurs could, of their own accord or at the request of the senate, inform themselves of the circumstances, and decree upon it. A consul could refuse to accept their decree while he remained in office, but on retiring he could be prosecuted. Auspicia oblativa referred mostly to the comitia. A magistrate was not bound to take notice of signs reported merely by a private person, but he could not overlook such a report from a brother magistrate. For example, if a quaestor on his entry to office observed lightning and announced it to the consul, the latter must delay the public assembly for the day.

BIBLIOGRAPHY.--On the subject generally, *see* A. Bouché-Leclercq, *Histozre de la divination dans l'antiquité* (1879), and his articles, with bibliography, in Daremberg and Saglio's *Dictionnaire des antiquitts;* J. Marquardt, *Ronzische Staatsverwaltung* (iii. 1885); articles "Augures," "Auspicium," in Pauly-Wissowa, *Realencyklopädie* (II. pt. ii., 1896); G. Wissowa, *Religion und Kultus der Romer* (1912), and by L. C. Purser (and others) in Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890). *(See* also DIVINATION, OMEN, ASTROLOGY, etc.)

AUGUST (originally *Sextilis*), the sixth month in the pre-Julian Roman year, which received its present name from the Emperor Augustus. The preceding month, *Quintilis,* had been called "July" after Julius Caesar, and the emperor chose August to be renamed in his own honour because in that month he had been admitted to the consulate, had thrice celebrated a triumph, had received the allegiance of the soldiers stationed on the Janiculum, had concluded the civil wars, and had subdued Egypt.

AUGUSTA, a city of Georgia, U.S.A., 171 mi. E. by S. of Atlanta, at the head of navigation on the Savannah river; the county-seat of Richmond county. It is on federal highways 1, 25, and 78; is a pivoted point for other southeastern roads; and is served by the Southern, the Atlantic Coast Line, the Central of Georgia, the Georgia, the Charleston and Western Carolina, and the Georgia and Florida railways and by bus lines. It is an inland port on the Savannah river, 201 mi. from the seaport of Savannah, and in 1937 a lock and dam were constructed by the war department and an increase in water-borne commerce followed. The city is protected by an 11 mi. levee. The city has an airport, with air mail, air passenger and air express service. Population (1940) 65,919.

Augusta has an average monthly temperature ranging from 48° F. in January to 81° in July, and an average of 8 hrs. of sunshine daily throughout the year. This, combined with its accessibility, and with the natural beauties of pine forests, dogwood, jasmine, azaleas, and other characteristic flora, has given it an established reputation as a winter resort. There are hotels of charm and distinction, and many beautiful private winter homes.

The city extends along the river, from Lake Olmstead on the north, for more than 3 mi. On its outskirts are the residential suburbs of Lakemont and Forest Hills; the country club with two 18-hole golf courses; the aviation field; the U.S. Veterans' Psychiatric hospital No. 62; and Pendleton camp, a private benefaction for disabled veterans of World War I (100 ac. of virgin woodland, with cottages built as required), given and endowed (1919) by his parents as a memorial to Lieut. John Pendleton King. Across the river in South Carolina are the residential suburbs of North Augusta. Three miles down the river is the new Sand Bar Ferry bridge. The giant oaks which shade its approach mark the site of the most famous duelling ground of South Carolina and Georgia, where the last duel on record was fought in 1875.

The main business thoroughfare of the city (Broad street) is 170 ft. wide, and in it stands the Confederate monument, a shaft of marble surmounted by the figure of a private soldier. On beautiful Greene street are the city hall and the county court house, and several monuments of interest: to the poets of Georgia, who include Sidney Lanier; to Samuel Hammond, a revolutionary soldier and statesman; to the men of Richmond county who fell in the war between the states; and to the three Georgia signers of the Declaration of Independence. Over the canal is a bridge erected as a memorial to Archie Butt, who went down with the "Titanic." The city is famous for its beautiful private gardens.

There are many buildings of historic interest: *e.g.,* St. Paul's Episcopal church (founded 1750); the First Presbyterian church (1804) and the manse where Woodrow Wilson passed his boyhood; the United States arsenal, the only one in the southeast of the Mississippi, which was established in 1816, and has occupied its present site since 1826; the chimney of the Confederate powder mill, which was the principal source of supply for the Confederate army; and many homes of men who mere prominent in the history of state and nation. A Celtic cross in St. Paul's churchyard marks the site of Fort Augusta, built by Oglethorpe in 1735. It was near Augusta that Eli Whitney set up and operated his first cotton-gin.

The medical department of the University of Georgia (see ATHENS), founded in 1829 as the Georgia Medical college, occupies a campus of 45 ac., on which are located also the University hospital (built and maintained by the city) and the Wilhenford hospital for children, both of which are under the medical and surgical control of the university medical department. The state school for mentally defective children is 10 mi. from the city. The boys' high school occupies a building erected for the Academy of Richmond county (founded 1783). Paine college (incorporated as Paine institute, 1883) is an institution for Negroes supported by the Methodist Church.

Georgia's earliest textile mills were located near Augusta. Between 200,000 and 400,000 bales are the current annual cotton receipts. There are a press cloth manufacturing plant and four textile mills which consume 150,000 bales of cotton annually. One of the world's largest cotton waste mills is there. Augusta manufactures candy, fertilizer and cottonseed products. It handles hard and soft woods, and this enterprise, measured in lumber feet, amounts to 200,000,000 ft. a year. Augusta brick and tile manufacturers ship 650,000 tons of clay products annually. Contiguous to a rich kaolin belt, Augusta produces fire brick and manufactures refractory and insulating material.

Augusta was founded in 1735 by James Edward Oglethorpe, and was named after the contemporary princess of Wales. The Carolina colonists had a trading post in the vicinity before Oglethorpe, and earlier still it had been the chief trading centre of the seven Cherokee nations. During the colonial period it was the scene of several parleys and treaties with the Indians. At the most important of these, in 1763, the Choctaws, Creeks, Chicasaws, Cherokees, and Catawbas, meeting with the governors of North and South Carolina, Virginia, and Georgia, agreed to the terms of the Treaty of Paris. At the opening of the Revolution the prevailing temper of Augusta was loyalist. The town was held by the British for a month in 1779, and again from May 1780 to June 1781. Except for these periods it was the seat of the state government in 1779–80 and again from 1783–95. Here met the Land court which confiscated the property of the loyalists of Georgia; and also the convention which ratified the constitution af the United States.

The town was incorporated in 1798 and secured a city charter in 1817. A steam packet to Savannah was established in 1817, and this stimulated the commercial development. By 1860 the popu-

lation had grown to 12,493. Throughout the Civil War the city was an important centre for the manufacture of military supplies.

AUGUSTA, the capital of Maine, U.S.A., and the shire-town of Kennebec county, at the head of navigation on the Kennebec river, 60 mi. N.E. of Portland. It has an airport, is served by the Maine Central railroad and bus lines, and in every direction radiate hard-surfaced highways and historic trails.

The population in 1930 was 17,198 and 19,360 in 1940 by the federal census.

The state capitol is a fine building of native granite, which still keeps the original front designed by Charles Bulfinch in 1829. It houses the state museum, which contains many exhibits of Maine fauna. The executive mansion is the former home of James G. Blaine, who lived here during most of his public life. Fort Western (erected 1754) was restored in 1919 as a historic monument. Across the river on a farm of 500 ac. is a state hospital for the insane, which was established in 1834. Lake Cobbosseecontee, one of the best fishing waters in Maine, is about 4 mi. W. of the city. The bridge across the Kennebec is 1,100 ft. long. The Kennebec dam (first built in 1837) is head of tide, 40 mi. from the Atlantic ocean.

The principal industries are the manufacture of paper products, cotton goods and shoes. Printing and publishing are also important, including the publication of several national periodicals.

The post office is rated in the first class. There is a paper mill manufacturing tissues, towels and napkins; a cotton mill with 1,761 looms and 71,440 spindles; a lumber mill produces long lumber and house finishings; and two shoe factories. The output of the 39 establishments within the city limits in 1940 was valued at over $12,000,000.

Augusta occupies the site of an Indian village, Koussinoc, where the Plymouth colony established a trading-post about 1628. In 1754 a fort was erected. A post office was established in 1794. The town was incorporated under the name of Harrington in 1797, and became the shire-town in 1799. It was chosen as the capital of the state in 1827, and became the seat of government in 1831, on the completion of the state house. The city charter was obtained in 1849.

AUGUSTA, a seaport of Sicily, 19 mi. N. of Syracuse by rail. Pop. (1936) 17,716 (town); 19.690 (commune). It occupies a part of the former peninsula of Xiphonia, now a small island, connected with the mainland by a bridge. Founded by the Emperor Frederick II (1232), it was almost destroyed by earthquake (1693) after which it was rebuilt. The castle is now a large prison. There are considerable saltworks at Augusta. The port and vicinity were bombed by the Allies in World War II after the Tunisian victory.

AUGUSTA BAGIENNQRUM, chief town of Ligurian Bagienni, identical with modern Bene Vagienna, on the upper course of the Tanaro, about 3½ mi. S. of Turin, Italy. It remained a tribal centre in the reorganization and replanning under Augustus, whose name it bears. There are remains of public buildings, in concrete faced with small stones, with bands of brick at intervals, an amphitheatre with major axis 390 ft. and minor axis 305 ft., a theatre with stage 133 ft. in length, and near it the foundations of what was probably a basilica, an open space (no doubt the forum), an aqueduct, baths, also one of the city gates, flanked by two towers 22 ft. square.

AUGUSTAN HISTORY, the name given to a collection of the biographies of the Roman emperors from Hadrian to Carinus (A.D. 117–284). The work, which, as we have it, is mutilated, the preface and a few lines being lost, professes to have been written during the reigns of Diocletian and Constantine, and to be the composition of six authors — Aelius Spartianus, Julius Capitolinus, Aelius Lampridius, Vulcacius Gallicanus, Trebellius Pollio and Flavius Vopiscus. Who really wrote it is unknown; the date is perhaps the reign of Julian; the whole tone is interpreted by Baynes (see below) as one of disguised propaganda in his favour.

The importance of the Augustan history as a repertory of information is very considerable, because it is frequently our only authority for the period it covers. It is, however, a most wretched work, both as history and as literature. In form, the biographies are plainly modelled upon Suetonius; the sources are obscure, the authorities quoted mostly unknown, if not imaginary. Marius Maximus and Aelius Junius Cordus, to whose qualifications the *Historia* Augusta itself bears no favourable testimony, are oftenest cited, and are mere names for us. The earlier lives, however, contain a substratum of authentic historical fact, which recent critics have supposed to be derived from a lost work of an annalistic nature. Another and less good source was a series of biographies of the emperors. As to the alleged extracts from public records, private letters, etc., of the emperors, and so forth, they are to be received with the utmost caution, so many being palpable forgeries as to create a prejudice against them all. No biographical particulars are recorded respecting any of the writers. From their acquaintance with Latin and Greek literature they must have been men of letters by profession, and very probably secretaries or librarians to persons of distinction. There seems no reason to accept Gibbon's contemptuous estimate of their social position. They appear particularly versed in law. Spartianus's reference to himself as "Diocletian's own" seems to indicate that he was a domestic in the imperial household. They address their patrons with deference, acknowledging their own deficiencies, and seem painfully conscious of the profession of literature having fallen upon evil days.

BIBLIOGRAPHY.—Editio princeps (1475). Casaubon (1603) showed great critical ability in his notes, but for want of a good ms. left the restoration of the text to Salmasius (1620), whose notes are a most remarkable monument of erudition, combined with acuteness in verbal criticism and general vigour of intellect. Of recent years considerable attention has been devoted by German scholars to the *History*, especially by Peter, whose edition of the text in the Teubner series (1884) contains (praef. xxxv.–xxxvii.) a bibliography of works on the subject preceding the publication of his own special treatise. For the latest comment, *see* Norman Baynes, *The Historia Augusta, its Date and Purpose* (1926, contains bibliography of earlier works).

AUGUSTA PRAETORIA SALASSORUM (mod. Aosta, *q.v.*), ancient town of Italy, district of the Salassi, founded by Augustus about 24 B.C. on the site of the camp of Varro Murena, who subdued this tribe in 25 B.C., and settled with 3,000 praetorian~.Pliny calls it the last town of Italy on the northwest, and its position at the confluence of two rivers, at the end of the Great and Little St. Bernard, gave it much military importance, which is vouched for by considerable remains of Roman buildings. The ancient town walls, enclosing a rectangle 793 by 624 yd., are 21 ft. high, concrete faced with small blocks. There are towers at the angles of the *enceinte*, and others at intervals, and two at each of the four gates, making a total of 20 towers altogether. They are roughly 32 ft. square, and project 14 ft. from the wall. The east and south gates exist (the latter, a double gate with three arches flanked by two towers, is the Porta Praetoria, and is especially fine), while the rectangular Roman street scheme divides the town into 16 blocks (*insulae*). The main east to west road, 32 ft. wide, divides the city into two equal halves, showing that the city guarded the road. Some arcades of the amphitheatre (diameters 282 ft. and 239 ft.) and the south wall of the theatre are also preserved, the latter to a height of over 70 ft., and a market place some 300 ft. square, surrounded by storehouses on three sides with a temple in the centre, and two on the open (south) side, and the thermae, have been discovered. Outside the town is a handsome triumphal arch in honour of Augustus. About 5 mi. to the west is a single-arched Roman bridge, the Pondel, which has a closed passage, lighted by windows for foot passengers in winter, and above it an open footpath, both being about 33 ft. in width. There are considerable remains of the ancient road from Eporedia (mod. *Ivrea*) to Augusta Praetoria, up the Valle d'Aosta, which the modern railway follows.

See C. Promis, *Le antichità di Aosta* (Turin, 1862); E. Bérard in *Atti della Società di Archeologia di Torino*, iii. 119 *seq.*; *Notizie degli Scavi*, passim; A. d'Andrade, *Relazione dell'Ufficio Regionale per la conservazione dei Monumenti del Piemonte e della Liguria*, 146 *seq.* (Turin, 1899); F. Haverfield, *Ancient Town Planning* (Oxford, 1917).

AUGUSTINE, SAINT (AURELIUS AUGUSTINUS) (354–430), bishop of Hippo in proconsular Africa, A.D. 396–430, was born at Tagaste, a small town in the eastern part of the adjacent province of Numidia, in the year 354. His father Patricius

became Christian late in life; his mother Monica seems to have been Christian from her girlhood. Both were probably of pure Roman birth, but it is seldom possible to examine the racial antecedants of provincials at that date, and there may well have been some Numidian or Punic blood in the family. In any case they were Africans, and the climatic influences of the country are perceptible in the natural bent of Augustine's character. It may be noted that he wrote sympathetically of the last struggle of Carthage, and, addressing the Romans of his own day, called the conqueror "ille Scipio vester." (Civ. Dei. i. 30. iii. 18) He was acquainted with the Punic language, and aware of its affinity with Hebrew; when a bishop, he insisted on the appointment of priests who could speak it. At barely 12 years of age he was sent to a school of grammar at Madaura, an ancient colony of veterans where all was traditionally Roman. Five years later, steeped in Latin literature, but imperfectly acquainted with Greek and actively disliking it, he passed to Carthage, partly at the cost of his wealthy townsman Romanianus, for a course of rhetoric. Formally made a catechumen in childhood, he was not a Christian. He still retained enough of his mother's teaching to feel dissatisfied with the Hortensius of Cicero, for the strange reason that it contained no reference to Jesus Christ, but this was probably an interest of nothing more than curiosity. The self-reproaches of his maturity afforded no reason for attributing to him any plunge into gross licentiousness during his student days, and the constant temptations to such conduct seem rather to have disgusted him, though he experienced their full force; but his moral standards were those of the time and place, even if he were temperate in practice. Continence seemed to him out of the question; he formed at once one of those engagements of concubinage which were reckoned tolerable even for Christians, and found himself before he was 20 years old the father of a boy to whom he gave the pious name Adeodatus. Shortly afterwards he came under the influence of Manichaean teachers, and for nine years was a hearer, critical but not scornful, looking forward to the remotely possible asceticism of the elect. The attitude is significant, showing what was already the bent of his spirit. Intellectual difficulties, he was told, would be solved when he had heard Faustus, the great master Faustus came lo Carthage; Augustine thought him a poor, unscholarly creature, contemptuously cast aside the whole system, and fell back on the scepticism of the Academy.

AFTER A STATUETTE IN THE CHURCH OF S. MARIA DELLE GRAZIE, AT AREZZO
ST. AUGUSTINE, THE GREAT CHRISTIAN BISHOP AND PHILOSOPHER

Conversion. — In this mood he crossed the sea to Rome with his small family, hoping to find employment there as teacher of rhetoric. Failure and disappointment awaited him, and a year later he accepted an invitation to lecture at Milan. He arrived there in the autumn of 384, and was soon joined by his mother, now a widow. The crisis of his life was approaching. He soon came under the influence of Ambrose, the statesman-bishop of the city, who was engaged in a sharp struggle with Justina, the Arian mother of the young emperor Valentinian, but the influence seems to have been rather moral than intellectual. He was deep in the study of Cicero, who taught him to seek an escape from pyrrhonism in the practical certitude of moral judgments It is not easy to disentangle the events of the next two years, for the chronology of the memories written in his *Confessions* appears to be confused. It will be more serviceable to distinguish concurrent movements.

(1) Monica was determined, in a way which seems curiously modern, to settle him in marriage, and a suitable bride was found who was not quite of marriageable age The most unpleasant incident of his life follows As n preliminary his faithful companion the mother of Adeodatus was dismissed and sent back to Africa, where she joined a religious community. In reminiscence Augustine betrays some sympathy with her grief, but is much more occupied with his own loss. The result was a renewed conviction of the impossibility of continence, which he freely discussed with his pupil, the naturally chaste Alypius, doing the young man no little harm. To this period we may refer the ejaculatory prayer, branded on his memory, "Give me chastity, but not yet!" The struggle of flesh and spirit, which had driven him to Manichaeism, was again active. The issue was soon decided. He took another concubine for the time before his marriage, and was probably blamed by none but himself.

(2) Ponticinnus, an officer of the palace, called on Augustine and Alypius one day, and, a Christian himself, was surprised to find a volume of St. Paul's Epistles lying on their table. The ensuing conversation led him to speak of two officers of the imperial staff at Treveri who casually found in a house which they visited a copy of the Life of *St. Anthony,* the great Egyptian hermit; they read of his austerities, and were moved to embrace the same mode of life. Augustine was overwhelmed with shame. Those soldiers could make an act of renunciation which he, student and philosopher pledged to contempt of the world, could not compass.

(3) The weakness of the spirit against the flesh was enhanced by the intellectual weakness of scepticism. From this Augustine passed at a bound to Neoplatonism. A man whom he unkindly describes as inflated with conceit introduced him to the works of Plotinus, translated into Latin by Marius Victorinus, the eminent rhetorician practising at Rome. He read them with a personal interest when he heard from Simplicianus the story of the conversion of Victorinus to Christianity in his old age. His memory of the immediate effect, as narrated in the Confessions, may be coloured by later studies, for he says that he found in them a contact with the doctrine of the Word as taught in the fourth gospel; but the effect was certainly great, and he was, in a sense, Platonist from that time onward.

(4) The scene in the garden is one of the great loci *classici* of religious psychology. He was sitting one day with Alypius, who knew most of the trouble. his soul torn by the bitter conflict going on within him. A sudden gust of tears drove him from the presence of his friend; he went into the garden, and flung himself down, sobbing "How long! to-morrow and to-morrow!" He then heard the voice of a child singing in the next garden "Tolle lege, tolle lege." Curious, even at that moment, to know whether the words belonged to some childish game, he could remember nothing of the kind At once he applied them to himself as a divine command, calmly returned to the house, took up a volume of St. Paul's Epistles, opened it and read the words that first met his eyes: "Not in rioting and drunkenness, not in chambering and wantonness, not in strife and envying: but put ye on the Lord Jesus Christ, and make not provision for the flesh in the lusts thereof." He showed the passage to Alypius, who read further, pointed to the next words, "Him that is weak in the faith receive ye" and applied them to himself. Together they went to Monica and told her what had happened.

(5) This narrative, written by Augustine himself with extreme simplicity, and the whole story of his mental anguish, have been questioned as inconsistent with what followed. One of the few clear notes of chronology available shows that soon after these events Augustine, sick with the heat alike of summer and of his internal conflict, took a reading party to a pleasant country house at Cassiciacum, lent by his friend Verecundus This can be dated Aug. 386. Here they rend, and discussed what they had been reading with youthful high spirits and interludes of rustic labours. Monica, the only Christian of the party, occasionally intervened with modesty and good sense. A shorthand writer took notes of everything, which Augustine reduced to connected narratives modelled on Cicero's Tusculan Disputations. These are the Dialogues *Contra Academicos, De Beata* Vita, and De *Ordine.* They are purely philosophic, with occasional glances at Christian doctrines currently but imperfectly known in the world. Critics such as Gourdon and Alfaric ask what traces are here to be found of the stricken penitent soul which Augustine described in his

Confessions 13 years afterwards. If that picture had been true, it is urged, he must at once have renounced his chair of rhetoric, seeking the ascetic life which so strongly attracted him; nor indeed would his new friends within the Christian Church have tolerated the retention of so pagan a profession by a convert. The latter objection seems to imply that Christians in general shared the sentiments affected in open hostility by the emperor Julian; but Ausonius and Sulpicius Severus in recent years had not thought it necessary so to act. The former calls for examination. To understand the tone of the Dialogues we have to remember that not one of the young men of the party was an instructed Christian, and some had no thought of breaking with the old religion: Augustine the penitent would not wear his heart on his sleeve with them. It is even more important to bear in mind that from the moment of the incident in the garden he found himself, as frequently happens in such cases, wrapped in a profound peace. We have no reason to suppose that his gaiety at Cassiciacum was either forced or affected. When writing his Confessions he cared for nothing in that episode except his meditations on the Psalter in hours of solitude; the *Dialogues* he dismissed as mere academic exercises, which indeed they were, finished in the lingering darkness of his unregenerate days. Many years afterwards he noted in his Retractations their inevitable faults.

From Cassiciacum he wrote to Ambrose asking to be received as a convert, and at Easter, 387, the bishop himself baptized him with Alypius and Adeodatus. He now resigned his chair, but lingered some months at Milan, editing the Dialogues, and also writing the two unfinished books of *Soliloquia* (a word which he seems to have invented) in which he rigorously cross-examined his consciousness. These he condemned in his old age as too Platonic, echoing the theory of anamnesis and Porphyry's contempt for objects of sense. It was perhaps because he was already getting free from those Platonisms that he left them unfinished. Another writing of this date De Immortalitate *Animae,* which got into circulation against his will, he found even more objectionable on the same score. He then resolved to return to Africa, with Monica and some intimate friends, planning a new mode of life. Nothing more is heard of the projected marriage. He did not yet, however, abandon his literary studies, and he finished the six books De *Musica* in Africa.

On the way thither Monica died, waiting at Ostia for embarkation. In the Confessions Augustine unveiled his passionate grief, and the consolation that foliowed. Equally interesting is the story of his last conversation with her, in which he follows almost verbally the method of Plotinus (Ennead. V. 2) for entering on the Mystic Ascent. It may show what elements of Plotinian theory had most affected him.

Life in Africa. — Augustine settled with his friends on the small estate of his family at Tagaste, where they lived a common life of study and devotion. Within a year Adeodatus died, a brilliant boy of 17, whom his father made interlocutor in a dialogue De *Magistro,* the gist of which is that all knowledge comes directly or indirectly from God. After less than three years of this life, he happened to visit Hippo Regius, where his reputation had preceded him. Possidius, a disciple and friend of many years standing, narrates as from his own mouth what happened. The aged bishop Valerius addressed his flock assembled in the church, urging them to find a candidate for the priesthood; they laid hands on Augustine and brought him forward; the bishop thereupon ordained him priest in the tumultuous fashion of which several examples are recorded in that age. This was early in the year 391. His reputation continued to grow, chiefly because of his conduct of controversy with the Donatists, and Valerius, afraid of losing him to another church as bishop, wrote to Aurelius of Carthage as primate of Africa, suggesting that he should be consecrated bishop at once with right of succession to Hippo. Writing to Paulinus of Nola (Ep. 31) Augustine described his hesitation about this unusual procedure, but precedents were quoted, in Africa and elsewhere, and it was decided so to proceed. Early in the year 395 Megalio, the primate of Numidia, was at Hippo with some other bishops, and Augustine was consecrated. In the following year, on the death of Valerius, he became bishop of Hippo. Four years before his own death (Aug. 28, 430) he was asked to nominate his successor, but he would not then allow the same procedure, having learnt in the interval that it was forbidden by the Council of Nicaea. It is interesting evidence that the Canons of Nicaea were not yet current in Africa 70 years after their enactment.

The rule forbidding translations of bishops was strictly observed in Africa, and Augustine was therefore fixed for life, at 40 years of age, in that small seaport. We made it famous. During more than half his episcopate the most resounding voices in the Catholic Church were Latin voices. Chrysostom was gone. Cyril was not yet come to his own. Augustine and Jerome, the bishop of a provincial town in Africa and the monk at Bethlehem who would not minister in the priesthood which had been forced upon him, had the weight of a whole hierarchy. Both ruled by the pen. Augustine never went beyond the confines of Africa and Numidia; his voice was heard occasionally in a provincial council at Carthage, constantly from his apostolic chair at Hippo; his letters, weighty and powerful like those of St. Paul, went everywhere. The length of some was portentous; the number of them must have been immense. Two hundred and twenty, almost all dated during his episcopate, have been preserved and collected by the piety of subsequent ages to fill, with some 50 received by him, a large volume in folio. His sermons, usually brief, seem to have been preserved by shorthand writers; collected, they form running commentaries on considerable parts of the Bible, notably the Psalms and the fourth gospel. Of all these, thrown off in the day's work, he took little further notice. Of formal tractates and larger works he calculated towards the end of his life (*Ep.* 224) that he had written more than 230, many of which he "retracted" or criticized in a chronological catalogue of great importance. Something is known of his manner of working. The greater treatises were written at intervals, extending in the case of the 15 books De Trinitate over several years. Twelve of these were dragged from him and put into circulation before final revision, with consequences which made him hasten to complete the work. The 22 books De Civitate *Dei,* begun three years after the sack of Rome by Alaric in the year 410, were issued separately as written, and finished in 426. This mode of composition led to excessive digressions, and reflections on current events, many of which appear also in the epistles. Apart from these great works and the Confessions, almost all his writings bear the stamp of their occasion.

Literary Style. — Professor Souter's judgment on Augustine that "even if he be not the greatest of Latin writers, he is assuredly the greatest man that ever wrote Latin," may seem excessive. More critically we may say that this African of the 4th century might have been as Ciceronian as Jerome had he wished, and unlike Jerome he would not have pretended to be ashamed of it. Avowing the use of a more vulgar style in preaching, he elected to write the language current among the educated of his own day. It was a more flexible idiom than that of the great classics, and he was a consummate master of its possibilities. He was a great coiner of phrases, which sometimes controlled his thought too powerfully and more often did the same disservice to a reader. The famous ejaculation of the Confessions, "*Da* quod iubes, et *iube quod vis,*" became the starting point of the Pelagian controversy. Phrases torn from their context have been made dangerous catchwords. His simple but mystical description of baptism, "Accedit *verbum* ad *elementum* et fit *sacramentum,*" isolated and supplemented by the peripatetic distinction of matter and form, is the foundation of a whole chapter of theology. He was fastidious about words, disliking the ambiguous *persona* as used in theology; he employed it because it was customary, and because he could find none better, "non ut *illud diceretur,* sed *ne* taceretur." (De *Trin.* v. 9.) He was uneasy about Jerome's revision of the Old Latin text of Scripture, and his warnings were treated by that irascible scholar as impertinent; but, as Mr. Milne has shown, he soon became reconciled to it. His Dialogues are among the lightest and best of their rather heavy kind.

Theology. — In the space at our disposal it is impossible to give an adequate account of Augustine's contribution to theology.

It is the more difficult because he was not himself—except when writing De Trinitate, and then only at intervals—a systematic thinker. To find in his *Civitas Dei* an adumbration of the *respublica christiana* of the middle ages, would be equivalent to putting it there. The book contained valuable materials for the exponents of that polity, but for Augustine himself the empire under Theodosius, though it might by the advent of justice have ceased to be grande *latrocinium,* remained none the less civitas terrena. Though he could bring himself after long resistance to accept its aid against the African schismatics, and though he could twist a text of the gospel into a justification of that attempt to "compel them to come in," he remained unhappy in conscience. It was a hateful expedient, and one of the weak spots in his greatness was a tendency to fall back on expedients, alike in argument and in action. In consequence of all this, we have to seek most of his theology in occasional writings, and to sift it out of a mass of irrelevancies. It says much for the solidity of his habitual thought if we can arrive in this way at anything coherent. That can be done, but only in fragments. It may be said that Augustinianism is a close-knit system. It is; but Augustine was not an Augustinian. The close-knit system was formed out of elements gathered from his writings and put together without regard to other elements no less proper to his thought. Almost from the time of his conversion he was entangled in one or another of three great controversies. As priest and bishop he found himself at grips with Donatists. He had already, before leaving Rome for Africa, undertaken as a personal task the refutation of Manichaeism. The publication of his *Confessions* brought upon him a challenge from Pelagius which was not disposed of while he lived. Each dispute in which he engaged led him to certain theological conclusions.

The Donatists.—The Donatists had at first a fairly good case. They were the true inheritors of Cyprian's doctrine of the Church, which they reduced to absurdity by pressing it relentlessly to a logical conclusion. A faction, though amounting to a majority, of the African Church, they concluded that all the rest of the Church had fallen away to apostasy because not in communion with themselves. The schism was the stupidest, and the controversy about it the most wearisome, that has ever troubled the Christian Church, but Augustine drew from it some important points of doctrine. When he appeared on the scene, it had lasted for 70 years, and was become inveterate. He took up the argument of Optatus of Mileum, which he reduced to doggerel verse for the benefit of the unlearned. Optatus had boldly thrown over Cyprian's theory, and argued that separation did not necessarily amount to apostasy; he therefore insisted, with some rough humour, on calling the Donatists his brothers, to their great annoyance; he maintained that he himself and they were alike sons of the one Church, held the same faith, and possessed the same sacraments. Augustine shrank from dismissing so rudely the great African saint, and laboured at an accommodation. He met the difficulty about the sacraments by drawing a distinction between a sacrament and its effect, which has been fruitful in later theology. He argued that a sacrament is valid, whoever the minister may be, if administered in accordance with the institution of Christ, but the proper effect of the sacrament does not reach the soul of a recipient who interposes an obstacle of faithlessness, of heresy or of schism. Yet the proper effect is produced by the divine operation, even if it lie dormant, and the removal of the obstacle by the conversion of the recipient will release it for the work of grace. The more fundamental difficulty he treated with less subtlety, arguing that the whole Church throughout the world was properly called *Catholica,* while local churches were so called only because they were, broadly speaking, in communion with the whole. The whole Church, on this ground, condemned the Donatists as not Catholic, and acknowledged their opponents as Catholic. It was to beg the question; for the claim of the Donatists was that they, and they alone, were precisely the whole Church. But this dialectical weakness does not obscure the great addition made by Augustine to current conceptions of the Catholic Church. From the atomic episcopate of Cyprian and the earlier reliance on the traditions of apostolic sees he advanced, without putting these aside, to the conception of a world-wide society influencing all its parts and all its members. "*Consensio populorum* atque *gentium,*" he says, was one of the strands binding him; in the same connection (Contra *Ep.* Fund. 5) he makes the memorable statement, "I should not believe the gospel, did not the authority of the Catholic Church move me thereto." This authority should be strictly understood; it was not in the nature of dominion or jurisdiction, but was the true Latin auctoritas.

Manichaeism.—He first attacked Manichaeism on the side of its determinism in the dialogue De libero Arbitrio. The conduct of the argument is rather sophistical, depending on the difficulty of expressing in Latin the distinction which we can easily make in English between wish and will. The purpose is to affirm a valid experience of freedom and power. For Augustine what is given in experience is the basis of all certainty. On this ground he had further to combat the Manichaean dualism of light and darkness, good and evil, equally unalterable and eternal. The Platonic dualism of mind and matter, soul and body, was dangerously akin to this; he escaped from it by the way of the emanation-theory of Plotinus, in which all things that exist emanate from the eternal One, the source of all, partaking of existence in a measure diminishing with distance. But he was not satisfied. For the jejune idea of emanation he substituted the Hebraic conception of Creative Will, drawn from the Sapiential Books of the Old Testament. This gave him his monistic basis. But absolute transcendence of the First Cause would induce another absolute dualism of creator and creature. The argument drove him to the conception of a continuous Nature extending from Supreme Being—ab eo *qui summe* est—to the lowest grade of existence. The word natura became equivocal; there is the one continuous *cursus naturae,* and there are the several *naturae* of existing things. He could see subdivisions. The deacon Caelestinus, in difficulty with some Manichaeans, was instructed to see nature in triplicate: a nature mutable in time and space, which is body; a nature mutable in time but not in space, which is soul; and a nature wholly immutable, which is God. Augustine was certainly not immanentist in the sense of making the creature constituent of the Creator, but his whole thought was of God immanent in the world, *ordinator* as well as creator, controlling all things "*aut* faciendo aut *sinendo.*" And God is Love. Therefore all that is in nature is essentially good.

Where then is evil? Augustine was not the sort of optimist to explain it away as a lesser good. He had the beginnings of the scientific mind, an insatiable curiosity about the most trifling facts of nature, which he sometimes deplored as a distraction from things of greater moment. Hence a firm adhesion to ascertained fact was one of his characteristics. He knew evil as a fact of his own experience. But a positive fact? That would mean a return to dualism. Plotinus taught him that it was negative, a lack of something, a defect in that which is fundamentally good, due to remoteness from the Source. He accepted the description but not the explanation, for he had abandoned the emanation-theory. He found the cause in natures which are nearest in the scale of being to the Creator; men, whom we know, and others perhaps higher, whose existence we assume. These have received the splendid gift of reason and a limited freedom, so that they are capable of resisting control. Such lack of conformity to creative will is evil, and the only evil that he can find in the world, all other natures being constrained to obedience. *Mala voluntas* is the only malum. But the creature whose will is thus depraved remains naturally a good thing. Hence the affirmation which he unweariedly iterates: "Omnis natura, inquantum natura est, *bonum* est." Even evil actions, regarded merely as actions in abstraction from the directing will, are not in themselves evil. In a case of murder it is right to admire the strength and skill with which the fatal blow is delivered. The completeness of his monism is illustrated by his treatment of miracle. He took no account of "supernatural" causes. The word was not yet invented, and the idea was foreign to his mind. A miracle is simply an unusual event occurring in the course of nature, the immediate cause of which is unknown: it is done "*non* contra *naturam,* sed contra quam est nota natura."

Pelagianism.—It might seem impossible to accuse Augustine of reverting to Manichaean dualism, but the charge was made in his lifetime and has often been repeated. In his third great controversy he was constantly on the defensive. Pelagius opened the attack at Rome, scandalized by the words *"Da quod iubes et iube quod vis,"* which he took to involve a denial of human freedom and responsibility. Augustine heard of the criticism, but for some time took no public notice of it, though it was being freely discussed in correspondence. At last he wrote in general defence of his teaching the three books *"De peccatorum meritis et remissione,"* in which he avoided mention of Pelagius. Not until after the condemnation of Coelestius in 412 by a council at Carthage, from which he was wisely absent, did he come into the open with a book *De Natura et Gratia* in answer to one *De Natura* by Pelagius, whose zeal for human liberty and moral responsibility he warmly commended. The regions ecclesiastically dependent on Rome were the stronghold of the new teaching, and when Innocent I. in 417 confirmed the sentence on Coelestius, adding a milder censure of Pelagius, he thought the trouble was at an end. *"Causa finita est,"* he announced in a sermon at Hippo. For him it was only beginning. Within a year Zosimus, Innocent's successor, reversed the judgment. A very large African council protested, and the imperial power was once more unhappily invoked. Honorius compelled Zosimus to cancel the reversal, and to publish a more formal condemnation of the two leaders, which should be signed by all the bishops of the Roman province. Eighteen of them refused to sign, and were banished from Italy by imperial rescript.

From the broken ranks of the party a brilliant champion emerged. One of the banished bishops was Julian of Eclanum, a kinsman of Paulinus of Nola. Finding shelter in the East with Theodore of Mopsuestia, he opened a personal campaign against Augustine, who had beyond question laid himself open to criticism by his doctrine of sin. Maintaining always the essential goodness of every creature, *inquantum natura est,* he measured the effect of sin upon human nature by his own experience of impotence in the face of sinful habit, without considering how far that experience was exceptional. He found the same weakness confessed by St. Paul in circumstances quite unlike his own. It amounted to a paralysis of the will, leaving him at the mercy of instincts, summed up comprehensively as *concupiscence,* which ought to be kept under control. A curious study of child-psychology convinced Augustine that this weakness was congenital, and here again he could lean on St. Paul, though with less assurance. It was therefore inherited. Still with St. Paul he turned to the myth of Eden, regarded as an adequate though symbolical account of human origins, and the source of trouble was found in the sin of the first parents, causing a weakening of the will to do good, transmitted to all their offspring. Augustine attempted three explanations of this transmission, physiological identity of parent and offspring, solidarity of race, and a fouling of the act of generation by the presence of concupiscence. The result was that all humanity is a *massa perditionis,* in a state of moral death, out of which individuals are lifted to renewed life and liberty by a special favour or grace of God perfected in the sacrament of baptism. The *massa perditionis* must not be understood in the sense of the "total depravity" imagined by later Augustinians, for that was ruled out by his metaphysical requirement of a remnant of good in every creature. The doctrine of original sin was not invented by Augustine. It was in St. Paul, and more or less in all Christian teaching before him. What he added was the forensic idea of *reatus,* of guilt attaching even to a new-born child by reason of the depravation of nature. He argued this against Pelagius from the practice of infant baptism, allowed and even encouraged by the Church, since baptism was for the remission of sin. The answer of the Pelagians seems to be complete; remission of sin is not the only gift of grace in baptism.

Julian began with a complaint that the part assigned to concupiscence in this teaching involved a denial of the sanctity of marriage, which Augustine rebutted without much difficulty. He further alleged that it involved the Manichaean conception of the flesh as intrinsically evil, and that the *massa perditionis* was nothing else but the Manichaean Kingdom of Darkness. If Augustine had been content to ignore these allegations, it is probable that no harm would have been done, but he insisted on answering at great length every question that was raised, with the result that he was engaged for the remaining 12 years of his life in a constantly developing controversy, obstinately defending every doubtful position. It is generally agreed that he was dialectically no match for his opponent, who drove him from point to point, from exaggeration to exaggeration. Thus in the difficult doctrine of predestination the fact of God's apparently arbitrary election of individuals to receive the gift of grace was twisted into a conclusion that by similar election the gift is refused to many for whom it is desired: *"tam multos volentibus hominibus sed Deo nolente salvos non fieri."* (*Ep.* 217.) The proposition that fallen man cannot without the help of grace fulfil the purpose of God was stretched to mean that he cannot do anything well-pleasing to God. This extension is found elsewhere than in expressly controversial writings; in the earlier books *De Civitate Dei* Augustine could say that God gave the empire of the world to the Romans as a reward for their virtues; in the later he did not indeed say, as he has been accused of saying, that the virtues of unbelievers are *splendida vitia,* but he came very near doing so. (C.D. v. 15; xix. 25.)

It was during this time of stress that he emitted those extravagances, inconsistent as he himself knew (*Retract.* ii. 1) with the saner thought of his maturity, which have been made the core of the system known as Augustinianism. Four years after his death Vincent of Lerin wrote in the *Commonitorium* a travesty of these, as an example of the novelty which is heresy; but he did not venture to put to it the name of Augustine.

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AUGUSTINE, ST. (died c. 613), founder of the Christian Church in southern England, and first archbishop of Canterbury, occupied a position of authority in the monastery of St. Andrew at Rome, when Gregory I. summoned him, probably in A.D. 595, to lead a mission to England. The apprehensions of Augustine's followers caused him to return to Rome, but the Pope furnished him with letters of commendation and encouraged him to proceed. He landed in Thanet in A.D. 597, and was favourably received by Aethelbert, king of Kent, who granted a dwelling-place for the monks in Canterbury, and allowed them liberty to preach. Augustine first made use of the ancient church of St. Martin, at Canterbury, which before his arrival had been the oratory of the Queen Berta and her confessor Liudhard. Aethelbert, upon his conversion, employed all his influence in support of the mission. In A.D. 597, Augustine was consecrated bishop by Vergilius at Arles, and in 601 received the pallium from Gregory and was given authority over the Celtic churches in Britain, as well as of all future bishops consecrated in English territory, including York, which was to be independent after Augustine's death. In A.D. 603 he consecrated Christ Church, Canterbury, and built the monastery of SS. Peter and Paul, afterwards known as St. Augustine's. At a conference with the British bishops at Augustine's Oak he endeavoured in vain to bring about a union between the Celtic and the Roman churches. In A.D. 604 he consecrated Mellitus and Justus to the sees of London and Rochester respectively. He died soon after-

wards, though the *Saxon Chronicle* records the date of his death as A.D. 614, and the *Annales Monasterienses* as A.D. 612.

See Bede, *Eccl. Hist.* (ed. by Plummer), i. 23–ii. 3.

AUGUSTINIAN CANONS, a religious order in the Roman Catholic Church, called also Austin Canons, Canons Regular, and in England Black Canons, because their cassock and mantle were black, though they wore a white surplice; elsewhere the colour of the habit varied considerably. The Lateran Synod of 1059 had urgently exhorted the clergy of every cathedral and collegiate church to live together and adopt some form of regularized common life.

The clergy of some cathedrals (in England, Carlisle), and of a great number of collegiate churches all over western Europe, responded to the appeal; and the need of a rule of life suited to the new regime was satisfied by the so-called Rule of St. Augustine, which dates from the 6th or 7th century (see AUGUSTINIANS). This Rule was widely adopted by the Canons Regular, who also began to bind themselves by the vows of poverty, obedience and chastity. In the 12th century this discipline became universal among them; and so arose the order of Augustinian Canons as a religious order in the strict sense of the word. They resembled the monks in so far as they lived in community and took religious vows; but their state of life remained essentially clerical, and as clerics their duty was to undertake the pastoral care and serve the parish churches in their patronage. They were bound to the choral celebration of the divine office, and in its general tenor their manner of life differed little from that of monks.

During the later middle ages the houses of these various congregations of Canons Regular spread all over Europe and became extraordinarily numerous. They underwent the natural and inevitable vicissitudes of all orders, having their periods of depression and degeneracy, and again of revival and reform. In the 15th century grave relaxation had crept into many monasteries of Augustinian Canons in north Germany, and the efforts at reform were only partially successful. The Reformation, the religious wars and the Revolution have swept away nearly all the Canons Regular, but some of their houses in Austria continued to exist. In England there were as many as 200 houses of Augustinian Canons, and 60 of them were among the "greater monasteries" suppressed in 1538–40.

See the *Catholic Encyclopedia,* art. "Austin Canons"; Gasquet, *English Monastic Life;* Heimbucher, *Orden und Congregationen* vol. i (1933), pp. 397–409.

AUGUSTINIAN HERMITS or **FRIARS,** a religious order in the Roman Catholic Church, sometimes (but improperly) called Black Friars (see FRIAR). In the first half of the 13th century there were in central Italy various small congregations of hermits living according to different rules. The need of co-ordinating and organizing these hermits induced the popes towards 1250 to unite into one body a number of these congregations, so as to form a single religious order, living according to the Rule of St. Augustine, and called the Order of Augustinian Hermits, or simply the Augustinian Order. Special constitutions were drawn up for its government, on the same lines as the Dominicans and other mendicants—a General elected by chapter, provincials to rule in the different countries, with assistants, definitors and visitors. For this reason, and because almost from the beginning the term "hermits" became a misnomer (for they abandoned the deserts and lived conventually in towns), they ranked among the friars, and became the fourth of the mendicant orders.

The reaction against the inevitable tendencies towards mitigation and relaxation led to a number of reforms that produced upwards of 20 different congregations within the order, each governed by a vicar-general, who was subject to the General of the order.

About 1500 a great attempt at a reform of this kind was set on foot among the Augustinian Hermits of northern Germany, and they were formed into a separate congregation independent of the general. It was from this congregation that Luther went forth, and great numbers of the German Augustinian Hermits, among them Wenceslaus Link the provincial, followed him and embraced the Reformation, so that the congregation was dissolved in 1526. The Reformation and later revolutions have destroyed most of the houses of Augustinian Hermits, so that now only about 100 exist in various parts of Europe and America; in Ireland they are relatively numerous, having survived the penal times. (See AUGUSTINIAN CANONS.)

AUGUSTINIANS, in the Roman Catholic Church, a generic name for religious orders that follow the so-called "Rule of St. Augustine." The chief of these orders are: Augustinian Canons (*q.v.*), Augustinian Hermits (*q.v.*) or Friars, Premonstratensians (*q.v.*), Trinitarians (*q.v.*), Gilbertines (see GILBERT OF SEMPRINGHAM, ST.).

St. Augustine never wrote a Rule, properly so called; but *Ep.* 211 (*al* 109) is a long letter of practical advice to a community of nuns, on their daily lifer and *Serm.* 355, 356 describe the common life he led along with his clerics in Hippo. When, in the second half of the 11th century, the clergy of a great number of collegiate churches were undertaking to live a substantially monastic form of life, it was natural that they should look back to this classical model for clerics living in community. And so attention was directed to St. Augustine's writings on community life; and out of them grew the "Rule of St. Augustine" followed by many congregations and orders founded then and later.

See E. A. Foran, *The Augustinians, from St Augustine to the Union, 1256* (London, *1938);* also *Lexikon für Theologie und Kirche,* Vol. *I,* cols. 812 sqq.

AUGUSTOW, a town of Poland, in the province of Bialystok, 50 mi. N. of the town of that name, on a canal connecting the Vistula with the Niemen. Pop. (1931) 12,156. It was founded in 1557 by Sigismund II (Augustus), and is laid out in a regular manner, with a market-place. It carries on a large trade in cattle and horses, manufactures linen and huckaback, and is a centre for the transport of timber from the Augustow forest. It was taken by the U.S.S.R. in 1939 and Germany in 1941.

AUGUSTUS, the title given by the Roman senate, on Jan. 17, 27 B.C., to Gaius Julius Caesar Octavianus (63 B.C.–A.D. 14), or, as he was originally designated, Gaius Octavius, in recognition of his eminent services to the state (*Mon. Anc.* 34), and borne by him as the first of the Roman emperors. The name is derived from the Latin *augeo,* increase (see Neumann in Pauly-Wissowa's *Realencyklopädie* s. v.), *i.e.,* venerable, majestic, Gr. Σεβαστός. The title was adopted by all the succeeding Caesars or emperors of Rome long after they had ceased to be connected by blood with the first Augustus.

Gaius Octavius was born in Rome on Sept. 23, 63 B.C., the year of Cicero's consulship and of Catiline's conspiracy. He came of a family of good standing, long settled at Velitrae (Velletri), but his father was the first of the family to obtain a curule magistracy at Rome and senatorial dignity. His mother, however, was Atia daughter of Julia, the wife of M. Atius Balbus and sister of Julius Caesar, and it was this connection with the great dictator which determined his career. In his fifth year (58 B.C.) his father died; about a year later his mother remarried, and the young Octavius passed under her care to that of his stepfather, L. Marcius Philippus. At the age of 12 (51 B.C.) he delivered the customary funeral panegyric on his grandmother Julia, his first public appearance. On Oct. 18, 48 (or ? 47) B.C. he assumed the "toga virilis" and was elected into the pontifical college, an exceptional honour which he no doubt owed to his great uncle, then dictator and master of Rome. In 46 B.C. he shared in the glory of Caesar's African triumph, and in 45 he was made a patrician by the senate and designated as one of Caesar's "masters of the horse" for the next year. In the autumn of 45 Caesar, who was planning his Parthian campaign, sent his nephew to study quietly at the Greek colony of Apollonia, in Illyria. Here the news of Caesar's murder reached him and he crossed to Italy. On landing he learnt that Caesar had made him his heir and adopted him into the Julian gens, whereby he acquired the designation of Gaius Julius Caesar Octavianus. The inheritance was a perilous one; his mother and others would have dissuaded him from accepting it, but he, confident in his abilities, declared at once that he would undertake its obligations and discharge the sums bequeathed by the dictator to the Roman

people. Mark Antony had possessed himself of Caesar's papers and effects and made light of his young nephew's pretensions. Brutus and Cassius paid him little regard and dispersed to their respective provinces. Cicero, much charmed at the attitude of Octavianus, hoped to make use of him and flattered him to the utmost, with the expectation, however, of getting rid of him as soon as he had served his purpose. Octavianus conducted himself with consummate adroitness, making use of all competitors for power, but assisting none. Considerable forces attached themselves to him. The senate, when it armed the consuls against Antonius, called upon him for assistance, and he took part in the campaign in which Antonius was defeated at Mutina (43 B.C.). The soldiers of Octavianus demanded the consulship for him, and the senate, though much alarmed, could not prevent his election. He now effected a coalition with Antonius and Lepidus, and on Nov. 27, 43 B.C. the three were formally appointed a triumvirate for five years for the reconstitution of the commonwealth. They divided the western provinces among them, the East being held for the republic by Brutus and Cassius. They drew up a list of proscribed citizens and caused the assassination of 300 senators and 2.000 knights. They further confiscated the territories of many cities throughout Italy and divided them among their soldiers. Cicero was murdered at the demand of Antonius. The remnant of the republican party took refuge either with Brutus and Cassius in the East or with Sextus Pompeius, who had made himself master of the seas.

Octavianus and Antonius crossed the Adriatic in 42 B.C. to reduce the last defenders of the republic. Brutus and Cassius were defeated and fell at the battle of Philippi. War soon broke out between the victors, the chief incident of which was the siege and capture by famine of Perusia and the alleged sacrifice of 300 of its defenders by the young Caesar at the altar of his uncle. But peace was again made between them (40 B.C.). Antonius married Octavia, his rival's sister, and took for himself the eastern half of the empire, leaving the west to Caesar. Lepidus was reduced to the single province of Africa. Meanwhile Sextus Pompeius made himself formidable by cutting off the supplies of grain from Rome. The triumvirs were obliged to concede to him the islands in the western Mediterranean. But Octavianus could not allow the capital to be kept in alarm for its daily sustenance. He picked a quarrel with Sextus and when his colleagues failed to support him, undertook to attack him alone. Antonius, indeed, came at last to his aid, in return for military assistance in the campaign he meditated in the East. But Octavianus was well served by the commander of his fleet, M. Vipsanius Agrippa. Sextus was completely routed and driven into Asia, where he perished soon afterwards (36 B.C.). Lepidus was an object of contempt to all parties, and Octavianus and Antonius remained to fight for supreme power.

The five years (36–31 B.C.) which preceded the decisive encounter between the two rivals were wasted by Antony in fruitless campaigns, and in a dalliance with Cleopatra which shocked Roman sentiment. By Octavian they were employed in strengthening his hold on the West, and his claim to be regarded as the one possible saviour of Rome and Roman civilization. His marriage with Livia (38 B.C.) placed by his side a sagacious counsellor and a loyal ally, whose services were probably as great as even those of his trusted friend Marcus Agrippa. With their help he set himself to win the confidence of a public still inclined to distrust the author of the proscriptions of 43 B.C. Brigandage was suppressed in Italy, and the safety of the Italian frontiers secured against the raids of Alpine tribes on the northwest and of Illyrians on the east, while Rome was purified and beautified, largely with the help of Agrippa (aedile in 33 B.C.). Meanwhile, indignation at Antony's un-Roman excesses and alarm at Cleopatra's rumoured schemes of founding a Greco-Oriental empire were rapidly increasing. In 32 B.C. Antony's repudiation of his wife Octavia, sister of Octavian, and the discovery of his will, with its clear proofs of Cleopatra's dangerous ascendancy, brought matters to a climax and war was declared, not indeed against Antony, but against Cleopatra.

The decisive battle was fought on Sept, 2, 31 B.C., at Actium on the Epirot coast and resulted in the almost total destruction of Antony's fleet and the surrender of his land forces. Not quite a year later (Aug. 1, 30 B.C.) followed the capture of Alexandria and the deaths, by their own hands, of Antony and Cleopatra. On Jan. 11, 29 B.C., the restoration of peace was marked by the closing of the temple of Janus for the first time for 200 years. In the summer Octavian returned to Italy, and in August celebrated a three days' triumph. He was welcomed, not as a successful combatant in a civil war, but as the man who had vindicated the sovereignty of Rome against its assailants, as the saviour of the republic and of his fellow-citizens, above all as the restorer of peace.

He was now, to quote his own words, "master of all things," and the Roman world looked to him for some permanent settlement of the distracted empire. His first task was the re-establishment of a regular and constitutional government, such as had not existed since Julius Caesar crossed the Rubicon 20 years before. To this task he devoted the next 18 months (Aug. 29–Jan. 27 B.C.). In the article on ROME: History (*q.v.*), his achievements are described in detail, and only a brief summary need be given here. The "principate," to give the new form of government its most appropriate name, was a compromise thoroughly characteristic of the combination of tenacity of purpose with cautious respect for forms and conventions which distinguished its author. The republic was restored; senate, magistrates, and assembly resumed their ancient functions; and the public life of Rome began to run once more in the familiar grooves. The triumvirate with its irregularities and excesses was at an end. The controlling authority, which Octavian himself wielded, could not indeed be safely dispensed with. But henceforward he was to exercise it under constitutional forms and limitations, and with the express sanction of the senate and people. Octavian was legally invested for a period of ten years with the government of the important frontier provinces, with the sole command of the military and naval forces of the state, and the exclusive control of its foreign relations. At home it was understood that he would year by year be elected consul and enjoy the powers and pre-eminence attached to the chief magistracy of the Roman state. Thus the republic was restored under the presidency of its "first citizen" (*princeps* civitatis).

In acknowledgment of this happy settlement and of his other services further honours were conferred upon Octavian. On Jan. 13, 27 B.C., the birthday of the restored republic, he was awarded the civic crown to be placed over the door of his house, in token that he had saved his fellow-citizens and restored the republic. Four days later (Jan. 17) the senate conferred upon him the cognomen of Augustus.

But it was not only the machinery of government in Rome that needed repair. Twenty years of civil war and confusion had disorganized the empire, and the strong hand of Augustus, as he must now be called, could alone restore confidence and order. Towards the end of 27 B.C. he left Rome for Gaul, and from that date until Oct. 19 B.C. he was mainly occupied with the re-organization of the provinces and of the provincial administration, first of all in the West and then in the East. It was during his stay in Asia (20 B.C.) that the Parthian king Phraates voluntarily restored the Roman prisoners and standards taken at Carrhae (52 B.C.), a welcome tribute to the respect inspired by Augustus and a happy augury for the future. In Oct. 19 B.C. he returned to Rome, and the senate ordered that the day of his return (Oct. 12) should thenceforward be observed as a public holiday. The period of ten years for which his *imperium* had been granted him was nearly ended, and though much remained to be done, very much had been accomplished. The pacification of northern Spain by the subjugation of the Astures and Cantabri, the settlement of the wide territories added to the empire by Julius Caesar in Gaul—the "New Gaul," or the "long-haired Gaul" (Gallia Comata) as it was called by way of distinction from the old province of Gallia Narbonensis (see GAUL)—and the re-establishment of Roman authority over the kings and princes of the Near East, were achievements which fully justified the acclamations of senate and people.

In 18 B.C. Augustus's *imperium* was renewed for five years, and his tried friend Marcus Agrippa, now his son-in-law, was associated with him as a colleague. From Oct. of 19 B.C. till the middle of 16 B.C. Augustus's main attention was given to Rome and to domestic reform, and to this period belong such measures as the Julian law "as to the marriage of the orders." In June of 17 B.C. the opening of the new and better age, which he had worked to bring about, was marked by the celebration in Rome of the Secular games. The chief actors in the ceremony were Augustus himself and his colleague Agrippa—while, as the extant record tells us, the processional hymn, chanted by youths and maidens first before the new temple of Apollo on the Palatine and then before the temple of Jupiter on the Capitol, was composed by Horace. The hymn, the well-known *Carmen Saeculare*, gives fervent expression to the prevalent emotions of joy and gratitude.

In the next year (16 B.C.), however, Augustus was suddenly called away from Rome to deal with a problem which engrossed much of his attention for the next 25 years. The defeat of Marcus Lollius, the legate commanding on the Rhine, by a horde of German invaders seems to have determined Augustus to take in hand the whole question of the frontiers of the empire towards the north and the effective protection of Gaul and Italy. The work was entrusted to Augustus's step-sons Tiberius and Drusus. The first step was the annexation of Noricum and Raetia (16–15 B.C.), which brought under Roman control the mountainous district through which the direct routes lay from North Italy to the upper waters of the Rhine and the Danube. East of Noricum, Tiberius reduced to order for the time the restless tribes of Pannonia and probably established a military post at Carnuntum on the Danube. To Drusus fell the more ambitious task of advancing the Roman frontier line from the Rhine to the Elbe, a work which occupied him until his death in Germany in 9 B.C. In 13 B.C. Augustus had returned to Rome; his return and the conclusion of his second period of rule were commemorated by the erection of one of the most beautiful monuments of the Augustan age, the Ara Pacis Augustae. His *imperium* was renewed, again for five years, and in 12 B.C., on the death of his former fellow-triumvir Lepidus, he was elected Pontifex Maximus. But this third period of his *imperium* brought with it losses which Augustus must have keenly felt. Only a few months after his re-appointment as Augustus's colleague, Marcus Agrippa, his trusted friend since boyhood, died. As was fully his due, his funeral oration was pronounced by Augustus, and he was buried in the mausoleum near the Tiber built by Augustus for himself and his family. Three years later his brilliant step-son Drusus died on his way back from a campaign in Germany, in which he had reached the Elbe. Finally in 8 B.C. he lost the comrade who next to Agrippa had been the most intimate friend and counsellor of his early manhood, Gaius Cilnius Maeccnas, the patron of Virgil and Horace.

For the moment Augustus turned, almost of necessity, to his surviving step-son. Tiberius was associated with him as Agrippa had been in the tribunician power, was married against his will to Julia, and sent to complete his brother Drusus's work in Germany (7–6 B.C.). But Tiberius was only his step-son, and, with all his great qualities, was never a very lovable man. On the other hand, the two sons of Agrippa and Julia, Gaius and Lucius, were of his own blood and evidently dear to him. Both had been adopted by Augustus (17 B.C.). In 6 B.C. Tiberius, who had just received the tribunician power, was transferred from Germany to the East, where the situation in Armenia demanded attention. His sudden withdrawal to Rhodes has been variously explained, but, in part at least, it was probably due to the plain indications which Augustus now gave of his wish that the young Caesars should be regarded as his heirs. The elder, Gaius, now 15 years old (5 B.C.), was formally introduced to the people as consul-designate by Augustus himself, who for this purpose resumed the consulship (12th) which he had dropped since 23 B.C., and was authorized to take part in the deliberations of the senate. Three years later (2 B.C.) Augustus, now consul for the 13th and last time, paid a similar compliment to the younger brother Lucius. In 1 B.C. Gaius was given *proconsular imperium* and sent to re-establish order in Armenia, and a few years afterwards (A.D. 2) Lucius was sent to Spain, apparently to take command of the legions there. But the fates were unkind; Lucius fell sick and died at Marseille on his way out, and in the next year (A.D. 3) Gaius, wounded by an obscure hand in Armenia, started reluctantly for home, only to die in Lycia. Tiberius alone was left, and Augustus, at once accepting facts, formally and finally declared him to be his colleague and destined successor (A.D. 4) and adopted him as his son.

The interest of the last ten years of Augustus's life centres in the events occurring on the northern frontier. The difficult task of bringing the German tribes between the Rhine and the Elbe under Roman rule, commenced by Drusus in 13 B.C., had on his death been continued by Tiberius (9–6 B.C.). During Tiberius's retirement in Rhodes no decisive progress was made, but in A.D. 4 operations on a large scale were resumed. From Velleius Paterculus, who himself served in the war, we learn that in the first campaign Roman authority was restored over the tribes between the Rhine and the Weser, and that the Roman forces, instead of returning as usual to their headquarters on the Rhine, went into winter-quarters near the source of the Lippe. In the next year (A.D. 5) the Elbe was reached by the troops, while the fleet, after a hazardous voyage, arrived at the mouth of the same river and sailed some way up it. Both feats are deservedly commemorated by Augustus himself in the Ancyran monument. To complete the conquest of Germany and to connect the frontier with the line of the Danube, it seemed that only one thing remained to be done, to break the power of the Marcomanni and their king Maroboduus. In the spring of A.D. 6 preparations were made for this final achievement; the territory of the Marcomanni (now Bohemia) was to be invaded simultaneously by two columns. One, starting apparently from the headquarters of the army of Upper Germany at Mainz, was to advance by way of the Black Forest and attack Maroboduus on the west; the other, led by Tiberius himself, was to start from the new military base at Carnuntum on the Danube and operate from the south-east.

But the attack was never delivered, for at that moment, in the rear of Tiberius, the whole of Pannonia and Dalmatia burst into a blaze of insurrection. The crisis is pronounced by Suetonius to have been more serious than any which had confronted Rome since the Hannibalic war, for it was not merely the loss of a province but the invasion of Italy that was threatened, and Augustus openly declared in the senate that the insurgents might be before Rome in ten days. He himself moved to Ariminum to be nearer the seat of war, recruiting was vigorously carried on in Rome and Italy, and legions were summoned from Moesia and even from Asia. In the end, and not including the Thracian cavalry of King Rhoemetalces, a force of 15 legions with an equal number of auxiliaries was employed. Even so the task of putting down the insurrection was difficult enough, and it was not until late in the summer of A.D. 9, after three years of fighting, that Germanicus, who had been sent to assist Tiberius, ended the war by the capture of Andetrium in Dalmatia.

Five days later the news reached Rome of the disaster to Varus and his legions, in the heart of what was to have been the new province of Germany beyond the Rhine. The disaster was avowedly due entirely to Varus's incapacity and vanity, and might no doubt have been repaired by leaders of the calibre of Tiberius and Germanicus. Augustus, however, was now seventy-two, the Dalmatian outbreak had severely tried his nerve, and now for the second time in three years the fates seemed to pronounce clearly against a further prosecution of his long-cherished scheme of a Roman Germany reaching to the Elbe.

All that was immediately necessary was done. Recruiting was pressed forward in Rome, and first Tiberius and then Germanicus were dispatched to the Rhine. But the German leaders were too prudent to risk defeat, and the Roman generals devoted their attention mainly to strengthening the line of the Rhine.

The defeat of Varus and the tacit abandonment of the plans of expansion begun 25 years before are almost the last events of importance in the long principate of Augustus. The last five

years of his life (A.D. 10–14) were untroubled by war or disaster. Augustus was ageing fast, and he was more and more disinclined to appear personally in the senate or in public. Yet in A.D. 13 he consented, reluctantly we are told, to yet one more renewal of his *imperium* for ten years, stipulating, however, that his stepson Tiberius, himself now over fifty, should be associated with him on equal terms in the administration of the empire. Early in the same year (Jan. 16, A.D. 13) the last triumph of his principate was celebrated. Tiberius was now in Rome, the command on the Rhine having been given to Germanicus, who went out to it immediately after his consulship (A.D. 12), and the time had come to celebrate the Dalmatian and Pannonian triumph, which the defeat of Varus had postponed. Augustus witnessed the triumphal procession, and Tiberius, as it turned from the Forum to ascend the Capitol, halted, descended from his triumphal car, and did reverence to his adopted father.

One last public appearance Augustus made in Rome. During A.D. 13 he and Tiberius conducted a census of Roman citizens, the third taken by his orders; the first having been in 28 B.C. at the very outset of his rule. The business of the census lasted over into the next year, but on May 11, A.D. 14, before a great crowd in the Campus Martius, Augustus took part in the solemn concluding ceremony of burying away out of sight the old age and inaugurating the new. The ceremony had been full of significance in 28 B.C., and now more than 40 years later it was given a pathetic interest by Augustus himself. When the tablets containing the vows to be offered for the welfare of the state during the next lustrum were handed to him he left the duty of reciting them to Tiberius, saying that he would not take vows which he was never destined to perform.

It was apparently at the end of June or early in July that Augustus left Rome on his last journey. Travelling by road to Astura (Torre Astura), at the southern point of the little bay of Antium, he sailed thence to Capri and to Naples. On his way, at Puteoli, the passengers and crew of a ship just come from Alexandria cheered the old man by their spontaneous homage, declaring, as they poured libations, that to him they owed life, safe passage on the seas, freedom, and fortune.

At Naples, in spite of increasing disease, he bravely sat out a gymnastic contest held in his honour, and then accompanied Tiberius as far as Beneventum on his way to Brundusium and Illyricum. On his return he was forced by illness to stop at Nola, his father's old home. Tiberius was hastily recalled and had a last confidential talk on affairs of state. Thenceforward, says Suetonius, he gave no more thought to such great affairs. He bade farewell to his friends, inquired after the health of Drusus's daughter, who was ill, and then quietly expired in the arms of the wife, who for more than 50 years had been his most intimate and trusted guide and counsellor, and to whom his last words were an exhortation to "live mindful of our wedded life." He died on Aug. 19, A.D. 14, in the same room in which his father had died before him and on the anniversary of his entrance upon his first consulship 57 years before (43 B.C.). The corpse was carried to Rome in slow procession along the Appian Way. On the day of the funeral it was borne to the Campus Martius on the shoulders of senators and there burnt. The ashes were reverently collected by Livia and placed in the mausoleum by the Tiber which her husband had built for himself and his family. The last act was the formal decree of the senate by which Augustus, like his father Julius before him, was added to the number of the gods recognized by the Roman state.

If we except writers like Voltaire, who could see in Augustus only the man who had destroyed the old republic and extinguished political liberty, the verdict of posterity on Augustus has varied just in proportion as his critics have fixed their attention, mainly, on the means by which he rose to power, or the use which he made of the power when acquired. The lines of argument followed respectively by friendly and hostile contemporaries immediately after his death (Tac. *Ann.* i. 9, 10) have been followed by later writers with little change But of late years our increasing mistrust of the current gossip about him and our increased knowledge of the magnitude of what he actually accomplished have conspicuously influenced the judgments passed upon him. We allow the faults and crimes of his early manhood, his cruelties and deceptions, his readiness to sacrifice everything that came between him and the end he had in view. On the other hand, a careful study of what he achieved between the years 38 B.C., when he married Livia, and his death in A.D. 14 is now held to give him a claim to rank, not merely as an astute and successful intriguer, or an accomplished political actor, but as one of the world's great men, a statesman who conceived and carried through a scheme of political reconstruction which kept the empire together, secured peace and tranquillity, and preserved civilization for more than two centuries. (H. F. P.)

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See also ROME: *History* and ROMAN RELIGION.

AUGUSTUS I. (1526–1586), elector of Saxony, was the younger son of Henry, duke of Saxony, and consequently belonged to the Albertine branch of the Wettin family. Born at Freiburg on July 31 1526, and brought up as a Lutheran, he received a good education at the University of Leipzig. He acted as regent of Saxony in 1552 during the absence of the elector, his elder brother Maurice. Augustus was visiting Denmark when by Maurice's death in July 1553, he became elector of Saxony.

The first care of the new elector was to come to terms with John Frederick, head of the Ernestine branch of the Wettin family, and to strengthen his own hold upon the electoral position. By a treaty made at Naumburg in Feb. 1554, John Frederick recognized Augustus as elector of Saxony in return for the grant of Altenburg and other lands. The elector, however, was continually haunted by the fear that the Ernestines would attempt to deprive him of the electorate, and his policy both in Saxony and in Germany was coloured by this fear.

In imperial politics Augustus acted upon two main principles: to cultivate the friendship of the Habsburgs, and to maintain peace between the contending religious parties. To this policy may be traced his share in bringing about the religious peace of Augustus in 1555, his tortuous conduct at the diet of Augsburg 11 years later, and his reluctance to break entirely with the Calvinists. On one occasion only did he waver in his allegiance to the Habsburgs. In 1568 a marriage was arranged between John Casimir, son of the elector palatine, Frederick III., and Elizabeth, a daughter of Augustus, and for a time it seemed possible that the Saxon elector would support his son-in-law in his attempts to aid the revolting inhabitants of the Netherlands. Augustus also entered into communication with the Huguenots; but his aversion to foreign complications prevailed, and the incipient friendship with the elector palatine soon gave way to serious dislike.

The hostility between the Albertines and the Ernestines gave serious trouble to Augustus. A preacher named Matthias Flacius, who held an influential position in ducal Saxony, began to make personal attacks on Augustus, and to incite Duke John Frederick to make an effort to recover his position. Associated with Flacius was a knight, William of Grumbach, who made inroads into electoral Saxony. After some delay, Grumbach and his protector, John Frederick, were placed under the imperial ban, and Augustus was entrusted with its execution. His campaign in 1567 was short and successful. John Frederick surrendered, and passed his time in prison until his death in 1595; Grumbach was taken and executed; and the position of the elector was made quite secure.

The elector imposed a strict form of Lutheranism in his dominion, and tortured and imprisoned the "Crypto-Calvinists" who followed the teaching of Melanchthon. In 1576 he made a serious but unsuccessful attempt to unite the Protestants upon the basis of some articles drawn up at Torgau. The change in Saxony, however, made no difference to the attitude of Augustus on imperial questions, and he continued to support the Habsburgs.

As a ruler of Saxony, Augustus was economical and enlightened. He favoured trade by encouraging Flemish emigrants to settle in the country, by improving the roads, regulating the coinage and establishing the first posts. He was specially interested in benefiting agriculture, and added several fine buildings to the city of Dresden. His laws were numerous and comprehensive. The constitution of 1572 was his work, and by these laws the church, the universities and the police were regulated, the administration of justice was improved, and the raising of taxes was placed upon a better footing (see SAXONY).

In Oct. 1585 the electress Anna died, and a few weeks later Augustus married Agnes Hedwig, a daughter of Joachim Ernest, prince of Anhalt. He died at Dresden on Jan. 21 1586. By his first wife he had 15 children, but only four of these survived him, among whom was his successor, the elector Christian I. (1560–91). Augustus was a covetous, cruel and superstitious man, but these qualities were redeemed by his political caution and his wise methods of government. He wrote a small work on agriculture entitled *Künstlich* Obst- *und Gartenbüchlein.*

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AUGUSTUS II. (1670–1733), "the Strong," king of Poland, second son of John George III., elector of Saxony, was born at Dresden May 12 1670. Upon the death of his brother, John George IV., in 1694, he became elector of Saxony as Frederick Augustus I., and in 1695 and 1696 led the imperial troops against the Turks, but without much success. When John Sobieski died in 1696, Augustus was a candidate for the Polish throne, and in order to further his chances became a Roman Catholic, a step which was strongly resented in Saxony. He secured his election and coronation in Sept. 1697, and his principal rival, F. L. de Bourbon, prince of Conti, abandoned the contest and returned to France.

Augustus continued the war against the Turks for a time, and made an alliance in 1699 with Russia and Denmark against Charles XII. of Sweden. The Poles would not assist, and at the head of the Saxons Augustus invaded Livonia, but he was defeated by Charles at Klissow in July 1702. Augustus was then deposed in Poland, and fled to Saxony. The alliance with Russia was renewed, and in reply Charles invaded Saxony in 1706, and compelled the elector to sign the Treaty of Altranstaedt in September of that year, to recognize Stanislaus Leszczynski as his successor in Poland, and to abandon the Russian alliance, During the War of the Spanish Succession, Augustus fought with the imperialists in the Netherlands, but after the defeat of Charles XII. at Poltowa in July 1709, he turned his attention to the recovery of Poland. Declaring the Treaty of Altranstaedt void and renewing his alliance with Russia and Denmark, he recovered the Polish Crown. He then attacked Swedish Pomerania. He was handicapped by the mutual jealousy of the Saxons and the Poles, and was compelled to promise to limit the number of his army in that country to 18,000 men.

Peace was made with Sweden in Dec. 1719 at Stockholm after the death of Charles XII., and Augustus was recognized as king of Poland. He spent his remaining years in futile plans to make Poland an hereditary monarchy, to weaken the power of the Saxon nobles, and to gain territory for his sons in various parts of Europe. He was a man of extravagant and luxurious tastes, and, although he greatly improved the city of Dresden, he cannot be called a good ruler. He sought to govern Saxony in an absolute fashion, and, in spite of his declaration that his conversion to Roman Catholicism was personal only, assisted the spread of the teachings of Rome. His wife was Christine Eberhardine, a member of the Hohenzollern family, who left him when he became a Roman Catholic, and died in 1727. Augustus died in Warsaw on Feb. 1 1733, leaving a son Frederick Augustus, who succeeded him in Poland and Saxony, and many illegitimate children, among whom was the famous general, Maurice of Saxony, known as Marshal Saxe (q.v.).

BIBLIOGRAPHY.—*See* Otwikowski, History of Poland under *Augustus II.* (Cracow, 1849); F. Foerster, Die *Höfe und Kabinette Europas im* achtzehnten Jahrhundert (Potsdam, 1839); Jarochowski, History of *Augustus II.* (Posen, 1856–74); C. W. Boettiger and T. Flathe, Geschichte des *Kurstaates* und Koenigreichs Sachsen (Gotha, 1867–73).

AUGUSTUS III., king of Poland (1696–1763) and, as FREDERICK AUGUSTUS II., elector of Saxony, the only legitimate son of Augustus II. ("the Strong"), was born at Dresden on Oct. 17 1696, and died there on Oct. 5 1763. He followed his father's example by joining the Roman Catholic Church in 1712. In Aug. 1719 he married Maria Josepha, daughter of the Emperor Joseph I., and became elector of Saxony on his father's death in Feb. 1733. He was then a candidate for the Polish crown; and having purchased the support of the Emperor Charles VI. by assenting to the Pragmatic Sanction, and that of the Tsarina Anne by recognizing the claim of Russia to Courland, he was elected king of Poland in Oct. 1733.

Aided by the Russians, his troops drove Stanislas Leszczynski from Poland; Augustus was crowned at Cracow in Jan. 1734 and was generally recognized as king at Warsaw in June 1736. On the death of Charles VI., in Oct. 1740, Augustus, as a son-in-law of the Emperor Joseph I., claimed a portion of the Habsburg territories. In 1742, however, he was induced to transfer his support to Maria Theresa, and his troops took part in the struggle against Frederick the Great during the Silesian wars, and again when the Seven Years' war began in 1756. Saxony was in that year attacked by the Prussians, and the Saxon army was forced to capitulate at Pirna in October. The elector fled to Warsaw, and made no attempt to recover Saxony from Frederick. When the treaty of Hubertsburg was concluded in Feb. 1763 he returned to Saxony.

He had five sons, of whom the eldest was Frederick Christian, who succeeded him; and five daughters, one of whom married Louis, the dauphin of France, and another Charles III., king of Spain. Augustus was content to leave Poland under the influence of Russia, and Saxony to the rule of his ministers. He took great interest in music and painting, and added to the collection of art treasures at Dresden.

BIBLIOGRAPHY.—*See* C. W. Boettiger and T. Flathe, Geschichte des Kurstaates und Konigreichs Sachsen (Gotha, 1867–73); R. Roepell, *Polen um die Mitte des 18. Jahrhunderts* (Gotha, 1876).

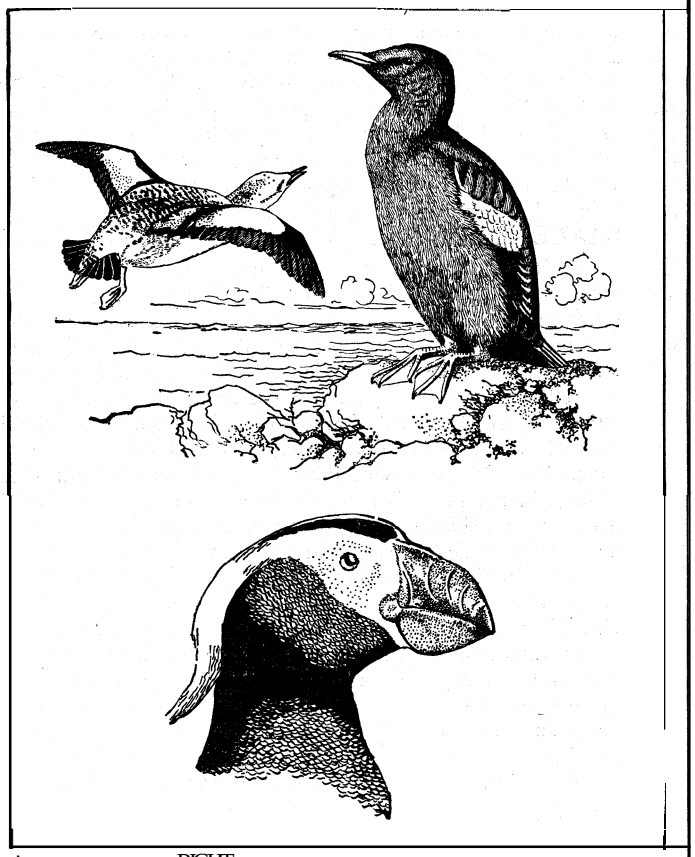
AUGUSTUSBAD, a watering-place of Germany, 10 m. E. from Dresden, close to Radeberg, in a pleasant valley. It has five saline chalybeate springs, used both for drinking and bathing.

AUKS, GUILLEMOTS or MURRES, and PUFFINS, northern oceanic birds of the family Alcidae, breed often in vast mixed communities on cliff ledges from Greenland, Iceland and Spitsbergen to the St. Lawrence, Maine, Norway and the British isles. As the legs are set far back, they stand upright. Most lay one large, blotched egg, pointed at one end so that it tends to roll in a circle, thus not falling from the ledge; the black guillemot (*Cepphus,* or *Uria,* grylle), length 14 in., lays two eggs; in summer it is black with a white patch on the wing; in winter the wings and tail are black while head and body are white. Other members of the family, black above and white below, have little seasonal change of colour. The puffin (*Fratercula arctica*), length 13 in., distinguished by a heavy, deep, scarlet and yellow bill, nests in a burrow or rock crevice. The common guillemot (U. troille), length 18 in., like the puffin, breeds south to Portugal; a subspecies is found in the north Pacific. Briinnich's murre (U. lomvia), length 18 in., is more northern, and has a pale line along the upper mandible. The razor-billed auk (*Alca* forda), has a deep, heavy bill; it sometimes wanders to the Great Lakes. The little auk (Alle alle), only 8 in. long, shares with the black guillemot the name "dovekie"; it is a source of wealth to the Eskimo, who

eat birds and eggs and make garments of the skins. When the young are grown all auks take to the ocean, spending 8 months on the stormy north Atlantic, south to the Azores.

The great auk *(Plautus,* or *Alca, impennis)*, 30 in. long, had lost the power of flight and was reduced to extinction by boat crews about 1844. A few skins and eggs have been preserved.

The cliffs along the Pacific coast of North America, Alaska and



AT TOP. LEFT TO RIGHT. BLACK GUILLEMOT (URIA GRYLLE) IN WINTER AND SUMMER PLUMAGE. BELOW: TUFTED PUFFIN (LUNDA CIRRHATA), PACIFIC COAST OF THE UNITED STATES

the Aleutian islands are the home of 13 species of this family: the tufted puffin *(Lunda cirrhata),* the horned puffin *(Fratercula corniculata)*, six auklets, three murrelets and Pacific representatives of the black and common guillemot.

AULARD, FRANÇOIS VICTOR ALPHONSE (1849–1928), French historian, and one of the leading authorities on the revolutionary period in France, was born at Montbron in Charente on July 19, 1849. Having obtained the degree of doctor of letters in 1877 with a Latin thesis upon C. Asinius Pollio and a French one upon Giacomo Leopardi (whose works he subsequently translated into French), he made a study of parliamentary oratory during the French Revolution, and published two volumes upon *Les Orateurs de la constituante (1882)* and upon *Les Orateurs de la législative et de la convention* (1885). With these works, which were reprinted in 1905, he entered a field where he soon became an acknowledged master. Applying to the study of the French Revolution the rules of historical criticism which had produced such rich results in the study of ancient and mediaeval history, he devoted himself to research in the archives, and to the publication of many important contributions to the political, administrative and moral history of that marvellous period. As professor of the history of the French Revolution at the Sorbonne and president of the Société de l'Histoire de la Revolution, he formed the minds of students who in their turn have done valuable work. He died in Oct. 1928.

BIBLIOGRAPHY.—To him we owe the *Recueil des actes du comité de salut public* (vol. i., 1889; vol. xvi., 1904); *La Société des Jacobins; recueil de documents pour l'histoire du club des Jacobins de Paris* (1889–97); and *Paris pendant la réaction thermidorienne et sous le directoire, recueil de documents pour l'histoire de l'esprit public à Paris* (1898–1902), which was followed by an analogous collection for *Paris sous le consulat* (1903–04). For the Société de l'Histoire de la Révolution Française, which brought out under his supervision an important periodical publication called *La Rdvolution française,* he produced the *Registre des délibérations du consulat provisoire* (1894), and *L'État de la France en l'an VIII. et en l'an IX.* with the reports of the prefects (1897), besides editing various works or memoirs written by men of the Revolution, such as J. C. Bailleul, Chaumette, Fournier (called the American), Hérault de Séchelles, and Louvet de Couvrai.

He has also written a *Histoire politique de la Rdvolution française* (1901), and a number of articles which have been collected under the title *Études et leçons sur la Rdvolution frangaise* (1893–1908). His *Taine, historien de la Rdvolution frangaise* (1908) is, as it were, the "manifesto" of the new school of criticism applied to the political and social history of the Revolution *(Les Annales Re'volutionnaires,* June, 1908).

His later works include *La guerre actuelle commentée par l'histoire* (1916), and *Le Christianisme et la Révolution française* (1925; Eng. trans. by Lady Frazer, 1927). He edited the *Histoire politique de la Grande Guerre* (1924).

See A. Mathiez, "M. Aulard, historien et professeur," in the *Revue de la Rdvolution française* (July 1908).

AULIC COUNCIL (*Reichshofrat*), an organ of the Holy Roman empire, originally intended for executive work, but acting chiefly as a judicature, which worked from 1497 to 1806. In the early middle ages the emperor had already his *consiliarii;* but his council was a fluctuating body of personal advisers. In the 14th century there first arose an official council, with permanent and paid members, many of whom were legists. Its business was largely executive, and it formed something of a Ministry; but it had also to deal with petitions addressed to the king, and accordingly it acted as a supreme court of judicature. It was thus parallel to the king's Eouncil in mediaeval England; while by its side, during the 1 jth century, stood the *Kammergericht,* composed of the legal members of the council, in much the same way as the Star Chamber stood beside the English council. But the real history of the Aulic Council, as that term was understood in the later days of the empire, begins with Maximilian I. In 1497–98 he created a new *Hofrat* to deal with "all and every business which may flow in from the empire, Christendom at large, or the king's hereditary principalities." It was thus to be the supreme executive and judicial organ, discharging all business except that of finance and the drafting of documents. But it was difficult to work such a body for the empire and for the hereditary principalities; and under Ferdinand I. it became an organ for the empire alone, the hereditary principalities being removed from its cognizance. As such an imperial organ, its composition and powers were fixed by the treaty of Westphalia of 1648. (1) It consisted of about 20 members—a president, a vice-president, the vice-chancellor of the empire, and some 18 others. The council followed the person of the emperor, and was therefore stationed at Vienna; it was paid by the emperor, and he nominated its members. whose office terminated with his life. (2) Its powers were nominally both executive and judicial. *(a)* Its executive powers were small: it gradually lost everything except the formal business of investiture with imperial fiefs and the confirmation of charters, its other powers being taken over by the Geheimräte, who were already constituted as a definite body for dealing with imperial affairs by 1527. *(b)* In its judicial aspect, the Aulic Council, exercising the emperor's judicial powers on his behalf, had exclusive cognizance of matters relating to imperial fiefs, criminal charges against immediate vassals of the empire, and cases "reserved" for the emperor. In all other matters, the Aulic Council was a competitor for judicial work with the Imperial Chamber (q *v.).*

See R. Schrbder, *Lehrbuch der deutschen Recktsgeschichte* (Leipzig, 1904). (E. B.)

AULIE-ATA, a district and town in the Syr-darya province of the Russian S F.S.R. The area of the district is 75,331sq.km. and the population is *227,016.* The Talas river waters the district and it has been a fertile loess oasis known to pilgrims and armies from Central Mongolia for centuries. The chief products are rice, cotton, wheat, barley, millet, potatoes, silk and grapes. Cattle, camels, horses, sheep and goats are reared. The town, Lat. 42° 52' N., Long. 71° 23' E., alt. *5,700* ft., has prospered since the railway through it to **Alma** Ata was built. Population *24,682.*

AULIN, TOR (1866–1914), distinguished Swedish violinist, was born at Stockholm and acquired wide renown as one of the most accomplished executants of his time. He also composed and conducted.

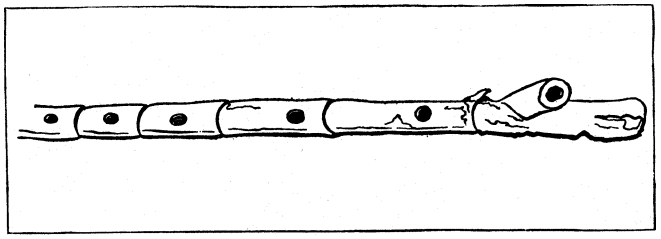
AULIS, an ancient town in Boeotia on the Euripus, on a rocky peninsula between two bays, near the modern village of Vathy, about 3m. S. of Chalcis. It was the traditional starting-place of the Greek fleet before the Trojan War, the scene of the sacrifice of Iphigenia.

AULNOY (or AUNOY), **MARIE CATHERINE LE JUMEL DE BARNEVILLE DE LA MOTTE,** BARONNE D' (*c.* 1650–1705), French author, was born at Barneville near Bourg-Achard (Eure). She married on March 8 1666, François de la Motte, a gentleman in the service of César, duc de Vendôme, who became Baron d'Aulnoy in 1654. With her mother, who by a second marriage had become marquise de Gudaigne, she instigated a prosecution for high treason against her husband. The conspiracy was exposed, and the two women saved themselves by a hasty flight to England. Thence they went (Feb. 1679) to Spain, but were eventually allowed to return to France in reward for secret services rendered to the government.

Mme. d'Aulnoy wrote fairy tales, *Contes nouvelles ou les Fées à la mode* (1698), in the manner of Charles Perrault. This collection (24 tales) included *L'Oiseau Bleu, Finette Cendron, La Chatte Blanche* and others. The originals of most of her admirable tales are to be found in the *Pentamerone* (1637) of Giovanni Battista Basile. Other works are: *L'Histoire d'Hippolyte, comte de Duglas* (1690), a romance in the style of Mme. de la Fayette, though much inferior to its model; *Mémoires de la cour d'Espagne* (1679–81); and a *Relation du voyage d'Espagne* (1690 or 1691) in the form of letters, edited in 1874–76 as *La Cour et la ville de Madrid* by Mme. B. Carey; *Histoire de Jean de Bourbon* (1692); *Me'moires sur la cour de France* (1692); *Mémoires de la cour d'Angleterre* (1695). Her historical writings are partly borrowed from existing records, to which she adds much that must be regarded as fiction, and some vivid descriptions of contemporary manners.

The *Diverting Works of the Countess d'Anois,* including some extremely untrustworthy "Memoirs of her own life," were printed in London in 1707. *The Fairy Tales of Madame d'Aulnoy,* with an introduction by Lady Thackeray Ritchie, appeared in **1892.** For biographical particulars *see* M. de Lescure's introduction to the *Contes des Ftes* **(1881).**

AULOS, in Greek antiquities, a class of woodwind instruments with single or double reed mouthpiece and either cylindrical or conical bore, thus corresponding to both oboe and clarinet. (Gr. αὐλός; Lat. *tibia;* Egyptian hieroglyphic, *Ma it;* mediaeval equivalents, *shalm, chalunteau, schalmei, hautbois.)* In its widest sense *aulos* was the generic term for instruments consisting of a tube in which the air column was set in vibration either directly by the lips of the performer, or through the medium of a mouthpiece containing a single or a double reed. Even the pipes of the pan-pipes were sometimes called *auloi* (αὐλοί). This is the prototype of the organ, which, by gradual assimilation of the principles of syrinx and bag-pipe, reached the stage at which it became known as the *Tyrrhenian aulos* (Pollux iv. 70) or the *kydraulos,* according to the method of compressing the wind supply *(see* ORGAN and SYRINX).



FROM MACAULAY FITZGIBBON, "THE STORY OF THE FLUTE"

THE AULOS, A PRIMITIVE KIND OF FLUTE USED BY THE GREEKS

At first the aulos had but three or four holes; to Diodorus of Thebes is due the credit of having increased this number (Pollux iv. 80). Pronomus, the musician, and teacher of Alcibiades (5th century B.C.), further improved the aulos by making it possible to play on one pair of instruments the three musical scales in use at his time, the Dorian, the Phrygian, and the Lydian, whereas previously a separate pair of pipes had been used for each scale (Pausanias ix. 12, 5; Athenaeus xiv. 31). The double reed was probably used at first, being the simplest form of mouthpiece. There is, however, no difficulty in accepting the probability that a single beating reed or clarinet mouthpiece was used by the Greeks since the ancient Egyptians used it with the as-it or arghoul (*q.v.*). Aristoxenus gives the full compass of a single pipe or pair of pipes as over three octaves. This, according to the tables of Alypius, would correspond to the full range of the Greek scales, and it is evident that the ancient Greeks obtained this full compass on the aulos by means of the harmonics. The aulos or tibia existed in a great number of varieties falling into two distinct classes, the single and the double pipes.

AUMALE, HENRI EUGENE PHILIPPE LOUIS D'ORLÉANS, DUC D' (1822–97), French prince and statesman, 5th son of Louis Philippe, Duke of Orleans, afterwards king of the French, and of Marie Amélie, princess of the Two Sicilies, was born in Paris, Jan. 16 1822. He inherited a large fortune from the Prince de Condé. Aumale entered the army at the age of 17, served in Algeria 1840–47, and was governor of the colony (1847–48). After the revolution of 1848 he went to England and occupied himself with military and historical studies.

Although his offer of service during the Franco-German War was declined, he resumed his place in the army in 1872 as general of division. He presided over the court martial which condemned Marshal Bazaine to death. In 1879 he became inspector general of the army. In the meantime he had been elected deputy for Oise to the Chamber. The act of exception of 1883 excluded him, with other members of ex-reigning families, from the army, and that of 1886 from exercising any public functions. Aumale protested, and was expelled, though he was permitted to return in 1889 on account of the bequest in his will of Chantilly with its art treasures to the Institute of France. The Duke was a member of the French Academy and the author of an unfinished *Histoire des princes de Condé.* He died at Zucco, Sicily, on May 7 1897.

See Georges Picot, *M. le duc d'Aumale* **(1898)**; Ernest **Daudet,** *Le duc d'Aumale* **(1898).**

AUMALE, a town of northern France, in the department of Seine-Inférieure, on the left bank of the Bresle, 47 mi NE. of Rouen. Pop. (1936) 1,972. The church is an interesting building of the 16th and 17th centuries and has a portal attributed to Jean Goujon. The town has glass and steel works.

The territory of Aumale in Normandy was granted to Odo of Champagne, brother-in-law of William the Conqueror, who founded the first line of counts of Aumale. Hawise, countess of Aumale, after the death of her first husband William de Mandeville, earl of Essex (d. 1189), was married to William de Forz, one of the commanders of the fleet under Richard I. during his crusade. He died in 1195, and his widow married Baldwin de Béthune, who became count of Aumale in her right. He died in 1213, and in 1214 William de Forz, son of Hawise by her second husband, was confirmed by King John in all his mother's lands. The territory of Aumale shared the fate of the rest of Normandy and was annexed to the French crown by King Philip Augustus; but the title of count of Aumale, derived from it, continued to be borne in England by William de Forz, and was passed on to his heirs in the form Albemarle (*q.v.*). Aumale itself was conferred by Philip Augustus as an appanage on his son Philip. It was subsequently granted by Louis VIII. to Simon, count of Dammartin, whose daughter, Jeanne, transferred it, together with the countship of Ponthieu, to the house of Castile, by her marriage with Ferdinand III. of Castile (1238). It remained in the possession of a branch of her descendants bearing the name of Ponthieu until it passed to the house of Harcourt on the marriage of Blanche of Ponthieu with John, count of Harcourt (1340). Marie d'Harcourt (d. 1476), heiress of Aumale, married Anthony of Lorraine, count of Vaudemont, and Aumale was created a duchy in the peerage of France for Claude and Francis of Lorraine in 1547. By the mar-

riage of Anne of Lorraine with the duke of Nemours in 1618 the. duchy of Aumale passed to the house of Savoy-Kernours. In 1686 Marie Jeanne Baptiste, duchess of Nemours and of Aumale and wife of Charles Emmanuel II., duke of Savoy, sold Aumale to Louis XIV., who gave it to his natural son, the duke of Maine. From him the dukedom devolved upon his brother, the count of Toulouse, and passed to the latter's son, the duke of Penthièvre, whose daughter married the duke of Orléans. Since the reign of Louis Philippe, king of the French, the title of duke of Aumale has been borne by a son of the duke of Orléans.

AUMERY: see AMBRY.

AUMONT, the name of a family which played an important part in French history. Jean d'Aumont, lieutenant-general to the king of France in the government of Burgundy, rendered important services to Louis XII. and Francis I. Another Jean d'Aumont (d. 1593), a marshal of France and knight of the Order of the Holy Ghost since its institution in 1578, fought against the Huguenots under the last of the Valois kings; but he was among the first to recognize Henry IV., and was appointed governor of Champagne and of Brittany where he had to fight the League.

His grandson Antoine (1601–69) was also a marshal of France (1651), governor of Paris (1662), duke and peer (1665). Louis Marie Augustin, duc d'Aumont (1709–82), was a celebrated collector of works of art. Louis Marie Céleste d'Aumont, duc de Piennes, afterwards duc d'Aumont (1762–1831), emigrated during the Revolution and served in the army of the Royalists, as also in the Swedish Army. During the Hundred Days he effected a descent upon Normandy in the Bourbon interest, and succeeded in capturing Bayeux and Caen.

AUNCEL, a balance formerly used in England; now, in dialectical use, a term for the weighing of meat by hand instead of by scales (from the Anglo-Fr. auncelle, a confused derivation from *l'auncelle,* Ital. *lancella,* a little balance).

AUNDH, a native State of India in the Deccan division of Bombay, ranking as one of the Satara Jagirs. Its area is 501sq.m.; its population was 76,507 in 1931, showing an increase of 18% in the decade. No tribute is paid. The chief, whose title is Pant Pratinidhi, is a Brahman. The State has suffered severely from plague. The town of Aundh is situated 26m. S E. of Satara. Pop. 3,741.

AUNGERVYLE, RICHARD (1287–1345), commonly known as RICHARD DE BURY, English bibliophile, writer and bishop, was born near Bury St. Edmunds, Suffolk, Jan. 24 1287, and educated at Oxford. He was made tutor to Prince Edward of Windsor (afterwards Edward III.), and was mixed up with the sordid intrigues which preceded the deposition of Edward II. On the accession of Edward III. his services were rewarded by rapid promotion. He was cofferer to the King, treasurer of the wardrobe and afterwards clerk of the privy seal. The King, moreover, repeatedly recommended him to the Pope, and twice sent him, in 1330 and 1333, as ambassador to the papal court, then in exile at Avignon. On the first of these visits he made the acquaintance of a fellow bibliophile in Petrarch, who records his impression (*Epist. Famil.,* lib. iii., Ep. 1) of the Englishman as "not ignorant of literature and . . . from his youth up curious beyond belief of hidden things." During his absence from England he was made (1333) dean of Wells. In September of the same year the see of Durham fell vacant, and the King overruled the choice of the monks, who had actually installed their sub-prior, Robert de Graystanes, in favour of Aungervyle. In Feb. 1334 he was made lord treasurer, an appointment he exchanged later in the year for that of lord chancellor. This charge he resigned in the next year, but he was repeatedly employed on the Icing's service abroad and in the defence of northern England.

Aungervyle sent far and wide in search of manuscripts, rescuing many treasures from the charge of ignorant and neglectful monks. "No dearness of price," he says, "ought to hinder a man from the buying of books, if he has the money demanded for them, unless it be to withstand the malice of the seller or to await a more favourable opportunity of buying." The record of his passion for books, his *Philobiblon,* was completed on his 58th birthday, and he died April 14 (May, according to Adam Murimuth) of that year, in great poverty. It seems likely that his collection was dispersed immediately after his death. But the traditional account is that the books were sent to the Durham Benedictines at Oxford, and that on the dissolution of the foundation by Henry VIII. they were divided among the libraries of Duke Humphrey of Gloucester, Balliol College, and Dr. George Owen. Only two of the volumes are known to be in existence.

BIBLIOGRAPHY.—The chief authority for the bishop's life is William de Chambre, printed in Wharton's Anglia Sacra (1691), and in Historiae Dunelmensis scriptores tres, Surtees Soc. (1839). It has often been asserted that the Philobiblon itself was not written by Richard de Bury at all, but by Robert Holkot. This assertion is supported by the fact that in seven of the extant mss. it is ascribed to Holkot in an introductory note. The original Latin text was printed at Cologne (1473), Spires (1483), Paris (1500), Oxford (1598 and 1599), etc. The best translation is that by Mr. E. C. Thomas, accompanying the Latin text, with full biographical and bibliographical introductions (1888). Other editions are in the Ktng's *Classics* (1902) and for the Grolier Club (New York, 1889, ed. A. F. West).

AUNIS was formerly a province (pays) of France, bounded on the north by Poitou, on the west by the Atlantic, and on the south and east by Saintonge. Its principal town was at first Chbtelaillon, and later La Rochelle; the latter city was founded in 1117 by Duke Guillaume X. of Aquitaine. Other towns are Saujon and St. Jean d'Angely. Aunis formed part of the diocese of Saintes until 1648. In that year it was joined to the former diocese of Maillezais (created in 1317), and the bishop's see was transferred to La Rochelle. For the administration of justice, Aunis came under the Parlement of Paris; it was subject to the jurisdiction of the *présidial* of La Rochelle. For military purposes, Aunis constituted a separate Government (gouuernement *général*) which included the islands of RC and Oléron and had its headquarters at La Rochelle.

Aunis (pagus Alnensis) possibly derives its name from its old capital Chbtelaillon (*castrum qui vocatur* Allionis). It very early became a feudal dependence of Poitou, and shared the political fortunes of that province. It now forms the north-western part of the department of Charente-Inférieure.

See L. Arcère, *Histoire* de la ville de la Rochelle et *du* pays *d'Aunis* (1756–57); Me'moires de la *Société* des Antiquaires de *l'Ouest* (1835 *seq.*); La Revue de Saintonge et *d'Aunis;* L. de Richemond, Documents *hist. inédits* sur *le département* de la *Charente-Inférieure* (1874).

AUNT SALLY, an English game popular at fairs, race-courses and summer resorts. It consists in throwing wooden or leather-covered balls at grotesquely dressed puppets, generally a female figure called "Aunt Sally," with the object of smashing a clay pipe, inserted either in the mouth or forehead of the puppet. In France the game is known as jeu de massacre.

AURA, formerly the supposed ethereal emanation from a volatile substance; applied later to the "electrical aura," or air-current caused by electrical discharge; in epilepsy (*q.v.*) to one of its premonitory symptoms; and in spiritualism (*q.v.*) to a light associated with the presence of spirit-forms. See AUREOLA; HYSTERIA.

AURAMINE, a yellow synthetic dye. There are several different methods of preparation. It crystallizes from water or alcohol in yellow scales, melts at 267° C, and carbonizes without previous fusion at 265°–280° C. It decomposes when heated as an aqueous solution, above 70° C, and when treated with acids. It dyes wool and silk direct, but cotton has to be nordanted previously. (See DYES, SYNTHETIC.)

AURANGABAD, a city of India, in the dominions of the nizam of Hyderabad, north-west division, situated 138m. from Poona, 207 from Bombay via Poona, and 270 from Hyderabad on the river Kaum. It gives its name to a district. It was founded in 1610 by Malik Ambar, an Abyssinian slave who had risen to great influence. Subsequently it became the capital of the Mogul conquests in south India. Aurangzeb, who erected here a mausoleum to his wife which has been compared to the Taj Mahal at Agra, made the city the seat of his government during his viceroyalty of the Deccan, and gave it the name of Aurangabad. It thus grew into the principal city of a province including nearly all the territory now the northern division of the presidency of Bombay, and was for long capital of the nizams after they became inde-

pendent of Delhi. They subsequently transferred their capital to Hyderabad, whereupon Aurangabad began to decline. In recent years the jungle has been cleared from the ruins of the citadel, mosque, etc., 2m. from the cantonment, and government offices have been built near the ruins. North of the city are Buddhist caves of the 7th century. Aurangabad is a railway station on the Hyderabad-Godavari line, 435m. from Bombay. In 1931 the population, with that of the military cantonments, was 36,870.

The district of Aurangabad has an area of 6,212 square miles. The population in 1931 was 944,793. It contains the famous caves of Ajanta, and also the battlefield of Assaye.

AURANGZEB (1618–1707), one of the greatest of the Mogul emperors of Hindustan, was the third son of Shah Jahan, and was born in Nov. 1618. His original name, Mohammed, was changed by his father, with whom he mas a favourite, into Aurangzeb, meaning ornament of the throne, and at a later time he assumed the additional titles of Mohi-eddin, reviver of religion, and Alam-gir, conqueror of the world. At a very early age, and throughout his whole life, he manifested profound religious feeling, perhaps instilled into him in the course of his education under some of the strictest Mohammedan doctors. He was early employed in the campaigns in Afghanistan where the Persians were fighting to recover Kandahar from the Uzbeg chief who had acknowledged the Mogul authority. The city surrendered to the Shah Abbás in 1648, and Aurangzeb's attempts to dislodge the Persians failed. The prince was then transferred to the army fighting on the southern frontier, where he had better success. In conjunction with the famous general, Mir Jumla, who had deserted from the king of Golconda, he seized and plundered the town of Hyderabad. His father's express orders prevented Aurangzeb from following up this success, and, not long after, the sudden and alarming illness of Shah Jahan turned his thoughts to the succession. Shah Jahan's eldest son, Dara, a brave and honourable prince, but disliked by the Mussulmans on account of his liberality of thought, at once seized the reins of government and established himself at Delhi. The second son. Shuja, governor of Bengal, a dissolute and sensual prince, raised an army to dispute the throne with Dara. Aurangzeb was too politic to put forward his claims openly. He made overtures to his younger brother Murad, governor of Gujarat, representing that he himself had no temporal ambition, and desired only to place a fit monarch on the throne, and then to devote himself to religious exercises and make the pilgrimage to Mecca. He therefore proposed to join Murad, who would thus have no difficulty in making himself master of the empire while the two elder brothers were divided. Murad at once accepted the offer. Their united armies then moved northward. Meanwhile Shah Jahan had recovered, and though Dara resigned the crown he had seized the other brothers pressed on. Shuja was defeated by Dara's son, but the imperial forces under Jaswant Singh were completely routed by the united armies of Aurangzeb and Murad. Dara in person took the field against his brothers, but was defeated. Aurangzeb then placed his father in confinement, in which he was kept for the remaining eight years of his life. Murad was assassinated, and Aurangzeb, with affected reluctance, ascended the throne in Aug. 1658. Dara, who again invaded Gujarat, was defeated and closely pursued, and was given up by the native chief with whom he had taken refuge. He was brought to Delhi and executed. Shuja was defeated and fled to Arakan, where he perished; Mohammed, Aurangzeb's eldest son, who had joined his uncle, was captured, thrown into the fortress of Gwalior, and died after seven years' confinement.

No similar contest disturbed Aurangzeb's long reign of 46 years which has been celebrated, though with doubtful justice, as the most brilliant period of the history of Hindustan. The empire certainly was wealthy, and extended from the Himalayas over the whole of northern and central India, for there were successively added to it the rich kingdoms of Bijapur and Golconda, but it was internally decaying and ready to crumble away before the first vigorous assault. Two causes principally had tended to weaken the Mogul power. The one was the intense bigotry and intolerant policy of Aurangzeb, which had alienated the Hindus and roused the fierce animosity of the haughty Rajputs. The other was the rise and rapid growth of the Mahratta power. Under their able leader, Sivaji, these daring freebooters plundered in every direction, nor could all Aurangzeb's efforts avail to subdue them. For the last 26 years of his life Aurangzeb was engaged in wars in the Deccan, and never set foot in his own capital. At the close of the long contest the Mogul power was weaker, the Mahratta stronger than at first. Still the personal ability and influence of the emperor were sufficient to keep his realms intact during his own life. His last years were embittered by remorse, by gloomy forebodings, and by constant suspicion, for he had always been in the habit of using espionage, and now only experienced its evil effects. He died March 3 1707, at Ahmadnagar, while engaged on an extensive but unfortunate expedition against the Mahrattas.

See S. Lane-Poole, *Aurangzib,* "Rulers of India" series (1893), and *History of the Moghul Emperors illustrated by their coins* (1892); Hosain Khan, *Letters of Aurangzeb* (Bombay, 1889).

AURAY, a town of France, in the department of Morbihan, 12 mi. W. of Vannes on the railway to Quimper Pop. (1936) 6,544. Coastal subsidence forming the island-studded Morbihan bay has submerged the lower valley of the Auray river and the tide reaches the town, giving it some coasting trade. The great stone monuments abounding near by are thought to indicate maritime intercourse already in prehistoric times. In the neighbourhood is the church of Ste. Anne d'Auray, famous for its pardon and one of the principal places of pilgrimage in Brittany. Auray is one of the chief centres in France for oyster breeding. There is an active coasting trade, the principal cargoes being mine-props for, and coal from, Great Britain. Auray also makes furniture, and trades in dairy produce and fruit.

AURELIA, VIA, ancient highroad of Italy, date unknown. It ran from Rome to the sea at Alsium, and thence along the west coast line of Italy, perhaps originally only as far as Cosa, but it was later extended to Vada Volaterrana, and in 109 B.C. to Genua and Dertona by means of the Via Aemilia, though a coast road as far as Genua at least must have existed long before. The name is applied in the Antonine Itinerary to these extensions, and even to the prolongation to Arles. Its line is in the main closely followed by the modern coast highroad.

See D. Anziani in *Mélanges de l'École Française* (1913), 174 *sqq.*

AURELPAN (LUCIUS DOMITIUS AURELIANUS) (Roman emperor, A.D. 270–275) was born of humble parents at Sirmium in Pannonia between A.D. 212 and 214. He had a distinguished military career, and on the death of the emperor Claudius II. Gothicus (270), Aurelian was proclaimed his successor, with the universal approval of the soldiers. His first task was to continue the war which had been begun by Claudius against the Goths. He drove them out of Moesia across the Danube, where he left them in possession of Dncia, which he did not think himself able to retain; the name was transferred to Moesia, which was then called Dacia Aureliani. The chronology, however, of Aurelian's reign is very confused, and the abandonment of Dacia is placed by some authorities towards its close. He next entered upon campaigns against the Juthungi, Alamanni, and other Germanic tribes, over whom, after a severe defeat which was said to have imperilled the very existence of the empire, he at length obtained a complete victory. Having thus secured the Rhine and Danube frontiers, he turned his energies towards the east, and in 271 set out on his expedition against Zenobia, queen of Palmyra (*q.v.*). At the same time he crushed two pretenders to the throne — Firmus and Tetricus. Firmus, a wealthy merchant of Seleucia, had proclaimed himself emperor of Egypt. Aurelian, who was at the time in Mesopotamia, hastened thither, and ordered him to be seized and put to death. Tetricus, who had been proclaimed emperor in the west after the death of Gallienus, and left undisturbed by Claudius II., still ruled over Gaul, Spain and Britain. A decisive battle was fought near the modern Châlons, in which Tetricus was defeated. The restoration of the unity of the empire was thus complete. In 274 a brilliant triumph, adorned by the persons of Zenobia and Tetricus, was celebrated at Rome.

Towards the end of 274, he started on an expedition against the Persians, halting in Thrace by the way. While on the march between Heracleia and Byzantium, at the beginning of the following year, hc was assassinated through the treachery of his secretary, Eros, who, in order to escape the discovery of his own irregularities, incited certain officers against the emperor by showing them a forged list, on which their names appeared as marked out for death.

Aurelian well deserved the title of restorer of the empire. He was a great soldier and a rigid but just disciplinarian, and in more favourable circumstances he would have been a great administrator. He was the first Roman emperor to wear the diadem, and assumed the title of Lord and God on medals. The restoration and enlargement of the walls of Rome, begun by him, was not completed till the reign of Probus.

BIBLIOGRAPHY.—The chief authority for the events of Aurelian's reign is his life by Vopiscus, one of the writers of the "Augustan History"; it is founded on Greek memoirs and certain journals deposited in the Ulpian library at Rome. See L. Homo, Le *Règne* de *l'empereur Aurélien* (1904), and Groag's art. in Pauly-Wissowa, Realencyklopadie, v. 1347 foll.

AURELIANUS, CAELIUS, a physician of Sicca in Numidia, who probably flourished in the 5th century A.D., although some place him two or even three centuries earlier. We possess a translation by Aurelianus of two works of Soranus of Ephesus (2nd century), the chief of the "methodist" school of medicine, on chronic and acute maladies — Tardae or *Chronicae* Passioizes, in five, and Celeres or Aczitae *Passiones* in three books. We also possess considerable fragments of his *Medicinales Responsiones,* also adapted from Soranus, a general treatise dealing with rules of health (*salutaria praecepta*) and the pathology of internal diseases (ed. Rose, *Anecdota Graeca* et Latiiza, ii., 1870). (Editions: Amman, 1709; Haller, 1774.)

AUREOLA, AUREOLE, the radiance of luminous cloud (fr. diminutive of Lat. *aura,* air), surrounding the figures of sacred personages in paintings. In the earliest periods of Christian art this splendour was confined to the figures of the persons of the Godhead, but it was afterwards extended to the Virgin Mary and to several of the saints. The luminous disk round the head is a *nimbus; nimbus* and aureole together constitute a glory. The *nimbus* in Christian art appeared first in the 5th century, but it was known still earlier in non-Christian art. Thus (though earlier Indian and Bactrian coins do not show it) it is found with the gods on some of the coins of the Indian kings Kanishka, Huvishka and Vasudeva, 58 B.C. to A.D. 41 (Gardner's Cat. of Coins of Greek aizd *Scythic* Kings of Bactria aizd *India,* Brit. Mus. 1886, plates 26–29). Its use has been traced through the Egyptians to the Greeks and Romans, representations of Trajan (arch of Constantine) and Antoninus Pius (reverse of a medal) being found with it.

AURÈS, a mountain mass in the south of the department of Constantine, Algeria (*q.v.*).

See M. W. Hilton Simpson, Among *the* Hill Folk of Algeria (1921).

AURIC, GEORGE (1899–), French composer, born Lodève, Hérault. With Honegger, Poulenc, and others, he first came under notice as one of a group of ultra-advanced composers calling themselves 'Les Six."

His earliest works showed the influence of Ravel and later of Satie, but more recently he has inclined to the methods of Stravinsky. He wrote the music for the Diaghilev ballet "Les Matelots."

AURICH, a town of Hanover, Germany. chief town of the district of East Friesland, on the Ems-Jade canal, 18 mi. N.W. of Emden. Pop. (1933) 6.544 It is built in the Dutch style and lies in a sandy but fertile plain, surrounded by promenades replacing the old fortifications.

The palace bf the counts of East Friesland is now government offices.

Close by is the *Upstallsboom,* the hill of oath and liberty where every year at Whitsuntide representatives of the seven Frisian coastlands used to assemble.

AURICLE, the external ear in animals. or an analogous part in plants, etc.

From a supposed resemblance to the ear of a dog, the term was applied to the upper cavities of the heart. The adjective "auricular" is more specially used in the phrase "auricular confession" (see CONFESSION), *i.e.,* private confession.

AURICULA (*Primula* auricula), an Alpine plant and a favourite spring flower. It thrives best in a cool soil and shady situation. The florists' varieties are grown in rich composts.

Auriculas are best germinated in a cold frame or cool greenhouse, in September or October, in a rich but light soil. They can be planted in the rock garden or border, preferably in mild climates, the following spring.

Auricuias may also be propagated by division, which is to be done in early spring. When seed has been saved from the finer sorts, the operation is one of considerable nicety, as it not infrequently happens that the best seedlings are at first exceedingly weak.

They generally flower in the second or third year, a few good sorts being all that can be expected from a large sowing. The summer heat in the United States makes the cultivation of auriculas rather difficult.

Auriculas prefer cool, moist sites and lacking this are best grown in a shaded, cool greenhouse.

AURICULAR CANAL, the tube leading from the external ear to the ear drum. It is about 1in. long and is lined by thin skin which is tightly bound to the cartilage and bone on which it rests. The outer one-third is formed by cartilage; the inner two-thirds by bone. The few short crisp hairs at the entrance of the canal serve as a barrier to dust and small insects. In the skin of the outer portion are glands which secrete a sticky yellow material called cerumen, or wax. This also serves to catch small particles. The cerumen sometimes becomes packed in, causing sudden deafness, and should then be removed by a physician. The short, straight, constricted tube, connecting the auricular with the ventricular portions of the embryonic heart is also known as the auricular canal.

AURIGA (the "charioteer" or "wagoner"), in astronomy, a constellation of the northern hemisphere. It was symbolized by the Greeks as an old man in a more or less sitting posture, with a goat and her kids in his left hand, and a bridle in his right. The ancient Greeks associated this constellation with many myths. Some assume it to be Erichthonius, son of Athena and Hephaestus, who was translated to the skies by Zeus on account of his invention of chariots or coaches. Others assume it to be Myrtilus, a son of Hermes and Clytie, and charioteer to Oenomaus, who was placed in the heavens by Hermes. The constellation contains Capella (*q.v.*).

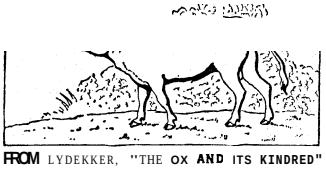
AURILLAC, central France, capital of the department of Cantal, 140m. N.N.E. of Toulouse, on the Orléans railway. Pop. (1936) 18,074. On the right bank of the Jordanne, it began with the 9th century abbey of St. Géraud. The Gothic abbey church was rebuilt in the 17th century. The 11th century castle stands on Roc Castanet. The abbey was a famous seat of mediaeval learning and this tradition was continued by a (17th century) college, now a museum and library. The chief manufactures are wooden shoes and umbrellas; and there is trade in cheese and in the cattle, horses, and mules reared in the neighbourhood. Aurillac is the seat of a prefect, and has tribunals of first instance and of commerce and a chamber of commerce.

AURIOL, VINCENT (1884–), French lawyer and politician, born at Revel, Haute Garonne, on Aug. 27, 1884. He became Socialist deputy for Haute Garonne; after the Party Congress of Tours (1920) which adhered to the Communist International, he remained with the minority which retained the name of Socialist Party (S.F.I.O.). Auriol was one of the authors of an international plan for the financial reconstruction of Europe and the settlement of the reparations question, which was adopted in 1921 by the German Socialists and the British Labour Party. He was president of the finance committee of the chamber, but resigned in July 1925. In 1934 he became leader of the opposition; and was minister of finance from 1936 to 1937; of justice, 1937; and for co-ordination of the services, 1938.

AURISPA, GIOVANNI (*c.* 1370–1459), Italian scholar, who did much to promote the revival of the study of Greek in

Italy, was born at Noto, in Sicily. In 1418 he visited Constantinople, where he remained for some years, perfecting his knowledge of Greek and searching for ancient mss. His efforts were rewarded by the acquisition of some 250 mss., with which he returned to Venice. Here he is said to have been obliged to pawn his treasure for 50 gold florins to provide for his immediate wants. Cosimo de' Medici, hearing of his embarrassment, redeemed the mss. and summoned the owner to Florence. Aurispa was secretary to Pope Eugenius IV., and afterwards to Nicholas V., who presented him to two lucrative abbacies. He died at Ferrara

AUROCHS, the name of the extinct wild ox of Europe (Bos *primigenius*), said by R. Lyddeker (11th edit. E.B.) and others to be the original stock whence the European domestic cattle was derived. It survived in the Jaktozowka forest in Poland until 1627 and an account, with woodcuts, appeared in Freiherr von Herberstein's *Moscovia,* published at Venice in 1550. The aurochs was of great size and black in colour, the British black Pembroke breed being said to resemble them closely, while the semi-wild park-cattle of Chillingham and elsewhere are an albino offshoot. Skulls and limb-bones of specimens standing 6 ft. at the shoulder have been found in the pleistocene gravels of the Thames valley.



FROM LYDEKKER, "THE OX AND ITS KINDRED"
AN AUROCHS (BOS PRIMIGENIUS)
After a picture copied from an oil painting on wood of A.D. 1500 and known as the Augsburg portrait

On the extinction of B. *primigenius,* the name "aurochs" was, in common parlance, transferred to the European bison (*q.v.*).

AURORA, the Roman goddess of the dawn, corresponding to the Greek Eos. According to Hesiod (Theog. 271) she was the daughter of the Titan Hyperion and Theia, and sister of Helios and Selene. By the Titan Astraeus, she was the mother of the winds Zephyrus, Notus, and Boreas, of Hesperus and the stars. Homer represents her as rising every morning from the couch of Tithonus (*q.v.*) and drawn out of the east in a chariot by the horses Lampus and Phaëthon to carry light to gods and men (Odyssey, xxiii. 253). From the roseate shafts of light which herald the dawn, she bears in Homer the epithet "rosy-fingered." The conception of a dawn-goddess is common in primitive religions, especially in the Vedic mythology, where the deity Usás is closely parallel to the Graeco-Roman. She is also represented as the lover of the hunter Orion (Odyssey, v. 121), the representative of the constellation that disappears at the flush of dawn, and of the youthful hunter Cephalus, by whom she was the mother of Phaethon (Apollodorus iii. 14. 3). In works of art Eos is represented as a young woman, fully clothed, walking fast with a youth in her arms; or rising from the sea in a chariot drawn by winged horses; sometimes, as the goddess who dispenses the dews of the morning, she has a pitcher in each hand. In the fresco-painting by Guido Reni in the Rospigliosi palace at Rome, Aurora is represented strewing flowers before the chariot of the sun. In Latin writings the word Aurora was used (*e.g.,* Virgil, Aen., viii. 686, vii. 606) for the East.

AURORA, a city of Kane county, Illinois, U.S.A., on the Fox river, 38 mi. W. of Chicago. It is on federal highways 30 and 34, state highways 31, 25 and 65; is served by the Burlington, Chicago and North Western. Chicago, Aurora and Elgin railways and for freight also by the Chicago, Milwaukee and St. Paul, and the Elgin, Joliet and Eastern railways; its area is 8·5 sq.mi. Its population in 1930 was 46.589, and was 47,170 in the 1940 federal census. About 15% are foreign-born.

Aurora is in the heart of the beautiful, productive Fox river valley. It has a high percentage of home ownership. The assessed valuation of property in 1940 was $26,955,729.

Aurora college, Marmion Military academy, Madonna high school and Jennings seminary are among its educational institutions. Shops of the Burlington railway, which was founded in Aurora in 1850, are there. It is an important industrial centre. The aggregate annual pay roll of its 154 manufacturing plants in 1940 was $11,511,800.

Among the leading products are road-building machinery, conveyors and loaders, steel cabinets, lockers and shelving, pumps and drills, pneumatic tools. doorway hardware, iron. brass and aluminium castings, clothing, corsets, toilet articles, brushes, typewriter supplies, advertising displays and automatic vending machines.

Aurora was settled in 1834 as a trading point and mill site. In 1837 the name Aurora was chosen and the city was chartered in 1857. It operates under the aldermanic form of government.

AURORA, a village of Cayuga county, N.Y., U.S.A., on Cayuga lake, 16 mi. south-west of Auburn, 26 mi. north of Ithaca. It is served by the Lehigh Valley railroad. It is beautifully situated in the heart of the Finger Lakes district. Its permanent population, which is stationary, was 372 in 1940 (federal census). It is, however, the seat of Wells college, a non-sectarian college for women, founded in 1868 by Henry Wells (1805–78). It has an annual enrolment of about 300, and its endowment amounted to $1,471,086 in 1940. Aurora was settled in 1789, chiefly from New England, and was incorporated in 1909.

AURORA BOREALIS: see AURORA POLARIS.

AURORA POLARIS, a phenomenon of the atmosphere, sometimes of great beauty, known in the northern hemisphere as the aurora borealis, in the southern hemisphere as the aurora australis. Confining our attention to the aurora borealis, about which we have far more information, we find that the number of auroras increases as we go further north to certain limits, and then decreases as the pole is approached. For Europe and Asia the latitude of maximum frequency is +70°, for America +60°. This means that while an aurora is very rarely seen in southern Europe, auroras may often be seen in the central United States.

There are many types of auroral phenomena, sometimes several types appearing simultaneously. These are known as arcs, rays, bands, curtains, draperies, coronas and diffuse glows. When the aurora is faint it is generally white; if fairly bright, yellowish; and when bright, many other colours, particularly red and green, appear. To the average American or European observer the most common forms are arcs and rays. The arc has its highest point on the magnetic meridian and frequently seems to reach to the horizon in the north-west and north-east. The under edge is more sharply defined, and as a consequence the sky below appears considerably darker than that above. When the arc is bright, the lower part will usually be red, the middle yellow and the upper part green. The arc may be visible alone, but frequently from it rays appear to spread out like the spokes of a fan. The auroral rays sometimes are stationary, simply appearing and disappearing without seeming to move. At other times there is a rapid cross motion and again they seem to shoot rapidly upward and then recede. These upward pulses are probably quite real, and may be due to progressive electric discharges.

Further north the direction of the dip needle approaches nearer to the observer's zenith and the corona effect is seen, with rays spreading in all directions from this central ring of light, and even reaching to the horizon. This is perhaps the most striking and beautiful of all types of auroras. The curtains and draperies seem to be luminous clouds of light, usually of irregular outlines, that hang vertically in the sky. These are rarely seen in lower latitudes. The colours in the same aurora frequently change rapidly, even in the same area of the sky, but on the average are said to be more brilliant in the arctic regions.

The height of an aurora may be determined by the usual method of making simultaneous observations on a certain luminous point therein from two stations whose distance apart is known. Such observations have been made with great success by photographing the aurora against a background of stars. By this method an upper limit of from 50 to 240m., and a lower limit of from 50 to 100m. have been fixed. These heights refer to auroras which occur in that portion of our atmosphere not illuminated by the sun. During the early part of the 20th century rays have been measured in some cases to heights of from 240 to 480 miles. On Sept 8. 1926, an unusual aurora was observed west of Norway. It appeared an arc to the eye, but the

photographs showed it was composed of a curtain of rays. These rays extended as high as 300m., but the diffuse form which ended the aurora reached the unexpected height of 600 miles. Calculation proved that this, as well as the rays in previous years which reached more than 240m. from the ground, were actually situated in that part of our upper atmosphere still illuminated by the sun. It seems proved therefore that sunlight has an ionizing action on the higher strata of our atmosphere, so that the illumination caused by the rays forming the aurora become visible at greater altitudes than when the light is withdrawn. These new heights for our atmosphere, which are derived from this work, open up most interesting questions as to how far it really does extend and what its physical properties must be at such great altitudes. The heights of meteors have long since proved that it was dense enough to cause them to become visible at least 120m. from the ground. Some phenomena of telescopic meteors may be explained by a height ten times as great, but other explanations of these phenomena are more probable. Thus auroral photographs give the first direct proof of such a great height for the atmosphere.

Trustworthy observers have, however, reported seeing the aurora between them and a mountain or cliff, or below clouds. This would mean an altitude of a mile or less. Also it is said to be accompanied by a crackling sound, like the rustling of silk. Such reports come from the far north where presumably the aurora would be nearer the ground. While difficult to explain, they have been made by so many observers that it is impossible arbitrarily to dismiss them as unreal.

In brightness different auroras vary immensely. Some are so faint as to be just visible, others exceed the light of the full moon, with all gradations between. A fairly good aurora might be compared to the Milky Way in brilliancy. On the whole they become more brilliant toward the Arctic Circle. The auroral spectrum has been carefully studied and large numbers of characteristic lines, particularly a bright green line, are observed. Indeed by photographing the night sky, when to the eye no aurora is visible, it is possible to obtain this line. The inference is that there is a permanent aurora. In the ordinary auroral spectrum many nitrogen lines appear, and recently the famous green line has been proved definitely to be due to oxygen. The line in question has a wave-length of 5,577.34 Angstrom units. The early hypothesis that this line was due to krypton had long been held improbable. Frozen nitrogen particles had also been suggested.

From observations extending over more than two centuries the numbers of auroras have been found to follow rather closely the numbers of sun-spots. These latter have a maximum approximately every 11 years. It is further found that more auroras appear in March and September, when the earth is more directly opposite the spot zones on the sun, than in June and December when such is not the case. On the earth it is found that whenever a brilliant aurora appears there is almost sure to be a magnetic storm, accompanied by heavy earth currents. These latter seriously disturb telegraph and cable lines, sometimes putting them out of commission for several hours. The magnetic storm is not necessarily confined to those areas over which the aurora is visible, but may extend over the rest of the earth as well. For the 19 great magnetic storms between 1875 and 1903, there was an average delay of 25 hours between the passage of the spots over the central meridian of the sun and the storm on the earth. Therefore we may infer with fair safety that the action, whatever its nature, was not propagated with the velocity of light. From what has been said it is clear that the appearance of an aurora must be closely connected with something that happens on the sun, and it is evident that the original outburst takes place on the sun and what is seen on the earth is a mere reflex action. That it is visible at all is due to the earth itself being an immense magnet surrounded by an atmosphere.

Since all bright shifting auroras are accompanied by magnetic storms, it seems certain that this type, and presumably all others, is caused by electric discharges of some kind. The current evidently must come from or be induced by the sun. Two theories have been advanced. One is that the cause lies in negative particles shot off by that body and caught in the magnetic field of the earth. The second is that alpha-particles, with a plus charge, come to us from radioactive substances in the sun. In some cases at least it has been possible to prove that only plus charges could explain the accompanying magnetic effects, but it has been pointed out that even were these particles to move with the velocity of light they could not penetrate the atmosphere to within a distance of 16m. from the earth's surface. (C. P. O.)

AURUNCI, the name given by the Romans to a tribe which in historical times occupied only a strip of coast on either side of the Mons Massicus between the Volturnus and the Liris, although it must, at an earlier period, have extended over a considerably wider area. Their own name for themselves in the 4th century B.C. was *Ausŏnes.* Greek writers applied the name Ausŏnia to Latium and Campania, while the Augustan poets used it as one of many synonyms for Italy. In history the tribe appears only for a brief space, from 340 to 295 B.C., and their struggle with the Romans ended in complete extermination. No record of their speech survives; but their geographical situation, and the frequency of the co-suffix in that strip of coast (besides *Aurunci* itself we have the names *Vescia, Mons Massicus, Marica, Glanica,* and *Caedicii*) *(see* R. S. Conway, *Italic Dialects,* p. 283 *et seq.)* rank them beyond doubt with their neighbours the Volsci (*q.v.*).

AUSABLE CHASM, a gorge of scenic and scientific interest situated in the north-eastern part of the State of New York, U.S.A. At this point, which is about midway in its course from the Adirondack mountains to Lake Champlain, the Ausable river has worn in hard sandstone a series of narrow zigzag chasms, the whole about 2m. long and in places 175ft. deep. The rocks forming the precipitous walls are of Potsdam formation and present an instructive display of fault lines and displacements.

AUSCULTATION, a term in medicine applied to the method of determining, by the sense of hearing, the condition of certain internal organs. Strictly, it should include audition of sounds produced within the body naturally and sounds induced artificially by the physician, but often the term percussion is applied to the last mentioned. In the beginning auscultation was direct only, the physician placing his ear over the heart or lungs, or, in percussion, tapping the part with his fingers. These methods are still followed but in the main some material is interposed between the listening ear or the percussing finger and the patient's body. In its modern sense auscultation dates from 1819 when Laennec invented the stethoscope. Some variations from the normal in heart or respiration sounds are associated with special morbid changes so constantly that diagnosis is certain.

The following are simple examples. When the normal heart sounds represented by "lūbb dfip" are replaced by "loove dfip" it is evidence that the mitral valve is not closing properly, if replaced by "lūbb" and a blowing sound in place of "dfip" the aortic valve is affected. When the normal slight rustle heard during inspiration and the almost silent expiration are replaced by crackling or snoring sounds there is evidence that the lung contains an abnormal fluid as in consumption or bronchitis. In cases of pneumonia, where the air in the lung is replaced by exuded and coagulated serum, a dull note replaces the normal resonant note on percussion. These examples might be extended indefinitely. One of the most striking instances of the value of auscultation is in the diagnosis of pregnancy. An adult woman's heart beats at the rate of some 75 per minute, a foetal heart beats at the rate of 120–140 per minute. (W. S. L.-B.)

AUSDEHNUNGSLEHRE: *see* **QUATERNIONS.**

AUSGLEICH, a German word meaning treaty, compact or compromise. It is specifically used to describe the compact, finally concluded in Feb. 1867, which regulated the relations between Austria and Hungary following upon the establishment of the dual monarchy. *(See* AUSTRIA-HUNGARY.)

AUSONIUS, DECIMUS MAGNUS (c. 310–395), Roman poet and rhetorician, was born at Burdigala (Bordeaux). He set up (in 334) a school of rhetoric in his native place, which was largely attended, his most famous pupil being Paulinus, afterwards bishop of Nola. After 30 years of this work, he was summoned by Valentinian to the imperial court, to undertake the education of Gratian, the heir-apparent. The prince had the

greatest regard for his tutor, and after his accession bestowed upon him the highest honours, culminating in the consulship (379). After the murder of Gratian (383), Ausonius retired to his estates near Burdigala. He appears to have been a (not very enthusiastic) convert to Christianity. He died about 395. Ausonius was rather a man of letters than a poet; his wide reading supplied him with material for a great variety of subjects, but his works exhibit no traces of a true poetic spirit; even his versification, though ingenious, is frequently defective.

His most important extant works are: in prose, *Gratiarum Actio,* an address of thanks to Gratian for his elevation to the consulship; *Periochae,* summaries of the books of the *Iliad* and *Odyssey;* and one or two *epistolae;* in verse, *Epigrammata,* including several free translations from the Greek Anthology; *Ephemeris,* the occupations of a day; *Parentalia* and *Commemoratio Professorum Burdigalensium,* on deceased relatives and literary friends; *Epitaphia,* chiefly on the Trojan heroes; *Caesares,* memorial verses on the Roman emperors from Julius Caesar to Elagabalus; *Ordo Nobilium Urbium,* short poems on famous cities; *Ludus Septem Sapientum,* speeches delivered by the Seven Sages of Greece; *Idyllia,* of which the best known are the *Mosella,* a descriptive poem on the Moselle, and the scandalous *Cento Nuptialis.* We may also mention *Cupido Cruciatus,* Cupid on the cross; *Technopaegion,* a literary trifle consisting of a collection of verses ending in monosyllables; *Eclogarum Liber,* on astronomical and astrological subjects; *Epistolae,* including letters to Paulinus and Symmachus; lastly, *Praefatiunculae,* three poetical epistles, one to the Emperor Theodosius.

There are no mss. containing the whole of Ausonius's works. Editio princeps (1472); editions by Scaliger (1575), Souchay (1730), Schenkl (1883), Peiper (1886); cf. Mosella, Böcking (1845), de la Ville de Mirmont (critical edition with translation, 1889), and De *Ausonii* Mosella (1892), Hosius (1894), English translation of works by H. G. E. White (Loeb series 1919).

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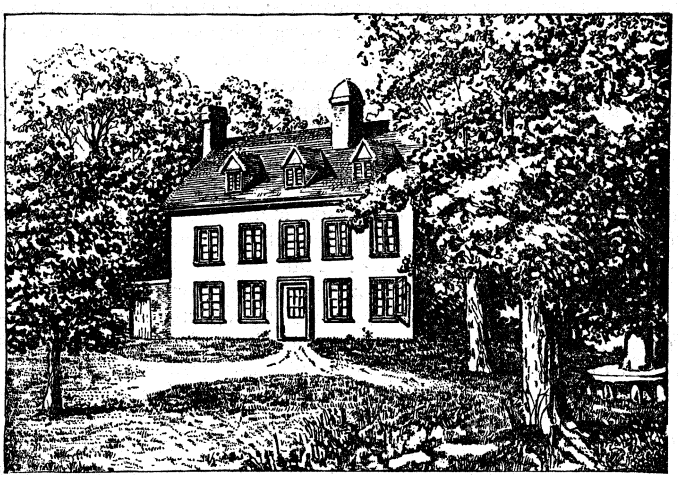
AUSSIG, same as USTÍ NAD LABEM (*q.v.*).

AUSTEN, JANE (1775–1817), English novelist, was born on Dec. 16, 1775, at the parsonage of Steventon, in Hampshire, a village of which her father, the Rev. George Austen, was rector. She was the youngest of seven children. Her mother was Cassandra Leigh, niece of Theophilus Leigh, a dry humorist, and for 50 years master of Balliol, Oxford. The life of no woman of genius could have been more uneventful than Miss Austen's. She did not marry, and she never left home except on short visits, chiefly to Bath. Her first 16 years were spent in the rectory at Steventon, where she began early to trifle with her pen, always jestingly, for family entertainment. In 1801 the Austens moved to Bath, where Mr. Austen died in 1805, leaving only Mrs. Austen, Jane and her sister Cassandra, to whom she was always deeply attached, to keep up the home; his sons were out in the world, the two in the navy, Francis William, and Charles, subsequently rising to admiral's rank. In 1805 the Austen ladies moved to Southampton, and in 1809 to Chawton, near Alton, in Hampshire, and there Jane Austen remained till 1817, the year of her death, which occurred at Winchester, on July 18, as a memorial window in the cathedral testifies.

During her placid life Miss Austen never allowed her literary work to interfere with her domestic duties: sewing much and admirably, keeping house, writing many letters and reading aloud. Though, however, her days were quiet and her area circumscribed, she saw enough of middle-class provincial society to find a basis on which her dramatic and humorous faculties might build, and such was her power of searching observation and her sympathetic imagination that there are not in English fiction more faithful representations of the life she knew than we possess in her novels. She had no predecessors in this genre. Miss Austen's "little bit (two inches wide) of ivory" on which she worked "with so fine a brush"—her own phrases—was her own invention.

Her best-known, if not her best work, *Pride and Prejudice,* was also her first. It was written between Oct. 1796 and Aug. 1797, although, such was the blindness of publishers, not issued until 1813, two years after *Sense and Sensibility,* which was written, on an old scenario called "Eleanor and Marianne," in 1797 and 1798. Miss Austen's inability to find a pcblisher for these stories, and for *Northanger Abbey,* written in 1798 (it is true that she sold that ms. in 1803 for £10 to Crosbie and Co., London, only,



THE BIRTHPLACE OF THE NOVELIST JANE AUSTEN. STEVENTON PARSONAGE, HAMPSHIRE

however, to see it locked away in a safe for some years, to be gladly resold to her later), seems to have damped her ardour; for there is no evidence that between 1798 and 1809 she wrote anything but the fragment called "The Watsons," after which year she began to revise her early work for the press. Her other three books belong to a later *date*—*Mansfield Park, Emma* and *Persuasion* being written between 1811 and 1816. The years of publication were *Sense and Sensibility,* 1811; *Pride and Prejudice,* 1813; *Mansfield Park,* 1814; and *Emma,* 1816—all in their author's lifetime. *Persuasion* and *Northanger Abbey* were published posthumously in 1818. All were anonymous, agreeably to their author's retiring disposition.

Although *Pride and Prejudice* is the novel which in the mind of the public is most intimately associated with Miss Austen's name, both *Mansfield Park* and *Emma* are finer achievements—at once riper and richer and more elaborate. But the fact that *Pride and Prejudice* is more single-minded, that the love story of Elizabeth Bennet and D'Arcy is not only of the book but *is* the book (whereas the love story of Emma and Mr. Knightley and Fanny Price and Edmund Bertram have parallel streams), has given *Pride and Prejudice* its popularity above the others among readers who are more interested by the course of romance than by the exposition of character. Entirely satisfactory as is *Pride and Prejudice* so far as it goes, it is, however, thin beside the niceness of analysis of motives in *Emma* and the wonderful management of two housefuls of young lovers that is exhibited in *Mansfield Park.*

It has been generally agreed by the best critics that Miss Austen has never been approached in her own domain. No one indeed has attempted any close rivalry. No other novelist has so concerned herself or himself with the trivial daily comedy of small provincial family life, disdaining equally the assistance offered by passion, crime and religion. Whatever Miss Austen may have thought privately of these favourite ingredients of fiction, she disregarded all alike when she took her pen in hand. Her interest was in life's little perplexities of emotion and conduct; her gaze was steadily ironical. The most untoward event in any of her books is Louisa's fall from the Cobb at Lyme Regis, in *Persuasion;* the most abandoned, Maria's elopement with Crawford, in *Mansfield Park.* In pure ironical humour Miss Austen's only peer among novelists is George Meredith, and indeed *Emma* may be said to be her *Egoist,* or the *Egoist* his *Emma.* But irony and fidelity to the fact alone would not have carried her down the ages. To these gifts she allied a perfect sense of

dramatic progression and an admirably lucid and flowing prose style which makes her stories the easiest reading.

Recognition came to Miss Austen slowly. It was not until quite recent times that to read her became a necessity of culture. But she is now firmly established as an English classic, standing far above Fanny Burney (Madame d'Arblay) and Maria Edgeworth, who in her day were the popular women novelists of real life while Mrs. Radcliffe and "Monk" Lewis, whose supernatural fancies *Northanger Abbey* was written in part to ridicule, are no longer anything but names. Although, however, she has become only lately a household word, Miss Austen had always her panegyrists among the best intellects—such as Coleridge, Tennyson, Macaulay, Scott, Sydney Smith, Disraeli and Archbishop Whately, the last of whom may be said to have been her discoverer. Macaulay, whose adoration of Miss Austen's genius was almost idolatrous, considered *Mansfield Park* her greatest feat; but many critics give the palm to *Emma.* Disraeli read *Pride and Prejudice* 17 times. Scott's testimony is often quoted: "That young lady had a talent for describing the involvements, feelings and characters of ordinary life which is to me the most wonderful I have ever met with. The big bow-wow I can do myself like anyone going; but the exquisite touch which renders commonplace things and characters interesting from the truth of the description and the sentiment is denied to me." (E. V. L.)

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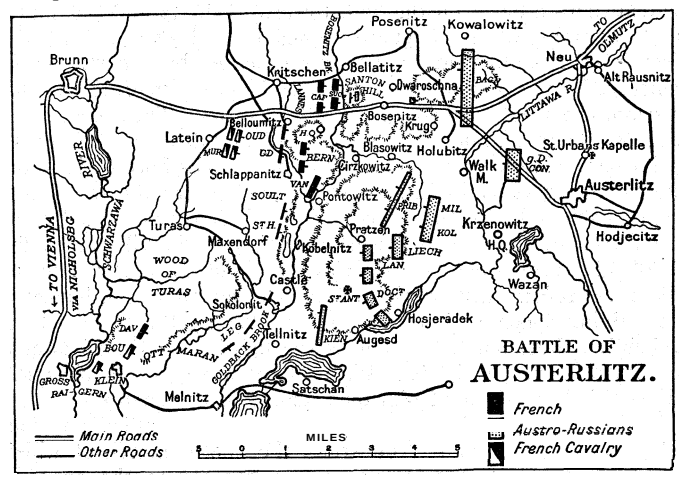
AUSTERLITZ (Czech *Slavkov*), a town in Moravia, 15 mi. E.S.E. of Brünn by rail Population 4,556, mostly Czech. It contains a magnificent palace belonging to the prince of Kaunitz-Rietberg, and a beautiful church.

The great battle in which the French under Napoleon I. defeated the Austrians and Russians on Dec. 2, 1805, was fought in the country to the west of Austerlitz, the position of Napoleon's left wing being almost equidistant from Brunn and from Austerlitz. The wooded hills to the northward throw out to the south and south-west long spurs, between which are the low valleys of several rivers and brooks. The scene of the most important fighting was the Pratzen plateau. The famous "lakes" in the southern part of the field were artificial ponds, which have long since been drained. On the west or Brunn side of the Goldbach is another and lower ridge, which formed in the battle the first position of the French right and centre. On the other wing is the mass of hills from which the spurs and streams descend; here the Olmütz-Brünn road passes. The road from Brunn to Vienna, Napoleon's presumed line of retreat, runs in a southerly direction and near the village of Raigern (3m. west of Melitz) which is very close to the extreme right of the French position, a fact which had a great influence on the course of the battle. (The course of events that led to the action is described under NAPOLEONIC CAMPAIGNS.) Napoleon, falling back before the advance of the allied Austrians and Russians from Olmutz, bivouacked west of the Goldbach, whilst the allies, holding, near Austerlitz, the junction of the roads from Olmutz and from Hungary, formed up in the valleys east of the Pratzen heights. The cavalry of both sides remained inactive, Napoleon's by express order, the enemy's seemingly from mere negligence, since they had 177 squadrons at their disposal. Napoleon, having determined to fight, as usual called up every available battalion; the splendid III. corps of Davout only arrived upon the field after a heavy march, late on the night of Dec. 1. The plan of the allies was to attack Napoleon's right, and to cut him off from Vienna, and their advanced guard began, before dark on Dec. 1, to skirmish towards Tellnitz. At that moment Napoleon was in the midst of his troops, thousands of whom had made their bivouac-straw into torches in his honour. The glare of these seemed to the allies to betoken the familiar device of lighting fires previous to a retreat, and thus confirmed them in the impression which Napoleon's calculated timidity had given. Thus encouraged, those who desired an immediate battle soon gained the upper hand in the councils of the tsar and the emperor Francis. The attack orders for Dec. 2 (drawn up by the Austrian general, Weyrother, and explained by him to a council of superior officers, of whom some were hostile, the greater part indifferent, and the chief Russian member, General Kutusov, asleep) gave the five columns and the reserve, into which the Austro-Russian army was organized, the following tasks: the first and second (Russians) to move south-westward behind the Pratzen ridge towards Tellnitz and Sokolnitz; the third (Russian) to cross the southern end of the plateau and come into line on the right of the first two; the fourth (Austrians and Russians under Kolowrat), on the right of the third, to advance towards Kobelnitz. An Austrian advanced guard preceded the 1st and 2nd columns. Farther still on the right the 5th column (cavalry under Prince John of Liechtenstein) was to hold the northern part of the plateau south of the Brunn-Olmutz road; across the road itself was the corps of Prince Bagration, and in rear of Liechtenstein's corps was the reserve (Russians under the grand-duke Constantine). Thus, the farther the four main columns penetrated into the French right wing the wider would the gap become between Bagration and Kolowrat, and Liechtenstein's squadrons could not form a serious obstacle to a heavy attack of Napoleon's centre. The whole plan was based upon defective information and preconceived ideas; it has gone down to history as a classical example of bad generalship, and its author, Weyrother, who was perhaps nothing worse than a pedant, as a charlatan.



BATTLE OF AUSTERLITZ, SHOWING **DISPOSITION** OF CONTENDING ARMIES **AND.** ABBREVIATED, NAMES OF GENERALS COMMANDING **DIVISIONS**

On Dec. 2, 1805, Napoleon broke the Austro-Russian centre at Pratzen while Murat, operating on the left, cut the enemy's communication with Austerlitz

Napoleon, on the other hand, with the exact knowledge of the powers of his men, which was the secret of his generalship, entrusted nearly half of his line of battle to a division (Legrand's) of Soult's corps, which was to be supported by Davout, some of whose brigades had marched from Vienna, 90m. in 48 hours. But the ground which this thin line was to hold against three columns of the enemy was marshy and densely intersected by obstacles. and the III. corps was the best in the *Grande Armée,* while its leader was perhaps the ablest of all Napoleon's marshals. The rest of the army formed in the centre and left. "Whilst they march to turn my right," said Napoleon in the inspiriting proclamation which he issued on the eve of the battle, "they present

me their flank," and the great counterstroke was to be delivered against the Pratzen heights by the French centre. This was composed of Soult's corps, with Bernadotte's in second line. On the left, around the hill called by the French the Santon (which was fortified), was Lannes' corps, supported by the cavalry reserve under Murat. The general reserve consisted of the Guard and Oudinot's grenadiers.

The attack of the allies was begun by the first three columns, which moved down from their bivouacs behind the Pratzen plateau before dawn on the and, towards Tellnitz and Sokolnitz. The Austrian advanced guard engaged at daybreak, and the French in Tellnitz made a vigorous defense; both parties were reinforced, and Legrand drew upon himself, in fulfilling his mission, the whole weight of the allied attack. The contest was long and doubtful, but the Russians gradually drove back Legrand and a part of Davout's corps; numerous attacks both of infantry and cavalry were made, and by the successive arrival of reinforcements each side in turn received fresh impetus. Finally, at about 10 A.M., the allies were in possession of the villages on the Goldbach from Sokolnitz southwards, and Davout's line of battle had reformed more than a mile to rearward, still, however, maintaining touch with the French centre on the Goldbach at Kobelnitz. Between the two lines the fighting continued almost to the close of the battle. With 12,500 men of all arms the Marshal held in front of him over 40,000 of the enemy.

In the centre, the defective arrangements of the allied staff had delayed the 4th column (Kolowrat), the line of march of which was crossed by Liechtenstein's cavalry moving in the opposite direction. The objective of this column was Kobelnitz, and the two emperors and Kutusov accompanied it. The delay had, however, opened a gap between Kolowrat and the 3rd column on his left; and towards this gap, and the denuded Pratzen plateau, Napoleon sent forward St. Hilaire's division of Soult's corps for the decisive attack. Kutusov was pursuing this march to the southwest when he was surprised by the swift advance of Soult's men on the plateau itself. Napoleon had here double the force of the allies; Kutusov, however, displayed great energy, changed front to his right and called up his reserves. The French did not win the plateau without a severe struggle. St. Hilaire's (the right centre) division was fiercely engaged by Kolowrat's column, General Miloradovich opposed the left centre attack under Vandamme, but the French leaders were two of the best fighting generals in their army. The rearmost troops of the Russian 2nd column, not yet committed to the fight on the Goldbach, made a bold counter stroke against St. Hilaire's right flank, but were repulsed, and Soult turned to relieve the pressure on Davout by attacking Sokolnitz. The Russians in Sokolnitz surrendered, an opportune cavalry charge further discomfited the allied left, and the Pratzen plateau was now in full possession of the French. Even the Russian Guard failed to shake Vandamme's hold. In the meanwhile Lannes and Murat had been engaged in the defence of the Santon. Here the allied leaders displayed the greatest vigour, but they were unable to drive back the French. The cavalry charges in this quarter are celebrated in the history of the mounted arm; and Kellermann, the hero of Marengo, won fresh laurels against the cavalry of Liechtenstein's command. The French not only held their ground, but steadily advanced and eventually forced back the allies on Austerlitz, thereby barring their retreat on Olmiitz. The last serious attempt of the allies in the centre led to some of the hardest fighting of the day; the Russian Imperial Guard under the grand-duke Constantine pressed closely upon St. Hilaire and Vandamme on the plateau, and only gave way when the French Guard and the Grenadiers came into action. After the "Chevalier Guards" had been routed by Marshal Bessières and the Guard cavalry, the allies had no more hope of victory; orders had already been sent to Buxhowden, who commanded the three columns engaged against Davout, to retreat on Austerlitz. No further attempt was made on the plateau, which was held by the French from Pratzen to the Olmiitz road. The allied army was cut in two, and the last confused struggle of the three Russian columns on the Goldbach was one for liberty only. The fighting in Tellnitz was perhaps the hardest of the whole battle, but the inevitable retreat, every part of which was now under the fire of the French on the plateau, was terribly costly. Soult now barred the way to Austerlitz, and the allies turned southward towards Satschan. As they retreated, the ice of the Satschan pond was broken up by the French artillery, causing delay to the sorely harassed columns. In the twelve hours from 7 A.M. to nightfall, the 65,000 French troops had lost 6,800 men, or about 10%; the allies (82,500 engaged) had 12,200 killed and wounded, and left in the enemy's hands 15,000 prisoners (many wounded) and 133 guns.

AUSTIN, ALFRED (1835–1913), English poet-laureate, was born at Headingley, near Leeds, May 30, 1835, and died June 2, 1913 at Swinford Old Manor, near Ashford, Kent. He was educated at Stonyhurst, Oscott, and London University, from which he was graduated in 1853, and was called to the bar four years later. He made his first noteworthy appearance as a writer with a satire called *The Season*, which showed both wit and observation. Austin published several volumes of verse: *Savonarola* (1881), a tragedy; *Soliloquies* (1882); *Prince Lucifer* (1887); *England's Darling* (1896); *The Conversion of Winckelmann* (1897), etc. For several years he edited *The National Review*, and wrote leading articles for *The Standard*.

After Tennyson's death in 1892, no new poet-laureate was nominated for several years. Eventually, in 1896, Austin was appointed. His verses for official occasions did not escape adverse criticism; his hasty poem in praise of the Jameson raid in 1896 being a notable instance. The most effective characteristic of Austin's poetry, as of the best of his prose, is a genuine and intimate love of nature. His prose idylls, *The Garden that I love* and *In Veronica's Garden*, are full of a pleasant open-air flavour, which is also the outstanding feature of his *English Lyrics*.

See his *Autobiography* (1911).

AUSTIN, JOHN (1790–1859), English jurist, was born on March 3, 1790. His father was the owner of flour mills at Ipswich and in the neighbourhood, and was in good circumstances. John was the eldest of five brothers. One of his brothers, Charles (1799–1874), obtained great distinction at the bar. John Austin entered the army at a very early age, and remained in the service until 1812. He then read for the bar, was called in 1818, and joined the Norfolk circuit. He never had any large practice, and retired in 1825.

On the foundation of University College, London, in 1826, Austin was appointed to the chair of jurisprudence, but his lectures did not begin until 1828. In the meantime he visited Heidelberg and Bonn to study German methods of legal teaching. There he made stimulating contacts with Savigny, K. J. A. Mittermaier, Niebuhr, Brandis, Schlegel and others. His class at University College was never a large one, but included a number of brilliant men: Sir George Cornewall Lewis, Charles Buller, Charles Villiers, Sir Samuel Romilly, and his brother, Lord Romilly, Edward Strutt (afterwards Lord Belper), Sir William Erle and John Stuart Mill. All of these have left on record expressions of the profound admiration which the lectures excited in the minds of those who heard them. But in 1832 Austin resigned for financial reasons, as he could not afford to live in London. In that year he published his *Province of Jurisprudence determined*, being the first ten of his delivered lectures compressed into six.

In 1833 Austin became a member of the royal commission on the criminal law and procedure. It appears from some notes made at the time that Austin, though he thought it his duty to sign the report (1834), strongly objected to some passages which it contained. It appears from the nature of these objections that nothing would have satisfied him short of a complete recasting of the criminal law.

In 1834 Austin gave a few lectures on the "General Principles of Jurisprudence and International Law," at the Inner Temple. He then went to live with his wife (*née* Sarah Taylor) and only child Lucie (afterwards Lady Duff-Gordon), at Boulogne. The Austins were in Malta, where Austin was on a government inquiry, from 1837–38. After their return they lived a good deal abroad, and in 1844 they settled in Paris, where they remained

until driven out of France by the Revolution of 1848. They then took a house at Weybridge, and there Austin remained until his death in Dec. 1859.

In 1842 Austin published in the *Edinburgh Review* an attack upon Friedrich List's system of trade protection *(Das nationale System der politischen Oekonomie)*. His pamphlet "A Plea for the Constitution" (1859) was a reply to Lord Grey's essay on "Parliamentary Government," and expressed Austin's view that the consequences to be anticipated from parliamentary reform were all of them either impossible of realization or mischievous. He thought that political power was safest in the hands of those possessed of hereditary or acquired property; and that without property even intelligence and knowledge afforded no presumption of political capacity.

Austin's first published lectures were almost forgotten when Mr. (afterwards Sir Henry) Maine began to lecture on jurisprudence at the Inner Temple. Both in his private and public lectures Maine constantly urged upon his hearers the importance of Austin's analytical inquiries into the meaning of legal terms. He used to say that it was Austin's inquiries which had made a philosophy of law possible. Undoubtedly Maine's influence revived for a short time the interest in Austin's teaching. Maine was lecturing about the time of Austin's death, and in 1861 Mrs. Austin published a second edition of the *Province of Jurisprudence,* and this was followed by two volumes which contained other fragments (*Lectures on Jurisprudence; or the Philosophy of Positive Law).*

Austin proposed to distinguish law from morals; to explain the notions which have been entertained of duty, right, liberty, injury, punishment and redress; and their connection with, and relations to, sovereignty; to examine the distinction between rights *in rem* and rights *in personam,* and between rights *ex contractu* and rights *ex delicto;* and further to determine the meaning of such terms as right, obligation, injury, sanction, person, thing, act and forbearance.

The *Lectures on Jurisprudence* were reviewed by J. S. Mill in the *Edinburgh Review* of Oct. 1863, and this review is republished in Mill's *Dissertations and Discussions,* vol. iii., p. 206. Professor Jethro Brown published (1906) an edition of Austin's earlier lectures, in which they are stated in an abbreviated form. There is a sketch of his life by his widow in the preface to the *Lectures on Jurisprudence,* which she published after his death.

AUSTIN, MARY HUNTER (1868–1934), American novelist and essayist, was born at Carlinville (Ill.), on Sept. 9, 1868. After graduating at Blackburn university in 1888 she went to California to teach. Later she settled in New Mexico and became the friend and chronicler of the nearby Indian tribes. Her first book, *The Land of Little Rain,* a poetical description in prose of the desert and its denizens, was published in 1903 and brought her immediate renown. She published several novels with scenes in the west and in the artistic centres of New York, where she spent much time, and wrote for the magazines on feminism, social problems, and the art of writing; but her chief interest and best work have been in her interpretation of the American Indian and his contribution to American life.

Besides *The Land of Little Rain,* her most notable books are *The Basket Woman* (1904); *The Flock* (1906); *Lost Borders* (1909); *Woman of Genius* (1912); *The Arrow Maker,* a play produced in New York in 1911; *20 Jayne Street* (1926); *The American Rhythm,* interpretation and translations of Indian poetry; *A Small Town Man* (1922); and *The Land of Journey's Ending* (1924).

AUSTIN, STEPHEN FULLER (1793–1836), an American frontier colonizer and founder of the principal settlements of English-speaking people in Texas during the 1820's, while that country was still a part of Mexico, was the oldest son of Moses Austin (1761–1821) who had himself inaugurated the project for the colonization of Texas during the last year or two of his life and Maria Brown, of Quaker descent. Moses was caught in the financial panic of 1819 and left the lead-mining region of southeast Missouri, where he had settled, for Texas. Here he obtained a grant of land for colonization purposes (Jan. 1821) but died six months later, leaving his son to carry out the enterprise. Stephen F. Austin had been educated at Bacon academy, Colchester (Conn.), and at Transylvania university, Lexington (Ky.), and had served in the territorial legislature of Missouri from 1814 to 1819, when the slavery question was raised to a high pitch over the Tallmadge proposal to exclude slavery upon the admission of Missouri as a state. Involved in his father's business misfortunes, he joined a general migration into the new territory of Arkansas, and opened a farm at Long Prairie, on the Red river, as a step towards Texas; but proceeding to New Orleans he learned that the approaches to Texas from that city were better. There he began the study of law and assisted in editing the *Louisiana Advertiser,* until the middle of July, 1821, when, with all the vigour of a young man, he entered Texas and, during the following winter, planned a substantial settlement near the coast between the Brazos and the Colorado rivers. Meanwhile a successful revolution had occurred in Mexico, and it became necessary for him to go to Mexico City to secure the confirmation of his grants, and for some years henceforward he was one of the main factors in the struggle between two civilizations for the possession of Texas.

In the interest of the slaveholding element of Anglo-Americans Austin successfully defeated the efforts of Mexican statesmen, who were supported by British agents and diplomats, to keep negro slavery out of Texas; and in 1833, when he failed to induce the Mexican government to make Texas a separate state in the confederation, so that the American settlers might have that liberty and self-government which they considered indispensable, he wrote home recommending the organization of a state without waiting for the consent of the Mexican congress, he was thrown into prison. He was released in 1835, the Texas Revolution followed, and Austin secured the help of money and men from people in the United States. In the end he found himself and his colonies practically submerged by the flood of adventurers and immigrants; and the revolution was successful. Sam Houston defeated him in a campaign for the presidency; and Austin died on Dec. 7, 1836, while serving in the subordinate position of secretary of state. As a colonizer on an advancing frontier where there was a contest between two civilizations and where one had to restrain his own followers and conciliate the defence, Austin's work was of a high order, and it constitutes his chief title to fame.

The late Professor George P. Garrison (d. 1910) laid foundations for modern studies in the lives and times of the Austins, Moses and Stephen F., in his *Texas* (1903) and *Westward Extension, 1841-1850* (1906). He has been succeeded by Professor Eugene C. Barker. *See* Barker: *Life of Stephen F. Austin* (1925); his edition of "The Austin Papers, published in *Am. Hist. Ass. Reports* for 1919, 1922 (issued 1924, 1928), and in a concluding volume by the Univ. of Texas Press (1927); and his *Mexico and Texas, 1821–1835* (1928); also reviews in *Southwestern Political and Social Science Quarterly* (June, 1926), and in *American Historical Review* (Jan. 1927, and later). (T. P. MA.)

AUSTIN, a city of Minnesota, U.S.A., 90 mi. S. of Minneapolis and St. Paul, on the beautiful Red Cedar river; the county seat of Mower county. It is a division point of the Chicago, Milwaukee and St. Paul railway, and is served also by the Chicago Great Western. The population was 18,307, 1940 federal census. Austin is a market for the fine livestock and dairy products of this area. It has a packing plant which slaughters 2,000,000 head of livestock a year; three hatcheries; greenhouses, the largest in the west; railway shops and a number of smaller industries. The city owns and operates its water, natural gas, light and power plant, and has a sewage disposal plant (built in 1940). At the head of Main street is the Horace Austin state park, and the city maintains five other parks. Austin was settled in 1855, incorporated as a village in 1868, and chartered as a city in 1873.

AUSTIN, the capital of Texas, U.S A., and the county seat of Travis county, on the north and south banks of the Colorado river, in central Texas. It is on federal highways 79, 290 and 81 and state highways 2, 71, 20, 29, 165 and 43; and is served by Missouri-Kansas-Texas, Missouri Pacific and Southern Pacific railroads, and bus, motor freight and air transportation lines. The area of the city is 30·909 sq mi. Population (1930) 53,120, with 68.9% native white, 18·6% Negro, 12·5% others; 1940 by federal census was 87,930

The site of Austin was selected by a commission appointed in 1836 by the republic of Texas to find the most attractive spot within its boundaries for the seat of government. It lies at a

point where the Colorado river issues from a canyon, and is built on bluffs 40–120 ft. above the river. To the east stretch gently rolling plains, dotted with farms. The state capitol, a vast building of red Texas granite, roofed with copper plates, was built (1881–88) by Chicago capitalists in return for 3,000,000 ac. of public land. The state library (230,000 volumes) is rich in material on the history of the southwest. The governor's mansion (1853), on a hill overlooking the capitol, is a fine example of southern colonial architecture. The home built by France in 1841 for her minister to the republic of Texas still stands; and the city cherishes a live-oak tree with a spread of 126 ft., under which the Indians and the white men made their treaties. On high ground half a mile north of the capitol is the main campus (40 acres) of the University of Texas, set aside for this purpose in 1839 by the congress of the republic. Other large tracts within the city are occupied by the athletic field, the "new" campus, and the "little" campus, and the university owns 400 acres along the river, between the city and the dam. The university was established and endowed by acts of the state legislature in 1858, 1876, and 1881. and was opened to students in 1883. The total enrolment in all departments except extension, summer school and medical branch was 11,078 in 1939–40 (7.630 men and 3,448 women). The endowment of the university amounts to over $39,000,000. Its library contains over 660,000 volumes, including important special collections in English literature (the Wrenn, Stark and Aitken libraries), Texas and Latin-American history; an archives collection (3,000,000 documents) including the Spanish archives of Texas and a newspaper collection (17,000 volumes). The medical branch of the university is at Galveston; the College of Mines and Metallurgy is at El Paso. St. Edward's university, a Roman Catholic institution for men (founded 1881), is 2 mi. south of the city. The Austin Presbyterian Theological seminary was opened in 1902; Concordia Lutheran college in 1926. There are several privately supported schools for Negroes. Eleemosynary institutions include Texas State school for deaf; school for the blind; Deaf, Dumb and Blind institute (coloured); Austin State school; Austin State hospital. Confederate homes for veterans of Civil War and for women are there. The assessed valuation of property in 1940 was $68,327,345. National bank clearings in 1940 were $93,676,418.30. The 63 manufacturing plants produced products valued at $3,916,727 in 1935. The largest industries are manufactures of brick and tile, bedroom furniture, building stone, food products. An active farm area produces cotton, corn, vegetables and livestock.

Lake Austin, Lake Travis, Marble Falls lake, Inks lake and Buchanan lake all produce power under Lower Colorado River authority, and provide splendid recreational opportunities within 55 mi. of Austin.

Austin was first settled in 1838 under the name of Waterloo. Its name was changed the next year in honour of Stephen F. Austin, when it was selected as the capital of the republic of Texas. It was incorporated in 1839, and has been the seat of government ever since, except for a time in 1842–45, when, under the influence of General Sam Houston, the city of Houston was used as the capital. In 1909 a commission form of government was adopted, and in 1926 a city manager was installed.

AUSTIN MOTOR COMPANY LIMITED, English motor-car manufacturing company, was founded in 1905 by Mr. Herbert Austin, later 1st Baron (1866–1941), engineer and pioneer of motoring. When foreign cars were in the ascendant in the United Kingdom, the Austin Motor Company developed its works at Longbridge, near Birmingham, with the object of supplying British built cars for home and export. Like many other firms the Company was badly crippled by war reaction and the collapse in general trading which occurred in 1920, but careful management and a broad-minded policy soon led to recovery and it now (1928) employs directly some 12,000 and indirectly about 60,000 persons.

In addition to the construction of cars the company undertakes foundry work in various metals, stamping, forging, pressing, sheet metal working and machining, etc. Statistics show remarkably high earnings by the workers, expansion in the turnover during the last few years of some seven times, and a greatly increasing export market. The equipment has been brought up to date and is capable of dealing with huge amounts of material; large quantities are handled continuously, and the various components are quickly assembled and turned out as finished cars, ready for the service required of them.

(A. P. K.)

AUSTRALASIA, a term formerly applied somewhat loosely to all the land, mainly insular, extending eastwards and south-eastwards from the south-eastern portion of Asia and occupying approximately the south-western quadrant of the Pacific. In its widest sense it has been taken to include, besides Australia (with Tasmania) and New Zealand, the Malay Archipelago and the Philippines; Melanesia (New Guinea and the island groups lying east and south-east of it as far as and including New Caledonia and the Fiji islands); Micronesia (the island groups extending from Pelew island and the Ladrones east-south-eastwards to include the Marshall and Gilbert groups); Polynesia (the scattered groups of islands extending eastwards from the above groups to about longitude 130° E.). But the Hawaiian islands, and even Antarctica, have been included under the heading "Australasia."

AUSTRALIA is situated wholly in the southern hemisphere between longitudes 113° 9′ E. and 153° 39′ E. and latitudes 10° 41′ S. and 43° 39′ S. (mainland, 39° 8′ S.). With an area of nearly 3,000,000sq.m. (2,974,581sq m.; mainland alone, 2,948,366sq.m.) it is the smallest continent and the Iargest island on the globe, approximating in size to the United States of America (3,026,789 sq m.) and being rather more than three-fourths of the size of Europe and over one-fifth of the area of the British empire. (Tasmania [*q.v.*] and other adjacent islands are included in the above, but Papua [*q.v.*] and mandated territories are excluded.) With a coast-line of 12,210m.—giving a proportion of 1m. of coast to 244 sq m. land surface (mainland alone, 1:261sq.m.; cf. Europe, 1:75; England and Wales, 1:25)—Australia is a markedly closed land mass. This fact, in conjunction with its shape (max. east–west extension c. 2,400m., north–south 1,970m.) and latitudinal position, profoundly influences the climatic, and hence its general geographical, character.

Position and general spatial relationships are potent factors in Australian geography. Extensive water surfaces lend comparative isolation except towards the north. Regarded as a south-eastern detached extension of the Asiatic land mass, Australia cannot be entirely dissociated in respect of geographical destiny from Asia, and the same may be said if we view it, or its eastern margin, as a section of the western Pacific seaboard. With regard to the Pacific the position of Australia is pregnant. Along with New Zealand it dominates geographically the south-west Pacific quadrant. Similarly it commands the south-east Indian Ocean, to which water-triangle—more enclosed in geographical than in physical fact—it forms, as it were, the south-east apex.

With regard to position in the British empire Australia shares with New Zealand extreme remoteness from the mother country (London-Suez-Colombo-Fremantle, 9,537 nautical m.; Liverpool-Panama-Sydney, 12,222 nautical m.), but is linked to the British Isles by two sea-ways (the Suez and the Panama routes) which span the Eastern and Western Hemispheres respectively and traverse the two great land-masses of the globe. Both routes—but particularly the former—lie athwart important units of the empire and both have longer alternative sea-routes. The Australian continent, also forms one of the "corner-stones" of the Indian Ocean, much of the territory adjoining which is under British administration. Finally Australia is situated diagonally across the Pacific from Canada and the route joining these Dominions (Sydney-Vancouver, 6,848 nautical m.) intersects, or runs adjacent to, perhaps a majority of the most important routes traversing that ocean.

Geomorphology (see also under Geology).—Australia, as the lines of folding and faulting show, has been built up against and on a core of pre-Cambrian rocks which to-day are most in evidence in the south-west and west. Against this massif were successively pressed up a series of sediments in roughly parallel strips along the

north, east and south-east so that the land area continued to grow in the directions mentioned until, after the last great (Carboniferous) period of folding, it possessed at the end of the Palaeozoic period the whole of, and more than, its present extension.

Subsequently, three main types of episode have determined the broad features of the present land-mass:

(1) The continuance, or extension, of crustal sagging in central and eastern Australia accompanied by marine transgressions and the formation of lakes with the accumulation of sediments. Since Cretaceous times the present land surface—if we except the south marginal areas—has remained uninterruptedly above sea-level.

(2) The progressive elevation of the eastern and south-eastern marginal portions of the continent to form the elongated belts of highland now known as the Eastern Highlands and the South Australian Highlands. These highlands, therefore, though composed of ancient materials and possessing much denuded upper surfaces are geologically of late formation.

(3) (a) The outpouring of vast sheets of basalt over large areas in east and south-east Australia, in Tasmania, and, to a less extent, in south-west Australia. Beneath these basalt "floods" existing features were submerged, valleys were covered up (*cf.* the "deep leads") and the already worn-down landscape was even more levelled. (b) A series of comparatively localised glaciations, which affected notably the Kosciusko Plateau and Tasmania and were accompanied by climatic conditions which supported in Central Australia herds of giant herbivorous and carnivorous animals. (c) Oscillations of the coast-line, and perhaps of sea-level, resulting, for instance, in the severance, the re-junction, and again the parting of Tasmania from the mainland; the subsidence of large stretches of continental margins particularly along the north-east, central-south, and south-west with consequential flooding of surface features; and, most recent of all, an elevation of the land, relative to the sea, of about 1 jft. (in places as much as 200ft.) widely marked round the Australian coast-line.

The above historical facts are clearly reflected in the present character of the Australian land-mass. Rising, in places with surprising steepness, from the great abyssal furrow which accompanies and well-nigh rings it in, the continental platform bounded by the 100-fathom line (*i.e.*, including the continental shelf) appears in plan as a broad flat disc with two irregular prolongations—one at the south-east corner comprising Tasmania, the other, much larger and more irregular, at the north comprising New Guinea. An elevation of the land (or a lowering of the sea) of about 200ft. in the case of Tasmania, of only about 100ft. in the case of New Guinea, would reunite these islands to the mainland. Elsewhere the continental shelf is remarkably narrow, especially along the south-east and east. On the north-east, on the other hand, a 1,200m. long stretch of down-faulted, and perhaps still sinking, coast has left room for the growth of one of the most remarkable coral-reefs—and also one of the longest, though not the best sheltered, semi-enclosed maritime water-ways—(see BARRIER REEF).

In detail also the varying physiographic—and hence often economic—character of the coasts is the direct outcome of tectonic history. The recently submerged coast-lines in the south-east (including Tasmania) present a frowning front, but also, where commodious and branching river-valleys have been "drowned," some of the finest of natural harbours (Sydney harbour; the submerged valleys of the Tamar and the Derwent in Tasmania). Along the north-east (Queensland) coast also, where the collapse of the continental margin has broken diagonally across the folds, or again in parts of the north-west and north, subsidence has given a series of natural inlets, the potential value of which, however, is often diminished by the amplitude of the tides. (Spring tides [range]: Townsville, 8–12ft.; Broad Sound, 30ft.; north-west coast, varying between *c.* 21 and 36 ft) Elsewhere waves, currents and tides have had greater effect, and here (*e.g.*, along many stretches of the west and north-west, south-west and south coasts) rocky promontories alternate with sandy bays and spits, and tied islands and sand-dunes are the seaward front of a low and featureless interior. In three places (the Ninety-Mile Beaches of north-west Western Australia and south-east Victoria, and at Great Sandy island [Queensland]) the set of the currents has permitted great accumulations of sand, and in several considerable stretches (Gulf of Carpentaria [south coasts]; Great Australian Bight; Spencer gulf, etc.) recent elevation has resulted in either low shelving shores (south coast of Gulf of Carpentaria; Spencer gulf) or in an unbroken line of cliffs (Great Australian Bight).

The exceedingly closed nature of the continent—the paucity of large and effective sea inlets—has already been referred to. The 135th meridian of east longitude divides Australia roughly into two divisions as regards surface configuration: To the west lies the great plateau, to the east the lowlands, followed nearer the coast by the belt of highlands. Each of these divisions is broadly expressive of the physical genesis and growth of the continent.

The Western Plateau.—This division includes the whole of Western Australia, most of the Northern Territory, besides much of the west and north-west of South Australia. It constitutes one of the "primitive" continental blocks of the earth's crust ("shields") and consists fundamentally of a complex of very old and very hard rocks (see Geology, below). Around its edges from the north-west to the south-east, and again along its inland (eastern) boundary the older rocks dip below younger formations which form the greater part of the coastal lowlands. These lowlands, 60–70m. wide along the west but broadening to 100–200m. towards the north-west and south-east, slope up very gently inland to heights of 600–1,000 feet. Here they frequently terminate abruptly against a scarp which rises to about 1,200ft.—in places to 4,000ft.—and which is the faulted edge of the interior plateau, though, owing to its steepness and its dissection by streams, it has often the appearance of a mountain range (*e.g.*, Darling Ranges). Elsewhere the transition to the plateau is more gradual, and on the south-east and south a limestone platform, formerly a sea-floor, rises from an unbroken line of perpendicular cliffs of 200–400ft. and forms the remarkable Nullarbor Plains. The interior plateau has an average elevation of perhaps 1,500ft.: its surface features result from the age-long denudation of the materials and structures which characterize it. The primitive folds have been truncated, the broad granitic masses worn down to a comparatively uniform level. Crustal movements have slightly lowered some areas and raised others.

Coastward draining streams, where these have attained to any size and power as in the south-west, north-west and north, have dissected the outer margins of the plateau and have worked out a rugged if subdued relief. In the north-west and Kimberley Divisions in particular the dissection of the horizontal or gently inclined strata has given rise to a characteristic landscape of table-land, ridge and canyon (Mt. Hann, 2,800ft.). Everywhere continued erosion has differentiated hard from less hard rocks, and ridges, spines (often of quartzite), granite erosion scarps ("break-away~"),isolated rocks or groups of rocks (Ayers Rock and Mt. Olga in Central Australia), and occasionally larger and more mountainous masses (Stirling Range, 3,640ft.; Hammersley Range, Mt. Bruce, 4,024ft.; etc.) arrest the eye and sharply frame the horizon. But apart from these and the Macdonnell (Mt. Heughlin, 4,800ft.) and Musgrave Ranges (Mt. Woodruffe, *c.* 5,000ft.) in Central Australia, there are no "mountains" in the ordinary sense. Over far the greater part an immense peneplain, the major elevations of which are imperceptible swellings, the chief hollows wide salt-floored flats, extends with expressionless monotony. Here broad expanses of sandy or clayey plain, there mile upon mile of sand-ridge (*e.g.*, in an area comprising the centre, and east and north of the centre of Western Australia); here wide levels floored with limestone (travertine); there rougher but hardly less level surfaces of laterite, with granite and quartz outcrops. Long lines, either level or of low inclination, and sharp scarp faces may in this direction or that bound the horizon and mark the sky-line of ridge and range. But the prevailing impression is flatness, the prevailing sense that of space. Not the desert, for the most part, of popular imagination, for the surface is peopled with trees, scrub or at least heath. But a great wide silence-filled land, a land of age where loneliness dwells.

The Central Lowlands. — To the plateau of the west succeeds, from about long. 135° E., a belt of lowlands. They extend from the Gulf of Carpentaria to the eastern coast of South Australia and the Victorian highlands; from the dissected margins of the western platform and the Central Australian ranges, to the highland foothills in the east. On the eastern side their boundary is somewhat indefinite but coincides approximately with the 1,000ft. contour. Some 900m. across at their maximum breadth (at about 29° S. lat.), they narrow northwards and southwards to barely half that distance. They are crossed in two places by low swells or saddles (Barkly, Selwyn and Kynuna highlands in the north; Barrier-Grey Ranges farther south [all *c.* 1,000ft.]). Along their eastern margin a few inconsiderable projections from the Beall and McGregor "Ranges" in Queensland. Further south the platform around the upper Lachlan river (Cobar-Wyalong peneplain, 600–900ft.) reaches out westwards towards the Barrier Range, and in the south-east are the striking South Australian highlands (Mt. Lofty and Flinders Ranges). Having regard to the above surface inequalities the area may be divided into (i) the Northern (or Gulf), (ii) the Central (or Lake Eyre), (iii) the Eastern (Upper Darling or Warrego), (iv) the Southern (Murray river), lowlands respectively, where each division corresponds to a more or less distinct drainage area. (The Lake Frome basin may be regarded as a subdivision of [ii].) But the actual continuity of these lowlands is seldom interrupted save around the edges, and the division lines are far from distinct.

The area represents the zone of crustal weakness or sagging where great quantities of sediments were deposited on the floors of inland gulfs and lakes and, later, wide sheets of river gravels and alluvium. The ancient rocks of the west sink below these newer formations but the Barkly and Selwyn uplands, with the adjoining Cloncurry area, are a north-easterly extension of the great plateau. Similarly, the Cobar-Barrier Range "peneplain," affected by recent elevatory movements, forms a sill partly separating and partly submerged by the more recent deposits. The outcrop of these older rocks ("inliers") has significance in connection with the occurrence both of workable minerals and of artesian water. The south-eastern portion of the central lowlands is, from a physiographical point of view, one of the most interesting in Australia. Complementary to the elevation of the south-eastern margins of the continent was a subsidence of its more central portions. The older "grain" of the land and the continental "backbone" had run in an east-west direction (cf. Macdonnell, Musgrave, Gawler Ranges). Rivers comparable, perhaps, with the Murray had discharged along the south coast which then lay farther to the south. Subsidence in the northern parts, coupled with the elevation of the Mt. Lofty-Flinders Ranges, disrupted this order, dammed back the streams, and caused or hastened the formation of great "lakes." (The surface of Lake Eyre lies normally about 39ft. below sea-Ievel.) A belt of country anciently the site of a mountain system (strongly folded Cambrian and older sediments), but worn flat by long denudation, was raised by crustal warping, probably in sympathy with the movements further east, and formed the Mt. Lofty-Flinders Range (St. Mary's Peak, 3,900ft.; Mt. Lofty, 2,334ft.) which, with its main spur continued in the Barrier Range, encloses on three sides the Lake Frome basin.

On the west side St. Vincent's and Spencer gulfs — the latter continued northwards by the Lake Torrens "rift" valley — probably represent areas of subsidence along divergent lines of fracture, while Yorke's Peninsula is a block left upstanding between them. To these facts of physical history are due many of the distinctive geographical characteristics of the area (*e.g.,* drainage features; human settlement; lines of movement). More recent was the volcanic activity which affected the coastal strip from Kangaroo island to south-western Victoria (Mt. Shanck, Mt. Gambier: volcanic cones with associated lakes). For the rest, the general features of the lowlands admit of little in the way of description. Rolling or undulating in the north and east, towards the south and centre they mostly flatten into seemingly boundless expanses of plain. Clothed with scattered timber, scrub and grass, they here and there spread flat pavements of clay or broken stones ("gibber" plains of Central Australia) to distant and unbroken horizons. Where the climate is dry, or where perhaps it was once drier than now (*e.g.,* in the North), forms of arid erosion — sharp steep-sided scarps surmounted by long flat crest-lines ("table-top" hills) and other similar shapes — are etched in the "desert sandstone" and reveal higher land-surfaces now all but gone. Sand-ridge (brick-red moving dunes, or fixed mounds calcareous within and only outwardly coated with sand) occupies some few areas (*e.g.,* eastern Central Australia and parts of the South Australian "Mallee"). In still other parts areas of limestone ("kunkar"; travertine) and ironstone gravels occur, but the most extensive and most characteristic are the vast alluvial sheets — gravels, clays and loams for the most part, often very fine and very deep — washed down by streams from distant highlands and laid by innumerable floods over many hundreds of square miles.

The Eastern Highlands (Including Tasmania). — The eastern and south-eastern borders of Australia are mainly highland, though there is also included a certain proportion of mainly coastal lowlands. The highlands have been termed "cordillera," but they are a more or less continuous belt of plateaux rather than a mountain chain or series. This character they owe — as indeed does the belt as a whole — mainly to two processes in the physical history of the continent; viz., the recent elevation of its eastern borders and the perhaps complementary subsidence beneath the sea of a considerable marginal strip. The last major folding or mountain-building processes in Australia occurred towards the close of the Palaeozoic age (Carboniferous period). The structures then reared in the labile zone which comprises, but extends far beyond, the eastern margins of the continent, have since then been subjected to continuous denudation — so far, at least, as can be judged from the portions which remain above sea-level. It was thus an ancient and very reduced surface which was "warped up" to form the highland rim. The uplift, however, was irregular ("differential") and was accompanied by much slipping and faulting, so that there resulted a number of unevenly tilted blocks which in some parts are more closely coherent, in others separated by gaps of varying width, such gaps representing very often areas of down-faulting or block-subsidence ("Senkungsf elder").

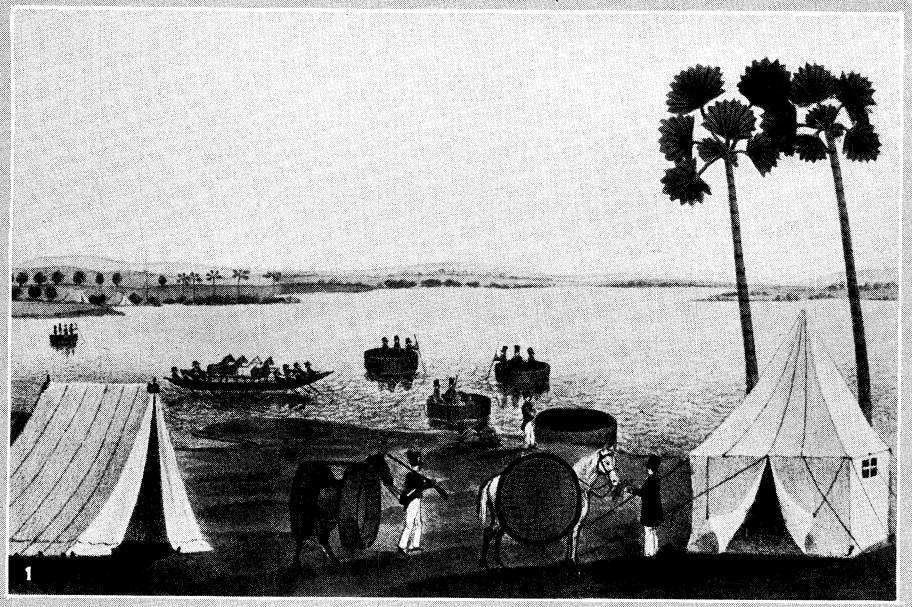
The prevailing plateau character of the summits is further attributable to (a) volcanic activity, whereby extensive areas throughout the belt were covered with sheet-flows, the surface levelled, and former irregularities of topography submerged ("deep leads");[1] (b) denudation intensified by the uplift (*cf.* the "peneplains" of the western slopes; "valley in valley" formations), and, more locally, by glaciations also (*e.g.,* in the south-eastern part of Australia and in Tasmania). But the uplift naturally worked in the opposite sense also since it reinvigorated erosive agencies and processes in general. The displacements mentioned had the effect of shifting the watershed on the whole further inland (exceptions are certain areas in the south-east of the continent), and the collapse of the eastern margins in particular gave the eastward-flowing streams greater cutting power. Thus the deep fresh-cut valleys are as characteristic of the scenery as are the old worn summit-levels, and this has resulted here and there in striking precipice and gorge topography (*e.g.,* scarp of New England Plateau) and occasionally in dislccated courses of streams (*e.g.,* upper Barron river in north-east Queensland).

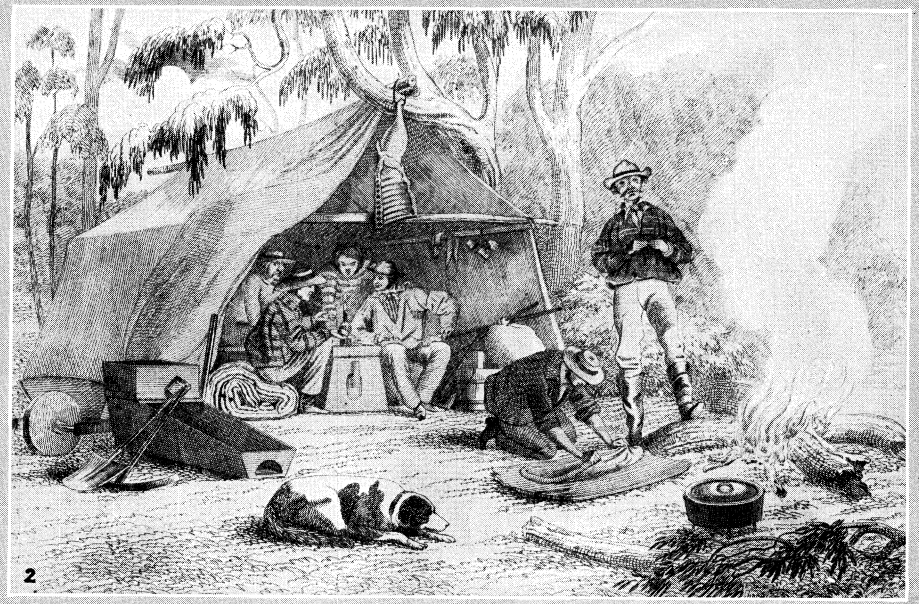
The highland belt falls into three fairly clear natural sections: the Northern Uplands; the Central and South-eastern Highlands (including Tasmania); the Southern Dividing Range. (See articles on various States.) (O. H. T. R.)

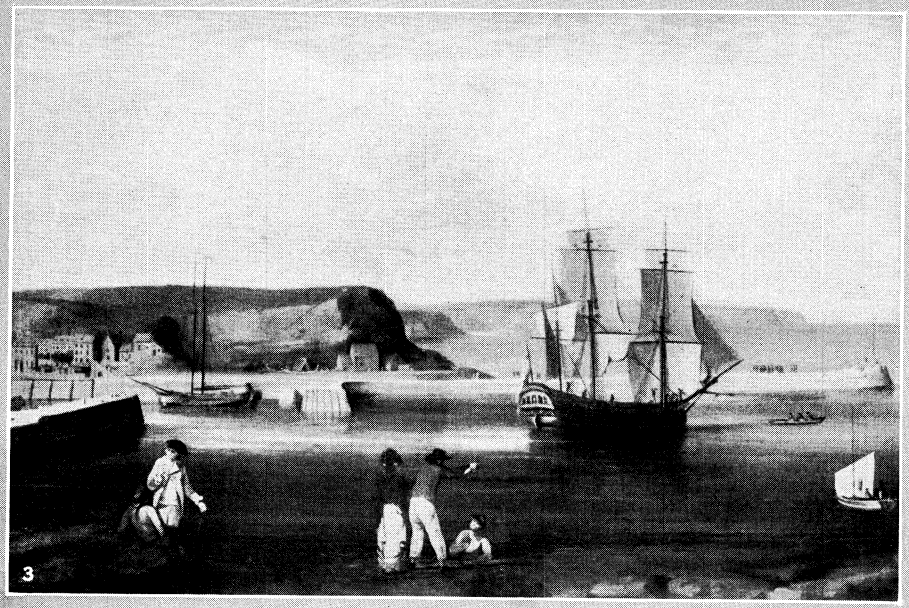
GEOLOGY

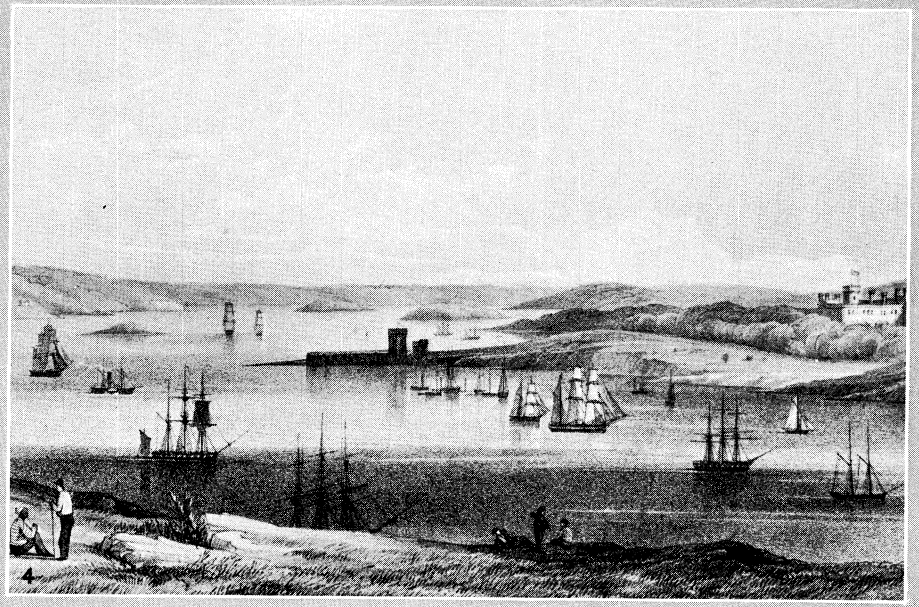
Australia is essentially the fragment of a great plateau land of Archaean rocks, the western portion of the continent constituting a Precambrian nucleus around which later sediments have been deposited and against which they have been folded. East of a line drawn through Cloncurry and Broken Hill the continent is built up of later deposits, with the exception of isolated areas of probably Precambrian rocks in the east Queensland zone extending

[1] The uplands composed of these volcanic rocks now form the watershed along considerable stretches of the highland belt.







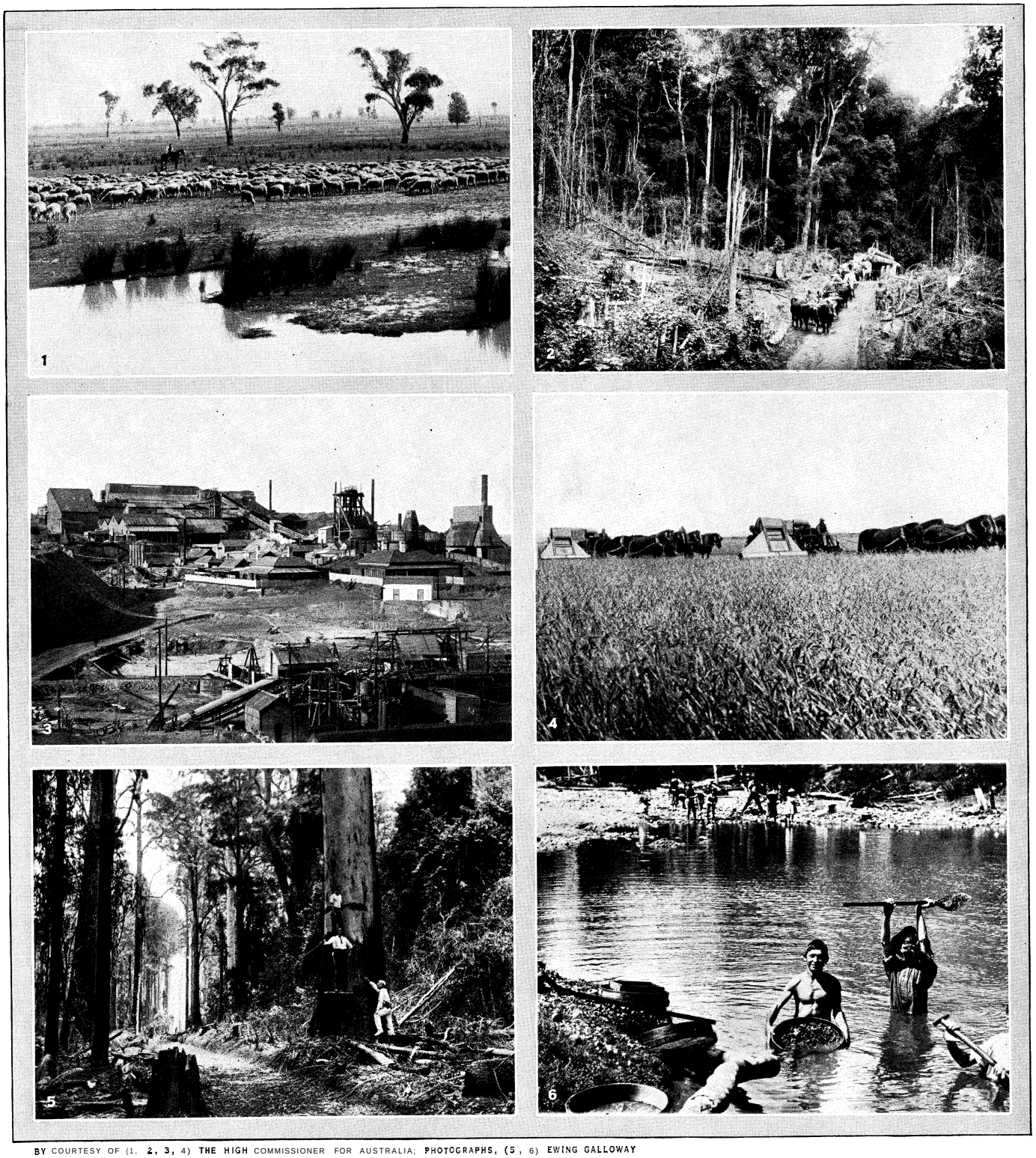


BY COURTESY OF THE HIGH COMMISSIONER FOR AUSTRALIA

EARLY COLONIAL DAYS IN AUSTRALIA

1. Engraving after a sketch in "A Friend of Australia," published in 1830, showing an expedition of colonists crossing a river in basket boats
2. From a lithograph, "The Diggers Examining the Day's Pan. A Bendigo sketch," printed in 1850 by Cyrus Mason. Bendigo is the name of gold diggings near Victoria
3. H.M.S. "Endeavour," barque, leaving Whitby Harbour on the expedition of 1769, with Captain James Cook in left foreground. From an old painting
4. Sydney Cove, showing the old government house and Fort Macquarie: from a print of 1848

AUSTRALIA



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VIEWS OF PHASES OF LEADING INDUSTRIES OF AUSTRALIA

1. A flock of sheep on the Liverpool Plains, New South Wales, after the seasonal shearing
2. Bullock teams hauling heavy logs from the state forest, Queensland
3. Lake View Star gold mine at Boulder, Western Australia
4. Teams of ten-foot-cut "Sunshine" harvesters at work in the wheat fields in Australia
5. Cutting timber in the eucalyptus forest along the Northern railroad in New South Wales
6. Sapphire mining in a small stream, Queensland

from Cape York peninsula to the latitude of Gladstone. A very similar geographical disposition of the Precambrian is revealed in the architecture of Tasmania, where Precambrian rocks are confined to a region west of a line drawn through Beaconsfield and Louisa bay on the extreme south coast. The stratigraphy and structure of this old terrain is best known in the State of Western Australia, essentially an old Precambrian land that has remained above sea level throughout Palaeozoic and later times.

The succession of Precambrian rocks in this State, is as follows:—

Archaean	Warrawoona series	Older Greenstones—basic lavas, tuffs and sills.
		Yilgarn sediments—para-schists and gneisses.
		Newer Greenstones—peridotites, gabbros, dolerites, porphyrites.
	Older granites and gneisses.	
Lower Proterozoic	Mosquito Creek series—conglomerates, quartzites, phyllites.	
	Kurrawang series—arkoses, conglomerates, slates.	
	Stirling Range series—quartzites.	
	Newer Granites.	
Upper Proterozoic	Nullagine series—conglomerates, sandstones, dolomitic limestones, basic and acid lavas.	

In the southern and central provinces of the State the greenstones of the Warrawoona series consist of highly folded hornblende and chlorite schists arranged meridionally or along north-north-west lines. They are enclosed in granites and gneisses of igneous origin which without exception appear to be transgressive. The principal gold mining centres of the State are situated within these greenstone belts or at their contacts with the invading igneous rocks. This Archaean platform is continued eastward into South Australia where a complex of para-schists, amphibolites and igneous gneisses underlie the greater part of Eyre peninsula. In central Australia the dominant structure lines of the Archaean rocks are latitudinal as seen in the Macdonnell range gneisses.

The Mosquito Creek series and Kurrawang series developed in the Pilbarra and Coolgardie areas respectively are dominantly sedimentary systems which, though intensely folded, show discordant relations to the Archaean rocks on which they rest. They in turn are penetrated by a later series of granites and granodiorites (Newer Granites). In the Kimberley region of northern Western Australia a great group of sediments and igneous rocks overlain by the Nullagine series is of Precambrian age, but little is known of the structure of this region beyond the striking V-shaped trend lines of the series outcropping from King Sound to the Northern Territory border. In the Northern Territory the Precambrian series is constituted in its lower part of schists largely of tuffaceous character penetrated by granite intrusions. They form a well-defined belt extending from Darwin to the region of Pine Creek.

In Queensland, a large area around Cloncurry is built up of Precambrian rocks, the age being definitely established by the presence of Cambrian rocks resting on the eroded edges of the series. It is probable, however, that the rocks of the Hamilton-Coen, Charters Towers, Gilbert and Etheridge goldfields are also of Precambrian age. In New South Wales the only undoubted area of Precambrian rocks is that surrounding Broken Hill, while in Victoria the granites and gneisses in the bed of the Glenelg river near Harrow and Balmoral represent an eastern outpost of the Precambrian rocks of south-eastern South Australia.

In South Australia, the lower portions of the Adelaide series principally developed in the Mount Lofty ranges have been ascribed to the Nullagine series by David. These lower members of the Adelaide series include a folded series of ilmenitic conglomerates, quartzites, slates and limestones passing upwards into a well defined glacial horizon (Sturtian tillite). These rocks are devoid of recognizable fossils. In the Flinders ranges at Wooltana and at Mt. Arrowsmith to the north of Broken Hill the series contains a volcanic horizon which is correlated with the lava zones of the Nullagine series.

As far as can be determined no orogenic movement ushered in the Cambrian era. Rocks of Cambrian age occur principally in the Kimberley district (Western Australia), Northern Territory, Cloncurry area (Queensland) and in the Mt. Lofty and Flinders ranges of South Australia. The great lava flows of the Antrim basalt plateau are followed by a series of Cambrian sediments carrying *Salterella*, and a somewhat similar relation is revealed in the Northern Territory. In the Mt. Lofty ranges and Flinders ranges a continuous section from the unfossiliferous Adelaide series to the *Archaeocyathinae* limestones of Middle Cambrian age has not yet been discovered, but the evidence here, as in the Kimberley region, points to no great stratigraphical break. Some portion of the Adelaide series is therefore probably of Lower Cambrian age.

The prominent tillite horizon (Sturtian tillite) in the Adelaide series is found at intervals over a zone extending from south of Adelaide into the far north of South Australia and is also developed in the Broken Hill district. Owing to the difficulty in defining the base of the Cambrian, it is uncertain whether this ancient tillite is Lower Cambrian or Late Proterozoic in age. In Queensland a gently undulating or horizontal series of fossiliferous Cambrian sediments discovered west of Cloncurry indicates an extension of the Cambrian sea into western Queensland. In Tasmania, the only known Cambrian rocks are the *Dikellocephalus* sandstones of Railton.

Heathcotian Series.—Of uncertain stratigraphic position are the so-called Heathcotian series of Victoria, variously ascribed to Upper Cambrian or Lower Ordovician age. These rocks in the type area of Heathcote consist of shales and radiolarian cherts associated with spilitic lavas and tuffs. These beds are strongly folded and followed apparently without break by Lower Ordovician rocks. The beds themselves contain a mixed fauna including purely Cambrian forms together with others of a more Ordovician aspect. A similar difficulty is met with in correctly placing the "Cambro-Ordovician" series of Tasmania. These rocks developed in the western portion of the island include slates, and extensive masses of sheared keratophyric lavas, tuffs and intrusions of the Dundas and Read-Rosebery areas.

Two strongly contrasted types of deposits are present in Australia's Ordovician system. The first, a littoral facies, is developed in central Australia and is represented in the region of Tempe downs, the Krichauff range, etc., south of the Macdonnell ranges. An immense thickness of sandstones and fossiliferous limestones were deposited in a shallow sea probably extending as far east as the Cairns range in Queensland. The fauna includes such forms as *Orthis, Isoarca, Raphistoma, Orthoceras* and *Asaphus.*

In Victoria a more pelagic type of deposit is represented by the Lower Ordovician graptolitic slates practically confined to an area west of the meridian of Melbourne. These beds have been subdivided into four zones, those of Lancefield, Bendigo, Castlemaine and Darriwill, each characterized by a typical graptolitic fauna. The chief productive goldfields in the western portion of the State occur in these zones near their contacts with granodiorites. Upper Ordovician rocks are chiefly developed in the eastern portions of the State and extend northward into New South Wales. The crystalline schists of the Albury-Omeo districts and of the region around Cooma (New South Wales) are believed to be of Ordovician age as they appear to pass gradually into unaltered fossiliferous Ordovician rocks.

At the close of Ordovician times a strong folding set in, accompanied in places by igneous intrusions. In New South Wales a marked unconformity separates these rocks from the succeeding Silurian strata.

Silurian Age.—Rocks of the Silurian age are entirely confined to the eastern States of the continent. The western coastline extended from western Tasmania through central Victoria and New South Wales into Queensland. The only undoubted fossiliferous Silurian rocks of the latter State occur at Chillagoe in the north, but it seems probable that the lower members of the Brisbane schists and their northerly extension in the Amamoor and Gladstone series are of Silurian age, and possibly, too, the Coff's Harbour series of north-eastern New South Wales. Silurian strata

form the most widespread Palaeozoic formation of New South Wales.

In the Jenolan district, the famous caves are hollowed out of limestones rich in *Pentamerus*, and other Upper Silurian limestones occur at Wombeyan, Bathurst, Orange and Wellington. In Victoria the Silurian system is divisible into a Lower or Melbournian series, mainly of sandstones and shales and an Upper or Yeringian series. These rocks cover a large portion of central eastern Victoria and contain much of the gold of the mining fields of this part of the State (Walhalla, Wood's Point, Rushworth, etc.). In Tasmania the West Coast range conglomerate series, which contains pebbles of the Cambro-Ordovician porphyroid series, is of Silurian age and underlies a Silurian limestone horizon. Here, too, are placed the limestones of the Gordon river, and the slates and sandstones of the Queen river, Zeehan and Middlesex.

The close of Silurian times witnessed great orogenic movements followed by intrusions of granites probably throughout south-eastern Australia and Tasmania. Widespread volcanic activity ushered in the Devonian era in south-eastern Australia. In Victoria a great group of dacite lavas was poured out over a landscape of folded Ordovician and Silurian sediments. These rocks are exposed in the Dandenongs, at Lilydale, Healesville and Macedon. Probably of similar age are the Snowy river porphyries of north-east Victoria, and the acid lavas of the Murrumbidgee valley. The former attain a thickness of 2,000ft., the latter probably 6,000ft. In both areas Middle Devonian sediments and tuffs with a rich marine fauna follow the lavas.

In north-eastern New South Wales and Queensland a Devonian sea, formed probably at an earlier date, and argillaceous sediments, tuffs, radiolarian shales and coral limestones were deposited in the Tamworth-Barraba region (New South Wales). Igneous action, represented in flows and shallow intrusions of spilites, keratophyres and dolerites, is especially prominent in the Middle Devonian rocks of this region. In Queensland the upper portions of the Brisbane schist series and its equivalents were laid down in a Devonian sea. A period of pronounced orogenic movement closed the Middle Devonian epoch over southern and central New South Wales, and gently inclined Upper Devonian sediments rest unconformably on older sediments as at Cobar and in the Parkes-Forbes district. The Upper Devonian quartzites and shales reach a thickness of 10,000ft. at Mt. Lambie.

In the Kimberley district of Western Australia a series of conglomerates, grits and limestones occur on the Elvire river and in the Napier range. The fauna indicates an Upper Middle or Upper Devonian age.

At the close of the Devonian age, orogenic movement associated with granitic intrusions disturbed the area west of the Blue Mountains, but in north-eastern New South Wales there is little sign of any stratigraphic break between the Upper Devonian and Carboniferous sediments which are folded together. In this region Carboniferous strata attain a thickness of 17,000ft. and extend in a wide folded belt from Port Stephens northward into New England. The succession is as follows:—

Lower Carboniferous	Burindi series (5,000ft.), mudstones, limestones. tuffs and some lavas.	
Middle Carboniferous Upper Carboniferous	Kuttung series (9,500 ft.)	Basal Stage Volcanic Stage Glacial Stage
Upper Carboniferous	Lower Marine series, Lochinvar Stage to *Eurydesma* horizon (2,600 ft.)	

At the close of Burindi times earth movements in this region led to a reversion to widespread land conditions, the commencement being told by the development of a great thickness of conglomerates (Wallarobba Conglomerates), which are likened to a "Flysch facies" comparable with the Siwalik conglomerates of the Sub-Himalayas. Then followed the accumulation of an immense zone of lavas, tuffs and sills extending almost meridionally throughout the area. During these volcanic outbursts the first signs of glaciation that subsequently enveloped much of the whole southern portion of Australia appeared, glacial tills and seasonally banded varve rocks being intercalated between the tufaceous beds. In Queensland Carboniferous rocks are best represented in the Star series, and beds of similar age occur in the Drummond range, and at Rockhampton. Possibly they are also represented in the far north in the Herberton series and on the Pascoe river. The base of the great geosyncline in the Bowen area is constituted of a great pile of volcanic rocks which are probably to be correlated with the volcanic stage of the Kuttung of New South Wales. In the State of Victoria probably the Mansfield series with their fish beds, the Avon river sandstones with *Lepidodendron australe* and similar beds at Iguana Creek belong to Kuttung times. The glacial conditions which set in during the Middle Carboniferous intensified near the close when an ice sheet covered large areas of southern Australia. In Victoria and South Australia no marine beds of Permian age are known, but in Tasmania, New South Wales and Queensland widespread marine conditions obtained. In the type area of New South Wales the total thickness of Permian strata reached 15,000ft. Marine beds are grouped into a lower and upper series separated by the Greta coal measures (100–200ft). Equivalent measures occur in Tasmania and Queensland. The final regression of the Palaeozoic sea from eastern Australia is represented by a second series of fresh-water beds and coal measures. In New South Wales they include the Tomago coal measures (500–1,800 ft.) and the Newcastle coal measures (1,600ft.) of Upper Permian age. The Permian beds contain a characteristic flora represented principally in Glossopteris and Gangamopteris while the typical Carboniferous Rhacopteris-Lepidodendron flora had died out in the Carboniferous. Glacial conditions persisted into the Upper Marine and a thickness of 10,000ft. of strata separates the lower glacial beds of the Kuttung from the glacial conglomerates in the Muree beds of the Upper Marine stage.

This latter stage in the Kiama area contains a thick series of latite lavas. In Queensland Permian deposits are known as far north as the Little river, west of Cooktown, but they are especially well developed over a region extending southward from the Bowen river to the New South Wales border. In Western Australia deposits of this age containing glacial horizons are known in the Irwin, Collie areas, and in the Gascoyne and Kimberley districts; in the latter deposits can be traced into the Northern Territory.

Triassic **Rocks, etc.**—The Triassic rocks of Australia are confined to a belt of rocks in southern Queensland and New South Wales. They are essentially fresh-water deposits and were deposited in two lake areas, one covering in New South Wales part of the Permian coal basin extending from the Shoalhaven river to Newcastle and westward to Lithgow, the other covering the south-eastern region of Queensland extending westward to Carnarvon and southward to the Clarence river in New South Wales. The deposits of the former lake are represented in the Hawkesbury series, subdivided into three stages (*a*) Narrabeen stage (1,800ft.), sandstones and chocolate shales with tuffs; (b) Hawkesbury stage (1,000ft.)—massive sandstones; *(c)* Wianamatta stage (800ft.)—shales. This series contains at its top a bed rich in foraminifera and ostracoda, pointing to a brief marine incursion over the Blue Mountain region. In Queensland the deposits of the second lacustrine area are chiefly represented in the Ipswich and Bundamba series. The former series contains at its base an acid tuff horizon (Brisbane tuff). Portions of the Mesozoic freshwater series of southern and eastern Tasmania are probably of Triassic age though they extend into the Jurassic. These beds include the Knocklofty sandstones (1,000ft.) overlying conformably the Permian series. The Fingal coal measures (1,200ft.) are probably to be correlated with the Jurassic coal measures of Victoria.

The Jurassic period witnessed a much wider extension of the lacustrine conditions characteristic of the preceding era. In eastern Tasmania and southern Victoria productive coal measures occur in rocks of this system. In the latter state a great lake covered portions of south Gippsland, and the Otway ranges and conglomerates, felspathic sandstones, mudstones and thin coal seams were deposited. Similar rocks occur further west in the valley of the Wannon. A large Jurassic basin occupied much of southern Queensland and portions of northern New South Wales and north-eastern South Australia. The sediments deposited in this basin supply artesian water to the great artesian basin.

In Queensland the Jurassic system includes the Walloon series and the Tiaro series in the Maryborough district. The latter series has at its top an horizon of andesitic and rhyolitic lavas and tuffs. The Jurassic beds of Western Australia occur in a long belt near the western coast, near Geraldton and at Shark's Bay, at Cape Riche, east of Albany, and in the Kimberley district. The maximum thickness of these beds is not less than 3,000ft. They include conglomerates, sandstones, oolitic limestones and lignite beds. The marine sediments contain a rich fauna and the ammonite beds are referred to a middle Bajocian age. At the close of the Jurassic, central and eastern Tasmania witnessed the widespread intrusion of a series of quartz-dolerite sills reaching 2,000ft. in thickness. They are associated with the Permian and Lower Mesozoic unfolded sediments, and form the tiers of central Tasmania.

Cretaceous Era.—The Cretaceous era in Australia was a period of great marine transgressions and regressions. In Cape York Peninsula, plant beds of Lower Cretaceous age underlying a marine Cretaceous series probably represent a continuation of the lacustrine conditions of Walloon times. Then followed an extensive marine transgression by which much of central and western Queensland, north-western New South Wales and northern South Australia were covered by a shallow epicontinental sea extending from the Gulf of Carpentaria and flooding one-third of the area of Australia. Possibly this sea extended southward into the Australian Bight, for marine Cretaceous beds underlie the Tertiary basin of the Nullarbor plains.

The principal marine horizons of the Australian Cretaceous constitute the Rolling Downs formation (Lower Cretaceous).

Aptian—Roma series, Maryborough beds, Eucla beds (in part).

Albian—Tambo series, Point Charles bed, Eucla beds (in part).

In Western Australia the Upper Cretaceous Gingin Chalk series which extends in a coastal belt north of Perth to the Murchison river contains a rich foraminiferal fauna and is palaeontologically distinct.

The first marine transgression in east Australia gave rise to the Roma series (blue clays) and probably represented the flooding of the Walloon basin by the sea. A non-sequence follows, the interval indicating a regression of the sea from the whole area to be followed by a second transgression during which a series of limestones represented by the Tambo beds was laid down. Both these seas appear to have had outlets to the north and south (Gulf of Carpentaria and Australian Bight). At the close of the Albian the sea finally withdrew from central and eastern Australia. The post-Tambo series of beds in the artesian basin include part of the so-called Desert sandstone. They are fresh-water beds and referred to as the Winton series. These beds reach a thickness of at least 4,000ft. in the Patchewarra bore. Lacustrine conditions probably extended into Lower Tertiary times.

In the Janjukian epoch the sea encroached over the region of the Nullarbor plains and sediments reach a thickness of over 1,000ft. In the east a marine transgression covered the Murray basin extending into the western plains of New South Wales. The sediments are principally polyzoal limestones, calcareous sandstones and clays. The Kalimnan and Werrikooian are much more limited in their distribution. The former is typically developed in eastern Victoria, but is also represented by the oyster beds of the River Murray cliffs and beds along the coast of St. Vincent's Gulf. The latter is typically developed at Limestone Creek, Glenelg river (Victoria), but appears in the Mallee bores and near Adelaide.

Probably the oldest terrestrial Tertiary deposits in southern Australia are the brown coal deposits, sands, muds and limestones recognized from bores at Newport and Altona Bay, south-west of Melbourne. These underlie the Balcombian (Oligocene) marine beds already referred to. The brown coal beds of Victoria are probably the thickest yet recorded in the world. Among the deposits of the Janjukian may be mentioned the Morwell brown coal deposits, the lignites of Moorlands (South Australia), plant beds underlying and overlying the older basalts of Victoria and the buried river drifts or deep leads of New South Wales and Victoria.

The non-marine deposits of Kalimnan and Werrikooian age include the newer deep leads of south-eastern Australia, *e.g.*, Gulgong and Forest reef in New South Wales and Brandy Creek near Beaconsfield, Tasmania. The lacustrine deposits of Launceston and the Derwent basin are probably of Kalimnan age.

Throughout eastern Australia and Tasmania the Middle and Upper Tertiary was a period of intense volcanic activity. The volcanic series can generally be subdivided into three series termed (a) Older basalts, (b) Alkaline series, (c) Newer basalts, and as such are well recognized in Queensland, New South Wales and Victoria. The earliest lavas are of Balcombian and Janjukian age while the newest lavas range from the Pliocene probably into Pleistocene times. In Victoria the newer series of basalts cover an immense area west of the meridian of Melbourne. The alkaline series is represented in Queensland, New South Wales, Victoria and Tasmania and include alkaline trachytes, solvsbergites, pantellerites, tinguaites, melilite and nepheline basalts. The leucite lavas of New South Wales and the Kimberley district of Western Australia are probably to be referred here.

The latest events in the geological history of Australia include the widespread epirogenic movements in which the eastern margin of Australia was warped up to elevations of over 3,000ft. above the sea. The Kosciusko area rose to an elevation of 7,000ft. and in Pleistocene times was the site of an ice cap, as was also much of the highlands of Tasmania. After the main uplift there followed a period of marked rift faulting, the foundering of Bass Strait, and the formation of the rift valleys of Spencer and St. Vincent's Gulf. Earthquake shocks indicate that adjustment is still in progress in these regions.

Information on the geology of Australia is principally contained in the publications of the State Geological Surveys and State Royal Societies. Reference may also be made to the Federal *Handbook*, **B.A.A.S.** 1914, chapter vii. "The Geology of the Commonwealth," by Sir Edgeworth David; Transactions of *the* ***New*** *Zealand* Institute, 1923, "Palaeozoic and Mesozoic Seas in Australasia," by W. N. Benson; and articles in the reports of the Pan-Pacific Science Congress, Australia, 1923. (C. E. T.)

GENERAL PHYSICAL CHARACTERISTICS

Geological and climatic factors have given Australia a singularly uniform surface, which either lies directly upon worn-down ancient rock or has been formed by filling in and levelling up. Barely one-twentieth of the mainland is over 2,000ft. above sea level, though the proportion is greater in Tasmania. Marked temperature variation, torrential rainfall and, more locally, ice, have produced rubble, gravels, sand and dust. Dust-laden winds, ceaselessly scouring, etching and filing-down, have carried the finer materials far and wide, while in less arid areas and ages wide-ranging floods have spread alluvial floors. Wind and water-laid deposits cover much of the interior which, deprived by climatic and tectonic processes of a powerful drainage system, lies half-buried under the products of its own decay. Hence one of the paradoxes of Australian scenery—great expanses of flat or billowing surface sweeping up to, and often half engulfing, sharp upstanding rocky forms which rise, massive and deep-scarred, over against them.

In spite of sandridge areas, great parts of the interior possess soils sterilized by climate (*e.g.*, Lake Eyre basin). Widespread surface or sub-surface concretions (laterite, ironstones, limestones, salt and gypsum) are also due mainly to arid conditions. The coastal belt (v. inf. Rivers and *Drainage*) exhibits great variety but includes the rich and ample slopes and river flats of Queensland, New South Wales, east Victoria and Tasmania. Inland the dark sticky soils of the moister terraces, plains and river-courses (*e.g.*, Upper Darling basin) are succeeded on drier slopes and flats (*e.g.*, western plains of New South Wales) by the well-known red soils, and almost the whole Lower Darling-Murray basin is covered with varied alluvial deposits. The Cretaceous (Rolling Downs) soils of Queensland, the (Tertiary) limestone soils of South Australia and of the Nullarbor plains (dry red soil about 1ft. deep) are soils developed *in situ*.

Most varied are the soils of the eastern highlands and Tasmania, ranging from poor sands and grits derived from silicious sandstones and granites to rich red-to-black loams of limestone origin or admixture. The Palaeozoic rocks (slates, shales, etc) yield in places rather poor clays, but widespread volcanic deposits provide fertile black-grey-red soils (cf. Darling Downs [Queensland]; south and south-west Victoria; New England plateau: Kimberley

Division [Western Australia]; Tasmania, etc.). Light sandy-to-loamy soils are widely distributed in southern Australia (cf. the "sand-plains" of Western Australia and the "Mallee" soils of South Australia and Victoria). These soils have not been leached out and are rich in mineral plant foods. Contrary to early prepossessions, they are mostly capable of great improvement and are being extensively occupied.

Rivers and **Drainage.**—Owing to climatic conditions, flatness and the warped-up rim, 64% of the Australian surface has internal (basin) drainage and some 43% no regular surface drainage at all (cf. Europe: 24% and 5%; world as a whole: 33% and 23% respectively). Three broad types of surface drainage may be distinguished: (i.) coastal, (ii.) interior ("enclosed"), (iii.) semi-enclosed. (i.) Coastal *drainage* is on the whole well-developed. The streams are often more important than their length suggests. Along the south, except towards the east and west extremities, streams are rare or poorly developed; there are more on the north. The subsidence of the eastern margins and the displacement inland of the watershed (*supra*) has enabled many of the eastern streams to enlarge their basins, while the increase of gradient and cutting-power has enabled them to cut through the interposed "ranges." The coast-range in Queensland in particular has forced several streams to cut through it close to their mouths (cf. Burdekin gorge). Short steep gradients and abundant rainfall give a fairly strong and constant flow; "drowned" estuaries facilitate access from the sea to some, the formation of deltas and bars (*e.g.*, Burdekin and Shoalhaven) hinders it in the case of others. The north-east Queensland streams have the longest courses and the largest basins (*e.g.*, Fitzroy: c. 500m. long; basin c. 55,000sq.m.) but New South Wales and Tasmania also have some fine streams. Regarded as economic factors these eastern streams assist penetration, settlement and general economic development (irrigation, hydro-electric power, etc.), and to a much less extent, in their lower stretches only, navigation.

Comparable are the rivers of the north and north-west coasts of the continent (*e.g.*, Fitzroy [c. 400m.], Ord [c. 300m.] besides the Victoria, Daly, Roper and McArthur). Many are navigable for considerable stretches and have economic possibilities though all suffer from a markedly seasonal ("monsoon") régime. The south-west coastal portion of Western Australia is well drained by small but fairly constant streams (*e.g.* Swan river), but those farther north, the Ashburton, Fortescue and others, are courses only occasionally utilized by water. By far the greater part of the western plateau has no organized surface drainage, courses normally dry carrying off the water of occasional downpours.

(ii.) Further east the inner Northern Territory and the central lowlands have a drainage better defined but intermittent. Large shallow depressions (*e.g.*, Lakes Woods and De Burgh in Northern Territory; Lake Eyre in South Australia) receive flood waters from near or distant uplands and then become more or less extensive patches of water, swamp and mud. Descending from the uplands of Queensland or Central Australia by normal channels (cf. valleys and gorges of the Macdonnell Range), the streams survive upon the plains only after heavy rain and then are more in the nature of moving floods. Drying up, they leave behind them broad channels with water-holes, or sometimes (Finke, Neales, etc., in central Australia) shallow beds lined with sand beneath which water may linger or flow.

(iii.) The Murray-Darling would rank as one of the world's greatest drainage systems if its volume throughout were on the same scale as its mileage. As it is. the system is somewhat one-sided (there are practically no western affluents); the flow, even occasionally of the Murray, is liable to interruption; a proportion of the quasi-tributaries seldom or never reach the main streams, and an oceanic outlet adequate to a great river is absent. Above the main confluence at Wentworth the Darling and Murray systems are distinct but similar. Each drains an approximately semi-circular basin rimmed by the south Queensland and north New South Wales highlands and by the south New South Wales and Victorian highlands respectively. The head-streams usually emerge from long, tortuous, and often narrow and precipitous highland valleys. On the lowlands they converge, in comparatively straight lines, on centres respectively near Bourke (Darling) and east of Euston (Murray).

In the north are the Macquarie (590m.), Namoi (430m.), Bogan, and others; in the eastern system the Murrumbidgee (c. 1,000m.), Lachlan (c. 800m.), Goulbourn (280m.), Mitta Mitta (125m.), Loddon (150m.). Descending to the lowlands these streams mostly slacken, begin to meander and deposit, to build their beds above the level of the plains, to flood, form distributaries ("anabranches") and lagoon-like "billabongs," and in dry periods to shrink to a string of water-holes or dry up altogether. A good many streams (Macquarie, Paroo, Avoca, Wimmera, etc.) are usually lost in swamps or sands. The Darling itself may be dry as long as 18 months at a time, and even the Murray occasionally ceases to flow.

The lower course of the combined Murray-Darling is very flat (gradient c. 3in. per mile). The river here flows through a wide flood plain between high and often cliffy banks. Near its mouth it expands into Lakes Alexandrina (*q.v.*) and Albert and has an outlet, but at times no outflow, into Encounter bay over a shifting sand-bar carrying 7–12ft. of water. In their plains course nearly all the streams of the Murray-Darling system lose enormous volumes of water by evaporation, by seepage (especially by old silted-up and buried channels), and increasingly also by the demands of irrigation. Under the most favourable conditions navigation can reach Walgett on the Darling and Albury on the Murray. The longest single stream-course is the Condamine-Darling-hlurray (c. 3,800m.), but it is obvious from the conditions above described that this and similar figures have little practical significance.

Sheets of standing water are naturally rare in Australia. The lakes which adorn many maps of Western and South Australia are mostly either extensive saline flats ("Lakes" Amadeus, Disappointment, etc.) or mud-flats receiving occasional (Lakes Gairdner, Frome, Torrens) or periodic (Lakes Eyre, Woods) flood-waters. Periodic also are the swamps, "billabongs," gilgais, etc., formed in the drainage courses of the great streams (v. *sup*). The only true lakes are those found in southern South Australia, in Victoria (some of them of the volcanic "crater" type) and in the eastern highlands, including Tasmania. Even Lake George, the largest of these, is subject to considerable variations.

Minerals.—Over considerable parts of the continent the ancient rocks are hidden under later (Mesozoic — Recent) deposits. In these rocks the chief minerals are salt and gypsum, bauxite and phosphatic deposits, opals (*e.g.* in west New South Wales and Queensland), some of the softer coals, besides alluvial deposits of gold and tin (v. p. 725). Improved methods of prospecting and surveying (*e.g.*, by geo-physical methods) will probably reveal minerals in the older rocks which underlie these newer formations. Petroleum oil, though perhaps not entirely absent (*e.g.*, in the Northern Territory and the Kimberley Division of Western Australia), has so far not been found in any quantity.

Ancient rocks, broadly speaking, constitute the outer portions of the continent, the eastern highlands, including Tasmania, forming a marked marginal belt. These rocks are extensively mineralized with metallic ores such as gold, silver-lead, copper, tin and iron, besides coal, phosphatic rocks and other non-metallic deposits. Australian minerals are therefore on the whole well situated for exploitation. Some important deposits are situated on or near the coasts (coal in New South Wales; silver-lead and copper in Tasmania; iron in South Australia and Western Australia), though Broken Hill, Cobar and Cloncurry are well inland. The continental margins are, moreover, the usually better watered and forested. The flatness and openness of the country (e g, in Western Australia) have in places favoured prospecting further inland, but here the supplies of timber and water diminish, and Broken Hill has suffered from dearth of water. Transport has often presented difficulties and there are fields potentially valuable which are still commercially inaccessible. Australia owes a considerable proportion of its railway mileage to minerals. The wide distribution and convenient situation of workable coal, the availability in the east (notably in Tasmania) of water for power,

and the facilities for marine coastwise transport also assist development of mineral resources. (See *Mining* and Minerals, p. 724.)

Primary occurrences of minerals are those in ancient rocks which have been involved, often at considerable depths, in mountain-building and other tectonic processes, and have become impregnated with bodies of ore. Such are the rocks of most of the western plateau, of virtually the whole of the eastern highland belt (including Tasmania), and of the South Australian and Barrier ranges, in which gold, tin, silver-lead, zinc, copper, iron, phosphatic rocks and many others are found in lodes (vertical to horizontal), reefs (cf. saddle-reefs), "replacement" zones, stockworks, etc., generally at or near contact-planes between different formations where stresses have occurred.

In the west, the mineralized areas are chiefly the north-west to south-east belts of "greenstone" schists, etc. (*v.* Geology, p. 704, *et* seqq.) of pre-Cambrian age; in the east somewhat later rocks (notably Silurian slates, etc.) are the chief seats of occurrence. Elevation and long-continued denudation have brought these mineral bodies near to the surface and, in places, left whole masses of ore-bearing quartz, etc., projecting as hills or ridges. Weathering also, by reducing exposed portions of lodes, has frequently brought about concentrations of ore in the upper parts ("secondary enrichment," *e.g.*, Mount Morgan, Queensland). The distribution of the mining industry, mining methods and mining profits have been, and continue to be, fundamentally dependent upon the conditions described.

Derivative deposits occur in (a) sedimentary strata such as the auriferous Nullagine conglomerates of north-west Western Australia (cf. the Banket deposits of South Africa), iron-impregnated sandstones, etc. These strata are in places more or less horizontal, and dissection by streams has made the ores more accessible. Most common, however, and widespread are alluvial deposits — notably of gold and tin. These river-bed ("stream") deposits, with which may be associated the auriferous sea-sands, derived originally from primary sources, have been widely covered up (10–100ft.) by later deposits — basaltic flows and river alluvium. These occurrences have also lent to Australian mining some of its most distinctive features.

Coal. — The coal resources of Australia are distributed along the eastern highlands, in Tasmania, and also, to a less extent, in South and Western Australia. The deposits, which occur in rocks ranging from the Permo-Carboniferous to Tertiary age, have mostly been preserved in hollows and basins in the underlying older rocks. The elevation, down-faulting and dissection of the eastern highlands, however, has exposed the seams in many areas so that they are easily worked. This applies particularly to portions of the largest deposit, viz., that of the great New South Wales (Triassic) basin which, shaped roughly like a saucer with its deepest part near Sydney, has numerous seams exposed at the surface near, or actually upon, the coast (*e.g.*, near Bulli).

The coals occur in seams of varying thickness and range from anthracite to lignite and include coking, steam and gas varieties. Their abundance, variety, accessibility and ease of working is leading, with the growth of population and of industries, to increasing exploitation. All the States (*qq.v.*) have useful supplies — South Australia has perhaps the least — and several of them have relatively enormous reserves. The additional advantage of marginal or coastal position and of sea transport gives them especial commercial value.

Water-power. — The northern rivers have very variable régimes and the Murray-Darling system has in addition insufficient gradients over most of its area. The eastern highland belt has steep gradients (including falls) on the coastward side and strong and fairly constant stream-flows and here, in a belt stretching from Cairns in Queensland to Victoria, some 650,000–1,300,000h.p. are available for development. Tasmania has some 400,000 located h.p. The coal deposits of the eastern highland belt greatly enhance the value of the water-power there, since the two sources of power can be worked in conjunction.

Water **Supply.**—Around the margins a belt varying in width roughly from 100 to 200 miles — broadest towards the south-east and including Tasmania, interrupted in the central west and central south — has normally a sufficient rainfall and run-off. Here capital cities, country towns and rural areas have abundant supplies, based often on extensive reticulation schemes. The corresponding parts of northern Australia have also adequate available supplies. In the drier parts of the country one finds both superficial and underground supplies.

Superficial supplies are derived from rainfall and include, besides occasional river, lagoon, pool and spring supplies, run-off stored in gravel screes at the base of, *e.g.*, granite hills, sand-hill soaks (many "sand-hills" have clayey or tufaceous interiors) and other similar sources. Superficial supplies are apt to fail, but water-storage in reservoirs, dams, tanks, underground cisterns, etc., has made steady progress and is now widely established and the incidence of irregular, if spasmodically heavy, rainfalls is being mitigated.

Underground artesian supplies underlie nearly one-third of the surface of the continent (c. 950,000sq.m.). Virtually the whole of the great central lowlands, besides large areas at the head of the Great Australian Bight and along the west and north-west coasts are included. If, as seems possible or even probable, a proportion of this water is derived from the harder rocks which underlie the basins ("connate" or "included" water), and not by the underground percolation and gravitation of rainfall ("meteoric" water), there is a definite, if a still extended, limit to the supplies available. Certainly in recent years the yields, which in many cases were over 1,000,000gal., and in one case reached 2,333,000gal., per diem, have almost everywhere declined by amounts ranging from 3% to about 7% per annum.

These wells vary in depth from 6,000ft. to 10ft., averaging *c.* 2,000–1,500ft. They are relatively costly to bore, and failure to find water entails loss. In artesian wells proper the water overflows, in sub-artesian wells it rises but does not flow. The temperatures at point of issue range from 212° F to 72° F and the waters are in general too highly mineralized for human consumption or even for irrigation, but are excellent for watering stock (see Pastoral and *Agricultural Industries*, p. 727).

Shallow sub-surface waters are widely distributed through the softer surface strata — Tertiary marine limestones and sandstones, alluvial gravels, silts, etc.—that mantle so much of the continent. They may be only a few feet below the surface and are derived originally from rainfall percolating directly, or through the intermediate agency of rivers.

In wet seasons, especially in the south (see *Climate*, below) where the rain falls in the cool season (when evaporation is lowest), great quantities of water lie upon the ground as pools or floods, and a large proportion of this water must escape underground. These waters are thus permanently available and are also readily accessible, failure to strike supplies involving no great loss. Unfortunately many are saline. Nevertheless, when made available by means of windmills, etc., these supplies constitute an economic asset the value of which has perhaps been inadequately recognized, and large tracts of country (*e.g.*, in South Australia) have been, and can still be, permanently settled by their means.

In general, large-scale conservation and supply schemes, though important, are perhaps less important than the aggregate of individually small but widely, and increasingly densely, distributed supplies which serve as a permanent safeguard.

Climate. — An island set in large water-bodies, Australia has for the most part equable conditions, but it is large enough to experience in its interior considerable extremes. Its size permits climatic differentiation, especially as between north and south, in which direction it stretches over some 33" of latitude (c. 11°–44° S.). At the same time, it has the least average elevation of all the continents and also a closed outline, and this makes for uniformity, and gives climatic — and hence often economic — regions on a large and simple scale. The great extent, moreover, of land lying between the lats. of c. 20° and 30° s. — *i.e.*, roughly along the tropic of Capricorn, and in a transition zone between two major rain regions — gives Australia a large area of low rainfall, increased because the eastern highlands force precipitation on the eastern rim.

Temperature. — About 38% of Australia lies north of the tropic and the northern two-thirds (roughly) has mean monthly temperatures in Jan. and Feb., 80°–85° F; in June and July, 55°–75° F; the southern third, go°–65" and 55°–50° in the same months respectively. In the ranges of temperature the influence of the oceans is very apparent. Tasmania has naturally very equable conditions, but the coastal parts almost everywhere have a low average ann. range (15"–zo°). Along the north, this low range (15°–8°) implies monotonous heat; elsewhere it is perhaps an advantage. Inland, extremes of temperature become increasingly marked and variations of over 80° occur. Thus in Central Australia shade temperatures of 110°–113° by day may be followed by night temperatures near or at zero, though even so the variations are not comparable with those experienced in, *e.g.,* Asia or North America (171° and 153° respectively). The south-east parts (including Tasmania) are the coolest, owing largely to the presence of highlands; the hottest are the north-west, Wyndham (av. ann.: 84·6°) being one of the hottest places on the globe. Heat spells are also longest and fiercest inland in the north-west and north (100° on 50 to 60 consecutive days); on the southern and eastern coasts they are less trying (go°: Perth, zo; Adelaide, 14; Melbourne and Brisbane, 8; Sydney, 4; Hobart, 3 consecutive days). Over considerable areas the heat is relatively dry, bearable, and, to those accustomed to it, invigorating. The same applies to the interior also, Central Australia being particularly healthy. Ground frosts occur everywhere except along the north and west margins. But the hot winds of summer are trying, and uneven heating sometimes causes "bumpy" conditions for flying. Summer in the north coastal parts is enervating (70° wet bulk temperatures) from Mackay to Broome.

Rainfall. — Conditions are, as it were, delicately balanced and very small differences (*e.g.,* an inch or two of rain more or less) may vitally affect economic conditions. Snowfall is normally restricted to the south-east highlands and Tasmania, where it lies for several months. Insularity and world position give Australia a rainfall which, predominantly marginal, swings around the continent from north-west to south-west and back again, completing a sort of circular return tour more or less regularly with the procession of the seasons.

In the north the rains are monsoonal and brought by depressions ("tropical lows") passing eastwards and south-eastwards. These rains fall in the hot season (chiefly in the six months November to April) and usually die away rapidly inland (c. 18°S. lat.). In the south the rains come mainly with depressions ("antarctic lows") which, travelling east, cover Tasmania and a strip of varying depth of the mainland. Rains are deposited upon the eastern highlands (from about 30° S. northwards) by the south-east trade winds which come moisture-laden from the Pacific. These rains vary locally according to the disposition of the opposing heights but are mostly heavy.

More occasional and irregular, but often very heavy, falls are brought by tropical storms on the north-east coast, by the passage of "anti-cyclones" in the south, and by tropical lows moving down behind (west of) the eastern highlands. These last sometimes penetrate to Victoria and even to Tasmania (*e.g.,* June 12, 1912) and they are welcome refreshers of the great pastoral plains of the eastern States. Finally there is the strip stretching roughly east and west from the lower Darling and south-west Queensland to the west coast about Sharks Bay, which has an average breadth of c. 550m. It touches the head of the Bight but narrows towards the west coast and occupies *c.* 1,000,000 sq m. or about one-third of the continent. This is "arid" Australia, with an annual rainfall of 10in. or less, where the marginal rains described above tail off and come feebly, irregularly, or seldom. The true "axis of aridity" swings north and south with the seasons, and the margins are visited by occasional rains from now the north, now the east, now the south. At the opposite extreme stands Tasmania with an abundant all-the-year fall, especially on its exposed western highland flank.

Four main rainfall regions have thus been distinguished: (1) the northern, with summer rains averaging 60in. or less (reckoning inwards) annually; (2) the southern, with winter rains averaging from 40in. downwards; Tasmania 110–20in.; (3) the eastern, sharing partly in both the above, but having "independent" sources of its own, from 60–40in., confined mainly to the eastern highland flank and thereafter falling off inland; (4) the "arid," with 10in. or less. The wettest portion of Australia is on the north-east Queensland coast (144–165in. av. ann.), and the driest about Lake Eyre (less than 5in.). Reliability of rainfall decreases as temperature increases towards the north-west and north of the continent, the extreme north and one or two other areas forming exceptions. The economic value of the rainfall — the moisture normally available after evaporation has taken its toll — is greatest in the area of uniform rainfall along the south-west and south-east marginal parts. Elsewhere there are district wet and dry seasons and inwards the rains become more spasmodic and more concentrated so that special adaptations are necessary ("dry farming"; water and fodder conservation, etc.).

Torrential and irregular precipitation is rather typical particularly in the north and north-east in summer. Hail occurs along the south in winter and over the south-east in summer. These cause considerable damage especially through flood destruction. Recurrent droughts have earned excessive notoriety. Storms visit chiefly the north and east parts: cyclones ("willy-willies") the north-west in November to April; hurricanes the north-east in January to April; "Southerly bursters" the south-east chiefly in October to February. The arid interior is the home of restless dust-carrying winds which periodically sweep down to discomfort the south. Tasmania, somewhat exceptional, has a climate like that of England — mild, moist and invigorating. (X.)

FAUNA AND FLORA

Fauna. — The Triclad Turbellarian (Land Planarian) genus *Geoplana* is largely confined to Australia, New Zealand and South America, with some species in South Africa and in Japan. Among earthworms the Perichaetidae are represented by obviously ancient forms in Australia; they are also important in South America and a few occur in south-east Asia, Perichaeta itself abundantly, and a few in Africa but none in the more northerly lands. It is noteworthy that the earthworms of New Zealand, though related to some Australian ones, show only a few species and are related to those of South Georgia, the Falklands and south Argentine and Chile. Peripatus, again, an ancient type related both to the segmented worms and to the arthropods, has species found in Australia, while other species characterize New Zealand, Sumatra, South Africa, South America and the West Indies. They are all land animals without means of distribution over the water and they are all ancient types of life. Their distribution is that of relicts of an old widespread fauna, they are now found only in discontinuous areas of survival as a result of physiographical isolation.

Ceratodus, a Dipnoan fish, survives in the rivers of Queensland, the other living Dipnoans being African and South American though fossils are widespread. The Port Jackson shark (*Heterodontus*) is another survival, in this case of the elasmobranchs (sharks) of the Secondary period.

As regards crocodiles and lizards Australia, especially in the north-east, where the crocodiles occur, is clearly related to Asia. Among the tortoises the family Chelydidae is found in Australia and South America, and fossils have been found in Europe. Here, then, we seem to have evidence from fossils to support the general thesis concerning discontinuous areas of survival (Chelydidae), as well as to suggest that Australia and Asia have been connected within the period of earth history since the first evolution of lizards; crocodiles may get across a fair breadth of sea. The great Queensland crocodile has been known to reach a length of 30ft. The leathery turtle has been taken in some Australian coastal seas. Australia has many snakes, several venomous ones.

'The running birds are represented in Australia by the emu and the cassowary. The emu is a known fossil from New Zealand, which had, until recently, gigantic flightless birds The cassowary occurs in Papua and some neighbouring islands as well as in Australia. The other running birds that survive are the ostriches in Africa and rhea in South America. The gallinaceous birds are

interesting in the same way; some ancient types, the Megapodes or mound builders are Australian but one species is found in south-east Asia; their probable nearest relatives, the Cracidae, are South American. The lyre-birds (Menura), the bower-builders, and the honey-eaters are other features of Australia.

But it is the mammalian fauna of Australia that presents the greatest interest. The Mammalia bear their young alive after nutrition in the uterus for a period through a vascular organ called the placenta. The young, after birth, are fed by the mother from her mammary glands; they develop a juvenile, or so-called milk-dentition, which is replaced by the second or adult dentition. Two genera in Australia, Ornithorhynchus and Echidna are survivors of early types in which these features are barely indicated; they lay eggs, have no placenta, and no tooth change, but they give milk though without teats; they form the order Monotremata which has obvious kinship with reptiles as well as with mammals. Echidna also occurs in Papua. The Marsupialia or pouched mammals are the only other order of mammals, apart from bats and rodents and introductions by man (but see below), found living in Australia. A few members of this order live in America, north and south and some in the eastern East lndies and Papua (see ASIA: *Fauna*) while related fossils are widespread. But, among marsupials, some have several front teeth on each side of the lower jaw and these include many Australian forms, the American opossums and fossils in the northern land mass of the Old World. Others like the kangaroos have more specialized features, one of which is that there are but two front teeth (one each side) in the lower jaw, and, outside Australia, the only member of this sub-group is Coenolestes, in Ecuador, but fossil relatives have been found in southern South America. This has led to suggestions of land connections via the Antarctic at some time such as the early Tertiary period when apparently the earth's climates were far warmer on the whole than now. Play has been made in this connection also with the special richness of the Marsupial fauna of Tasmania. Other workers think that the idea of restriction of survivals to southern isolated lands is what is again illustrated here. Some of the Australian Marsupials (*e.g.,* the bandicoot) have been shown to possess degenerate traces of the processes of placental nutrition and of tooth change.

The dingo or wild dog is a remarkable feature in Australia and opinion concerning it has varied from time to time; it has been said to be a human introduction, *i.e.,* to be feral and not a real wild animal; bones, however, have been found which have been claimed to be of a date long before the arrival of man in Australia and the feral character has been denied on anatomical grounds as well. The wide distribution of *Canis* is a point to be borne in mind, as also the fact that it can swim. Bats and rodents have such special means of distribution that their occurrence in Australia raises no problem of the kind above discussed. The dingo appears to be increasing.

The native fauna has almost ceased to have economic significance in Australia. The kangaroo, once hunted for his skin, and the wombat are becoming rarities, though the native birds are abundant, interesting and often beautiful. The feral buffaloes of the north-west (*e.g.,* Melville Island) have been nearly exterminated. Ants and termites are a destructive pest, especially in the north. To the ranks of pests have been added the rabbit, fox, sparrow and starling, and even camels have been known to become feral in central Australia.

Vegetation and Flora.—The sand-ridge country of the west and north-west interior, the "gibber" and clay loam plains of the Lake Eyre basin, rock highlands and rock patches in various parts are bare over considerable areas or for considerable periods. The sand-ridges, with their included clay strips, have sparse and stunted scrub and "porcupine" grass; the clay plains of central Australia produce from their richness amazing growths of grass, herb and flower after rains—deceptive glories, suddenly appearing and as quickly vanishing. Over much of the arid interior the plant population is sparse, stunted and relatively depressing in appearance. Climatic influences obviously dominate vegetation in Australia, but geological factors play a part, and from Western Australia to Queensland pastoral, agricultural and other lands, granites, sandstones, "sand-plains," etc., are distinguished by types and names of plants, or plant associations. Between and outwards from the areas mentioned above, there extend vast plains, for the most part of seasonal grassland and permanent scrub, in which acacias of various sorts are common, particularly "mulga" scrub. The scrub thickens in brakes and patches and the seasonal river-courses are lined with larger trees (*e.g.,* River and Swamp gums). On the south side salt-bush, a valuable fodder plant, is widespread. The pastoral value of all this type of country is considerable and as yet little utilized (*e.g.,* Burt plains north of the Macdonnell range). It occupies a large oval extending from the central west coast to west Queensland and New South Wales, and from the central north nearly to the Bight and Gulf region of the south. Outwards it merges into another belt, or series of belts, of wooded grasslands. In the north-west, north and (inland) north-east, tropical savanna predominates. Here summer rains followed by a long dry season give a prevailingly open landscape with much fine grassland and varying proportions of woodland composed of rather small trees. In Queensland the term "brigalow scrub" is applied to the wood element. Considerable patches of real forest occur, notably in the rich alluvial valleys of the north-west and also towards the east Queensland highlands. On the south side—in the areas having *c.* 10–20in. average annual rainfall—the characteristic tree-scrub is "mallee," a eucalypt with a bunchy growth above ground and massive pancake-like base and root-crown. Mallee country, once called "desert," is now producing wheat over wide areas. The "brigalow" country of Queensland, etc., includes some of Australia's best pastoral lands, as do also the west plains of Queensland and New South Wales with their wide open stretches of grass and low scrub and tree-belts by water-courses and waterholes. There remain the outer margins of the continent, from north-east Queensland round t a the extremity of South Australia, with Tasmania and south-west Australia as well. Here are rainforests proper ranging from the tropical (almost equatorial) to the cool temperate type (Tasmania). Sometimes they are sharply marked off from the inland types, but more often they are more or less open in character, with grassy grounds and patches, merging gradually into the wooded grass-lands behind. This transition is marked on the west flanks of the highlands by a belt of timber more open and having smaller trees. The forests of north-east Queensland (the Queensland "brush") are luxuriantly grown, matted with lianas, and contain soft-wood trees. Southwards these pass into a eucalypt forest which reaches its finest development in Gippsland, the home of Australia's giant trees (Max. recorded: height, 326ft. 1in.; girth [6ft. from ground], 25ft. 7in.). The Gippsland forests, with their deep tree-fern valleys, are famous in Australia, and hardly less so are those of Tasmania (conifers and beeches), and of south-west Australia (jarrah, karri, tuart, etc.).

Australian vegetation as a whole has a marked individuality. One feature is the great predominance—at least in the southern parts—of eucalypts of which some 320 species are known. Another is the great range, in area and in species (c. 412), of acacias ("wattles") many of which give their names to well-known types of scrub (mulga, brigalow, myall, etc.), the golden wattle being the "unofficial floral emblem of Australia." Spinifex is widely known by name outside Australia, but the "Native (or Cypress) pine," "she-oaks," "black-boys," besides numerous flowering shrubs and plants, are more widely typical of the Australian "bush" Forest fires, all too frequent and destructive, and the practice of ring-barking, give many square miles a look gaunt, ghostly and forlorn, softened sometimes by shimmering heat and the blue distant haze. There is in Australian vegetation a reminiscence of age-long struggle, a savour of the rocks and climate, of survival, not without effort, from past ages into an exacting present. Economically Australian vegetation has possibilities not fully utilized (see Forestry, etc., below, p. 726, et seq.). Of all plant pests introduced, the prickly pear is the most menacing and costly. By 1922 it had covered an (estimated) area of 60,000–70,000 sq.m. (*cf.* England and Wales, area, 58,300 sq.m.), a space "twice the total area in Australia under all crops," and was spreading at the

rate of *c.* 230 sq.m. per annum in south Queensland and north New South Wales. It prefers the richest lands, often forms a solid impenetrable mass, is of little economic value, and is difficult to destroy by mechanical or chemical means. Recent experiments, however, with insect parasites justify hope that the pest may be controlled if not exterminated. Destruction of forests is introducing changes in hydrographic conditions. Problems of soil erosion and run-off are arising and need attention.

(O. H. T. R.)

Brief reference must be made to the phytogeographical interest of the Australian flora. The plants of north-east Australia include many trees, mostly of soft woods and lianas, which have relatives in Papua and Melanesia and they represent an intrusive flora which reached Australia ere Torres Strait divided it from Papua. This intrusive flora has exterminated the older indigenous one in the coastlands of the Gulf of Carpcntaria, of Queensland and of northern New South Wales but it has not been able to penetrate much beyond these limits, within which the annual rainfall is at least 30in. and in many places over 40in. The rest of Australia is largely characterized by types of plants which are often peculiar to the continent, or are related to plants of other southern lands and show every indication of being survivors of quite ancient elements of the world's flora. The eucalypts and the peculiar acacias have already been mentioned. The Proteaceae are hard-leaved plants found in Australia, New Zealand, Caledonia, southern South America and South Africa and they are believed to be survivors of an old element in the world's flora. Araucaria, a coniferous genus, is also important in both Australia and South America while Andansonia Gregorii in north-west Australia is closely related to the African baobab. These are all indications of the survival in Australia and other southern lands of types once more widely, perhaps generally, distributed in the great northerly lands but pressed out there by evolution of newer types and surviving in southern lands which have now for a long period been more or less isolated from the larger northern masses. (X.)

ETHNOLOGY

Physical Anthropology. — The Australian "black-fellow" is not black, but chocolate brown. He is below the average height of Englishmen, has strong wavy hair, well developed beard whiskers and moustache, usually jet black. Women wear the hair short. While the average index for Australian skulls is 71·5, the range in the living subject is from 80·5 to 66.6. The head is often high and ridged, with a retreating forehead. The eyebrow ridges are heavy, the nose has its root set deeply and is distinctly broad. There is much variation, which has been regarded as evidence of admixture or of the survival of intermediate and generalized characters of a really primitive nature. Blood tests reveal two distinct blood groups and there are grounds for thinking that in the very distant past at least two streams of immigrants met and fused — one of them being akin to elements surviving in the south of India, in Ceylon, the Malay Peninsula and in Indonesia.

Social Organization. — The tribe in Australia is a group distinguished from its neighbours by possessing a distinct language and a tribal name and by inhabiting a defined territory. Here and there groups of contiguous tribes are, or were, more or less loosely allied so that the present great number of separate tribes may be due to the gradual disruption of once larger communities. Of any real combination or cohesion there was no trace and the association may be modern and temporary. Each tribe consists of a number of exogamic totemic clans (see EXOGAMY and TOTEMISM), which, generally, are matrilineal in the east and patrilineal in the west. In all tribes marriage is between persons who stand in a certain relation of consanguinity. In one type the man marries a woman who is the daughter of his mother's brother (maternal uncle), while in the other type a man marries his mother's mother's brother's daughter's daughter, and the Australian system displays an intense recognition of actual relationship by consanguinity. Both types are found in proximity but type 2 (in which the marriage of first cousins is impossible) is more common. Each tribe, with rare exceptions, is primarily divided into two halves, moieties, which are again divisible into two or four sections. The primary division into moieties prohibits the marriage of brothers and sisters; the second division into sections prohibits the marriage of brothers and sisters and of parents and children, but allows that of first cousins, while the third division into sub-sections prohibits the marriage of first cousins as well. Ingenious arrangements exist by which, when male and female descent tribes come into contact, the position of the children can fit into the social system of either tribe. The status of headman, within certain limits, is hereditary in one or two cases; in the generality of tribes the old men exercise authority in virtue of their magical powers (see GERONTOCRACY).

The exogamic system, with variation in details, is universally bound up with the beliefs that every person is the re-incarnation of some former individual, and that the identity of the human ancestor or type merges into the totem animal. There are complicated initiation rites, circumcision, subincision (the penile urethra being laid open from the meatus to the junction with the scrotum), removal of teeth, head-biting, tossing the novice in the air, fire-ceremonies. There are rites for women analogous to the initiation rites of the men, but fewer in number and less elaborate. The purpose of the rites is to establish the authority of the elders, to inculcate self-restraint and manliness, and finally to bring about a progressive revelation of the tribal secrets.

Religion. — In the category of the sacred, the powerful, the worshipful, the aweful, the numinous, are included all the forces which sustain and stabilize Australian society; all the ideas, beliefs and practices which express the attitude of society in that level towards the material of religion. Beliefs as to the physical, psychical, physiological nature of man, as to the nature of the world in which and by which he lives, are preserved in the complicated myths, legends and ritual recorded by many observers. Man shares life with other creatures and is akin to them, and is therefore constrained to behave towards them as sharers of a common life. In the medley of beliefs there is great variation, with a common plan in which here and there appears the belief in a Creator Deity.

Sanctity, power, authority, reside in man and in objects fabricated or adorned or modified by man. The churinga especially form a class of sacred objects in wood or stone varying in length from six to seven feet to two or three inches and of various shapes. The term "Bull-roarer" is used of the smaller kind and there are two main forms of this article which have definite distribution and association with specific forms of initiation.

An important class-of rites are performed for the welfare of the totem, animal or plant, and are held customarily just when there is the promise of the approach of a good season. As a rule, the headman or director of ceremonies is required to partake ceremonially of the plant or animal, thus breaking the rule of sanctity partly to acquire its virtue for himself. Others not members of the same totemic group are then free to use the plant or animal. Co-operation of this nature throughout the group brings the constituent clans together, and has a social value by reason of its economic importance.

Mode of Life. — There is no agriculture, no domestication of animals, no permanent settlement. Wind screens of rough branches serve as shelters. The Australian is a hunter, fisher, food-collector. In the north, bark canoes and dug-outs are found while on the north-east of Queensland outrigger canoes are used. At the present day we find a practically complete series of stone tools from crude eolith forms to well-fashioned leaf-shaped spear heads and polished axes. The work varies according to the material available, the pressure of need, etc. Fragments of glass bottles are chipped, and telegraph insulators have been stolen for the purpose of making spear heads. The bow is not used. The boomerang (*q.v.*), the throwing stick, the digging stick, the shield, the club, and the tray, form the instruments of the chase and the daily toil for food. Clothing, as protection against the climate or as required by ideas of modesty, is unknown in many parts, but some use skins. Such articles as are worn are in intention decorative, due to special requirements, or to religious needs, and the materials are provided by nature and by the ani-

mals hunted. They are skilled trackers, keen observers of the habits of the creatures on which they subsist, and they possess an extensive knowledge of the properties of plants, using them to poison pools. The daily weapons are used as musical instruments to make a noise, while conch shells are also employed. Well-made string bags are fashioned of knitted twine, from fur or vegetable fibre, or finely split rattan, and in some parts are made to hold water or honey. Their art uses but few colours, and is mainly geometric, though plant and animal designs occur. Contrasting colours are often boldly used.

General.—So great is the variety of detail in every respect of the activities of the black-fellow over this great area that no universal statement can be made with safety. Thus there are at least six entirely different methods of treating the dead, each of which is found in other parts of the world; five or six distinct initiation ceremonies; and three distinct methods of fire-making. while the distinctiveness of art and craft work shows an endless capacity for variation and invention, within well defined and narrow limits imposed by the physical environment and the long isolation of the countrv from external contacts. There have been movements, combinations, dispersions, recombinations, variations, changes of interest and environment. changes of stress. Whatever helps to denote the group and to distinguish it effectively from other contiguous groups, has received emphasis, has disturbed the balance of ideas, of customs which—strange and complicated as they now are—represent undoubtedly the outcome of internal stresses and strains, as well as the contacts with external agencies, and are far, as the legends current among them indicate, from the earliest order. The range of variation is ultimately limited, but within those limits the Australian black-fellow has achieved much by his native ingenuity.

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HISTORY

It is impossible to say who were the first discoverers of Australia, although there is evidence that the Chinese had some knowledge of the continent so far back as the 13th century. The Malays, also, would seem to have been acquainted with the northern coast; while Marco Polo, who visited the East at the close of the 13th century, makes reference to the reputed existence of a great southern continent. A map on which a large southern land is shown still exists, dedicated to Henry VIII. of England, and the tradition of a Terra Australis appears to have been current for a long period before it enters into authentic history.

THE DISCOVERY OF AUSTRALIA

In 1603 a French navigator named Binot Paulmyer, sieur de Gonneville, was blown out of his course, and landed on a large island which was claimed to be the great southern land of tradition, although Flinders and other authorities are inclined to think that it must have been Madagascar. Some French wrilers confidently put forward a claim that Guillaume le Testu, of Provence, sighted the continent in 1531. The Portuguese also advance claims to be the first discoverers of Australia, but so far the evidence cannot be said to establish their pretensions. As early as 1597 the Dutch historian, Wytfliet, describes the Terra Australis as the most southern of all lands, and proceeds to give some circumstantial particulars respecting its geographical relation to New Guinea, venturing the opinion that, were it thoroughly explored, it would be regarded as a fifth part of the world.

De Torres.—Early in the 17th century Philip III. of Spain sent out an expedition from Callao, in Peru, for the purpose of searching for a southern continent. The little fleet comprised three vessels, with the Portuguese pilot, De Quiros, as navigator, and De Torres as admiral or military commander. They left Callao on Dec. 21, 1605, and in the following year discovered the island, now known as Espiritu Santo, which De Quiros, under the impression that it was indeed the land of which he was in search, named La *Austrialia del Espiritu Santo*. Sickness and discontent led to a mutiny on De Quiros's vessel, and the crew, overpowering their officers during the night, forced the captain to navigate his ship to Mexico. Thus, abandoned by his consort, De Torres was compelled to bear up for the Philippines to refit, and sailed through the strait that bears his name; he may even have caught a glimpse of the northern coast of the Australian continent. His discovery was not, however, made known until 1792, when Dalrymple rescued his name from oblivion, bestowing it upon the passage which separates New Guinea from Australia. De Quiros returned to Spain and petitioned the king to despatch another expedition for the purpose of prosecuting the discovery of the Terra Australis. He was finally successful in his petitions, but died before accomplishing his work, and was buried in an unknown grave in Panama.

Dutch Discoverers.—The first Europeans to land in Australia were the Dutch. In 1606, the "Duyfken" or "Dove," sailing from Java, entered the Gulf of Carpentaria and reached Cape Keerweer. Some of the crew went ashore, but, attacked by natives, made no attempt to investigate the country. In the next fifty years, Dutch navigators explored the north and south-west coasts, leaving memorials of their boats in such names as Arnheim Land and Cape Leeuwin. Among them was Pelsaert, who, about 1640, described in unfavourable terms the inland country on the west, and, incidentally, wrote the first account of the kangaroo. By 1665 the Dutch possessed rough charts of the west coast, and gave to the mainland the name of New Holland.

In 1642 Abel Janszoon Tasman sailed from Batavia on Aug. 14. After a visit to the Mauritius, then a Dutch possession, Tasman bore away to the south-east, and on Nov. 24 sighted the western coast of the land which he named Van Diemen's Land, in honour of the governor of the Dutch East Indies. The honour was later transferred to the discoverer himself, and the island is now known as Tasmania. Tasman doubled the southern extremity of Van Diemen's Land and explored the east coast for some distance. The ceremony of hoisting a flag and taking possession of the country in the name of the Government of the Netherlands was actually performed, but the description of the wildness of the country, and of the fabulous giants by which Tasman's sailors believed it to be inhabited, deterred the Dutch from occupying the island, and by the international principle of "non-user" it left their hands.

Dampier.—The first English navigator to sight the Australian continent was William Dampier in 1688. He was supercargo of the "Cygnet," a trader whose crew had turned buccaneers. On his return to England he published an account of his voyage, which resulted in his being sent out in the "Roebuck" in 1699 to prosecute his discoveries further. To him we owe the exploration of the coast for about 600m.—from Shark's Bay to Dampier's Archipelago, and thence to Roebuck Bay. He appears to have landed in several places in search of water. His account of the country was quite as unfavourable as Pelsaert's. He described it as barren, and, but for the kangaroo, almost devoid of animals. In 1696 the East India Company fitted out an expedition with the object of searching on the western shores of New Holland for traces of a Dutch vessel lost twelve years previously. This expedition reached the island of Rottnest, which was thoroughly explored, and early the following year a landing party discovered and named the Swan river. The vessels then proceeded northward, making fairly accurate charts of the coast-line.

Cook.—The great voyage of Captain James Cook, in 1769–70, was primarily undertaken for the purpose of observing the transit of Venus, but he was also expressly commissioned to ascertain "whether the unexplored part of the southern hemisphere be only an immense mass of water, or contain another continent." H.M.S. "Endeavour,)' the vessel fitted out for the voyage, was a small craft of 370 tons, carrying twenty-two guns, and built originally for a collier, with a view rather to strength than to speed. The transit was successfully observed from the island of Tahiti. Cook then turned south and beat about the Pacific in search of the east coast of Australia. On Oct. 6, 1769, the coast of New Zealand was sighted, and two days later Cook cast anchor in Poverty Bay,

After voyaging westward for nearly three weeks, Cook, on April 19, 1770, sighted the eastern coast of Australia at a point which modern geographers identify with Cape Everard.

The "Endeavour" then coasted northward, and Botany Bay was discovered on April 28, 1770. As it appeared to offer a suitable anchorage, Cook entered the bay and dropped anchor. The ship brought-to opposite a group of natives who were cooking over a fire. Cook and his men were not a little astonished that these natives took no notice of them or their proceedings. But when a landing was attempted, two natives, each armed with a bundle of spears, presented themselves on a projecting rock and made threatening signs to the strangers. It is interesting to note that the ingenious wommera, or throw-stick, which is peculiar to Australia, was first observed on this occasion. As the men were evidently determined to oppose any attempt at landing, a musket was discharged between them, in the hope that they would be frightened by the noise. But it produced no effect. Cook examined the bay in the pinnace, and landed several times; but by no endeavour could he induce the natives to hold any friendly communication with him. From the great variety of new plants there obtained Botany Bay derives its name. Before leaving, Cook performed the ceremony of hoisting the Union Jack and thus took formal possession for the British Crown.

Cook then sailed northward. He saw and named Port Jackson, but forbore to enter the finest natural harbour in Australia. Broken Bay and other inlets, and several headlands, were also seen and named, but the vessel did not come to an anchor till Moreton Bay was reached, although the wind prevented Cook from entering this harbour. He next landed at Bustard and Keppel Bays and the Bay of Inlets. After sailing 1,300m. in safety, the "Endeavour" one night suddenly ran into shallow water and struck heavily. Only with great difficulty and with the loss of guns and other heavy gear was she floated off next evening. The land was soon made near the mouth of a small stream, which Cook called, after his ship, the Endeavour river. A headland close by he named Cape Tribulation. The ship was steered into the river, and there careened and thoroughly repaired. Cook, having completed the survey of the east coast, to which he gave the name of New South Wales, sighted and named Cape York, the northernmost point of Australia, and took final possession of his discoveries northward from 38" S. to 10½° S. on a spot which he named Possession Island. Thence he returned to England by way of Torres Straits and the Indian Ocean.

Cook's second voyage, undertaken in 1772, with the "Resolution" and the "Adventure," is of less importance. The vessels became separated, and both at different times visited New Zealand. Captain Tobias Furneaux, in the "Adventure," also found his way to Storm Bay in Tasmania. In 1777, Cook, while on his way to search for a north-east passage between the Atlantic and Pacific oceans, again reached the coast of Tasmania and of New Zealand.

Cook in 1770 believed that Tasmania was an island, but on his last voyage he seems to have changed his mind, and, until 1798, when Bass, accompanied by Flinders, discovered the strait which bears his name, Tasmania was considered part of the mainland.

In Jan. 1788 a British colony was founded at Botany Bay, and Australian history began.

INLAND EXPLORATION

For twenty-five years the colonists were acquainted only with the country along the coast extending northwards about 70m. from Sydney and about a like distance to the south. This narrow strip, not more than 50m. wide at its broadest part, was shut in to the west by the Blue Mountain range.

The Blue Mountains attain a height of between 3,000 and 4,000 ft. only, but they are intersected with precipitous ravines, 1,500ft. deep, which baffled every effort to reach the interior until, in 1813, Blaxland, Lawson, and Wentworth, after crossing the Nepean river at Emu Plains and ascending the Dividing Range, obtained a view of the grassy valley of the Fish river. A line of road was constructed across the mountains as far as the Macquarie river by the surveyor, Evans, and the town of Bathurst laid out. This marks the beginning of the occupation of the interior of the continent.

Some small expeditions were made from Bathurst, resulting in the discovery of the Lachlan, and in 1816 Lieutenant Oxley, R.N., accompanied by Evans and Allan Cunningham, the botanist, led an expedition to trace the course of the Lachlan in a westerly direction. The results were disappointing. In a circuitous journey of 800m. Oxley discovered that the Lachlan, east of 147° E., ended in swamps, and that, below Mt. Harris, the Macquarie did the same. He crossed the Arbuthnot Range and the Liverpool Plains; then, ascending the Peel and Cockburn rivers, at last reached the sea at Port Macquarie. Captain King in three voyages next explored the north-west coast, and Melville Island was settled for a short time. Then in 1823 Oxley reached Moreton Bay and Port Curtis (690m. north of Sydney) and found the river Brisbane. About the same time Hamilton Hume and Hovell set out from Lake George, crossed the Murrumbidgee, and, skirting the foothills of the Australian Alps, reached the river Hume. Crossing the Murray at Albury, the explorers followed the western shore of Port Philip and reached the coast near the future site of Geelong. In 1827 and the two following years, Cunningham explored both sides of the Liverpool Range, some of his discoveries, including Pandora's Pass and the Darling Downs, proving exceedingly valuable.

Desiring to trace the courses of the large rivers flowing west, Governor Sir Ralph Darling, in 1828, sent out an expedition under Captain Charles Sturt, who, turning westward from the Macquarie marshes, struck a large river, with many affluents, to which he gave the name of the Darling. The course of the Murrumbidgee, a deep and rapid river, was followed by the same explorer in 1831. He travelled on this occasion nearly 2,000m., and discovered that both the Murrumbidgee and the Darling finally joined another and larger river, the Murray. In 1833 Sir Thomas Mitchell, after establishing a depot at Fort Bourke, traced the Darling southwards for 300m. and confirmed Sturt's report that it joined the Murray about 142° E. Meantime, Eyre explored the country north and west of Adelaide, travelling in 1840 all the way along the barren sea-coast of the Great Australian Bight, from Spencer Gulf to King George Sound. He also explored the interior north of the head of Spencer Gulf. Sturt, however, in 1845 made his way from the Darling northward to the very centre of the continent, reaching about S. lat. 24° 25.

Leichhardt.—In 1844 Dr. Leichhardt set out in quest of an overland route from the military station of Port Victoria, on the coast of Arnheim Land, to Moreton Bay. He went first along the Dawson and the Mackenzie in Queensland. Thence he ascended the source of the Burdekin, and, crossing the table-land to the west, easily reached the Gulf of Carpentaria. Skirting its shores as fas as the Roper, he crossed Arnheim Land to the Alligator river, and arrived at Port Victoria, after a journey of 3,000m., accomplished within a year and three months. In 1847 Leichhardt attempted to cross the continent from east to west. His starting-point was the Fitzroy Downs, north of the river Condamine, in Queensland. But he had not proceeded far before he met his death, his last despatch dating from the Cogoon, April 3, 1848. In the same region, from 1845 to 1847, Sir Thomas Mitchell and E. B. Kennedy explored the northern tributaries of the Darling, and a river in S. lat. 24°, named the Barcoo or Victoria, which flows to the south-west. This river was more thoroughly examined by A. C. Gregory in 1858. Kennedy, while attempting to explore the peninsula of Cape York, from Rockingham Bay to Weymouth Bay, was killed by the natives in 1848.

Other valuable achievements include Captain Banister's discovery of the route from Swan river to King George Sound, and the journey of Robinson and G. H. Haydon in 1844, from Port Philip to Gipps' Land. In Western Australia the Arrowsmith, the Murchison, the Gascoyne, and the Ashburton rivers were explored, by Captain Grey, Roe, Governor Fitzgerald, R. Austin, and the brothers Gregory, whose discoveries have great importance from a geographical point of view.

Stuart.—The error of Eyre in believing that Lake Torrens, Lake Eyre, and Lake Gairdner were but one vast lake was discovered by Babbage and Major Warburton in 1858. In this and the year following, Stuart explored the same district more fully. He next attempted to win the reward of £10,000 offered by the South Australian legislature to the man who should first cross the continent from south to north. He started, in March 1860, from

Adelaide, passed the lakes and found fertile country till he crossed the Macdonnell Range. On April 23 he reached the most central marked point of Australia, now named Central Mount Stuart. He pushed on to S. lat. 18°, but then abandoned his task owing to illness. Next year he made a second attempt, but advanced only one degree further north than in 1860, a failure due to lack of water and to the density of the scrub.

Burke and Wills.—Meanwhile the colonists and the legislature of Victoria provided funds for an expedition from hfelbourne to the Gulf of Carpentaria. The leading men of the party were Robert O'Hara Burke, an officer of police, and William John Wills, of the Melbourne observatory. Leaving the main body of his party at Menindie on the Darling under a man named Wright, Burke, with seven men, five horses and sixteen camels, pushed on for Cooper's Creek at S. lat. 27° 40′, E. long. 140° 30′. Wright was to follow him to this proposed depot, but Burke, weary of waiting, left four men behind, and, accompanied by Wills, King, and Gray, on Dec. 16, 1860, with one horse and six camels, began to cross the desert. In spite of great difficulties, they passed the McKinlay range S. lat. 21° and 22°, and reached the Flinders river, where though they did not actually stand on the shore of the Gulf they met the tidal waters of the sea. In effect, they had succeeded, and on Feb. 23, 1861, they began the return journey. On April 16, Gray fell ill and died. Five days later, the others had repassed the desert and gained the depot. That very day the men in charge had left in despair to rejoin Wright, who at length moved to Cooper's Creek, but, incredible to relate, neglected to search for the missing explorers. Burke, Wills and King wandered about in the district till near the end of June. They subsisted miserably on the bounty of some natives and by feeding on the seeds of a plant called nardoo. At last both Wills and Burke died of starvation. King, the sole survivor, was saved by friendly blacks, and was found alive in Sept. by A. W. Howitt's party, which had been sent to discover Burke.

Four other parties were sent out that year from different Australian provinces. Three of them, respectively commanded by Walker, Landsborough and Norman, sailed to the north, the two last named landing on the shores of the Gulf of Carpentaria, while Walker marched inland from Rockhampton. The fourth party, under J. McKinlay, from Adelaide, made for the Barcoo (Cooper's Creek) by way of Lake Torrens. Landsborough crossed the continent from north to south, between Feb. and June 1862; and McKinlay, from south to north, before the end of Aug. in that year, New South Wales and Queensland, east of the 140th degree of longitude, were examined. The Barcoo, the Flinders, the Gilbert, the Gregory, and other rivers were also explored. These valuable discoveries were made in the attempt to relieve the lost explorers. The bodies of Burke and Wills were recovered and brought to Melbourne for a solemn public funeral.

Stuart, in 1862, made his third attempt to traverse the continent from Adelaide. He started in Jan. and on April 7 reached the point where he had turned back in 1861. He then pushed on, through a very thick forest, with scarcely any water, till he came to the streams which supply the Roper. Having crossed a table-land of sandstone which divides these streams from those running to the western shores of Arnheim Land, he passed in July down what is called the Adelaide river of north Australia, and came at length to the Indian Ocean. The electric telegraph connecting Australian cities with London follows the line thus explored.

A third part, at least, of the interior of the continent, from about 120° to 134° E. long., an extent of half a million square miles, still remained unexplored. On April 21, 1873, William Christie Gosse, with men and horses provided by the South Australian Government, started from the telegraph station 50m. south of Central Mount Stuart (S. lat. 22°, E. long. 134°) to strike into Western Australia. He passed the Reynolds range and Lake Amadeus, but was compelled to turn south, where he found well-watered grassy land, and having travelled above 600m. to 26° 32′ S. and 127° E., was forced to return. In the same year, Major Warburton, with thirty camels, provided by Mr. (afterwards Sir) T. Elder, of South Australia, left the telegraph line at Alice Springs (23° 40′ S., 133° 14′ E.), and succeeded in making his way to the De Grey river in Western Australia. Overland routes between all the widely separated Australian provinces had now been discovered. Hann, Warner, Tate and Taylor, in 1873, explored the country north of the Kirchner Range, Queensland. G. Elphinstone Dalrymple, with Hill and Johnstone, finished, in Dec. 1873, a coasting expedition in which they surveyed the inlets and navigable rivers of the Cape York Peninsula.

Forrest.—In 1874, John (afterwards Sir John) Forrest was despatched by the Perth Government to explore the immense tract of country out of which flow the rivers falling into the sea on the northern and western shores of Western Australia. Leaving Yewin, lat. 28° S., long. 116° E., Forrest travelled north-east to the Murchison river, and followed its course to the Robinson ranges; thence he advanced eastward along the 26th parallel. He safely reached the overland telegraph line at Peake station, and, after resting, journeyed south to Adelaide. Seventeen degrees of desert had been traversed in five months, a very wonderful achievement. In his report Forrest showed that pastoral settlement could not extend to the spinifex region; and the main object of subsequent explorers was to determine the extent of the desert in the direction of north and south. Ernest Giles in his third attempt crossed the Central Australian Desert. Through the generosity of Sir Thomas Elder, of Adelaide, Giles's expedition was equipped with camels. It started on May 23, 1875, from Port Augusta. Working westerly along the line of the 30th parallel, Giles reached Perth in about five months. After a short rest, he journeyed back, for the most part between the 24th and 2 jth parallels, and reached the overland telegraph line in about seven months. His report proved that the interior of Australia west of 132° E. long. is a sandy and waterless waste, entirely unfit for settlement.

Recent Explorers.—The list of explorers since 1875 is a long one; but most of the smaller expeditions concerned themselves with the search for gold. Amongst the more important explorations may be ranked those of Tietkins in 1889, of Lindsay in 1891, of Wells in 1896, of Hiibbe in 1896, and of the Hon. David Carnegie in 1896–97. Hiibbe, sent by the South Australian Government to discover some stock route to the gold-fields of Western Australia, journeyed safely from Oodnadatta to Coolgardie, but reported that no such stock route was practicable.

In July 1896, the Hon. David Carnegie equipped and led an expedition to find a stock route between Coolgardie and Kimberley. In eight months he had travelled 5,000m. No practicable route for stock was discovered, and the desert showed few, if any, traces of gold, the search for which and for unoccupied pasturage quickly diminished the areas, nowhere extensive, of unexplored Australia.

POLITICAL HISTORY

Early Colonization.—Of the six Australian states, New South Wales is the oldest; for in 1788 Port Jackson was founded as a penal station for criminals from England; and the settlement retained that character, more or less, during the subsequent fifty years, transportation being virtually suspended in 1839. The colony, however, from 1821 had made a fair start in free industrial progress. By this time, too, several of the other provinces had come into existence. Tasmania, occupied as early as 1803, had been an auxiliary penal station under New South Wales, but in 182 j it became a separate province. From this island, ten years later, parties crossed Bass Strait to Port Phillip, where, under New South Wales, a new settlement was soon established. Out of this grew, in 1851, the State of Victoria. In 1827 and 1829, an English company endeavoured to plant a settlement on the Swan river, and this, added to a small military station established in 1825 at King George Sound, constituted Western Australia, which, however, did not become autonomous till 1890. On the shores of St. Vincent's Gulf (discovered, with Spencer's Gulf, by Flinders in 1802) another joint-stock company, between the years 1835 and 1837, created South Australia, as an experiment in the Wakefield scheme of colonization. Finally, in 1859, Queensland was separated from New South Wales.

The first British governors at Sydney, from 1788, were naval or military officers in command of the garrison, the convicts, and the

few free settlers. In the twelve years' rule of General Macquarie, closing with 1821, the colony made a substantial advance. By means of bond labour, roads and bridges were constructed, and a route opened into the interior beyond the Blue Mountains. The population was 30,000, three-fourths of them convicts. Captain John McArthur in 1803 had introduced the rearing of fine wool sheep, and the community profited greatly thereby. During the next ten years, 1821–31, the colony increased, and eventually, in the administration of Sir Richard Bourke (1831–37), obtained political representation by means of a legislative council.

Melbourne, which began with a few huts on the banks of the Yarra-Yarra in 1835, was in 1840 a busy town of 6,000 inhabitants, the population of the whole district, with the towns of Geelong and Portland, reaching 12,850. Its import trade amounted to £204,000, and its exports to £138,000. At Melbourne there was a deputy governor, Mr. Latrobe, under Sir George Gipps at Sydney. Adelaide had its own governors, first Captain Hindmarsh, next Colonel Gawler, and then Captain George Grey. Western Australia progressed but slowly, with less than 4,000 inhabitants altogether, under Governors Stirling and Hutt.

Discovery of Gold.—In spite of a commercial crisis, from 1841 to 1843, caused by extravagant land speculations and inflated prices, Australia had made sound progress. The wool clip of 1852 amounted to 45,000,000lb.; and South Australia had opened valuable mines of copper. The population of New South Wales in 1851 was 190,000; that of Victoria, 77,000; and that of South Australia about the same. At Summerhill Creek, 20m. north of Bathurst, gold was discovered, in Feb. 1851, by E. Hargraves, a gold-miner from California. In Aug. it was found at Anderson's Creek, near Melbourne; a few weeks later the great Ballarat gold-field was opened; and then that of Bendigo to the north. Throughout Australasia all ordinary industry was left for the one exciting pursuit. The copper mines of South Australia were for the time deserted. Immigrants from Europe, and to some extent from North America and China, poured into Melbourne, where the arrivals in 1852 averaged 2,000 persons in a week. The population of Victoria was doubled in the first twelve months of the gold fever, and the value of imports and exports was multiplied tenfold between 1851 and 1853. ,The colony of Victoria was constituted a separate province in July 1851, and Latrobe was appointed governor.

General Problems.—At the beginning of 1860 all the states, except West Australia, had received the boon of responsible government. The main questions at issue were now the secular as opposed to the religious system of public instruction, protection as opposed to a revenue tariff, vote by ballot, adult suffrage, abolition of the convict system, and free selection of lands before survey. All these questions were settled within the next twenty years, with the exception of woman's suffrage. Of the states, the first to grant this was South Australia in 1894, and the last, Victoria in 1908. The Federal franchise was given to women from the outset.

Taking the states as a whole, agrarian legislation has been the most important subject of parliamentary debate. Such legislation seeks to ensure permanent settlement on the land, to encourage tillage, or tillage joined to stock-rearing, and to discourage large estates devoted chiefly to grazing. The land question is a difficult one and the laws are continually being amended. Since 1870 there have been five radical changes made in New South Wales. In Victoria the law has been altered five times, and in Queensland and South Australia seven times.

Immigration.—To prevent or regulate the immigration of coloured races has been the aim of much legislation in the states. The agitation against the influx of Chinese began very soon after the gold discoveries. The European miners objected strongly to their presence on the diggings. The allegations made concerning the Chinese really amounted to a charge of undue industry. The Chinese were hard-working and had the usual fortune attending those who work hard. They spent little on drink or with the storekeepers, and were, therefore, by no means popular. As early as 1860 there had been disturbances of a serious character, and the Chinese were chased off the goldfields of New South Wales, serious riots occurring at Lambing Flat, on the Burrangong goldfield. The Chinese difficulty, so far as the miners were concerned, was solved by the exhaustion of the alluvial deposits; but the mere proximity of China has always appeared a menace to Australia and, at the many conferences of representatives from the various states, the Chinese question invariably held a prominent place. The absence, however, of any Federal authority made common action difficult. In 1888 the last important conference on the Chinese question was held in Sydney and attended by delegates from all the states. The conference resolved that it was necessary to limit the number of Chinese immigrants in order to prevent their becoming an important element in the community. The states, thereupon, either enacted new laws in this sense or amended those existing. This prejudice against Chinese was extended to all Asiatics. But a large number of these were British subjects, and the Imperial Government would not sanction any direct restriction on the movement of British subjects within the Empire. Eventually the difficulty was overcome by the device of an educational test based on the provisions of an act in operation in Natal. It was provided that a person should be prohibited from landing in Australia who failed to write in any prescribed language fifty words dictated to him by the commonwealth officer supervising immigration. The agitation against the Chinese was promoted and kept alive almost entirely by the trades unions, and the restriction acts were the first legislative triumph of the Labour Party, although it was not at the time directly represented in parliament.

Bank Crisis.—In 1893 occurred the bank crisis. Its effects were felt most severely in Queensland, New South Wales, and Victoria, above all in Melbourne. The crisis was by no means a sudden crash, and even when the failures began they were spread over a period of sixteen weeks.

The first noticeable effect was a great scarcity of employment, since much capital was locked up in the banks that had failed. Wages and rents fell precipitately; building almost ceased; credit was greatly restricted, and all speculative enterprise came to an end. The consuming power of the population was greatly diminished, and in 1894 imports decreased by four and three-quarter millions. But good came out of evil. Trade was put on a sound basis, and the abuses of the credit system were abolished. Above all, agriculture everywhere expanded, and the mining industry revived. But for the low prices of staple products, the visible effects of the crisis would have passed away within a few years.

In 1902 occurred the great drought. The disaster was due, in part, to the improvidence of pastoralists, who had made no sort of provision for feeding stock in times of drought. But the lesson was learnt, and, as the year 1903 proved most bountiful, the effects of the disaster quickly passed away.

FEDERATION

In the report of the committee appointed in 1852 to prepare a constitution for New South Wales, the following passage occurs: "One of the most prominent legislative measures required by the colony, and the colonies of the Australian group generally, is the establishment at once of a general assembly, to make laws in relation to those intercolonial questions that have arisen or may hereafter arise among them. The questions which would claim the exercise of such a jurisdiction appear to be (1) intercolonial tariffs and the coasting trade; (2) railways, roads, canals, and other such works running through any two of the colonies; (3) beacons and lighthouses on the coast; (4) intercolonial gold regulations; (5) postage between the said colonies; (6) a general court of appeal from the courts of such colonies; (7) a power to legislate on all other subjects which may be submitted to them by addresses from the legislative councils and assemblies of the colonies, and to appropriate to any of the above-mentioned objects the necessary sums of money, to be raised by a percentage on the revenues of all the colonies interested." This wise recommendation received scant attention, and, though Federation at no time actually dropped out of sight, thirty-five years passed before any practical steps were taken towards its accomplishment. Meanwhile a sort of makeshift, was devised: the imperial parliament permitted the formation of a Federal council, to which any colony that felt inclined could send delegates. Of the seven colonies New South

Wales and New Zealand stood aloof. The council moreover was merely a deliberative body. It had no executive fupctions and possessed no control of funds or other means to give effect to its decisions. Little interest, therefore, was taken in its biennial meetings. In 1899, on the eve of Federation, the council sat for the last time. Major-General Edwards had, in 1889, reported on the defences of Australia. In view of this report, Sir Henry Parkes took such action as led to a conference in Melbourne of representatives from each of the seven colonies. This conference adopted certain resolutions which affirmed the desirability of an early union, under the Crown, of the Australasian colonies, on principles just to all, and provided that steps should be taken for the appointment of delegates to a national Australasian convention. Accordingly the various Australasian parliaments appointed delegates to attend a national convention which was held in Sydney on March 2, 1891. Sir Henry Parkes was elected president. He moved a series of resolutions embodying the principles necessary to establish, on an enduring foundation, the structure of a Federal Government. These resolutions were slightly altered by the conference, and were adopted in the following form: —

1. The powers and rights of existing colonies to remain intact, except as regards such powers as it may be necessary to hand over to the Federal Government.

2. No alteration to be made in states without the consent of the legislatures of such states, as well as of the Federal parliament.

3. Trade between the federated colonies to be absolutely free.

4. Power to impose customs and excise duties to be in the Federal Government and parliament.

5. Military and naval defence forces to be under one command.

6. The Federal Constitution to make provision to enable each state to make amendments in the constitution if necessary for the purposes of federation.

On March 31 Sir Samuel Griffith, chairman of the committee on constitutional machinery, brought up a draft Constitution Bill. This was carefully considered by the convention in committee of the whole and adopted on April g. The convention then formally dissolved. The bill, however, fell absolutely dead, though desire for federation still survived, especially in Victoria.

In 1894 an unofficial convention was held at Corowa, at which the cause of federation was strenuously advocated, but it was not until 1895 that the movement obtained new life. Mr. (afterwards Sir) G. H. Reid of New South Wales convened a meeting of premiers, in which all the colonies except New Zealand were represented, and it was agreed that each parliament should be asked to pass a bill enabling the people to choose ten representatives on a Federal convention; this convention was to frame a Federal Constitution which should be submitted to the people for approval by means of the referendum. During the year 1896 Enabling Acts were passed by the New South Wales, Victoria, Tasmania, South Australia and Western Australia, and delegates were elected by popular vote in all the colonies named except Western Australia, where the delegates were chosen by parliament. The convention met in Adelaide on March 22, 1897, and, after drafting a bill for the consideration of the various parliaments, adjourned till Sept. 2. The delegates reassembled in Sydney, and debated the bill in the light of suggestions made by the legislatures of the federating colonies. As it was announced that Queensland wished to join the proposed union, the convention again adjourned. The third session was opened in Melbourne on Jan. 20, 1898, but Queensland was still unrepresented. The draft bill was finally adopted on March 16 and remitted to the various colonies for submission to the people.

The constitution was warmly received by Victoria, South Australia and Tasmania, but in New South Wales great opposition was shown. The main points of objection were the financial provisions, equal representation in the Senate, and the difficulty of amending the constitution in a conflict with the smaller states. The statutory number of votes necessary for the acceptance of the bill was 80,000. The result of the referendum in New South U7ales showed 71,595 votes in favour and 66,228 against, and the bill was accordingly lost. In Victoria, Tasmania, and South Australia, on the other hand, it was accepted by triumphant majorities. Western Australia did not put it to the vote, as the Enabling Act of that colony only provided for joining a federation of which New South Wales should form a part. The general election in New South Wales, held six or seven weeks later, was fought on the Federal issue. The new parliament decided to send the premier, Mr. Reid, into conference, with a request that the other colonies should reconsider those provisions which were most generally objected to in New South Wales. The other colonies readily agreed to this course of procedure. A premiers' conference, at which Queensland was for the first time represented, met in Melbourne at the end of Jan. 1899. Something was conceded to the claims of New South Wales, but the main principles of the bill remained intact. The bill, as amended, was triumphantly carried in Victoria, South Australia and Tasmania. New South Wales and Queensland carried it also, and the way was now clear for a decision on the part of Western Australia. The Enabling Bill passed through its various stages, and the question was then adopted by referendum.

The colonial draft bill was submitted to the imperial government for legislation as an imperial act. Six delegates were sent to England to explain the measure. A bill was presented to the British parliament and speedily became law. Under this act, which was dated July 9, 1900, a proclamation was issued on Sept. 17 of the same year, declaring that, on and after Jan. 1, 1901, the people of New South Wales, Victoria, South Australia, Queensland, Tasmania, and Western Australia should be united in a Federal commonwealth under the name of the Commonwealth of Australia.

Provisions of the Act. — The six colonies entering the Commonwealth were denominated original states, and new states might be admitted, or might be formed by separation, or union of two or more states or parts of states; and territories (as distinguished from states) might be taken over and governed under the legislative power of the Commonwealth. The legislative power was to be vested in a Federal parliament, consisting of the sovereign (represented by a governor-general), a senate, and a house of representatives. The Senate was to consist of the same number of members (not less than six) for each state, the term of service being six years, but subject to an arrangement that half the number would retire every three years. The House of Representatives was to consist of members chosen in the different states in numbers proportioned to their population, but never fewer than five. The first House of Representatives was to contain seventy-five members. For elections to the Senate, writs would be issued in the name of the state governor, and for general elections of the House of Representatives in the name of the governor-general. The Senate would choose its own president, and the House of Representatives its speaker; each house would make its own rules of procedure; in each, one-third of the number of members would form a quorum; the members of each must take oath, or make affirmation of allegiance; and all alike would receive an allowance of £400 a year. The legislative powers of the parliament have a wide range, many matters being transferred to it from the colonial parliaments. The more important subjects with which it deals are trade, shipping and railways; taxation, bounties, the borrowing of money on the credit of the Commonwealth; the postal and telegraphic services; defence, census, and statistics; currency, coinage, banking, bankruptcy; weights and measures; copyright, patents, and trade-marks; marriage and divorce; immigration and emigration; conciliation and arbitration in industrial disputes. Bills imposing taxation or appropriating revenue must not originate in the Senate, and neither taxation bills nor bills appropriating revenue for the annual service of the Government may be amended in the Senate, but the Senate may return such bills to the House of Representatives with a request for their amendment. Appropriation laws must not deal with other matters. Taxation laws must deal with only one subject of taxation; but customs and excise duties may be dealt with together. Votes for the appropriation of the revenue shall not pass unless recommended by the governor-general. The constitution provides means for the settlement of disputes between the houses, and requires the assent of the sovereign to all laws. The executive power is vested in the governor-general, assisted by an executive council appointed by

himself. He has command of the army ana navy, and appoints Federal ministers and judges. The ministers are members of the executive council, and must be, or within three months of their appointment must become, members of the parliament. The judicial powers are vested in a high court and other Federal courts, and the Federal judges hold office for life or during good behaviour. The High Court has appellate jurisdiction in cases from other Federal courts and from the supreme courts of the states, and it has original jurisdiction in matters arising under laws made by the Federal parliament, in disputes between states, or residents in different states, and in matters affecting the representatives of foreign powers. Special provisions were made respecting appeals from the High Court to the sovereign in council. The constitution set forth elaborate arrangements for the administration of finance and trade during the transition period following the transference of departments to the Commonwealth. Within two years uniform customs duties were to be imposed; thereafter the parliament of the Commonwealth had exclusive power to impose customs and excise duties, or to grant bounties; and trade within the Commonwealth was to be absolutely free. Exceptions were made permitting the states to grant bounties on mining and (with the consent of the parliament) on exports of produce or manufacture, but Western Australia for a time was partially exempted from the prohibition to impose import duties.

The constitution, parliament and laws of each state, subject to the Federal Constitution, retained their authority; state rights were carefully safeguarded, and an inter-state commission was given powers of adjudication and of administration of the laws relating to trade, transport, and other matters. Provision was made for alteration of the constitution of the Commonwealth, but no alteration could be effected unless the question had been directly submitted to, and the change accepted by, the electorate in the states. The seat of government was to be within New South Wales, not less than 100 m. distant from Sydney, and of an area not less than 100 sq. m. Until other provision was made, the governor-general was to have a salary of £10,000, paid by the Commonwealth. Respecting the salaries of the governors of states, the constitution made no provision.

Lord Hopetoun (afterwards Lord Linlithgow) was chosen governor-general, and Mr. (afterwards Sir Edmund) Barton became prime minister. The first parliament under the constitution was elected on March 29 and 30, 1901, and was opened by the Prince of Wales on May 9 following.

The administration of Papua, which had been for some time in the hands of the Queensland Government, was transferred in 1906 to the Commonwealth, and a lieutenant-governor, assisted by an executive and a legislative council, appointed. Under the Treaty of Versailles (1919), Australia accepted the Mandate over German New Guinea and the adjacent islands (see NEW GUINEA; MANDATE).

In Oct. 1908 the Yass-Canberra district, near the town of Yass, N.S.W., was at length selected by both Federal houses to contain the future Federal capital, Canberra (*q.v.*). In 1913 the foundation stone was laid; in 1923 the Parliament House was begun; and on May 9, 1927 the Duke of York opened the first parliament which met in the capital.

THE LABOUR MOVEMENT

The free immigrant and the time-expired convict (who both objected to the competition of the bond labourer) were the pioneers of the Australian Labour movement. After transportation ceased, Labour strove mainly to secure shorter hours. The principle of an eight-hour day was conceded in several trades, and from 1873 to 1889, in spite of a steady fall in the cost of living, wages remained as high as ever. Thus the Labour unions, though as yet without political influence, had proved themselves effective.

After 1884 Labour troubles became frequent, especially in the mines of New South Wales. Work had become difficult to obtain, and some industries had been carried on without any profit. A strike of Newcastle miners, having lasted twenty-nine weeks, came to an end in Jan. 1890. On Sept. 6 the silver mines closed down, and a week later 40,000 men came out. The Great Strike had begun. There were riotous scenes in Sydney and on the coalfields. Towards the end of Oct. 20,000 shearers were called out, and many other trades concerned with the handling and shipping of wool joined in the strike. But early in Nov. the employers gained a decisive victory. The result was the entry of Labour into politics.

Parliamentary Labour Party.—Several attempts had been made by individuals belonging to the Labour Party to enter the New South Wales parliament, but it was not until 1891 that the occurrence of a general election gave the party the looked-for opportunity for concerted action. The results of the election came as a complete surprise; for the Labour Party captured 35 seats out of a House of 125 members. The old parties almost equally divided the remaining seats, and, as a fusion was impossible, the Labour representatives dominated the situation. It was not long, however, before Labour itself became divided on the fiscal question; and, when a Protectionist government came into power, about half the Labour members, by consistent support, enabled it to maintain office for about three years. The party as a political unit was thus destroyed. It was therefore determined to support only those Labour candidates who pledged themselves to vote as the majority of the party had decided. Under this "solidarity pledge," the Labour Party contested the general election of 1894. The result was the loss of 16 seats; but a signal triumph was won for solidarity: very few of those who refused to take the pledge were returned, and the adherents of the united party were able to accomplish more with their reduced number than under the old conditions.

The two features of the Labour Party in New South Wales are its detachment from other parties and the control of the caucus. The caucus, which is the natural corollary of this detachment, determines by majority the vote of the whole of the members of the party, independence of action being allowed on minor questions only. The party has refrained from formal alliance with the other great parties of the state. It supports the Government as the power alone capable of promoting legislation, but its support is given only so long as the measures of the Government are consistent with the Labour policy. This position the Labour Party has been able to maintain with great success, owing to the circumstance that the other parties have been almost equally balanced.

All the other states followed New South Wales in forming a parliamentary Labour Party. It may be noted that South Australia, in addition to the pledge of solidarity, requires that candidates shall have worked for their living at manual labour; and this qualification of being an actual worker was strongly insisted upon at the formation of the party and strictly adhered to, although the temptation to break away from it and accept as candidates persons of superior education and position has been very great.

On the formation of the Commonwealth a Labour Party was established in the Federal houses. It comprised one-third of the representation in the House of Representatives, and a still larger proportion in the Senate. The party was, however, formed on a broader basis than the state parties; for the solidarity pledge extended only to votes upon which depended the fate of a government. The conscription issue of 1916 broke up the Labour party. In 1927 it had not yet regained political power in the federal parliament, and had lost it in the states of South Australia and New South Wales.

LEGISLATION

Australian legislation in the closing years of the 19th century and the first decade of the 20th bore the most evident traces of the Labour Party's influence. In all the colonies every branch of domestic industry has been subjected to the control of specially constituted tribunals, which were empowered among other important functions to fix the minimum rate of wages to be paid to all grades of workmen. (See also the articles ARBITRATION; INDUSTRIAL RELATIONS; TRADE UNIONS.)

Victoria.—Victoria, in 1873, was the first state to pass factory laws. In 1884 a royal commission, appointed two years earlier to inquire into the conditions of employment in the colony and into certain allegations of "sweating" that had then recently been made, reported that: "The most effective mode of bringing about

industrial co-operation and mutual sympathy between employers and employed, and thus obviating labour conflicts in the future, is by the establishment of courts of conciliation in Victoria, whose procedure and awards shall have the sanction and authority of law." This report led to the passing of a number of acts which, proving ineffectual, were followed by the Factories and Shops Act of 1896, passed by the ministry of Mr. (afterwards Sir Alexander) Peacock. This measure, together with several subsequent amending acts, of which the most important became law in 1903, 1905, and 1907, forms a complete industrial code in which the principle of state regulation of wages is recognized and established. Its central enactment was to bring into existence (1) "Special Boards," consisting of an equal number of representafives of employers and workmen respectively in any trade, under the presidency of an independent chairman, and (2) a Court of Industrial Appeals. A special board may be formed at the request of any union of employers or workmen, or on the initiative of the Labour department. After hearing evidence, which may be given on oath, the special board issues a "determination," fixing the minimum rate of wages to be paid to various classes of workers of both sexes and different ages in the trade covered by the determination, including apprentices, and specifying the number of hours per week for which such wages are payable, with the rates for overtime when those hours are exceeded. The determination is then gazetted, and it becomes operative over a specified area, which varies in different cases, on a date fixed by the board. Either party, or the minister for Labour, may refer a determination to the court of industrial appeals, and, should a special board fail to make a determination, the court may itself be called upon to frame one. The general administration of the Factories and Shops Acts is vested in a chief inspector of factories, subject to the minister of Labour in matters of policy. Before the end of 1906 fifty-two separate trades in Victoria had obtained special boards, by whose determinations their operations were controlled.

South Australia.— A similar system was introduced into South Australia by an act passed in 1900 amending the Factory Act of 1894, which was the first legislation of the sort passed in this state. In 1912 an Industrial Court was founded which, unlike that of New South Wales, but like that of the Commonwealth, can call a compulsory conference in any industry in order to avert a strike. The system includes punishment for strikes and lockouts.

Slueensland.— In Queensland, where the earliest factory legislation dates from 1896, keen parliamentary conflict raged round the proposal in 1907 to introduce the special boards system for fixing wages. More than one change of Government occurred before the bill became law in April 1908.

New South Wales.—In New South Wales, whose example was followed by Western Australia, the machinery adopted for fixing the statutory rate of wages was of a somewhat different type—modelled on the Industrial Conciliation and Arbitration Act of New Zealand (1894). A similar measure, under the guidance of the attorney-general, the Hon. B. R. Wise, was carried after much opposition in New South Wales in 1901, to remain in force till June 30, 1908. By it an arbitration court was instituted, consisting of a president and assessors representing the employers' unions and the workers' unions respectively; in any trade in which a dispute occurs, any union of workmen or employers registered under the act is given the right to bring the matter before the arbitration court, and if the court makes an award, an application may be made to it to make the award a "common rule," which thereupon becomes binding over the trade affected, wherever the act applies. The award of the court is thus the equivalent of the determination of a special board in Victoria, and deals with the same questions, the most important of which are the minimum rates of wages and the number of working hours per week. The act contained stringent provisions forbidding strikes; but in this respect it failed to effect its purpose; several strikes in which there were direct refusals to obey awards occurred in the years following its enactment.

Western Australia,— In 1900 and 1902 acts were passed in Western Australia still more closely modelled on the New Zealand act. They reproduced the institution of district conciliation boards in addition to the arbitration court; but these boards were a failure here as they were in New Zealand, and after 1903 they fell into disuse. In Western Australia, too, the act failed to prevent strikes taking place. In 1907 a serious strike occurred in the timber trade, attended by all the usual accompaniments, except actual disorder, of an industrial conflict.

Federal Arbitration Act **of** 1904.—In all this legislation one of the most hotly contested points was whether the arbitration court should be given power to lay it down that workers who were members of a trade union should be employed in preference to non-unionists. This power was given to the tribunal in New South Wales, but was withheld in Western Australia. It was the same question that formed the chief subject of debate over the Federal Conciliation and Arbitration Act, which, after causing the defeat of more than one ministry, passed through the Commonwealth parliament in 1904. It was eventually compromised by giving the power, but only with safeguarding conditions, to the Federal arbitration court. This tribunal differs from similar courts in the states inasmuch as it consists of a single member, called the "president," an officer appointed by the governor-general from among the justices of the High Court of Australia. The president has the power to appoint assessors to advise him on technical points; considerable powers of devolution of authority for the purpose of inquiry and report are conferred upon the court, the main object of which is to secure settlement by conciliatory methods. The distinctive object of the Federal Act, as defined in the measure itself, is to provide machinery for dealing with industrial disputes extending beyond any one state, examples of which were furnished by the first two important cases submitted to the court—the one concerning the merchant marine of Australia, and the other the sheep shearers, both of which were heard in 1907. An additional duty was thrown on the Federal arbitration court by the Customs and Excise Tariff Acts of 1906, in which were embodied the principles known as the "New Protection." By the Customs Act the duty was raised on important agricultural implements, while, as a safeguard to the consumer, the maximum prices for the retail of the goods were fixed. In order to provide a similar protection for the artisans employed in the protected industries, an excise duty was imposed on the home-produced articles, which was to be remitted in favour of manufacturers who could show that they paid "fair and reasonable" wages, and complied with certain other conditions for the benefit of their workmen. The chief authority for determining whether these conditions are satisfied or not is the Federal arbitration court. In 1926 a special Federal arbitration court, entitled the Commonwealth Court of Conciliation and Arbitration was founded, consisting of three "judges" and a chief "judge."

The same period that saw this legislation adopted was also marked by the establishment of old age pensions in the three eastern states, and also in the Commonwealth. By the Federal Act, passed in the session of 1908, a pension of ten shillings a week was granted to persons of either sex over sixty-five years of age, or to persons over sixty who are incapacitated from earning a living. The Commonwealth legislation thus made provision for the aged poor in the three states which up to 1908 had not accepted the principle of old age pensions, and also for those who, owing to their having resided in more than one state, were debarred from receiving pension in any. The pension was raised, in 1919, to fifteen shillings a week, and, in 1925, to one pound.

Tariff.—An important work of the Commonwealth parliament was the passing of a uniform tariff to supersede the six separate tariffs in force at the establishment of the Commonwealth, but many other important measures were considered and some passed into law. During the first six years of federation there were five ministries; the tenure of office under the three-yearly system was naturally uncertain, and this uncertainty was reflected in the proposals of whatever ministry was in office. The great task of adjusting the financial business of the Commonwealth on a permanent basis was one of very great difficulty, as the apparent interests of the states and of the Commonwealth were opposed. Up till 1908 it had been generally assumed that the constitution required the treasurer of the Commonwealth to hand over to the states, month by month, whatever surplus funds remained in his hands.

But in July 1908 a Surplus Revenue Act was passed which was based on a different interpretation of the constitution. Under this act the appropriation of these surplus funds to certain trust purposes in the Federal treasury is held to be equivalent to payment to the states. The money thus obtained was appropriated in part to naval defence and harbours, and in part to the provision of old age pensions under the Federal Old Age Pension Act of 1908. The act was strongly opposed by the Government of Queensland, and the question was raised whether it was based on a true interpretation of the constitution. The chief external interest, however, of the new financial policy of the Commonwealth lay in its relation towards the empire as a whole. At the Imperial Conference in London in 1907 Mr. Deakin, the Commonwealth premier, was the leading advocate of colonial preference with a view to imperial commercial union; and, though no reciprocal arrangement was favoured by the Liberal cabinet, who temporarily spoke for the United Kingdom, the colonial representatives were all agreed in urging such a policy, and found the Opposition (the Unionist Party) in England prepared to adopt it as part of Mr. Chamberlain's tariff reform movement. The Australian ministry therefore, in drawing up the new Federal tariff, gave a substantial preference to British imports, and thus showed their willingness to go farther. Indeed by the Tariff Act of 1921 this favourable treatment of the United Kingdom was considerably extended. *(See* BRITISH EMPIRE.)

RECENT YEARS

The second decade in the history of the Commonwealth was a period of national development. The rapidity of this development was due to the World War, but many signs in Australian political history of the period 1910–28 suggest that war merely hastened what peace would have attained in the end. The construction of the transcontinental railway, the creation of the Australian navy, and the provision of compulsory military training in time of peace, were all products of the years before the War.

Pre-War Period. — The purely political history of this period was marked by several distinctive features. In the first place, there was the definite commitment of the people to certain political doctrines — notably Protection and the maintenance of the "White Australia" policy. In the second place, after 1907, now that questions of tariff had largely ceased to interest the voter, the Labour Party became an important influence in Federal politics. Indeed at the end of 1921, not only was it the sole force in opposition to the Federal Government but it actually held office in every state except Victoria.

The year 1910 saw the end of the third Deakin administration, and in February the House was dissolved. The elections which followed resulted in a substantial victory for the Labour Party under Mr. Fisher, who had previously been prime minister from Nov. 1908 to June 1909. He now returned to office with a working majority both in the Senate and in the House of Representatives. In May 1911 he submitted to a referendum certain amendments of the Federal Constitution, without which the Government could not carry out its avowed programme. These amendments sought to give the Commonwealth Parliament fuller powers to deal with questions of trade and commerce, with labour problems and with monopolies; but the proposals were defeated by about 250,000 votes.

Nevertheless, Labour carried on for two more years, and actually brought into effect important schemes for national defence. The credit for the inception of these schemes was due to the Deakin administration, which in 1909 had not only brought in a Bill enforcing military training on the young men of the Commonwealth, the first instance of compulsory service in an English-speaking community, but also decided to give practical effect to the sweeping recommendations of the Imperial Defence Committee. But Labour had offered no serious opposition to these measures, and when it succeeded to office it spared no effort in giving them the fullest possible effect. Among other legislation of this period was the grant of a "maternity bonus" of £5 on the birth of each child, and the transfer of the Northern Territory from South Australia to the Commonwealth. In 1926 the Federal Government offered to relieve Western Australia of the burden of the north-western part of her territory.

Australia During the World War. — In May 1913 another General Election was held in the Commonwealth. It had a singularly unsatisfactory result in so far as Mr. Deakin's successor, Mr. (afterwards Sir Joseph) Cook, obtained a majority in the House of Representatives but was unsuccessful in the Senate. In these precarious circumstances he managed to survive until July 30 1914 when a dissolution of both Houses was granted. Five days later, war broke out. There was an immediate outcry for the abandonment of the elections, but the writs were already out, and an attempt to arrange an allotment of seats and form a National Government signally failed. For nearly two months Mr. Cook and his colleagues conducted Australia's war effort, and it is to them that the credit for the initial organization of the Australian Imperial Force belongs.

The election took place on Sept. 17. Again Mr. Fisher triumphed, and he at once proved that Labour was no less ready and eager than its opponents to put every effort into the war. For more than a year Mr. Fisher remained at the head of affairs. Then, in Oct. 1915, he accepted the appointment of High Commissioner in London and was succeeded by the attorney-general, Mr. W. Morris Hughes.

For the next seven years the political history of the Commonwealth was dominated by the personality of Mr. Hughes. His services to Australia and to the Empire may have been somewhat over-estimated when he was in power, but there is little doubt that, in the reaction that followed his fall, they came dangerously near to being forgotten altogether.

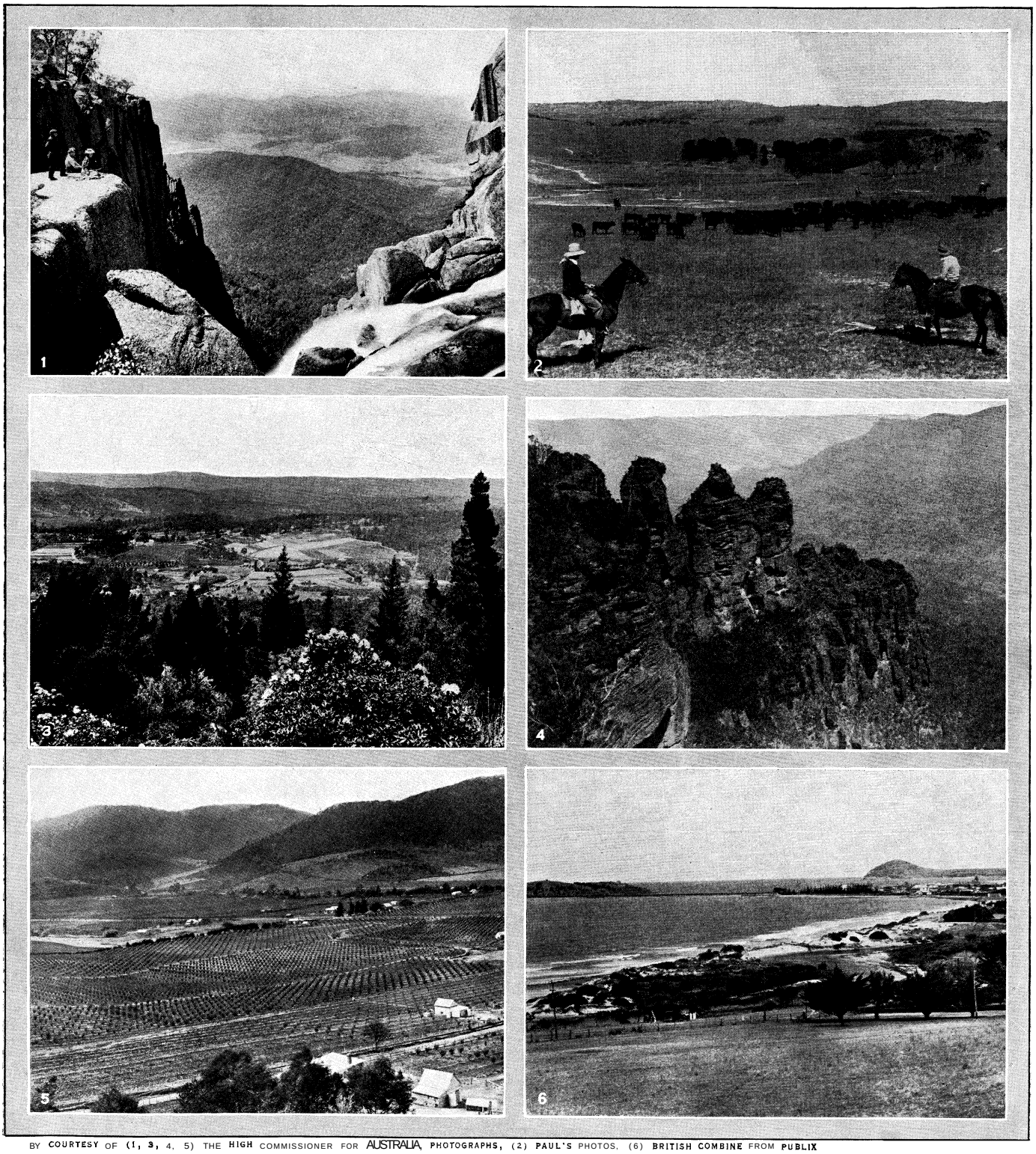
In 1916 he travelled to Great Britain, where he achieved remarkable success by his hard-hitting speeches. But with his return to the Commonwealth there came an anticlimax. The tide of recruiting had begun to fall, the best of Australia's manhood had already left for the front, and the nation waited for Mr. Hughes to declare for the measures of conscription which he had advocated so whole-heartedly abroad. He hesitated, and finally decided to submit the question of conscription to a referendum. The referendum was held and conscription was decisively rejected by the people.

The immediate result was the break-up of the Labour Party. A second referendum and a second defeat made it impossible for Mr. Hughes to remain leader of a party which had officially rejected the most vital clause of his policy, and in 1917 he crossed the floor of the House and formed the Australian National War Government. The new Ministry was recruited mainly from the ranks of the former opposition and included only three of the prime minister's former colleagues. The Armistice came a year after the reshuffle and once again Mr. Hughes visited England. His vigorous assertion of Australian claims, both in London and at Versailles, re-established his popularity.

The War Effort. — The sacrifices of the nation are shown by the following figures: Australia sent 329,883 troops overseas. The casualties of this force reached the high proportionate total of 314,078, of which 59,302 were deaths from wounds or disease. Other casualties from wounds or gas totalled 166,819, and there were 87,957 cases of sickness. The financial drain of the War on a young nation of fewer than 6,000,000 inhabitants was appalling. It is estimated that the total war expenditure, in which pensions and allowances played a large part, was, up to June 30, 1927, nearly £660,000,000.

Australia made generous provision for ex-service men. Pensions payable for total disability ranged from £2 to £3 a week, with extra provision for a wife and all children under 16 years of age. Ex-soldiers and sailors were liberally helped to re-establish themselves in civil life, and the Commonwealth Government, co-operating with the state governments, provided farming lands, grants and loans for houses, working capital, etc. A scheme was also formed to provide education for war orphans and the children of incapacitated ex-soldiers.

Post-War Problems. — Labour had been badly beaten at a "khaki" election in 1919, and Mr. Hughes was branded as a traitor by his old associates. The Nationalists were divided, for the new

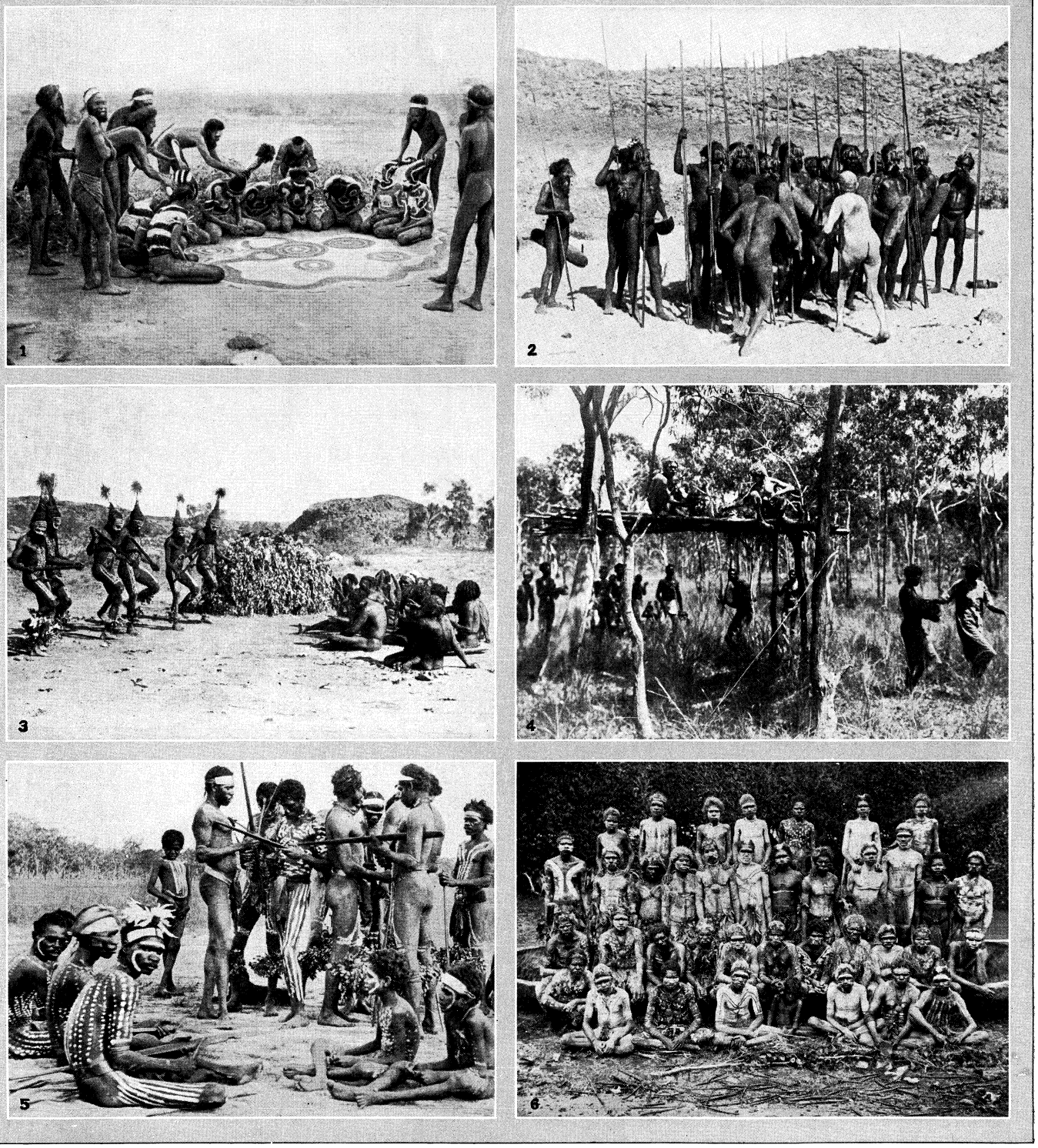


BY COURTESY OF (1, 3, 4, 5) THE HIGH COMMISSIONER FOR AUSTRALIA, PHOTOGRAPHS, (2) PAUL'S PHOTOS, (6) BRITISH COMBINE FROM PUBLIX

VIEWS IN AUSTRALIA AND TASMANIA

1. Mount Buffalo gorge, Victoria, overlooking a beautiful section of country
2. Herding cattle on an Australian ranch
3. Piccadiliy, South Australia, as viewed from Carnmow, Mount Lofty Summit
4. "The Three Sisters," rocky pinnacles of the Blue mountains, in New South Wales
5. An apple orchard in the Bagdad valley, Tasmania
6. Victor harbour in South Australia, with Granite Island at the extreme left

AUSTRALIA



(1, 2, 3) FROM SPENCER AND GILLEN, "THE ARUNTA," MACMILLAN; PHOTOGRAPHS, (4, 6) INTERNATIONAL NEWSREEL, (5) EWING GALLOWAY

TRIBAL CUSTOMS AND CEREMONIES OF ABORIGINES OF AUSTRALIA

1. Representatives of the Warramunga tribe removing their grotesque headgear after a ceremonial dance
2. Atninga Arunta tribe. The women in the foreground are testing the shields of the men after their return from an avenging expedition. One has covered her body with white pipeclay because she is in mourning
3. The totemic dance performed by masked members of the Arunta aborigine tribes, of Queensland, in which they imitate the frog and the kangaroo. This is a part of the Tjitjingalla corrobboree (ceremony)
4. A platform in the northern territory of Australia on which the natives bury their dead. The corpse is wrapped in leaves and bark and left on the platform for a year
5. A tribe of savages in the "bush" near the coast of southwest Australia, regarded as the most savage people of the antipodes. They consist almost entirely of criminal aborigines and their offspring
6. Picture of a group of aborigines of the northern territory of Australia after decorating themselves with coloured clay and ochre in preparation for the corrobboree

"Country Party" was disposed to flirt with Labour. There were personal considerations as well, and although Mr. Hughes paid a successful visit to the Imperial Conference of 1921 his success was coldly received by his own countrymen.

The eighth parliament of the Commonwealth came to an end at the close of 1922. The elections, held in December, were marked by the most violent personal bitterness, and, although Labour again suffered defeat, it was evident that no alliance of Nationalists and the Country Party was possible under the leadership of Mr. Hughes. An acceptable successor was found in Mr. Stanley Melbourne Bruce. His first task was to form a coalition with the strongly reinforced Country Party. Dr. Page, its leader, became Treasurer, and the administration was known as the Bruce-Page ministry. But Mr. Bruce was the real leader, and by the time he came to visit London for the Imperial Conference of 1923 his position was firmly established.

The chief business of the Conference was concerned with Imperial Preference. Mutual preference was agreed to between Great Britain and Australia. But the new Government of Mr. Ramsay MacDonald neither carried out these arrangements nor approved of a naval base at Singapore. Mr. Bruce replied by a new naval programme, a scheme to assist exporters, and a series of Bounty Bills to help the primary producer. A reciprocal trade treaty with Canada was also sanctioned.

A long series of shipping strikes culminated in the crisis of 1925. Shipping in Australian ports was held up and trade production seriously affected.

A general election was held in Nov. 1925, which resulted in the heavy defeat of the Labour Party in both Houses. Voting was compulsory under a penalty of £2.

The year 1927 was disturbed by two strikes of unusual magnitude. The strike of the sugar-cane workers in Queensland spread to the railway unions, and threatened a serious constitutional crisis, which was, however, averted by the firmness of the Queensland premier, Mr. McCormack. The strike of the waterside workers, at the end of the year, was even more serious. A bill imposing penalties for unjustified strikes and lock-outs was introduced in the Commonwealth Parliament.

In 1916 the Commonwealth Shipping Line had been floated by Mr. Hughes. Heavy reverses were experienced, and the Australian Government was compelled to advocate the disposal of the line. In Nov. 1927 Mr. Bruce defeated the Labour vote of censure on his policy, and on April 24. 1928, he announced the acceptance of the White Star Line's tender of £1,900,000. Mr. Bruce became prime minister in 1928, but was succeeded in 1929 by the Labour leader, Mr. J. H. Scullin. In January 1932 a government was formed by Mr. J. A. Lyons, leader of the United Australia Party. In August 1935, Sir Alexander Gore Arkwright Hore Ruthven succeeded Sir Isaac Isaacs as Governor General, and Australia, following Canada and South Africa decided to appoint a High Commissioner in London. In June 1935, a Joint Committee of Lords and Commons in London declined to entertain a petition from Western Australia dealing with the secession controversy. The British Committee held that such a petition should be presented by the Commonwealth as a whole.

CONSTITUTIONAL QUESTIONS

Experience has demonstrated the marked rigidity of the Australian Constitution. Between 1908 and 1927 only one amendment was carried in accordance with the procedure outlined in section 128. The situation foreseen by certain critics, in which proposed amendments would be carried by sweeping popular majorities, but lost to an opposition strong enough to control three small states, did not occur. The submission of proposed alterations to a referendum proved a sufficient barrier.

Proposed Amendments. — In 1910, simultaneously with the general election of April 13, electors were asked to decide on two constitutional amendments. By section 105 of the constitution the power of the Commonwealth to take over the debts of the states was limited to debts already existing at the date of the Commonwealth's establishment. By the amendment, state public debts incurred later could also be taken over. This amendment was accepted by a majority. The other proposal, although passed in Parliament, was rejected. It related to the allocation of the customs and excise revenue bet een the Commonwealth and the states. Under section 87, the Commonwealth's share was limited to one-fourth of its total. This arrangement was to continue for a period of ten years and thereafter until the Commonwealth Parliament otherwise provided. Parliament resolved, however, to diminish the proportion left to the states to an amount representing £1.5.0. for each unit of population — and to do so, not by statute, a course which was open under section 87, but by constitutional amendment, in order to give the states a somewhat more stable claim on the proportion left to them. At a slightly later date, an ordinary statute to the same effect was passed. The effect of this was greatly to enhance the financial importance of the Federal Government, while the corresponding reduction of the states' share in customs and excise revenue, by approximately 50%, initiated a period of considerable stringency in their finances.

A further unsuccessful effort to amend the constitution was made in 1911. On April 26 of that year, a referendum was submitted to the people the object of which was to give to the Commonwealth parliament power to deal with the following matters: —

(a) Trade and commerce, without any limitations, instead of "trade and commerce with other countries, and among the states."

(b) The control and regulation of corporations of all kinds, except those formed not for the acquisition of gain. (Only "foreign corporations and trading and financial corporations formed within the limits of the Commonwealth" came under the jurisdiction of the Federal parliament.)

(c) Labour and employment, including wages and conditions of labour and the settlement of industrial disputes generally, including disputes in relation to employment on state railways. (Conciliation and arbitration by the Commonwealth operate only in the case of any industrial dispute extending beyond the limits of any one state.)

(d) Combinations and monopolies in relation to the production, manufacture, or supply of goods or services.

This proposal was rejected by a majority and also by a majority in every state except Western Australia. On the same occasion and as an outcome of the same legislation, it was proposed to insert in the constitution the following sub-section: —

"When each House of Parliament, in the same session, has by resolution declared that the industry or business of producing, manufacturing, or supplying goods, or of supplying any specified services, is the subject of any monopoly, the Parliament shall have power to make laws for carrying on the industry or business by or under the control of the Commonwealth, and acquiring for that purpose on just terms any property used in connection with the industry or business."

This proposal was also rejected by closely similar voting. In 1913 the same proposed alterations of the constitution, with certain minor changes, were again submitted in the form of six separate amendments. They were again rejected, although on this occasion a majority for them was obtained in Queensland, South Australia and Western Australia, while New South Wales, Victoria and Tasmania were hostile. In 1919 proposals were again submitted to a referendum for extending the legislative powers of the Commonwealth relating to industrial disputes and the nationalization of monopolies. Both proposals were rejected. On this occasion South Australia was hostile, but Victoria gave a majority for the proposals, as did Queensland and Western Australia. In 1926 Mr. Bruce's Government desired to give further powers to the Commonwealth in regard to (a) Industry and Commerce and (b) Essential Services. The proposals were submitted in a referendum on Sept. 4, and both were rejected by a majority.

Decisions of the High Court. — Apart from action of a legislative character directly altering the nature of the constitution, there must be noted, within the period 1900 to 1925, certain constitutional changes due to the activity of the High Court. In connection with cases of overlapping of State and Federal powers, what amounted in the circumstances to a new principle, was enunciated by the majority of the Court in the following terms: —

"That section (sec. 109) which says 'When a law of a State is inconsistent with a law of the Commonwealth, the latter shall pre-

vail, and the former shall, to the extent of the inconsistency, be invalid,' gives supremacy, not to any particular class of Commonwealth acts, but to every Commonwealth act, over not merely State acts passed under concurrent powers but all State acts, though passed under an exclusive power, if any provisions of the two conflict; as they may." (The Amal. Soc. of Eng. *v.* the Adelaide S.S.Co.—28 C.L.R.129.)

This important determination has obviously affected the independence and dignity of the states. The total disbursement, *e.g.*, to be made to its railway or other industrial servants by any state, may now depend not on the decision of the taxpayers of the state, but on that of an organ of the Federal Government (the Court of Conciliation and Arbitration). This would appear to be a substantial derogation of the states' financial autonomy, which in other portions of the constitution is carefully safeguarded. The High Court also decided the true meaning of section 92 of the constitution, the important part of which is as follows:—

"On the imposition of uniform duties of customs, trade, commerce and intercourse among the States, whether by means of internal carriage or ocean navigation, shall be absolutely free."

The attempts of various states to maintain control over some commodity whose place of origin was within their territory met with varying degrees of success. In New South Wales the state had taken over the whole of the wheat in the state, and refused to sell it in other states except upon its own terms. The Court held that this constituted no violation of section 92. The ownership had passed to the King. If his advisers wished to export it to another state they were free to do so. Later a New South Wales statute purported to make public property of pigs. Here, however, the Legislature had provided that the ownership should pass only upon a proclamation, and that in the interim no holder should export except in certain conditions. This additional provision, as infringing the prohibition of section 92, was held to be invalid.

When a similar question arose in Queensland over the position created by a statute (modelled upon the New South Wales statute) in which the operative words were equivalent, the Court changed its attitude and. on fuller consideration, came to the conclusion that in the interval preceding the actual transfer of stock, or meat, to the King, an intermediate type of property interest, not previously known to the law, had been created, and that it was within the province of the state Legislatures to create such new forms of property. Confronted later with the somewhat different problem presented by the action of the Queensland parliament in endeavouring to make it unlawful for the trader to sell commodities within Queensland at anything above an officially proclaimed price, the Court held that so far as it sought to impose this prohibition upon traders of other states this act was invalid. (McArthur *v.* Queensland 28 C.L.R. 530.)

This decision also has affected the standing of the constituent states of the Commonwealth, by imposing a definite limitation upon their legislative powers. Whether the same limitation would apply to the legislation of the Commonwealth was, of course, not a matter to be decided. But the majority of the Court indicated clearly that they considered it would not. The net result of the judgment would thus appear to exclude a whole field of legislation from the jurisdiction of the states and leave it, subject to any further decision of the High Court, to the Commonwealth.

In June 1927 a conference between the Federal prime minister and the State premiers established the principle of a Loan Council under the Commonwealth to prevent unchecked and competitive borrowing by State Governments, a measure described by Mr. Bruce as "the most important financial measure submitted to the Commonwealth parliament since the Commonwealth was constituted."

Australia and the League of Nations.— From the inception of the League, Australia has sent delegations to the Assembly. In 1924 both parties in the Federal parliament were represented. Since 1922 a woman has always been sent as substitute delegate. Australia has also taken part in every conference of the International Labour Office. League of Nations unions exist in all the six states, and useful propaganda work has been done. The public opinion thus created has been of service in the good administration of the Mandated Territories. A chair of anthropology founded at Sydney university should help to train suitable administrative officers.

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See also special articles on the different States of the Commonwealth of Australia.

(H D. N.)

DEFENCE

The development of a self-reliant national spirit in Australia can be traced directly to the withdrawal of British troops in 1870 which caused Australians to face the question of defence without immediate help from elsewhere. The despatch from Sydney of a contingent of New South Wales troops amidst scenes of great enthusiasm to fight in the Sudan in 1885 marked a further step towards co-operation with Great Britain in emergencies. The occasion was marked by a prophetic speech by the prime minister (W. B. Dalley) "All statesmen who contemplate disturbing the world's peace will from this time not limit their calculations as far as England is concerned to her ironclads and to her armies. They will consider the rapidly increasing millions of colonial subjects." Further demonstrations, from all the six Australian colonies, occurred in Jan. 1895, and all sent contingents to the Boer War of 1899–1902, at which period we can date the birth of the Australian nation. In March 1901 the newly-formed Australian Federal Government took charge of defence questions and of the existing defence forces. These included:— from New South Wales, 9,338; Victoria, 6,335; Queensland, 4,028; South Australia, 2,932; West Australia, 2,096; Tasmania, 2,024; making a total of 26,753, excluding cadets, reserves, rifle clubs, etc. Universal service in time of war, for all able-bodied men between the ages of 18 and 60 years, was introduced in 1903–04; universal military training, made law for the first time in modern days for any English-speaking community, was in force in 1911. The necessary legislation had been passed in 1909 on the advice of Lord Kitchener. 412,953 Australians joined the military forces in the World War of 1914–18, and 331,781 of them served outside their own country, suffering 214,630 casualties including 56,132 deaths, and establishing for all time the fame of Australians as hard and skilled

fighters. The year 1921 saw another administrative advance, the establishment of a divisional organization, wherein the traditions and the laurels earned in Gallipoli, in Palestine and in France and Flanders can be maintained in perpetuity. Such has been the history of military developments in Australia since 1864, when other European nations began to acquire territory in Australasian waters, to the present day.

Present-day Army.—The military forces of the Commonwealth of Australia are composed of a permanent force and of a citizen force known as the militia. In time of war all men between the ages of 18 and 60 who are British subjects and have resided in Australia for 6 months or more are liable to serve in the latter, but in 1929 the provisions of the Defence Act making militia service compulsory in time of peace were suspended The militia is recruited from men between 18 and 40 years of age, who are engaged for periods of three years and may be re-engaged for successive periods of one year each until the age for retirement (48) is reached. The permanent force is recruited by voluntary enlistment for five years' continuous service, with re-engagements for periods of three years. Its principal function is to train the citizen force and cadet units, and to provide a skeleton force to man posts of strategic importance.

Strength and Organization.—The budget effective strength of the permanent force in 1937–1938 was 2,448 (subsequently in course of expansion to 7,500), of whom 261 were officers of the staff corps—*i.e.*, graduates of the Royal Military College. In this year the total strength of the military forces was rather over 37,000, but on the outbreak of the war in September 1939, the militia amounted to 78,000. The permanent force includes, besides the staff corps, certain coastal defence and anti-aircraft units, together with details of survey corps, army service corps, army ordnance corps, army medical and veterinary corps, and it is intended to form other field units. Apart from a few ordinary regular units who train throughout the year, it is organized for instruction and administration. The militia is organized to provide the peace nucleus of the field army, with line of communication and maintenance units, and part of the personnel for the coastal and anti-aircraft defences.

Following reports in 1938 by the inspector-general to the forces, the army was re-organized into four commands, Northern (Queensland), Eastern (New South Wales), Southern (Victoria, S. Australia, Tasmania), Western (W. Australia) and the independent garrison of Port Darwin, so that army headquarters now has to deal directly with only five subordinate headquarters. The higher direction of Australian defence policy is controlled by a council of defence, composed of the prime minister, the treasurer, the minister for external affairs, the minister for defence and the chiefs of staff of the three services. The administration is conducted by the defence department, while naval, military and air boards administer the respective services, and government factories are under the supervision of the munitions supply board. There is a defence committee exactly analogous with the chief of staff's sub-committee of the committee of imperial defence. The military board is composed of the minister for defence, the chief of the general staff, the adjutant-general, the quartermaster-general, the finance member and secretary.

Military Education.—The military college at Paddington, N S.W., trains both Australians and New Zealand cadets for four years, the Australians joining the permanent force. On receipt of commissions graduates are attached to a regular regiment or corps in Britain or India for a year's training. There is a school of artillery at Sydney, a small arms school at Randwich, N.S.W., and an Army Service Corps training school at Melbourne. There is a central training depot for the permanent force. The co-ordination between the British and Australian land forces is close: the Australian general staff is a branch of the imperial general staff, and Australian officers graduate at the staff and imperial defence colleges. But in manufacture of munitions Australia is self-supporting.

The only permanent fortifications in Australia are those defending certain harbours and anchorages considered to be of strategic value to the Australian and British navies.

Air Force.—The Royal Australian air force is not embodied in the army. It is administered by the Air Board, which has representatives at the Air Ministry in London; the Board consists of three air force members and a finance member. In 1938 the strength (budgetary effectives) of the R.A.A.F. was 2,472. but in that year and 1939 a program of expansion was adopted and plans were passed to promote the manufacture of aircraft in the Dominion: thus in December 1938 a supplementary appropriation increased air force expenditure from £12,512,000 to £16,444,000. On the outbreak of war in 1939 it was decided to send a detachment of 3,200 men to Europe.

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(G. G. A.; X.)

Navy.—Until the end of the 19th century the Australian Colonies relied upon the mother country for Naval Defence. From 1895, under the Australasian Defence Act an annual payment of £100,000 was made towards the expense of the squadron in Australasian waters and this contribution was increased to £200,000 in 1903, in which year the training of the Australian Naval Reserve Force was commenced. Later the Commonwealth Government decided to form an Australian navy for its own defence, and in 1909 the first units, three destroyers, were ordered in England. There followed the laying down of a battle-cruiser ("Australia") and two cruisers ("Sydney" and "Melbourne"), and with the arrival of these ships in Australian waters in 1913, the Royal Australian Navy came into being as a fleet unit. This squadron, controlled during peace by the Commonwealth Government, is in war time at the disposal of the British Admiralty, though it may not leave Australian waters without the concurrence of the Commonwealth Government.

In 1914, on the outbreak of war, the Australian fleet, to which two submarines had been added was first employed in the capture of the German Pacific Colonies, and afterwards, under the direction of the Admiralty, served in all parts of the world, its most notable achievement being the sinking of the "Emden" by H.M.A.S. "Sydney" in Nov. 1914. After the armistice all warship building was suspended and the personnel was reduced, by 25 per cent, to 3,500. As a result of the Washington Treaty the battle cruiser "Australia" was disposed of by sinking her and the number of ships in commission were reduced from 25 to 13. In 1925 the Commonwealth Government decided to bring their fleet up to date by building two 10,000 ton cruisers ("Australia" and "Canberra"), two submarines and a seaplane carrier. These ships, completed in 1928, brought. the strength of the Royal Australian Navy to 6 cruisers (2 modern) 12 destroyers (6 modern) a seaplane carrier, 3 submarines and 4 sloops. The chief naval base is at Sydney and at the Officers Training College at Jervis Bay and the Training Schools at Geelong the training is similar to that in the establishments in Great Britain. Australian Naval expenditure from 1922–28 averaged approximately £2,500,000.

(S. T. H. W.)

ECONOMIC AND INDUSTRIAL DEVELOPMENT

General Conditions of Settlement.—Regarding the continent as an area for settlement, size implies room, scope, variety. Its world position implies an element of remoteness and isolation, but with contacts, which are physically most direct, with south-east Asia and Pacific marginal lands. These are factors which must exert a permanent influence. If they are to be counteracted in any special human "interest" (*e.g.*, British empire), a definite effort is required—the more so as isolation in the case of Australia implies individuality, not to say, insularity.

An island with a long coast-line and hence a potentially well-developed coastal and maritime life, Australia is yet a continent with continental interests. The most influential characteristic of its surface is perhaps its flatness. Owing largely to this, minerals (including coal), sub-surface waters and easily-worked soils are widely available, while movement and transport—except where coastal highlands create obstacles—are facilitated. On the other hand surface-drainage and water-power possibilities are not bene-

fited, though the juxtaposition of lowlands and steep-rising, valley-seamed highlands favours irrigation works and also gives in places a welcome change of climate and scenery within a small space.

Climate is a strong determinant as regards settlement: in climatic conditions some of Australia's major problems are rooted. Here size implies variety: Australia has climates ranging from sub-equatorial to cool temperate. Flatness, or low relief, here works mostly adversely. Australia—unlike, *e.g.*, Africa—has comparatively little lofty land in the tropics where it might mitigate temperatures. Instead, the most mountainous parts are in temperate latitudes occupying space which would be more valuable were it low. The rims of the continent, again, catch much of the rain, especially on the east, and though there is strictly no "dead heart," the areas of maximum vitality are broadly peripheral. So far as heat alone is concerned, few parts of Australia seem unsuited for "whites," especially as "tropical" diseases are few. The dry heat of most of the continent, including the inner north, is not unhealthy, provided hygienic modes of living are observed. The hot, damp, coastal lowlands, on the other hand, present a different problem. Much of the richer (alluvial) soil of the north is thus situated and often, in addition, liable to floods.

Apart from questions of health, humidity broadly speaking determines economic productivity, mining excepted. The vegetation belts or areas (*v. supra*) serve as rough indices. They show a general progression from more intensive agricultural, forestry and industrial possibilities in the coastal parts to more extensive and mainly pastoral possibilities inland, the process of closer settlement having, in historical fact, gradually pushed the large holdings in many parts backwards into the interior. Over very large areas, and in a degree not paralleled in a country like England, an assured water-supply is the essential prerequisite of settlement and of economic stability. Useful soils in great variety abound but, while those situated in humid areas are, or were originally, mostly tree-clad, those having a lighter cover are in drier parts. Thus, where the change of environment for British peoples is least, the initial effort of settlement is often greatest: conversely, where little labour (in clearing) is required, the necessity for adaptation and for learning new methods (*e.g.*, dry farming) is greatest. Pests, animal and vegetable, are further to be reckoned with, and variability of climate, particularly of rainfall, introduces uncertainty. Production statistics in Australia, partly for this reason, often show considerable variations and are best considered over periods of years. In many respects, therefore, Australian conditions demand close and even rigid adaptation and in turn they stamp upon those who learn to conform a certain regional individuality.

Regional Character of **Settlement.**—What precisely that regional character is will depend largely on the type of people who settle there. The "aboriginal" population (c. 60,000) is now confined mainly to the north and north-west. They include (*e.g.*, in the north-west) some fine types. The Australian "black," in fact, is more intelligent, adaptable and capable of civilization than is usually believed. Of the remaining population, 6,629,839 (Census, June 30, 1933), a very large proportion has been derived from the British Isles, though the proportion of native-born Australians is rapidly growing. (Census 1933: born in Australia, British Isles and New Zealand together, 97.62%; other European countries, 1·43%; remainder, ·90%.) The settlement and development of Australia therefore depends, and will probably continue to depend, essentially upon the adaptability of British stock to Australian environmental conditions. In this connection the situation is on the whole favourable. The necessarily marginal and sub-oceanic character of much of Australia's life is particularly favourable to British inherited experience, especially in the more southerly latitudes. British peoples also possess a talent for executive and administrative government of the "committee" or "board" type. This has proved particularly useful in Australia where the physical difficulties facing centralized control are considerable and local self-government is essential. Further, some of Australia's chief problems—water-supply, irrigation, etc.—demand large-scale corporate action for their solution. This has been achieved (*e.g.*, by the various water-boards and conservation commissions) democratically and yet with reasonable efficiency. The same applies, broadly speaking, to the physically large-scale problems of political and social organization (*e.g.*, education). British settlers, moreover, adapt themselves to Australian environment and learn, if somewhat slowly, to cope with its often imperious dictates. On the other hand they have shown as yet little special ability, or will, to adapt themselves to damp tropical conditions. Hence, perhaps, the real threat of "alien," including southern European (*e.g.*, Italian), immigration which is felt as a menace in proportion as it may succeed under conditions which the dominant stock will not readily tolerate. On the whole the severity of Australian "controls" seems to have had few ill effects, though it has perhaps intensified individualism. It is leading to the development, not only of an Australian type, but of regional subtypes—a fact noticeable not only among human-kind, but amongst the sheep and cattle population also. At the same time. physical isolation contains germs of danger and is evoking special efforts to counteract it (*e.g.*, by the development both internally and externally of "wireless," aerial transport, etc.). Another phenomenon, due partly to the same cause, is the marked tendency towards concentration in cities. In this, not in itself wholly harmful, there may be traced the working of factors which are partly sociological but partly also economic and which make for the development of Australian civilization.

Compared with, say, the North American continent Australia bulks small in terms of absolute economic values. Measured by the physical scale and difficulty of its problems, by the small number of people and the relatively short time they have been engaged, the economic development and national productivity are impressive. Partly, no doubt, this is due to relative lateness of growth whereby the purely pioneering stage has been curtailed and the weapons and technique of 19th century civilization were available. But largely also the new and vitalizing environment, the challenge of great tasks and greater rewards, have liberated energy and widened the scope of its application, so that Australia, continentally and in its own individual way, reflects and epitomizes the processes and impulses which created, and which sustain, the British empire. The second major stage of Australian development is now closing or closed. The new era, born partly in the experiences of war and inspired more or less consciously by external examples and ideals (*e.g.*, of the United States), is marked by the large-scale application of science to the solution of national problems, whereby a people, vigorous and intelligent, is organizing its next great advance and is seeking, with virtual certainty of success, to enlarge, intensify and strengthen its hold over a somewhat baffling physical environment.

MINING AND MINERALS

The broader aspects of mineral occurrence in Australia have been referred to above. Although the value of production from the mineral industry is now much less than that of the agricultural and pastoral industries, it was the discovery of gold which first attracted settlement on a large scale, and hence laid the foundations of the country's present development. Pending a complete geological survey, it is as yet impossible to arrive at an accurate estimation of Australia's mineral wealth; but it can be safely stated that by comparison with, *e.g.*, the United States, a country of about the same area, the mineral resources are small. Further prospecting will almost certainly reveal new deposits, however, and in some cases, deposits known to exist have not as yet been worked. Until 1931 the mineral production of Australia had been in slow decline for many years. One of the main causes of the decline was the exhaustion of many ore-bodies which, although exceedingly rich, had in some cases been worked continuously since the middle of the nineteenth century. Other factors contributing to the decline of the industry were: high costs of production and transport, low prices, labour difficulties, inaccessibility of deposits and difficulties of exploitation.

With the enhanced prices of precious metals after 1931, the decline was arrested, and since that date production has increased (value of Australia's mineral production 1932—£15,583,391; 1937—£32,296,980). Gold was for the greater part responsible

for this increase, but the production of silver, zinc, lead, copper and coal also increased. It is noteworthy that since 1931 advanced geological methods and technical improvements have been employed in existing concessions. Mines regarded as unworkable or extinct have thus been reopened, and so the increased output of Australian mines must not be ascribed entirely to the discovery of fresh deposits. Between 1900 and 1930 Australian mining remained in a stationary position, the value of the annual output being about £23,500,000. In the meantime the development of other industries reduced the relative importance of mining in Australian economy, for whereas in 1910 mining represented 12·3% of the total annual production, in 1926 mining represented 6% and in 1936, 6.6%. New South Wales has for long been the chief producer of minerals (1937, £11,988,088). The other states are, in order of importance: West Australia (£9,171,372), Queensland (£4,392,492), South Australia (£2,502,795), Tasmania (£2,282,365), Victoria (£1,832,019), and Northern Territory (£127,849).

Gold.—The maximum recorded production of gold was £16,300,000 in 1903. From 1903 to 1930 production diminished (minimum 1929, £1,814,000) as a result of the exhaustion of many fields, and owing to the high commodity prices of the post-war era. Australia's share of the world production of gold fell from 24·4% (1910) to 2·6% (1930).

Currency devaluation in various countries after 1931 evoked a sharp rise in the production of gold and in 1938 Australia produced 1,570,000 fine oz. (4.2% of world production) compared with 467,742 oz. in 1930. Until 1898 Victoria was the chief producer but since that date West Australia has held the first place (maximum in 1903, £8,770,000; 1937, £8,689,000). Third in order of importance comes Queensland. The remaining states produced in aggregate less than £1,000,000 worth (9% output) in 1937. The greater part of the gold is obtained from reefs, especially in West Australia and Victoria, but in the Eastern Highlands alluvial washing is important (chiefly New-South Wales and Victoria), while some gold is obtained from the smelting of other ores, chiefly copper. Australia ranks fifth in order of gold production, coming after South Africa, Russia, Canada and the U. S. A.; and in 1936 33,000 workers were employed in the industry.

Silver-lead.—These minerals are found in close association, particularly in New South Wales. The peak of production was reached in 1918 (£6,100,000—*c.* 6% of the world's production) but owing to labour troubles and economic crises production fell off sharply. The 1936 figure (£4,900,000—3·8% of the world's production) represents a recovery since 1931. Broken Hill, in New South Wales, is the chief centre of production, and up to 1936 had contributed £163,000,000 to the wealth of Australia. The output of silver-lead from Broken Hill reached its maximum in 1923 (value £5,700,000), and in 1936 production was valued at £4,600,000, comprising over 75% of total Australian production. Mount Isa, in Queensland, discovered in 1923, produced a large quantity of the silver and all of the lead obtained in the state during 1936. In spite of early hopes this new field is by no means as important as Broken Hill (1936, Mount Isa £899,000, Broken Hill £3,820,000). The Magnet, Lyell and Zeehan mines of Tasmania produced £215,449 in 1936, and of this lead accounted for the greater proportion. About 12% of the silver (103,000 oz.) was obtained from copper ores. New discoveries of ore have been made near Franklin Harbour and Rapid Bay (South Australia), but as yet little attempt has been made to exploit them.

Zinc.—The greater part of Australian zinc is produced at Broken Hill, where since 1909 improved methods have allowed extraction of the metal from silver-lead ores (prod. 1936, £1,120,000). The remaining proportion of Australian zinc was produced at the Mount Isa mines (see above) and in Tasmania, where production recommenced in 1936 after a lapse of 5 years.

Tin and Copper.—Tin is derived from alluvial deposits and from lodes, veins, etc., usually in association with acid granites. New South Wales (Tingha area), Tasmania (Mount Bischoff), and Queensland (Herberton, Stanthorpe, etc.) are the chief producers. Output has fallen from £1,500,000 (1907) to £658,000 (1936). Owing to high production costs Australia is greatly affected by fluctuations in the price of tin, and so output varies from year to year according to world conditions. Copper mining is similarly subject to price fluctuations. The Queensland and New South Wales fields have ceased or restricted production, so that 70% of Australian production now comes from the Mount Lyell mines of Tasmania, which have the advantages of high grade ore and hydro-electric power. Copper production reached its maximum output in 1917 (£4,860,000) with 9,000 persons employed; in 1936 production was valued at £797,000, with 1,800 workers.

Iron.—The full extent of Australian iron-ore reserves is not as yet fully known, and a survey was being carried out in 1939. Deposits of large extent occur at Yampi Sound (West Australia) and at Iron Knob (South Australia), and a recent estimate placed the quantities available at 100 million tons and 150 million tons respectively. In view of the relative smallness of these reserves, the Commonwealth government in 1938 prohibited the export of iron-ore, in order to conserve resources which would otherwise have been exhausted within two generations. In 1936 over 95% (1,887,000 tons) of Australian ore was purchased from the Iron Knob field. New South Wales produced 4,500 tons of ore together with a small quantity of oxide, much of which was used in the gas, paper and chemical industries. The Yampi field has not yet entered the production stage, and the balance of Australian iron production was obtained as a by-product of the Mount Lyell (Tasmania) copper and silver mines.

Other Minerals.—Besides the above Australia contains a wide range of minerals both metallic and non-metallic, including gemstones (opals, etc.). Although many of these deposits are individually small, they are of considerable aggregate value. Production is dependent on prices, and during the last few years has been intermittent, especially since 1929. Australia possesses important deposits of tungsten, which remain to be exploited at the present time.

Coal.—In 1930 a Royal Commission estimated the actual and probable coal reserves as follows.—Bituminous: New South Wales 13,929,000,000 tons; Victoria 40,000,000; Queensland 2,238,000,000; Tasmania 244,000,000; sub-bituminous and brown coal: Victoria 37,000,000,000 tons; Queensland 67,000,000; South Australia 57,000,000; Western Australia 3,500,000,000. Total 57,075,000,000 tons, of which 16,451,000,000 are bituminous. The most important field is the Permo-Carboniferous basin of New South Wales. The situation of the coal deposits in close proximity to centres of population; the ease with which they can be worked; and in some cases the association of coal with other minerals (*e.g.* iron) have led to extensive exploitation, so that in addition to forming the basis for a metallurgical industry, and providing for home consumption, there is an export surplus.

In New South Wales, the coal-bearing strata occupy an area of *c.* 15,000 sq.mi., and extend some 160mi. along the coast on either side of Sydney, and about 150mi. inland from it. They form a saucer-like body, the productive rim of which outcrops towards the north, south and south-west. The three principal fields are situated on these outcrops: *viz.* the Greta seams between West Maitland and Cessnock, uhich extend for about 15mi. and form the most important coal mining district in Australia; the Illawarra (Southern) field round Bulli on the coast; and the Lithgow (Western) field, 9 jmi. from Sydney. The Maitland-Cessnock coal is excellent for gas making and household purposes, whilst the product of the other two fields is a very good steaming coal. A fourth field situated round Newcastle (Northern field) is now largely worked out. The production of coal from these fields reached a maximum of 11,500,000 tons in 1924, and after falling to 6,000,000 tons in 1931 reached 9,200,000 tons in 1936. Of the total quantity of coal won in New South Wales, the Northern field has produced about 68%, the Southern 21% and the Western 11%. The coal deposits of Queensland are scattered along the whole length of the eastern highlands, and include some anthracitic varieties, soft coal of Trias-Jurassic and Cretaceous age, and harder Permo-Carboniferous types. The Ipswich district (Trias-Jurassic) produces nearly half of the Queensland total, and other soft coal areas are Darling Downs (Trias-Jurassic) and Maryborough (Cretaceous). Attention is now being paid to the harder

varieties, the Bowen and Clermont districts being increasingly exploited. The 1936 output of about 1,000,000 tons was still below the peak production of 1929.

Victoria possesses fair quality coal of Jurassic age in South Gippsland. Production reached 400,000 tons in 1936. Of much more importance are the Morwell lignite deposits—78oft., the thickest known, which produced in 1936 over 3,000,000 tons of brown coal, all but 2,000 tons being produced by the state-owned open cut at Yallourn. The coal supplies the Melbourne district with light, power and fuel (briquettes).

Western Australia has scattered deposits of various geological ages, those at Collie and the Irwin river (Wilga) being Permo-Carboniferous. The Wilga field is unworked and the five collieries at Collie produced 560,000 tons (1936–37). Tasmania has some deposits of varying quality, chiefly in the north-east (production 1936, 130,000 tons). South Australia possesses lignite in certain regions (*e.g.*, Leigh Creek) but no exploitation has yet taken place, and she is dependent upon imported coal.

In spite of a recovery from economic depression the amount of coal mined in 1936 (11,370,000 tons; value £6,600,000) was still below the early post-war level of production (1924, 13,750,000 tons; value £11,600,000), and the change in value is a sufficient indication of altered conditions. There was formerly a considerable export trade in coal (1913, 2,000,000 tons) chiefly to the S. W. Pacific area, but owing to adverse conditions exports had diminished to 300,000 tons in 1936–37. The change-over to oil burning has also adversely affected the trade in bunker coal, which fell from 1,600,000 tons in 1913 to 600,000 in 1936–37. The remainder of the coal is consumed within Australia, but owing to the nearness of the coalfields to tide-water and the scarcity of land communications, a considerable amount of coal is moved by sea to the various states. The New South Wales fields supply almost all of the coal which moves by sea, either abroad or to other states, and Newcastle handles over 80% of this trade. In 1936–37 66% of New South Wales coal was consumed locally, 24% was exported to Australian ports, and 10% was exported abroad. The growth of metallurgical industries has resulted in an increased production of coke (1936, 893,000 tons New South Wales; 23,000 tons Queensland). With the development of Australian mining, imports of coal and coke (chiefly from Britain) are decreasing—yearly average of imports 1927–32, 190,000 tons; 1932–37, 14,000 tons. Deposits of oil shale exist in New South Wales and in Tasmania. Production commenced in 1939 at Newnes (N.S.W.), but the Tasmanian Oil Company ceased production in 1935, and it is doubtful whether oil-production will have any great development in Australia.

Metallurgical Industries.—Associated with ore-mining are concentrating and smelting processes, which often in themselves amount to considerable operations. In some instances, especially in Western Australia, difficulties of communications have led to the development of refining industries on the mining fields themselves, but the tendency is becoming increasingly common to carry out these activities at a few centres which have the advantages of cheap transport and abundant supplies of fuel, fluxes and raw material. Hence the greater part of the smelting industry is localized in New South Wales (at Port Kembla, Sydney and Newcastle) and handles ores from New Zealand and New Guinea as well as from the Commonwealth; ten factories (1937) in N.S.W. were smelting non-ferrous metals. Australian tin ores are smelted at Launceston, and the Electrolytic Zinc Co., of Risdon (Hobart) deals with ores from Broken Hill (N.S.W.), and Tasmania. Three other instances require special mention: (1) The smelting of Broken Hill silver-lead ore at Port Pirie (South Australia) 254mi. distant by rail, near the north-east extremity of Spencer's Gulf. The bulk of the ore is now sent direct to Port Pirie because fuel and fluxes are more cheaply available there. (2) The Broken Hill Proprietary Company began in 1915 to produce iron and steel at Pprt Waratah, near Newcastle (N.S.W.). The ore is obtained from Iron Knob (South Australia) 35mi. inland from Spencer's Gulf, where high-grade ore stands out as hills 400–600ft. high and is mined by open cut (1936 production, 1,887,000 tons). Limestone flux is derived from Melrose (north-west Tasmania), and coking coal from the Maitland (N.S.W.) field. An extension of the industry to South Australia is contemplated. The steel products formerly exported to South Africa are now absorbed by Australia herself, where the demand for steel products is increasing. (3) At Port Kembla the old established firm of Hoskins was joined by English companies to form the Australian Iron & Steel Co.; a large up-to-date plant has been erected at this port, which possesses outstanding geographical advantages for the assemblage, treatment and distribution of materials and products.

Australian production of iron and steel goods has been fostered by various bounty Acts, and by high tariffs, and is at present restricted to the state of New South Wales. In 1913 production was very small, but in 1937 900,000 tons of pig-iron, 1,000,000 tons of steel ingots and 800,000 tons of steel rails, bars, etc., were produced. This development has been accompanied by a corresponding growth in mechanical engineering—railway and other transport needs, agricultural implements and machinery—which is tending to make Australia independent of foreign supplies. In 1938 there were 1,037 engineering, and 437 smelting works in Australia, with an annual output valued at about £61,000,000.

Forestry.—Scientific forestry is of comparatively recent date in Australia, the establishment at Canberra (1926) by the Commonwealth Government of a national school of forestry marking an important stage in development. Although the greater part of the continent has some vegetation cover, latest estimates place the forest area at 19,500,000 acres (1·02% of the total area), a figure which is some 5,000,000 acres less than a former estimate (cf. Gt. Britain 5·4%, New Zealand 20·2%, United States 24·7%). By the end of 1937 16,900,000 acres had been preserved as State forests, and a further 8,000,000 acres of forest and bush had been placed under temporary reservation. In the past, land settlement has been the prime consideration; so that the more accessible areas have been cleared of timber, and a large proportion of the present forest reserves consists of mountainous slopes and highland ridges, especially in the Eastern States. Furthermore, unrestricted cutting for timber and fuel has depleted supplies, and recurring forest fires have caused considerable damage, particularly in New South Wales and Victoria. Wasteful methods have been employed in timber cutting and, although now reduced, losses during cutting have in the past amounted to as much as 60%. An annual consumption of 12cu.ft. per caput of wood for fuel is another factor of importance. Australian forests range from the tropical rain type (70in.-140in. average annual rainfall) in the north-east through sub-tropical to the temperate rain type. The 30in. isohyet can be taken as the limit of useful forest growth, and thus the forested areas occur only in certain coastal regions, and on parts of the Eastern Highlands, as well as over most of Tasmania. Indigenous softwoods are rare (less than 5% of the total) and occur chiefly in Queensland and northern New South Wales (bunya, hoop, Queensland Kauri and other pines, besides non-coniferous softwoods) and in Tasmania (huon, celery-top, King William pines). Both coniferous and broad-leaved types include valuable cabinet wood (*e.g.*, red cedar) and have been much exploited. In consequence, Australia finds it necessary to import a large quantity of her timber requirements: in 1936–37 timber products (including wood-pulp) were imported to the value of £2,257,000, and of this over 90% was for softwood (chiefly from Canada, Norway, Sweden and the United States). Efforts are being made to increase the home production of softwood by the cultivation of imported species (*e.g.*, the Monterey pine, *Pinus* insignis) (**v.** *inf.*). About 95% of the timber trees of Australia belong to the genus Eucalyptus, of which over 400 species are recognized. A belt of cypress trees is found along the south-eastern margins of the Eastern Highlands, and tropical cabinet woods occur in the north. The relatively large supplies, rapidity of growth, strength, durability, variety and freedom from insect growth render the hardwoods a valuable asset for constructional purposes, and thus they have been used somewhat unsparingly in Australia itself. Western Australian jarrah and karri have a wide reputation, and logs are exported chiefly to Gt. Britain, New Zealand, South Africa and China, to the value of about £1,000,000 annually. Attempts have been made to make Australia independent

of imported wood-pulp by the planting of the *Pinus insignis* in the south-east of the continent, and by the utilization of certain eucalyptic hardwoods. The efforts have met with some success, but Australia still imports (1936–37) over £400,000 worth of wood-pulp. Eucalypts, certain varieties in particular, yield valuable gums and oils. Eucalyptus oil has long been distilled, and in addition to the large quantities of the crude oil which are used in ore-concentration (flotation process) there is an export trade (from Victoria) to Great Britain and Germany which in 1936–37 reached £80,000. Other forest products include various tan-barks, which are obtained chiefly from various species of wattle. After the War of 1914–18, the wattle supplies became greatly depleted, and for a time Australia had to rely on importations from Natal, derived from plants originally introduced from Australia. Since 1928, however, Australian exports of tan-bark (chiefly to Europe) have exceeded imports, although the latter are still considerable (1936–37, imports £6,600; exports £8,400). Another important product is sandalwood, which is exported from Western Australia to China (1936–37, £106,000).

Trees and forests fulfil a more general function, that of checking erosion, regulating run-off and fixing loose earth, which in a country such as Australia is an exceedingly valuable one. Regulating legislation exists (*e.g.* as regards forest fires), but federal supervision is lacking, and much remains to be done through the medium of scientific forestry. It is estimated that under proper treatment the forest resources could supply the needs of a population of 22½ millions, but at the present time timber imports exceed exports by £1,200,000, and the total annual forest production is valued at only £7,300,000.

Fisheries. — Although Australia possesses a wide variety of fish and inland waters have been enriched by the introduction of new stocks, development in the fishing industry has been slow. Inland fishing is largely a sporting activity, and sea fishing, though continuous and even systematic in certain areas, has hitherto been insufficiently organized on a large scale. In an attempt to remedy these defects, governmental regulations have been framed restricting the exploitation of the fishing grounds, and subjecting all large catches to inspection. In certain instances (*e.g.* in New South Wales and Queensland) state governments have improved local conditions, and state trawling has been carried on since 1919. A fishery research vessel was put into commission in 1938, and a laboratory and research station was opened at Port Hacking (N. S. W.) in 1939 — indications that efforts are being made to develop the industry on a scale commensurate with natural resources. Two good fishing grounds are known, one c. 200 sq.m. in area lying south-east from Sydney Heads, the other c. 300 sq.m. situated to the north-east of Cape Howe. Here in 30–75 fathoms, over a floor open but with rocky patches, excellent results have been obtained first by the New South Wales government and later by private trawling enterprise. It is believed that the grounds south of Victoria (Bass Strait) and in the Great Australian bight will prove equally productive, and the shallow seas to the north of the continent offer further potentialities. Catches from the two previously mentioned grounds are sold chiefly in the Sydney, Melbourne, and South Queensland markets. Fishing of another type is carried on in the estuaries and bays of New South Wales and Victoria (Port Phillip). Oyster breeding is of some importance but is virtually restricted to New South Wales and Queensland. Difficulties of transport and marketing. and irregularity of supply have been serious obstacles to the development of the industry, and as a result per caput consumption is rather low (c. 13 lb. per annum; cf. Great Britain c. 42 lb.) In 1936–37 the total Australian catch was valued at £1,369,000 of which New South Wales produced £660,000, Victoria £204,000, and South Australia £200,000.

At various parts along the north and north-west coasts from Cape York to Shark's Bay and particularly along the Great Barrier Reef, pearl oysters, btche-de-mer (trepang), turtle, etc. are obtained. The boats engaged in this work numbered 221 in 1937 (Queensland 95, Western Australia 90) with *c.* 2.000 men. It is stipulated that wherever Asiatic labour is used the boat must be owned and managed by Europeans, and it is only on these conditions that permits to introduce Asiatic labour are granted. Pearl-shell (with pearls, trepang, etc. as by-products) was obtained to the value of £340,000 in 1937 (pearls £5,000, trepang £6,000), and turtle and trochus shell produced was valued at £52,000. Exports of pearl-shell in 1937–38 were valued at £345,580 The pearl oysters live at depths of 4–20 fathoms, but are mainly collected at 7–8 fathoms. In the west, Broome is the chief centre; on the east, Thursday Island in Torres Straits. During 1936–37 fish valued at £1,540,000 was imported into Australia, the greater part being tinned, and consisting chiefly of salmon (from Canada), herrings (from Great Britain), and sardines (from Norway). In view of the fact that in 1936–37 the value of imports exceeded the total value of Australian production by about £200,000, indications that the fishing industry is being systematically, if slowly, developed by the Commonwealth are encouraging; but the situation outlined above makes it very evident that there is a great deal still to be done before a really satisfactory result can be achieved.

PASTORAL AND AGRICULTURAL INDUSTRIES

Pastoralism is one of the oldest, historically most interesting, and economically most important industries in Australia. About 55% of the Commonwealth is estimated to be available for pastoral pursuits only (mining value apart), and although price levels have fallen greatly during the last decade, the value of production is approaching the former average of £110 million per annum (1936–37, £105 million) and the industry produces 23% of the national wealth, coming second only to manufacturing (38%). (With dairying and allied industries included the relative figures are £155 million and 33%). The importance of the industry in Australia's export trade is even more marked: the average annual exports (1927–37) are about £61 million—51% of total export values (with dairying included, £71 million and 60%). Agricultural exports (24%) are therefore second in importance. In this result climatic conditions play a large part. The climate of Australia is on the whole favourable to stock. At the same time regional and local climatic differences give rise to differentiations, *e.g.,* as between the cattle (meat), sheep and dairying industries (and cf. differentiation in breeds of sheep). Aridity sets severe limits; some 20% (*c.* 600,000 sq m) of the total area has at present little value, even as pastoral land, and in another 20% the conditions have proved more or less precarious. Droughts are an undoubted disadvantage; they recur irregularly, but on an average perhaps once in every 4 or 5 years. In one year (1894–95) one station on the Darling is said to have lost 90,000 out of 276,000 sheep. In the two years' drought which prevailed in Queensland (1926–28), 8 to 10 million sheep and 2 million cattle were lost — (total loss some £15–16 million). At the same time they are seldom universal; they interdict growth and enforce rest, and are followed by vigorous recuperative periods. They exercise a severely selective effect on vegetation and thus restrict the natural fodder to certain types. Economically they are perhaps no worse than the grasshoppers and locust visitations of Uruguay and the Argentine and perhaps less handicapping than the annual snows of Canada. Artesian and sub-artesian waters have increased and stabilized the carrying capacity over wide areas, while, as Government wells along the great overland stock-routes, they constitute essential links in lines of movement. Droughts are also being fought by conservation of water and of fodder (hay and ensilage), by improvement of transport, removal of stock to unaffected areas, and by avoiding overstocking in periods of plenty. Australia is well endowed with natural fodders many of which are highly nutritious and also either drought-resisting or capable of rapid growth upon the advent of rains. The value of Australian salt-bush as a dry area fodder has led to its cultivation in *e.g.,* the Union of South Africa. On the other hand native noxious plants (poison plants; burrs. etc.), though not very plentiful, exist and their numbers have been greatly augmented by imported varieties. More important, perhaps, is the selective action of the climate (v. sup.). Thus certain Australian fodders may be deficient in essential constituents (*e.g.,* phosphorus). Moreover the tendency of stock is to denude, to "eat out" the best fodder-plants, to spread pests, puddle clayey soils (cattle in particular), break up light ones, upset drainage,

start erosion, and generally to disarrange the natural balance and impoverish feeding grounds. Droughts and rabbits aid these processes. Moreover "artificial" fodders have not been used to the same extent as, for instance, in the United States or New Zealand. The use of these, however, is increasing and, in general, more attention is being paid to the conservation and improvement of pastures. Careful breeding is needed to maintain the standard of Australian flocks and herds. Here, also, regional differentiation comes into play and breeding stock from Tasmania, etc., mill be imported to New South Wales or Queensland. The pastoral industry in Australia has many scourges (blow-fly [sheep]; tick [cattle] ; pleuro-pneumonia, etc.). Dingoes still cause immense aggregate loss in the "back-blocks" and beyond: the loss in Queensland alone is estimated at some £100,000 per annum. They breed in the cattle country, where they are more or less ignored, and invade the sheep areas and even the outlying farm lands. They have even made certain areas impossible for sheep and have led to cattle being substituted for these. Though difficult to master they are perhaps slowly yielding to the advance of settlement. Not so the rabbit. Spreading like a flood over vast areas of country, rabbits eat up the pasture, ring-bark trees; devour seedlings, intensify the effects of drought and reduce the stock-carrying capacity of the Commonwealth by perhaps one-fifth. Vast sums have been spent in fencing, trapping, poisoning, etc. Extermination plans have lacked the large scale organization necessary for complete success, and although in operation for over 10 years, exports of frozen rabbits and their skins have recently tended to increase (1932–33 £1,000,000—1935–36 £2,000,000).

The general flatness of Australia greatly favours the pastoral industry. While in a sense size is essential to the industry, it also often implies great distances and involves special problems of movement and transportation. Drovers in the north charge for droving cattle per hundred miles. Where coastal highlands interpose steep gradients, the cattle industry is at a disadvantage as compared with the Argentine or New Zealand where a flatter terrain, a denser railway net, or shorter distances are present singly or in combination. The distance of Australia from its present chief markets in northwest Europe also entails special problems for the meat export trade, as well as for the dairying industry. Pastoralism in Australia is steadily following the general lines of evolution of this industry. On the one hand are the enormous pastoral holdings, millions of acres, unfenced save for the "home" paddocks, provided with natural water only and natural pasture; carrying flocks and herds numbering some hundreds of thousands but having a low average density both of animal and human population (*e.g.*, 4–5 head cattle, 25–100 sheep per square mile; on the northern cattle runs, one white man, assisted perhaps by aboriginal stock hands, per 500 square miles). Droughts are severely felt; distances to market are often great; much risk and speculation is entailed but occasional rich fortunes are made. At the other end — (omitting dairying) is stock-raising as an element in mixed farming. Here sheep — not cattle as yet to any extent — form an integral part of the rotation system. Individual holdings and flocks are small but the aggregate number of head that can be carried is great. Somewhere between these extremes lies the bulk of Australian pastoralism to-day. But size is relative and distinctions must be drawn. Cattle require more food and room than sheep (*v. inf.*). Much depends on the class of country, and also on position in relation to markets. Thus in North Queensland 20–35,000 acres of land are considered necessary, but nearer markets 10,000 acres suffice. But broadly speaking the tendency is to restrict areas, and to this end legislation in the various States has steadily tended. Along with this goes the effort to intensify methods and stabilize production and returns. Fencing, water and fodder conservation, pasture improvement, scientific breeding and management, disease and pest-elimination or control, improved transport, handling and marketing are all making gradual headway. Physical, economic and also some political difficulties remain, but the industry is steadily emerging from the old "gambling stage" (especially since the advent of cold storage), and gives promise.

Sheep, cattle and horses are the pillars of Australian pastoral wealth. Horse-breeding is associated to a considerable extent with the other branches of the pastoral industry and also with agriculture. Australian conditions suit horses, and by careful breeding fine types have been evolved suitable to varying localities and needs. Notable is the endurance of Australian horses under hot and dry conditions, as was proved in Egypt and Palestine in the World War and by their export to India for army remounts. This export has however declined from 18,000 (1901) to 4,000 (1937). Australian horses total about $1\frac{3}{4}$ million, of which New South Wales possesses 32%, Queensland 25% and Victoria 20%.

Sheep. — Sheep constitute by far the most important single element in the pastoral industry. In 1937 Australia (with 114 million) possessed the greatest number of any country in the world. The annual export of sheep products has averaged (5 years to 1937) about £54 million (total exports of pastoral industry over same period averaged £71 4 millions, inclusive of dairy products). Australia, possessing about one sixth of the world's sheep, produces about a quarter of the world's wool, and exports wool valued at about £55 million, *i.e.* about 80% of the total export values of the whole pastoral industry and 35–45% (value) of Australia's total exports. The chief sheep areas are disposed in a belt some 300 miles broad which runs from about central Queensland roughly parallel with the east and south coasts, but well inland, until it meets the coast in the south-west of Victoria. Other areas lie east and north of the South Australian "gulf" region, in Eyre's peninsula and in a belt extending from above Albany to Pilbara and into the Kimberleys in Western Australia. From the coastal regions sheep are largely excluded by humidity which induces footrot and other ailments, but also by agriculture and dairying. Sheep are increasingly kept in the drier farming areas where they afford a valuable safety element. Sheep in their turn tend to displace cattle. Thus the sheep belt, while it largely interpenetrates the wheat belt, is markedly antithetical to the cattle areas. On the whole sheep seem to do best where the average temperatures are about 65–75° and where the average annual rainfall is 20–35 in.; in such parts the average densities amount to 100–200 head per square mile. The distribution of sheep was in 1936 as follows: New South Wales 48%, Victoria 16%, Queensland 18%, South Australia 7%, Western Australia 8%, Tasmania 2%, of a total of 114 million head. Western Australia has suffered a setback owing to drought. Most important also is the differentiation and specialization within the industry. On the economic side the issue is between meat and wool, broadly between the merino (fine wool and carcase — c. 46 lb.) and cross-bred (coarse wool and carcase — c. 60 lb.). The production of cross-bred wool has in recent years fluctuated, but comprises about 15–20% of the wool marketed, the remainder being merino. There is a continuous demand for these fine wools, and since Australia is specially suited for producing them, output is maintained, and about half the world's supply of merino wool now comes from the Commonwealth, its supremacy being securely established. At the same time the cross-bred, with the all-round returns (wool, mutton, fat, lambs) fits better into the farming regime. The farming areas also have a damper climate which cross-breds can better stand. Merinos do better in large flocks on the open plains with natural pastures. Australians eat 70 lb. of mutton and lamb per caput per annum; the home market is therefore considerable--of 18 million head slaughtered in 1936 (480 million lb.), 70% was consumed locally. Hence the attempt to stabilize the "dual-purpose" animal; the evolution of a special type, the Corriedale; and the effort to secure in cross-breds maximum bulk combined with the finest possible quality wool. Australian wools are as a whole unrivalled, and have occasionally fetched remarkable prices. The average weight of fleece has been raised to *c.* 8 lb. (prize fleeces: 30–40 lb.) and, with the advent of the shearing machine, shearing and its attendant processes have reached a high degree of technical efficiency. Shearing, owing to the size of Australia and the range of the climate, goes on virtually the whole year. The sheep are sheared, dipped, branded; the wool is baled, loaded on wagons or, in the far interior, on camels, and transported often many hundreds of miles Motor transport, however, is becoming

increasingly common. Practically the whole of the Australian clip is now sold in Australia, the markets—which are held in all the capitals and in some other towns as well (*e.g.*, Albury; Geelong)—being visited by buyers from the great wool-consuming countries. Of the total clip Australia now retains about 7% for home consumption, and the remainder is exported (90% in the "greasy" unscoured state) chiefly to Great Britain (39%), Japan (17%), France (16%) and Belgium (15%). Of the total wool imports of the United Kingdom, Australian wool forms 37% in quantity and 44% in value. Compared with this export trade other branches of the industry (*e.g.* frozen lamb and mutton trade; trade in skins, etc.) are of much less importance. (Total value of lamb and mutton exports 1936–37, £5.1 million). More important is the Australian woollen manufacturing industry, which has grown considerably, especially since the World War (1914–18). In 1926 the 45 million lb. of wool supplied 50 woollen and tweed mills, situated mainly in the capitals and larger towns. In 1939 there were 90 mills (52 of which were in Victoria), as well as 297 hosiery and knitting mills. The value of the output reached £12·2 million in 1936–37.

Cattle.—Though Australia is a first-class natural cattle-country the cattle industry has never attained a position comparable with that of sheep and wool. The reasons are complex and difficult to define. A "pioneer" industry, it has held, dairying excepted, mainly to the outskirts of settlement and civilization. Here large areas of sheep land have been available, while the adaptability and mobility of cattle maintain them under conditions intolerable for sheep. Thus cattle in Australia show a notably wide distribution, from the cool districts of the south to the tropical north, from the coastal lands of the east (dairying) well into the dry interior. Only aridity seems to set limits, for cattle, to attain condition, require plentiful nourishing fodder and, ideally, should not have to walk more than 2½ miles to water—(they can, and do. go further). Thus (meat) cattle have been slowly forced back by wheat and sheep into remoter or rougher country and so far little attempt has been made to fit them, like sheep, into a mixed farming system. Hence Queensland has the greatest cattle population (5·9 million head out of a Commonwealth total of c. 13–14 million—44%. Cattle max. 1921: 14·4 million), and in this State meat cattle hold the field everywhere except in the south-east (dairying) parts and in the central and central-south sheep areas. So, too, the North Territory and north-west west Australia (notably Fitzroy and Victoria river basins and Barkly tableland) have a relatively large cattle population and in these areas are some of the greatest natural cattle areas of the world. Dairy cattle, in contrast, occupy fairly clearly marked areas (mainly coastal) in South-east Queensland and north-east and east New South Wales, and also in Victoria and Tasmania. (Reckoning in dairy cattle, New South Wales has one million head—33%: Victoria has ·9 million—30%. of Australia's cattle). In the remoter parts conditions are relatively primitive, though artesian bores have been provided in Western Queensland and on the Barkly tableland. At the same time white labour is costly and mustering, droving, etc., are expensive. Droughts have consequently been severely felt and their ravages are evidenced by the fluctuations in numbers of head (1894–1902: 12 million–7 million—42% loss) Nor has much money or attention been devoted to scientific breeding and the quality of animal and of meat has suffered. Long droving and rail distances, uneconomic methods of handling and transporting, high transportation costs also operate detrimentally in parts. Australia consumes nearly 81% of her total beef production (average for 3 years ending 1937—1,200 million lb., ann. per caput consumption: 140–160lb.—*cf.* United Kingdom 641b), but in respect of exports she is at a disadvantage as compared with her competitors—notably the Argentine. Until 1932 she could send practically none of her exports to the United Kingdom chilled, and chilled is preferred to frozen meat. The Australian meat-freezing industry, moreover, is carried on in many small and widely separated works and this increases costs and difficulties of transport. The Western Australian Government freezing works at Wyndham are among the most successful. Operating for 6 months (April–September. *i.e.*, during the dry season) they deal with some 25,000 head of cattle. employ 200–300 hands and maintain the pastoral industry in this region. Australian exports of meat have fluctuated considerably (average for period 1932–37: £2½ million); her hide exports are valued at (1937) £900,000 per annum. The bulk of these exports goes to the United Kingdom, the USA., and some European countries.

Dairying.—Dairying is geographically and economically fairly distinct from the cattle industry. It has made great progress in recent years and it has an assured market in the United Kingdom which can but improve, especially if certain transportation problems can be solved. The warm, "open-air" climate is in general favourable, but, though dairying is carried on inland in conjunction with mixed (wheat and sheep) farming, the tendency has been to concentrate in the areas of assured and plentiful rainfall and also near the great city markets and export facilities. Thus while the coastal parts of New South Wales (particularly in the north) and of south-east Queensland have shown marked increases of production, the inland areas in many cases have shown little or no advance. In Victoria also the chief dairying districts lie along the south coast. Thanks to stringent and efficient Government regulation and encouragement (both as regards production and marketing), to careful breeding and the adoption of scientific-and co-operative methods, the yield of milk and the output and export of high-grade butter—recently of cheese and concentrated milk also—has increased. The home consumption is very high (c. 30lb. butter and cheese per caput: cf. United Kingdom *c.* 25lb.) and production varies greatly with the season, but taking butter as a general index of the dairy industry as a whole, out of a total production varying between 396–469 million lb. (5 years 1932–37), Australian (net) exports amounted to 174–262 million lb. valued at £8–£10 million. More or less closely associated with dairying are pig-rearing, poultry and bee-keeping. Of these products the first-named are consumed almost entirely in Australia. The total value of dairying productions averaged, during the period 1932–37, £25 million, while exports during the same period have ranged from £9–£11 million. In 1936–37 Australia supplied 14% of the total butter imports of the United Kingdom; New Zealand (£15·3 million) and Denmark (£11·9 million) alone exceeding this figure.

Agriculture.—Agriculture has advanced to the third place amongst the major Australian industries (£75–90 million—c. 20% of total annual production of all industries), in spite of fluctuations of seasons. Teaching and research and Government agricultural departments have done much to solve local problems. The physical problems are those of adaptation to climate and soil; nearly 80% of the cultivated area is now regularly manured, largely by superphosphate manufdctured in Australia from rock imported largely from Nauru and the Gilbert and Ellice Islands (Fertilizer imports: *c.* £1 million of which c. 70%—rock phosphate, milled in some 100 factories.) Light soils, so wide-spread in Australia, are successfully worked by use of fertilizers, "dry" and mixed farming methods, etc. Mixed farming, fodder cultivation and conservation (ensilage, etc.) are also extending as a provision against droughts and will gradually introduce greater stability, and irrigation agriculture is being studied. Grading, transport and marketing are being improved, and co-operative methods are gaining ground (cf. wheat and cotton pools). This introduces another aspect of the question. The total area under cultivation has steadily expanded to c. 20 million acres (1% of the total area of the Commonwealth. Of their respective total areas Victoria has *c.* 8·5% under cultivation; New South Wales, 2·5%; Tasmania 1·6%; South Australia 1·5%), and the productivity has correspondingly advanced (v. sup.). The total number of population engaged in agriculture has however declined, especially during the last few years (1913, 211,000; 1923, 202,000; 1936–37, 190,000), and thus, with an extension in the cultivated area and increased efficiency in production, far fewer people are retained on the land. Australian farming still favours extensive methods. Wheat occupies *c.* 60% of the total cultivated area, the recent expansion of which is mainly due to increased wheat production: mixed farming, on the other hand, has made little corresponding progress.

Whereas in Europe hay is derived chiefly from meadow and other grasses, the drier climate and more variable rainfall of Australia necessitate its cultivation by plough. The 3 million acres normally under hay (15% of total cultivated area, annual yield 3–4 million tons) consist predominantly of wheat, oats and lucerne, while the same crops and some others are cut as green forage (½–1 million acres). Moreover, in bad seasons, or if prices fall, crops intended for grain will be cut for green forage or for hay, so that the dividing line between agriculture and pastoralism is fluctuating as well as indefinite. Australian agriculture exhibits broad differentiation into tropical, sub-tropical and temperate types, though each of these retains distinctly Australian features and there is more or less overlapping and interpenetration. (Vide individual States.)

Wheat. — In recent years, in spite of occasional adverse seasons and markets, the area under cultivation has advanced (1936–37) to c. 12·3 million acres representing c. 60% of the total cultivated area — (giving a yield of 12·9 bushels per acre) — and the total value of the crop to £30–40 million. As with sheep, wheat has been gradually forced away from the moister coastal areas — where rust works damage and where dairy and mixed farming are more profitable — and it now occupies a belt which follows roughly the direction of the coast-line from the Darling Downs (Queensland) along the west and south-west slopes of the New South Wales highlands, across central north and north-west Victoria to Yorke and Eyre's peninsulas (South Australia), in which State it impinges on the coast. It is resumed in south-west Australia where it forms an inland belt running south-east — north-west, also roughly parallel with the coast, but meeting it near Geraldton. Artificial manuring (superphosphates); the 3 year rotation grain-grazing-bare fallow, the latter associated in drier areas with moisture-conservation methods of tillage (dry-farming); improved types of wheat, the product of scientific breeding, have all contributed to the progress of wheat-growing. Winter rainfall (April to October) determines cultivation limits. By far the greater part of the wheat-belt, therefore, is bounded outwards by the 20 in., and inwards by the 10 in. winter rainfall line. Consequently New South Wales (c. 4 million acres; 48–78 million bushels), Victoria (3·2 million acres; 30–50 million bushels), South Australia (3.5 million acres; 27–45 million bushels), Western Australia (3·1 million acres; 20–40 million bushels), are the chief wheat-growing States. The areas of heaviest production are in South Australia (north from Adelaide) and in New South Wales (a strip c. 100 miles wide extending from Dubbo to Albury), but production in Western Australia is rapidly increasing (1937–38: 3 million acres; 36 million bushels). Yields in places (*e.g.*, South Australia; and in mixed farming practice) reach 30–40 bushels, but cultivation is generally extensive and yields vary greatly according to rainfall (e g., the Victorian farmer gets c. 1 bushel per acre for every 1 in. [winter] fall). The average yield is between 12 and 13 bushels per acre; the quality, however, is high and Australian hard wheats command good prices (5s.od. per bushel, 1937). The fact that the total production of wheat, in spite of bad seasons, has averaged 162 million bushels during the last 5 years (Max. 1932–33: 214 millions) indicates increasing skill and the elimination of risk. Of this total an annual average of nearly 54 million bushels (8·19 bushels per caput of population) is retained for seed or food, the remainder being exported. In the period 1932–33—1936–37 exports of wheat varied between 61.6 and 119·5 million bushels of which 33.9% (in the aggregate) went to the United Kingdom. This total includes small quantities of flour (the total exports of which in the season 1937–38 were valued at £6,052,321). As labour and transport conditions gradually improve, as farming becomes more intensive and markets expand, Australia, which has perhaps some, half million square miles of available wheat lands, will doubtless very largely increase her production of wheat.

Other Grains and Root Crops. — Besides a variety of minor grain and legume cultures oats (1.5 million acres: 16.6 million bushels) are produced chiefly in Victoria, all but c. 2 million bushels (oatmeal) being used as grain food for cattle. Barley (85% malting barley) cultivation is increasing in South Australia (65%) and Victoria (21%) and 2½–3 million bushels are exported annually. *Maize*, grown for grain mainly in the sugar areas (***v.*** *inf.*) gives good returns, but its cultivation (300,000 acres: 7.8 million bushels) has declined and quantities are now imported annually (South Africa). With improved methods and the development of the tropical north, production will probably expand. Interesting is the attempt to develop the Australian production of rice, the cultivation of which in the (Murray-Darling) irrigation areas, fostered by a customs duty, is expanding (1926–27: 5,100 acres; 1936–37: 23,000 acres). Root crops play a smaller part in Australian arable farming than they do in North-west Europe. Potatoes, for which the soils and climate of Victoria and Tasmania are admirably suited, have been neglected in recent years. Production varies (1936–37: 364,000 tons; £2 million) but with improved methods these figures could be considerably increased. Sugar-beet is grown to some extent in Victoria and efforts are being made to stimulate production, so far with no marked success.

Sugar, Cotton, Tobacco. — Sugar and cotton both require freedom from frost, considerable warmth and moisture for their growth; prefer rich soils; repay scientific cultivation (manuring, pest-control, etc.); demand much labour particularly at specific seasons. Both industries have secondary industries associated with them (crushing and refining; ginning) and are markedly dependent upon world-market conditions. In Australia, further, both represent a patriotic attempt to achieve national independence (cf. rice, and woollen manufacturing industry [v. sup.]), to vindicate the feasibility of the "white Australia" policy and the superiority of the "small" free owner-cultivator as against the coloured labour plantation system. They have thus greater significance than their actual status might imply, though perhaps not more than their undoubted prospects warrant.

Sugar is grown in areas scattered down the east coast of Queensland (notably Cairns, Mackay, Bundaberg) and in north coastal New South Wales (Grafton-Lismore). The climate is suitable, the alluvial soils rich, there is plenty of room for expansion, and this has, on the whole, been steady (1936–37; total acreage: 318,000 acres [90% in Queensland], of which 230,000 acres were actually producing). Cultivation has been increasing in New South Wales where the yield is higher (24·3 tons cane per acre; cf. Queensland 18·7 tons). The total annual production has averaged (10 years) c. 600,000 tons sugar (from 4.35 million tons cane. Max. production: 1936–37: 782,000 tons from over 4 million tons cane). Of this output c. 50% is consumed in Australia (111 lb. per caput) and the remainder is exported. The industry enjoys Commonwealth protection and support without which, since the abolition of coloured labour, it could not survive. Australia at present pays several millions yearly for its "white" sugar industry, and the keeping of the export sugar prices down to a competitive level involves considerable difficulties. These might be solved either by full preference in the United Kingdom or by a voluntary world limitation of output. Associated with this agricultural industry is the milling of cane (c. 36 mills, almost all in Queensland). Of the products, raw sugar, molasses, etc. (annual value c. £10 million) the raw-sugar is refined in 7 refineries (2 each in Queensland and Victoria; 1 each in South Australia, Western Australia and New South Wales).

Cotton can probably be grown along a coastal strip extending from Newcastle (New South Wales) to Bundaberg (Queensland) and in a belt stretching across the base of Cape York Peninsula through the Northern Territory to the Victoria River basin. Post-war conditions — particularly the Empire cotton-growing campaign — have stimulated production. The planters are small-holders using, often, family labour. The area planted (Queensland only) rose (1936) to 62,000 acres (19·2 million lb.) but the infant industry is sensitive to physical (climatic) and economic (world-market) conditions and there have been many fluctuations. Stringent Government control (seed, planting, ginning, etc) is exercised, and Government also assists both production and marketing and also the nascent cotton-manufacturing industry.

Tobacco of excellent quality can be grown in Australia, and **a** serious attempt to expand production has recently taken place;

as a result, although many fluctuations have occurred, output has risen from 1·6 million lb. (1926–30) to 6·5 million lb. (1931–35).

Vines and Fruit. — These represent one of the most valuable and interesting minor specializations of Australia, the production of which holds out great promise. Vines grow mainly in South Australia and Victoria (Commonwealth acreage, 1936–37: 120,000: South Australia 56,000; Victoria 41,000) where the climate is admirably suited to them. After considerable difficulties Australian wines, supported by a Commonwealth bounty, have gained a footing in external (mainly the United Kingdom and New Zealand) markets (Exports, 1936–37: £1,000,000). Of increasing value also has been the production and export of raisins and currants (chiefly from Victoria). The export trade depends largely upon the British market but the average annual (net) export is valued at £1·5 million.

Fruit-growing fairly accurately represents climatic conditions in Australia and ranges from bananas, pineapples, etc. in Queensland to apples, berry-fruits, etc. in Tasmania, but a larger denominator comprising both sub-tropical (oranges, lemons, peaches, apricots) and "northern" (pears, plums, cherries, etc.) fruits is common to all states according to local position and climate. The industry, subject largely to the capacity of British markets, is capable of great expansion, and improved methods of culture and marketing are now being achieved. The trade has expanded in both fresh and dried fruits (1936–37: f3.4 million; of which £1·3 million was for apples and £2 million for dried fruits).

Irrigation. — The extensive water-conservation works of Australia supply water either for domestic use in urban or rural (farming) districts, for stock (*e* g., north andnorth-west Victoria), or for irrigation purposes. The development of irrigation, an obvious consequence of the warm climate and erratic rainfall, is taking place chiefly along, and in connection with, the east highland belt from Queensland to Victoria. In Queensland the roomier valleys and larger streams of the east are encouraging large-scale developments (Dawson river scheme) on the coastward side but in New South Wales and Victoria the relief and drainage generally favour the inland flank. Exceptions are the irrigation areas of Victoria south of the Dividing Range (Werribee; Macallister), and perhaps also the South Australian (Lower Murray) areas. The highland and valley configuration give considerable catchment areas (Dawson river: 9,000 square miles; Murrumbidgee: 5,000 square miles; Lachlan: 3,200 square miles, above dam sites) and rainfall, though fluctuating, is adequate on the highlands (*e.g.*, Goulbourn, Victoria valley: 20–52 in.). The valleys, often long, deep and conveniently narrow at the mouth. afford dam and reservoir sites. The alluvial soil of the valley-floors and plains is mostly rich and the hot sunny climate suits fruit and other cultures. Transport distances and facilities, if not ideal, are not prohibitive (cf. Central Murray to Melbourne; Upper Murrumbidgee to Sydney; Lower Murray to Adelaide).

Thus there has grown up, upon the basis of early private undertakings, the characteristic conservation and irrigation and similar public commissions. Victoria has the superior physical position and, with some 519,000 acres actually occupied, takes precedence as an irrigation state; New South Wales has some 152,000 acres occupied; South Australia has large areas, and Queensland is developing one large (Dawson river) and some smaller schemes. The most noted dams are the Burrinjuck (Upper Murrumbidgee, New South Wales) which is designed to impound some 20 square miles and to water well over 1½ million acres. Besides the old and flourishing Mildura settlement, Victoria has extensive schemes along the Murray and its tributaries (Goulbourn system: c. 1 million acres), and in South Australia besides Renmark a series of irrigation and drainage works have lined the lower Murray for many miles with growing settlements. In the upper reaches the supply of water is by gravitation; lower down pumping is necessary. Besides vines (grapes, raisins, currants) and fruits and vegetables of various kinds, these irrigation areas are engaging in fodder (lucerne) growing and in dairying, in fruit-canning and other activities. Finance bulks largely in these schemes which also depend upon expansion of markets, since they produce far in excess of Australia's home demands. Closely connected with them is the extensive program for regulating and locking the Murray river (*q.v.*), and the great Hume reservoir which will open up a further extensive area.

MANUFACTURING INDUSTRY

Australia desires to employ her own nationals in working up her own raw materials. In 1911 368,000 people were engaged in industry, and 450,000 in 1929. During the economic crisis the number fell by over 25% to 336,000, but since 1932, employment has increased by about 8% per annum, and over 523,000 persons were employed in 1936–37, the highest total ever recorded. The (net) value of manufactured products, which in 1915 was f 59 million, had by 1936–37 risen to three times that figure, namely £177 million. In 1925–26 the figure was f143 million. In producing over 37% of the total, industry now occupies the leading position as a winner of national wealth. It is true that in Australia many very small concerns are classed as "factories," as are others which use no mechanical power. Thus (1936–37) there were some 20,000 factories (out of a total 25,600 = 82%), employing between them nearly $ of all the operatives in Australia, which individually had under 20 hands (average 5·8 hands). Similarly, 7% of all the factories use no mechanical power. On the other hand, there are about 895 factories employing an average of 280 hands each (250,000 operatives out of a total of 523,000 in Australia). Manufacturing is largely concentrated in or near the capital cities (*i.e.*, on or near the coasts), where markets, labour, fuel, transport facilities and raw materials are, if not cheap, more readily available. It is also mainly connected with primary production. Thus from pastoralism arise meat preserving (freezing, etc.); fell-mongering and wool-scouring, tarring, boot-making, soap- and candle-making, textile and clothing industries; from agriculture, flour, sugar (raw and refined), jam, biscuits, beer, etc.; from dairying, butter, cheese, bacon, etc.; from forestry, lumber (saw-milling), furniture; from mining, concentrates, pig-iron and steel, coke, gas, foundry and engineering products (agricultural implements); electric light and power. Somewhat more complex are vehicle construction (wagons, etc.; motors; cycles); railway and tram construction; electrical machinery, printing, etc.

Power is derived almost entirely from coal and applied through the medium of steam (31%) or, increasingly, electricity (64%). Gas, oil and water-power are naturally little in evidence. Hence New South Wales, with its resources in coal, raw materials and population is the leading industrial State. It has the most (364) large concerns, employs the greatest horse power (513,000) and number of hands (211,000) chiefly in the manufacturing of metallurgical, food and drink and (woollen) textile products (As long ago as 1928 a Sydney firm secured a large contract [£500,000] for the construction of high-power locomotives.) Its (net) output (£76 million) represents 43.5% of the total manufacturing output of Australia. Victoria is not far behind in natural advantages or in development (345 larger concerns; 429,000 horse power; 192,000 hands) but its chief industry is (woollen) textiles, food and metallurgical industries coming next. (Output: f 58 million [net] = 30% of total.) Australian industry works almost entirely for the home market (*i.e.*, not reckoning made-up dairy products — butter, cheese, bacon, etc.—as manufactures). Only about 5% of the goods manufactured are exported and these form only *c.* 4.5% of the total exports in value. The industry thus reflects in some degree the standard of wealth and comfort in the Commonwealth, for amongst the most important products are food and drink, textiles, furniture, heat and light, while the metallurgical industry, the most important of all, works for self-sufficiency in the basic requirements of practically all the other industries.

Foreign Trade.—Since the advent of Federation abolished inter-State customs, overseas trade alone comes into consideration. The total foreign trade of Australia during the 5 years 1932–33—1937–38 ranged from £135 million to £225 million per annum; (1937–38: f 225 million; Max 1924–25: £319 million), or an average of *c.* £30 per head per annum (1937–38: £34 17.0). The fall in the aggregate value of Australian trade is in part due to the drop in commodity prices after 1929 Of this trade by far the

greatest bulk is composed of exports of Australian products and imports for domestic consumption, since the transit (re-export) trade of Australia amounts to no more than some £2 million per annum.

From 1892 to 1919–20 Australian exports normally exceeded imports; until 1930 the reverse was normal. Since 1930 exports have again exceeded imports (in 1936–37 by £44,000,000). New South Wales and Victoria have approximately 42% and 29% respectively of the total trade, South Australia and Queensland having each some 10%.

Exports. — Exports have varied in value from £104 million (1930–31) to £157 million (1937–38) (Australian currency) compared with £134 million (1921) to £141 million (1929) in the pre-depression period. Of these totals about £2.5 million represents re-exports, and some £2–3 million per annum, not included above, represents ships' stores. During the decade 1926–27 to 1936–37 the pastoral industry provided (chiefly in the form of wool) over 51% of the value of the total exports; agriculture over 24% (mainly wheat and flour); mining, 10·3%; dairying. 8.9%; forestry and fisheries, 1·1%; manufacturing, 4%. Exports classed as primary produce thus amount to 96% in value, Australia exporting 46·8% (value) of all its primary products, and only 3.4% of its manufactured products. The above figures, however, since they represent values, include the effect of price changes, *i.e.* the lower values of Australian exports in recent years do not altogether denote a corresponding decrease in quantities (*e.g.,* index numbers of Melbourne prices have varied as follows [base = 1911, 1,000]: 1920, 2,055; 1929, 1,803; 1931, 1,428; 1937, 1,656). Thus-allowing for the effect of price-changes, the advance of £16 million in exports since 1929 represents a much greater "real" gain than the figures indicate. The greatest proportional advances have been made by agriculture and dairying.

The more important exports have been mentioned under the various industries (*v. sup.*). They go chiefly to the United Kingdom (1921–22: c. 45%; 1937–38: £73 millions = 52% of the value of the total exports). Wool, wheat and butter were the chief items. France takes c. 7% (1937–38: £9 6 million). Japan: *c.* 4% (£5·9 million). United States: *c.* 3% (£3.3 million). New Zealand: 6% (£7 million). Canada: 2% (£2 million).

Imports. — Imports mounted fairly steadily until 1926, after which there began a diminution which lasted until 1932 (1926–27: £165 million = £26 per caput; 1931–32: £45 million = £7 per caput; 1937–38: £114 million = £16 per caput). Of the total (value) the United Kingdom supplies a decreasing amount (1921–22: 51·4%; 1937–38: 41% = £46 million) — machinery, etc. (£16 million), textiles (£11 million), besides paper, chemicals, whisky and manufactured goods. The United States: 15% (1937–38) = £17 million, mainly motor cars and parts, oil, manufactured goods. Japan: 4·8% (£5 million) — textiles (chiefly silk), machinery, manufactured goods. Germany: 3.7% (£4 million) — machinery, chemicals. Dutch East Indies: 6·8% (£7.5 million) — petroleum and crude oil, tea. Canada: 7·2% (£8 million) — paper, motor chassis and parts, timber, machinery, tinned fish. New Zealand: 1·5% (£1.7 million) — gold, timber, hides and skins. Except for the year 1936–37, the percentage of imports from British countries declined during the period 1933–38. The proportion of imports from Canada increased; but that of India and New Zealand declined. The rise of the United States proportion has been the most notable feature in recent years, although this was tending in 1939 to decrease. German imports regained some of the ground which they lost (chiefly to America and Japan) after the War of 1914–18. Part of the trade now goes direct to Europe instead of to the United Kingdom for re-export to Australia; and the shift of trade can also be partly explained by the fact that Australia's needs are growing more complex, and cannot be satisfied from a single source. A symptom of this change is the growing trade with Pacific countries (Japan, East Indies, Canada, United States).

Between 1921 and 1926 Australia's trade with British countries declined from 63% to 54% In the year following the Ottawa conference of 1932, a new Customs Tariff Act came into operation, by which, although Australian products — manufactures in particular — were protected, preferences were accorded to British products. In 1936–37 trade with British countries comprised 57% of the total, and imports of British origin benefited to the extent of £7.9 million. Similarly exports to the United Kingdom benefited by £5.5 million under British preferential tariff rates. Imperial trade reciprocity, of fairly long standing in certain instances, has been repeatedly modified (notably after the Ottawa Conference of 1932) and is still comparatively experimental.

COMMUNICATIONS AND TRANSPORT

After Canada, Australia has the greatest length of railway per head of any country (4.08 m. per 1,000 pop.; cf. Canada 4.43; British Isles 0.47). But in relation to area, Australia has only 9.36 m. per 1,000 square m., a lower figure than any country except Brazil and Egypt (cf. Great Britain and Ireland: 223·57 m.). Hence the significance of the motor car, the "caterpillar" car, and other modern traction devices, and still more of the aeroplane and flying-boat. Shape helps to explain the separateness of the various systems, the close conjunction of railway with coastwise shipping transport, and the mathematical quality (circumferential as well as radial) of the system Flatness favours movement over very large parts, but along the east and south-east, and elsewhere where highlands run parallel to the coast, transport is impeded. Thus the main lines Melbourne-Sydney and Sydney-Brisbane were built behind and over the eastern highlands, the main net is also developing inland, and the south-east coasts generally have few important railways. Connected with relief also is the presence of excellent harbours at various points along the east, south-east and south-west coasts, in Tasmania, and in the north-west and north. Even with future large developments Australian routes will be largely circumferential — we may look forward to a hollow oval of lines running roughly parallel to the coasts, but with some "short cuts" (*e.g.,* Adelaide-Sydney; Brisbane-Darwin); many "radial" lines (*i.e.,* chiefly mineral and pastoral lines roughly at right angles to the coast); and at least one "diameter" (Adelaide-Darwin). In minor ways climate presents some problems such as heat, dust, water-supply (*e.g.,* non-saline water for locomotive boilers), floods (wash-aways), etc. Starting sporadically, as it were, and as the needs of each mining, each wool, wheat or farming area demanded, the separate State railway systems with various gauges have gradually become more widely integrated until they begin to show a truly continental character. State jealousies are gradually laid aside; and the motor-car and the aeroplane are contributing to this result.

Roads, **etc.**—Over considerable parts of Australia bullocks, horses, mules, donkeys, camels are used as beasts of draught or burden; bush-tracks and country roads are little more than trodden or wheel-marked lines subject, especially in the north, to interruption by floods. Roads outside the settled farming areas are mostly poor and labour costs too high to permit much improvement. But motor cars and lorries are now revolutionizing Australian inland transport, reducing days and distances — (the continent has been repeatedly crossed by car, once from Darwin to Adelaide in 6¾ days) — and making, life in the "out-back" increasingly possible. In the pastoral industry, in particular, motor-transport will probably play an increasing part, *e.g.,* moving stock or supplying fodder in droughts; wool transport, etc. Still more the aeroplane is quartering time and space, quadrupling mails in number and frequency; carrying stores, "spare parts," medicines, doctors; and in general, along with "wireless," extending the range of social and economic forces and unifying the continent. In recent years the number of motor vehicles has increased very rapidly; one person in about 8 owns a car and in 1937 imports reached £5.5 million in value (70,000 vehicles) of which £2.5 million represented imports from the United States of America and £3 million from the United Kingdom. With State-owned railways, however, motor omnibuses are not permitted to compete but only to act as "feeders" or extensions of them.

Waterways. — The Murray-Darling system provides in all some 4,200 navigable m.: the Murray is navigable for about 7 months (July to January), the Darling only very irregularly, and the whole system is badly handicapped for lack of a good ocean out-

let. The head of navigation on the Murray is Albury (goo m. above the South Australian border), and on the Darling, Walgett (1,758m from their confluence at Wentworth), while the Murrumbidgee is at best navigable to Narrandera. But Echuca is the limit of normal river traffic on the Murray, and for the 500mi. in South Australia Morgan is the traffic centre. The trade is mainly in pastoral products (wool, tallow, etc.) and some agricultural products downstream, and supplies and stores upstream, carried in the characteristic flat-bottomed, two-decker river steamers; but the trade has dwindled greatly as railways offer preferential rates. The future of the Murray-Darling as a water-way system is bound up with the schemes for large-scale regulation and development—locking, etc.—schemes destined to be but partly fulfilled for some time to come (see MURRAY RIVER). Of the northern rivers the Victoria, Daly and Roper are navigable for stretches of c. 100, 70 and 90mi. respectively, the last for craft drawing 14ft., but in the wet season they are often violent. Most of the streams on the east, south-east and south-west are useful only for short stretches near their mouths (which are sometimes sand-barred), but their "drowned" lower valleys often provide useful harbours.

Railways.— By 1937 the total length of railway lines in Australia open for general traffic stood at 27,896mi. In addition some 3,000mi. were privately owned, consisting mostly of "light" lines, built (under licence) by companies engaged in the lumbering, mining, sugar and other industries, though 800mi. of these lines were open for general traffic. The remainder were public property: Federal (Commonwealth) Government, c. 2,000mi., State Governments, c. 25,000mi. The total capital cost of the public lines was (1937) £336 million, or c. £49 per caput of population. The State railways had a net revenue of c. £11·9 million offset by interest charges. Australian railway construction has hitherto been financed largely from London, and in 1937 interest on railways loan expenditures (excluding Federal lines) amounted to £12·3 million. Loss on capital cost has thus been incurred. Costs both of construction and of "running" are high. Salaries have continuously increased, along with the cost of living, as a result of wage awards. At the same time Australia pays something for its progressiveness, and something for its physical handicaps. Railways have a "developmental" character. Profits may not be expected for some years after construction. The longest lines, moreover, those which reach out into the interior, often have the least (average) traffic—especially "outwards" freight—offer the lowest freight rates to encourage settlement, and thus show the highest working costs. And yet these lines are precisely those which are doing most to develop the continent. The Federal railways (*i.e.* the Trans-Australian, Central Australia, Federal Capital Territory, and North Australia). besides being truly "national," are predominantly of this character. (Trans-Australian lines: Kalgoorlie-Port Augusta and Port Pirie; Port Augusta-Alice Springs; Darwin-Birdum; and others.) The losses which such lines incur have been for the most part foreseen and have been deliberately incurred, either for national (development or defence) purposes, or in the expectation that they would ultimately vanish. And this has now come to pass: in 1927 the Federal railways for the first time showed a net profit (£27,213) though this was still offset by interest charges of £318,700. The (State) railways--especially in the east and south-east—suffer from physical (relief) factors and also from the fact that they are roughly paralleled by coastwise maritime routes, which are preferred not infrequently by passengers as well as for goods. These State railways are to a large extent centred on the capitals --which are also usually the chief ports—and hare developed as independent systems. Queensland possesses the longest mileage (1937: 6,567mi., 3ft. 6in. gauge) comprising 5 lines (with branches) penetrating to mineral (*e.g.*, Cloncurry) and pastoral (*e.g.*, Longreach) areas in the interior; a long coastal line (with branches) from Brisbane to Cairns; a more developed network in the south-east, besides some detached sections. New South Wales (6,124mi. of 4ft. 8½in. line) has a wide-spread net draining the wheat and pastoral Riverina, tapping the pastoral lands and rivers of the Central North and debouching on Sydney and Newcastle. A coastal line now runs north to Queensland and south for a shorter distance. One line now crosses the west plains to Broken Hill and one goes south to the Australian Alps. Victoria (4,721mi.; 5ft. gin.) has the densest net. It spreads fanwise north and west from Melbourne to the Murray, Wimmera and western districts, and also east along the coast into Gippsland. These are mainly farming (wheat, sheep, etc.) lines with Warrnambool and Portland as secondary (west) ports. Western Australia (4,357mi.: 3ft. 6in.) has a well developed grid paralleling the south-west coast and opening up the wheat, sheep, etc., areas inland from Northampton to Albany, besides several long "mineral" lines (Perth-Kalgoorlie; Geraldton-Meekatharra; Port Hedland-Marble Bar, etc) penetrating radially inwards. The South Australian system (2,529mi.: main lines, jft. gin.; others, 3ft. 6in.) centres mainly on Adelaide and is developed eastwards (lower Murray valley: fruit, etc., and Mallee: wheat) and northwards (wheat, etc.). More detached sections serve the south-east districts (Mount Gambier) and Eyre's peninsula, and long inland lines bring ores from Broken Hill to Port Pirie (Spencer's gulf) and open up Central Australia (Oodnadatta). Tasmania's system (651mi.: 3ft. 6in.) is developed mainly in the north with important branches to the west (mineral) district and south-east through the fertile agricultural valleys to Hobart. As these systems developed they were gradually linked at the State boundaries, and main lines connecting, first the east capitals and then also (1917) Perth, came into existence (Perth-Brisbane: 3,475mi.; 6 days, 1¾ hours, schedule time). Recently also the States have come to co-operate, for their mutual advantage, by cross-border systems (*e.g.*, Victoria and New South Wales across the Murray; Victoria and South Australia in the Mallee and Mount Gambier-Portland railways). To this end the Commonwealth (Federal) influence also steadily contributes, representing the wider national interests. Thus the gauge problem—3 breaks and changes on the Perth-Brisbane journey—is now being faced. Two important breaks in the transcontinental line have already been removed, and other proposals are under consideration.

Aviation.— The Civil Aviation Department (Commonwealth) has been active in encouraging research, construction, and in opening up commercial routes. In 1937, Australia had over 117,000mi. of approved regular service routes, with 256 landing grounds controlled by the Federal Government. All large towns are now linked by air, and a regular service is maintained with New Guinea and Great Britain. Certain of the air services are subsidized by the Government, and a scheme came into operation in 1938 by which first class mail is carried between London and the Dominions by flying-boats. Mail despatched from Australia is, however, surcharged. An air ambulance service was developed (1.928) at Cloncurry, in Queensland, for settlers in remote districts; and bases now exist at Wyndham, Port Hedland (Western Australia), and Broken Hill (New South Wales). In 1936–37 civil aviation machines covered over 8,000,000 miles, carrying 102,000 passengers, 822,000lb. of goods and 168,000lb. of mail, with a loss of 19 killed and 14 injured. Meteorological services are provided at main capital city aerodromes, and new first class stations have been provided on the Singapore and New Guinea routes. Radio aerodrome control came into operation in 1938 at the Brisbane, Sydney, Melbourne and Adelaide airports.

Posts, Telegraphs, **etc.**—Besides the normal inland postal services, which often operate over long distances, Australia has an extensive coastal packet service plying between the various ports of Australia and to outlying islands and Tasmania, as well as overseas mail services to Pacific ports, North America and Europe (Fremantle-London, via Suez; average time: 26½ days; Sydney-London via San Francisco: average 3j3 days). Mails are increasingly carried, especially to outlying settlements, by aeroplane (*v.sup.*). There were (1937) c. 346,000mi. of inland telephone lines (122,000 of which are used for telegraph also). and wireless telegraphy and broadcasting are becoming increasingly common and are a boon to remote parts. In spite of increased labour costs, superannuation and pensions, and reduced rates and charges, the posts, telegraphs and telephones of Australia, which are under Federal control, have been worked at a profit recently (1936: £3·3 million). Australia is connected by

cable with Europe (a) via South Africa by two routes, of which the shorter (Adelaide-Perth-Mauritius, etc.) is 15,919mi., (b) via Norfolk island, Suva, etc.–Vancouver Island. thence across Canada, etc., is 14,707mi., (c) Adelaide-Darwin-East Indies, East Asia and Siberia; 13,52jmi. Submarine cables also link Australia with New Zealand, New Caledonia and other adjacent islands. The number of cablegrams received and despatched had mounted (1936–37) to 1,439 million (New South Wales: 742,000; Victoria 477,000). In 1927 a '(beam" wireless service was established between England and Australia and wireless communication (including telephony) has since then been established between Australia and the more important centres of the Old and New Worlds.

Shipping.—Australian trade (passenger, mail and cargo) is carried in some 6.3 million tons (1936–37) of shipping, or slightly less than 1 ton per caput of population. The total volume has increased fairly steadily (1921–22: 4.56 million, 1929–30: 5·5 million tons), and the average tonnage of vessels from 2,910 tons to 3,823 tons (1936–37). Vessels trading overseas engage in interstate trade only under restricted conditions. The tonnage engaged solely in interstate traffic is 16–18 million, coastwise traffic being very well developed. The proportion of British-owned (oversea) cargo-carrying tonnage had until recently been in decline (1921–22: 86%, 1932–33: 66%, 1936–37: 73% carrying 72% of the total cargo). The foreign tonnage is engaged mainly in trading between Australia and its home ports (*e.g.* French: New Caledonia and France; Dutch: Holland and Dutch East Indies). The sale of the Commonwealth Line (1928) to private interests—the result of the failure of the experiment in (Federal) Government shipping—has reduced the amount of Australian tonnage (1937 = *c.* 5% of the total), which is now mainly engaged in Pacific and coastal trade. The total amount of cargo discharged and shipped amounted in 1937 to 14 million tons, of which 6.5 million tons is interstate cargo.

Ports.—The principal Australian ports are: Sydney (1936–37: 10·9 million tons entered): to London (Suez) 11,538 nautical miles, Naples, 9,438, Yokohama 4,316, Singapore 4,306, San Francisco 6.467, Vancouver 6,848, Panama 7,692, New York (Panama) 9,704, Auckland 1,264. Melbourne (8.1 million tons): to Sydney 576 nautical miles, Adelaide 499, Hobart 443. Adelaide (4.9 million tons): to Fremantle 1,353 nautical miles. Newcastle (N.S.W.) (4.8 million tons). Brisbane (4·5 million tons): to Sydney 474 nautical miles. Fremantle (3.5 million tons): to London (Suez) 9,537 nautical miles, Naples 7,437, Colombo 3,120, Cape Town 4,708. (For other ports see under the various States.)

Finance.—Under finance, Commonwealth and State finance have to be distinguished, though the relations between the two have been repeatedly modified (*v.* inf.). Commonwealth receipts have risen fairly steadily from £64 million (1921–22) to £89 million (1937–38), the chief sources being (1937–38) customs (£33 million), excise (£15 million), income tax (£9 million), and revenue from business undertakings (£17 million). Expenditure has risen to £85 million (1937–38): some of the items are—war pensions, etc. £19 million; pensions £16 million; posts, telegraphs, etc. £14 million; railways and new works £4.6 million; defence £6.3 million; Home and Territories Department £1 million. The total cost of the war of 1914–18 and subsequent war services (repatriation, gratuities, etc.) was estimated (1937–38) at £563 million. Of note also is expenditure on behalf of superannuation and pensions (old age, invalid, war) and maternity allowance (£4 per child). State revenues had risen (1937–38) to £126 million, derived chiefly as follows: public services (railways, water-supply, etc.) £54 million; taxation £37 million; land (sale or lease) £4 million; and also, from Commonwealth subsidies, £10 million. Expenditure is mainly on account of interest on debt, £39 million; railways, £34 million; educational, £11 million; medical and charitable, £13 million. The total public debt (Commonwealth and State together) had risen in 1936–37 to £1,419 million, = £207 13s. 11d. per caput. Loans, originally raised by the States, but from 1912 onwards by the Commonwealth also, mill in future be raised entirely by the Commonwealth—on behalf of itself or of the States—acting on the advice of the Australian Loan Council, virtually a committee of Federal and State treasurers. Loan moneys are mostly expended on development of communications (chiefly railways); on water supply and conservation; land purchase and settlement; vermin control (rabbit-proof fences, etc.); public buildings; and defence

Australians are taxed (1937–38) at £17 6s. od. per caput, the total amount paid in taxes being £118,741,000 (Commonwealth £69 million, State £49.69 million). The Financial Agreement Act of 1928 reorganized the relationship between Commonwealth and State finance; the outstanding arrangements being that the Commonwealth took over (from 1929) all State debts, contributes £7.5 million annually to interest charges, and also contributes towards the extinction of the debts in 58 years. Debts incurred after July 1927 are to be extinguished, by a similar arrangement, in 53 years.

Australia has two mints (Melbourne and Perth) issuing silver and bronze coin and gold bullion. Since 1931 no gold coins have been minted. The total issue of gold had amounted in 1937 to £462 million (bullion £58 million), and Treasury notes in circulation totalled £48 million. There was formerly a third mint at Sydney, but this was closed in 1926.

Banking in Australia is conducted by the Commonwealth Bank—virtually a central bank together with a savings bank business—and 16 joint stock banks, 3 of which are foreign institutions and exist mainly for the purposes of exchange. The banking business is highly profitable, and reveals a high degree of national thrift. The dividends declared in 1937 totalled *c.* £4 million, and averaged 7%. The profits of the Commonwealth Bank alone aggregate, since its inception in 1922, £14·5 million (1938). In 1938 the cheque paying banks held deposits to the value of £391·5 million (= £56 16s. od. per caput of population), against assets of £465 million; while the Commonwealth Bank holds assets of £65 million. State savings banks exist in Victoria. South Australia and Tasmania; former savings banks in other States having been merged in the Commonwealth Bank (Savings Dept.). Savings bank deposits amounted (1938) to £225 million = £34 18s. od. per caput of population, out of which the Commonwealth Savings Bank held £143 million. Of a special nature are the agricultural (rural) banks, conducted by the States, which grant credit to settlers, and in general exist to promote settlement and development.

POPULATION, IMMIGRATION AND SETTLEMENT

The total population of the Commonwealth of Australia, as returned by the Census taken on June 30, 1933, was 6,629,839. Of this total New South Wales, which includes only about 10·4% of the whole area of the Commonwealth, had the greatest portion, 39·23% (or 2,600,847 inhabitants); Victoria, with only about 3% of the territory of the country, had 27·45% of the population (or 1,820,261 inhabitants); while Northern Territory with over 17·5% of the entire area, had but ·07% of the population (or 4.860 inhabitants). The division by sex was approximately equal for the continent as a whole, but in the cities and the more closely settled parts there appeared a slight preponderance of females (e g., in New South Wales, Victoria and Tasmania) while in the more pioneering areas—notably in Queensland and Western Australia, the reverse holds. Aboriginals and half-castes are now reduced to some 75,000, mainly in the northern areas. They are now protected by the Governments, reserves have been created, and they are cared for by various missionary bodies, sometimes with encouraging results (*e.g.*, the mission stations in the north-west). It seems, however, still an open question to what extent they will survive civilization. Of the 49.849 other non-Europeans (including half-castes), 25,143 are Asiatics—mainly pearl-fishers and Chinese (c. 11,000) (laundry and joinery workers in the cities; market-gardeners and cooks on "out-back" stations). The great bulk of the population (c. 98%) is of British origin and born in Australia—(a rapidly increasing proportion)—the British Isles or New Zealand. Increase in population has been (1921–33) at the rate of 1·38% per annum, and is due partly to "natural" increase and partly to immigration. In the quarter century 1901–26, 80% of the total increase was "natural." A comparatively low birth-rate (22 per 1,000; cf. Great Britain: 20·3) is counterbalanced by a low death-rate (9.4 per 1,000, cf. England and

Wales: 11.6; Scotland: 13) with a resulting "natural" increase of 13·9 per 1,000 (England and Wales: 6.9; Scotland: 8·4). The remaining 20% has resulted from immigration which has recently varied very widely (see below).

With 2.23 people per square mile Australia is the most sparsely populated continent (cf. Europe: c. 127), but the densities vary greatly as between and within the different States. Victoria is the most densely populated (20·71 per sq. mile), Tasmania (8 68), New South Wales (8·41) having also fair densities (cf. South Australia: 1·53; Queensland: 1·41; Western Australia: 0·4j). Hitherto, in fact, for settlers from north-west Europe the southern and south-east portions of the continent have been found most habitable. Apart from mining settlements (which account for perhaps under 2% of the total population) some 40% of Australia, having less than 1 j in. average annual rainfall, is useful chiefly for pastoral purposes and is hence thinly peopled. In the tropical areas (40% of total) there are some 180,000 people, 100,000 of whom are in the east coastal parts of Queensland. Besides a smaller area in the south-west, a block of c. ½ million square miles (c. 17% of the continent) in the south-east holds 70% of the population and produces c. 75% of the total wealth, and to this area may be added south-east Queensland and north-east New South Wales which are also areas of relative concentration. Within the areas of greater density, again, the outstanding feature is the preponderance of urban population, viz., 64% of the total (New South Wales: 69.24%; Victoria: 65·39%; the lowest being Tasmania: 51·49%) due mainly to the growth of the capital cities. Thus 46·87% of Australian population is "metropolitan"; in Victoria and Southern Australia about 54%, in New South Wales and Western Australia over 47% of the population is in the respective capitals and the six Australian capitals together contain 46·87% of the whole Commonwealth population. (Sydney: [Dec. 31, 1939], 1,302,890 pop.; Melbourne: 1,046,750.) The situation is disturbing particularly because it is intensifying (cf. "metropolitan" population in 1911= 38%), but it is not entirely unnatural or portentous. The causes are complex: amongst them are probably: (1) the desire, strong under Australian conditions and operative particularly amongst the younger generation, for the opportunities and amenities of city life. (2) the same type of desire on the part of successful pioneers (farmers; pastoralists) to retire and enjoy their wealth and leisure in cities. (3) the profitableness of "extensive" methods of land utilization (*e.g.*, wheat farming; pastoralism: *v. sup.*) coupled with the isolation and lack of amenities often implied. (4) the growth of manufactures and commerce in the urban (coastal) centres. Droughts and the decline of mining are perhaps contributory and more or less occasional causes and the fiscal (protectionist) policy has also been blamed—with some reason, though it is probably an effect rather than a cause.

The result is reflected in the proportions of population engaged in various pursuits. Of the total "bread-winners" (1921: 2.3 million=~.43% of total population) some 31% work for wages or salaries. Again, in 1921, 31·2% of the "bread-winners" (725,800) were engaged in industry (1911: 28.4%); 25.8% (600,000) in primary production (1911: 30·4%); 15·3% in commerce (1911: 14·5%); domestic occupations, 9% = 210,000 (1911: 10% = 203,000); transport and communications: 9% (1911: 8%); professional, 8.7% = 202,000 (1911: 7.3% = 147,000). Thus nearly all occupations connected with urban life in Australia have received accessions, but the country occupations, and also domestic occupations, have relatively, and in the case of mining and, pastoralism, absolutely declined.

Immigration and its problems are closely related to these facts. Unemployment, most marked and most concentrated in the cities with their young and sensitive industrialism, affects public opinion—the city voter is normally in the majority. The immigrants themselves often come from urban conditions and in times of stress readily revert to these conditions. Unemployed persons sometimes refuse to take work outside the cities. The country has thus, in a sense, its apertures blocked and the inflow is carefully filtered. Alien immigration is strictly regulated—the main features of the "White Australia" policy are well known—and the objection to immigration of southern Europeans (Italians) and even of Maltese has recently become pronounced. Land tenure conditions may, at times and in places, have some effect, but the steady policy of all the Governments, through their highly elaborated and varying laws and regulations, is to encourage not only settlement but closer settlement on the land and, when the need has been felt, public opinion has not failed to compel the "discovery" of suitable settlement areas. The settler is regarded as an asset: given a good start in time he becomes a revenue-producer besides a citizen and a father of citizens. Thus the most generous treatment is usually accorded—land, implements and stock, scientific advice, seed, credit, easy repayment terms, special freights and such educational and general social amenities as are possible. Large estates are bought and thrown open to closer settlement. The following proportion of the States and Commonwealth were (1937) occupied by private individuals or corporations under various conditions—freehold or under lease or licence (mining, pastoral, timber, etc.): New South Wales: c. 92%; Queensland: 83%; Victoria: 70%; South Australia: 57%; Tasmania: 54%; North Territory: 56%; Western Australia: 38%; Commonwealth: 58%; and there have been considerable recent increases in Western Australia, South Australia and Queensland. The root causes influencing migration are deep-rooted and the various Government agreements to promote migration (*e.g.*, Joint Commonwealth and States Immigration Scheme [1920]; British and Commonwealth Governments Migration Agreement, 1925), while admirably and generously conceived, have hardly produced the anticipated results. Immigration reached a maximum in the period 1921–25, but after 1927 a decline set in, and the depression years after 1929 saw a net loss of population due to extensive emigration from the Commonwealth. During the decade 1930–40 there was a large increase in the proportion of immigrants from Southern Europe; but in spite of various settlement plans (notably group settlement and nomination schemes) permanent new arrivals in Australia have decreased very considerably (1927—60,000; 1937—16,000) and in the same period the number of persons entering with official "assistance" fell from 30,000 to 141. Recently there has been an attempt to encourage the migration of young people by such schemes as the "Big Brother" movement; the Fairbridge Farm Schools in Western Australia; and the South Australia apprentice scheme; and by the farm training of many young refugees from Central Europe.

SOCIAL CONDITIONS: GENERAL SUMMARY

In Australia a small community, British by descent and in tradition, has entered and is developing an area relatively large, unoccupied and sharply characterized—an area also in the nature of a frontier, isolated and yet confronting massive populations. Herein lies the key to Australian social conditions. In Australia British ways and traditions persist but are liberated, as it were, from certain inhibitions. British ideas and ideals prevail, but with perhaps more of the vehemence of youth. British economic and political methods continue, but modified by a new physical environment and the uncertainty and inexperience entailed. Democracy takes very concrete, and sometime novel, forms. The ingrained striving for independence and equality and the deep-seated desire for racial integrity and a high standard of social life involve difficult questions; but Australian life is based on sobriety, business ability and common sense.

Normal primary education is provided free by the States (1936: 10,307 schools; 906,221 scholars with an average attendance of 87.4%). Medical care of children is established and extraordinary efforts are made to cater for the sparsely-populated areas (*e.g.*, half-time schools; "travelling" schools; itinerant teachers; correspondence teaching; lending libraries). Secondary education and the training of teachers is now highly organized and liberal scholarships and bursaries are available. Agricultural education is well-established and progressive, and technical education in general is amply provided for. The educational systems are gradually being internally co-ordinated (New South Wales has led the way) to culminate in the university. There are six universities, those of Sydney, Melbourne and Adelaide being the oldest and best endowed. Good museums, libraries and galleries

(art, etc.) exist. Some £10 million of public money is spent annually on education in all its forms, and in addition there is the expenditure of private schools, which are numerous and usually good. Public hygiene stands at a high level. Legislation affecting food, drugs, milk, etc., is enforced; infant and child welfare is attended to as well as the control of infectious diseases. Public water-supply and sanitation are efficient in all the more settled areas, many of the former schemes being on a very large scale (cf. Western Australia's goldfields' supply; Southern Australian supply schemes). The Institute of Tropical Medicine (Townsville) is an illustration of the volume of trained thought focussed on national problems, a movement typified now by the manifold activities of the Council of Scientific and Industrial Research. These features are related to the largely urban character of that society. The high proportion of persons engaged in professional (including civil service) pursuits is one incidental corollary but the rise of industrialism in recent years is partly a cause and partly an effect of urban life. Australia has been called the "working man's paradise" and its government an "aristocracy of labour." Under adult suffrage labour wields great political power: the trade unions include (1937) some 856,000 members, matched, it is true, by some 169,600 persons organized in employers' associations. The "basic wage" principle, and the "44 hour week"—though in detail alterations and modifications continually occur-express the determination that every man, woman and child shall have a modicum of health and happiness. State pensions (old-age, invalid, maternity) and the child endowment practised in New South Wales—are regarded as part of a citizen's rights. Distinct from this are the extensive public and semi-public charities amounting to c. £8 million (1937). In a small and much-governed community—there are six State Legislatures besides that of the Commonwealth, with, in all, some 609 representatives—State interest and control is an accepted principle and the system of bounties, bonuses, protective tariffs, etc., is applied in the social no less than in the economic sphere. The State, in fact, being the people, thinks and cares for itself. Critics assert that Australians show a tendency to regard their public services too exclusively as citizen-supporting possessions and too little as business organizations subserving general utility.

If this is so, it is essential that the community as a whole should pay its way. Australia has a public debt of £1,275 million (1937–38) incurred by borrowing.

Compulsory arbitration is in force, but strikes during the period 1932–37 occasioned the loss of over 2 million working days and £1.7 million in wages (cf. 1926–30, *c.* 10 million days lost). The main causes of industrial wage disputes are wage questions and working conditions, and thus the relatively small number of strikes since 1931—loss of 2 million days between 1932–37=smallest loss in any 5 year period since 1912—is related to the fall of prices, which has enhanced the "real" value of wages.

At the same time some advantage has been taken of the Arbitration Court rulings: matters having become so confused that the Commonwealth Government has been compelled to take steps to simplify and regularize the situation.

At the same time the young Australian manufacturing industries are somewhat sensitive to economic conditions. The number of unemployed has fluctuated (1937–38) round about 40,000 per annum (=9·3% of total Union members) and those unemployed, along with their industries, are mainly in the cities. At the same time Australian national wealth, even though partly based on borrowed capital, is considerable, and this wealth is, on the whole, well distributed. But it is, after all, productive capacity which constitutes real wealth, especially viz-a-viz borrowed capital. The total production of Australians in 1936–37 was estimated at c. £456.7 million or £67.1 per caput, and, if the year 1911 be taken as basis of reference (=100), this represents a productive activity of 163. Thus, though fluctuations, and also serious crises are bound to arise, Australian economics are probably securely based. In common with other young countries she has undergone somewhat violent crises but the steady movement is towards the development of her resources, towards an influx and growth of population, and towards her conversion from a debtor to a creditor nation.

Some 20% of the Commonwealth is of little apparent value except possibly for sporadic mining. A further 50–55% is, apart from possible mining value, probably of permanent value for pastoralism only, while 21% is good–fair agricultural land, the drier parts suitable mainly for wheat-growing. Besides knowledge, therefore, a sense of responsibility is necessary if Australia is to be wisely developed. The "White Australia" policy—morally and economically justifiable on Australian pre-suppositions-demands determination and some self-denial if it is to be maintained in practice. The Australian will have none of the "tropical plantation" system which he, perhaps shrewdly, identifies with the interests of capitalism rather than with the interests of the coloured races. But neither could a Queensland sugar industry be maintained indefinitely unless paid for strictly out of Australia's own pocket. Unfortunately there has developed a differentiation—hardly an antithesis—in economic tendencies. On the one hand primary production, land settlement and development, with free trade or deflated protection: on the other industrial and manufacturing development with its concomitants protection and urban—or at least centralized life. On the one hand complete economic self-sufficiency; on the other fuller participation in world, and particularly imperial, economics. The advocate of the former points to increasing output and self-sufficiency and also complains of unemployment. The latter points out that $\frac{4}{5}$ of the wealth is produced on the land, that labour is scarce and dear, and immigration retarded. And certainly agriculture and pastoral development have in recent years not made the advances anticipated and the pastoralist has perhaps to complain of political quite as much as of economic or physical disabilities. Fortunately this seems but a phase. Manufacturing is a young growth in Australia and so far works mainly for the home market. If ever foreign competition has to be met in an overseas (export) market, it seems inevitable that costs of production will have to be abated, or greater efficiency achieved. Meanwhile the older industries—pastoralism and agriculture—though in a degree specializations, have long had to cope with world trade conditions. And if the manufacturing industry is to continue to expand, it will do so most easily with an expanded home market. Thus, it seems, things must adjust themselves, especially as Australia, even in manufacturing industry, will have in some degree to specialize. Fortunately indications are not wanting that these facts are becoming appreciated. Australia can hardly fail to prosper.

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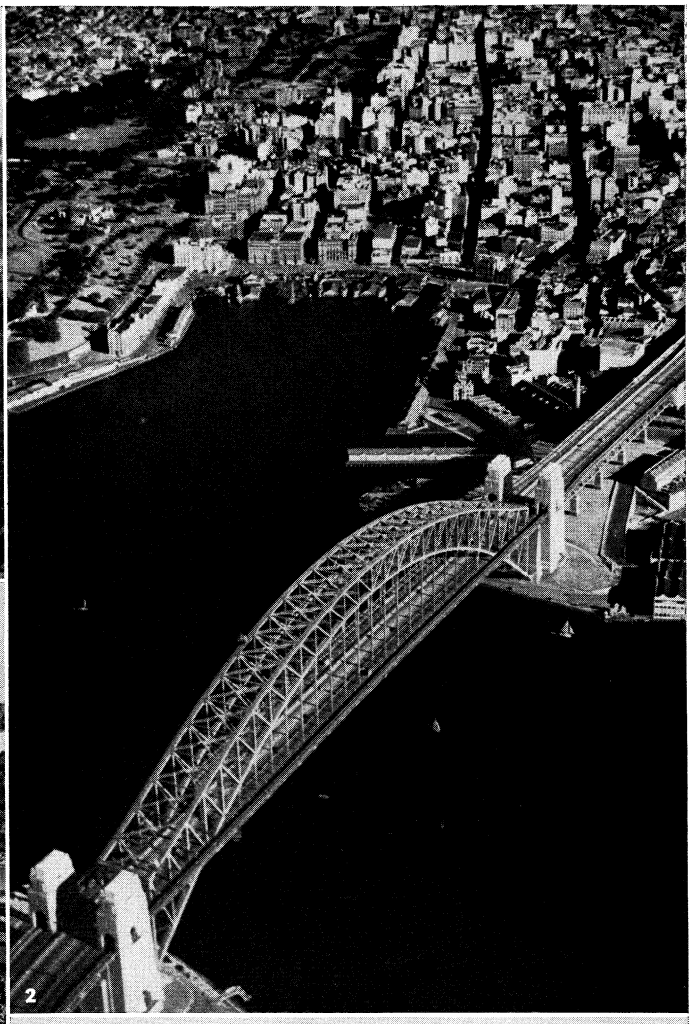
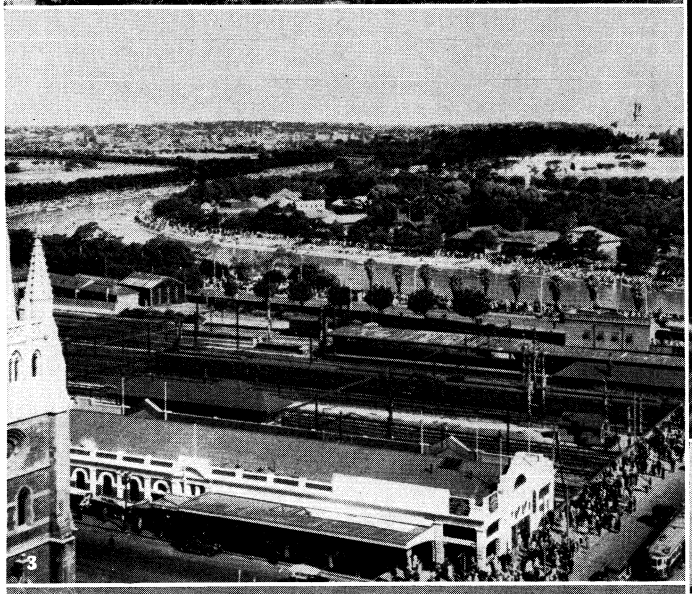
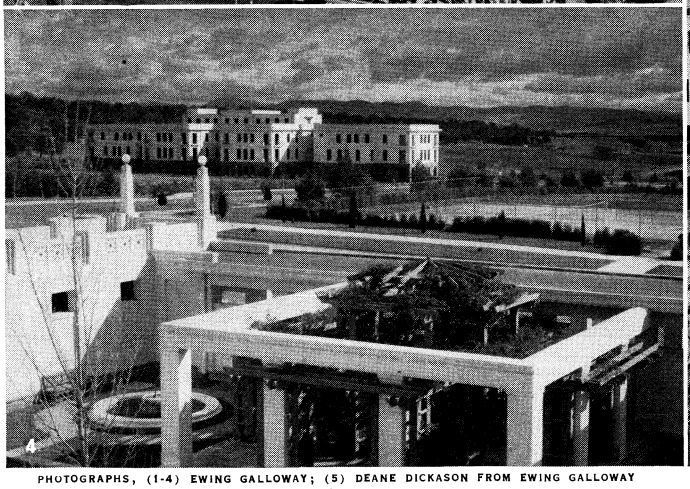




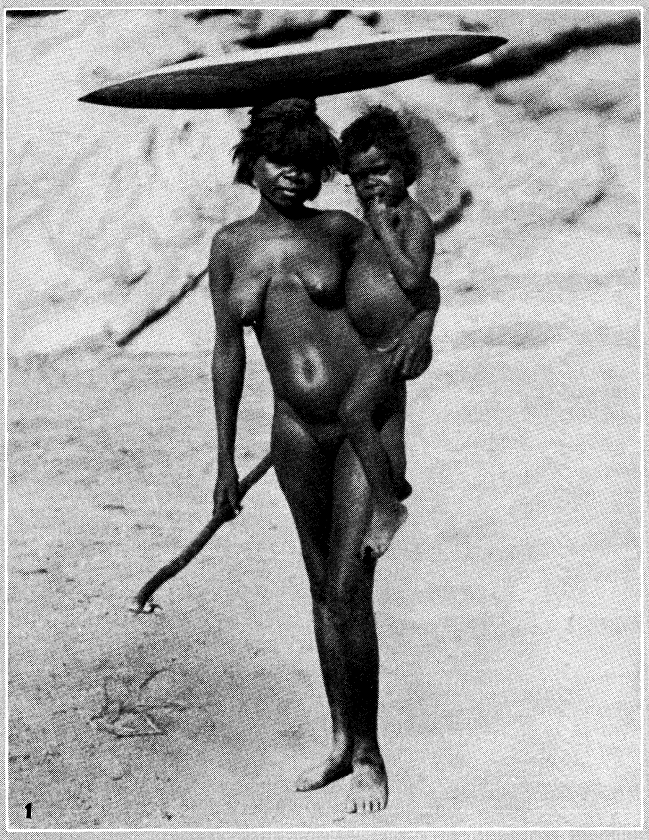


PHOTOGRAPHS, (1-4) EWING GALLOWAY; (5) DEANE DICKASON FROM EWING GALLOWAY

CITIES OF AUSTRALIA

1. Business district of Sydney, capital of New South Wales, with Hyde park in the foreground
2. Aerial view of Sydney, showing harbour and steel-arch bridge completed in 1932
3. Melbourne, capital of Victoria, during a regatta on the River Yarra
4. Commonwealth offices at Canberra, the capital of Australia
5. Queen street, the main shopping thoroughfare of Brisbane, capital of Queensland

AUSTRALIA



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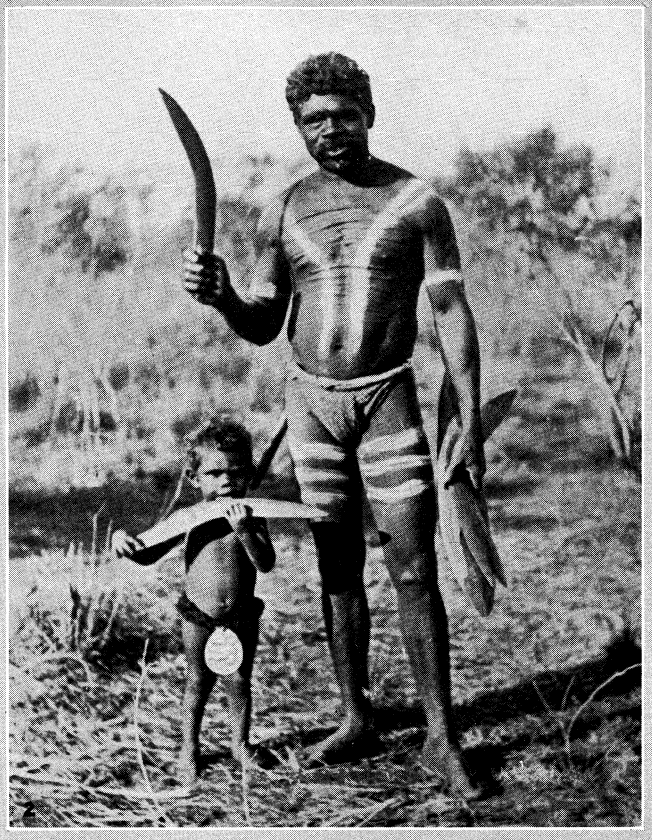

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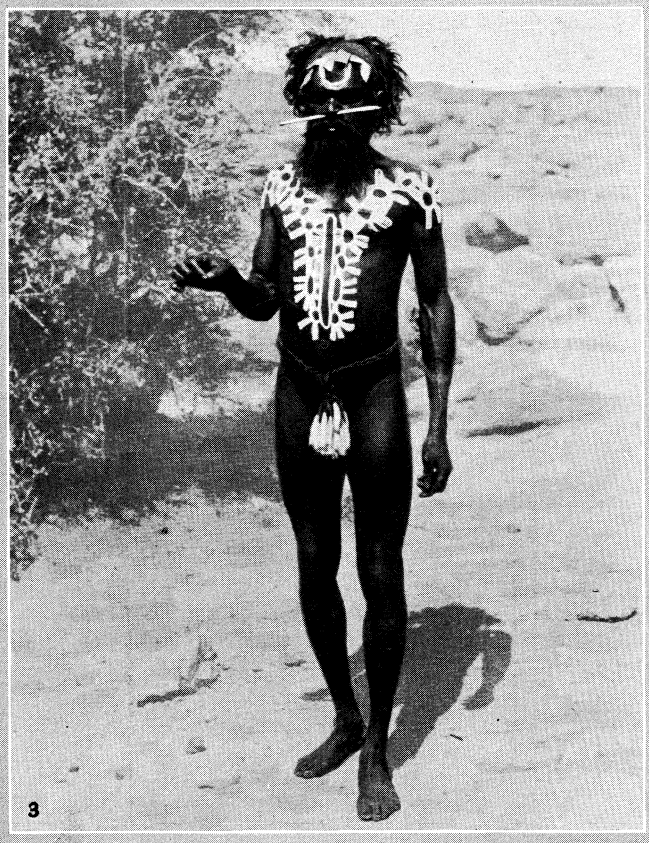

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(1, 3) FROM SPENCER AND GILLEN, "THE ARUNTA," (MACMILLAN); BY COURTESY OF (2) THE HIGH COMMISSIONER FOR AUSTRALIA; PHOTOGRAPH, (4) INTERNATIONAL NEWSREEL

TYPES OF AUSTRALIAN ABORIGINES

1. Arunta woman and child. The mother is going out into the scrub in search of seeds and roots for food, carrying a digging stick in one hand and balancing a pitcher on her head
2. A Broome native and his child with boomerangs, the aboriginal weapon, in their hands
3. Arunta medicine man, showing the ***erunchilcha*** or "devil's hand" on the forehead and a design on the body, with the black line representing the ***Eruncha*** or "evil one"
4. Wooden image from the "Devil Devil House" which the natives believe protects them from ghosts and other evil spirits

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See also under individual States and special articles. (O.H. T. R.)

AUSTRALIAN LANGUAGES, the aboriginal dialects of Australian natives. There are two fundamental phonetic features which, as it seems, are to be found in all the Australian tongues: in the first place the lack of all fricatives (s, f, x) which occur only in the youngest languages and but seldom, though there are palatalizations of the dentals (ty, dy) that repeatedly pass over to affricates (ts, dz); in the second place the lack of a discrimination of voiced and voiceless consonants within the same language; thus there exists neither k nor g, neither t nor d, neither p nor b, but a sound intermediate between both, taken by some investigators as voiced (g, d, b), by others as voiceless (k, t, p).

Simplicity in the initial and final sounds is found with the youngest languages, whereas the oldest languages of Australia (in the north-west, north and south-east) show also double consonants as initials (kl, pl, tr, pr and others) and final sounds (lk, lt, rk, rt and others).

The characteristics of grammatical structure are very different according to the different groups. The most essential grouping is to be derived from a division into Northern and Southern languages. For a long time only the languages of south-west Australia and south Australia, Victoria, New South Wales and Queensland were known, those of north-west and north Australia becoming known much later.

Northern Languages. — The languages belonging to this group have no intrinsic relation to the Southern languages. Among themselves they show no relation of any sort in vocabulary and but little in grammar, so that there is, in a limited space, a great diversity of languages. The area of these languages begins in the west with Roebuck bay, goes eastwards thence in 19° to 21° of southern latitude on the course of the rivers Flinders and Leichhardt, is interrupted by a branch of the Southern languages, turns thence north to the 17th° and ends at the same degree on the east coast at about Cape Flattery. In the centre the Aranda penetrate beyond the 28th° of southern latitude.

Southern Languages. — The Southern languages are divided into three sub-groups: (1) an older West group comprising the north-west and the Northern Territory, with some languages of Cape York peninsula. It is characterized by grammar and vocabulary, also by vocalic, sonantic (r, l, nasals) and consonantic (also double consonantic) final sounds. To it belong: the Western language with the Ruby creek language; the King's sound l.; the Ord R. l.; the Katherine R. l.; the Woolmunga l.; the Larakiya, the Cobourg peninsula l.; the Karandi; the Walsh R. l.; (2) a younger Eastern group, comprising the southern centre and the east with exclusively purely vocalic final sounds. To it belong: Aranda with its dialects: Yaroinga, Underekebina, Aranda, Wychinga; Yelina; Walooker; Chingalee; Leeanuwa; Mingin; Cape York languages with dialects: Otati, Yaraikana, Gudang; Island dialects: Nggerikudi, Coen River dialect, Mapoon R. dialect; (3) the Central group, the youngest group with vocalic and consonantic (l, r, nasals) final sounds; due perhaps to a blending of the West and East groups. To it belong: Woolna; Caledon bay l.; Roper R. l.; Akoonkul (Akoonkun); Princess Charlotte bay language. Except for some fundamental features of the grammar the languages are radically dissimilar. They have in common the preposition of the genitive and possessive and the use of suffixes and postpositions. A dual occurs with the personal pronoun besides singular and plural. The Cape York group has a trial. In the first person plural (dual, trial) an inclusive form (comprising the person addressed) and an exclusive form are repeatedly distinguished. In the Island languages of the Cape York group the third person singular (and the first person) distinguishes special forms for masculine and feminine; the Daly river language also discriminates bet een animate and inanimate. The Southern languages comprise by far the greatest part of Australia. Aranda, which belongs to the Northern languages and in the centre penetrates deeply into the south, almost splits them into an East group and a West group.

These languages are connected by common traits in the personal pronoun and the more or less complete occurrence of the names of the following parts of the human body: da (wa), mouth; *tyalana*, tongue; *mura*, hand; *ngama*, breast; *dara*, thigh; *dina*, foot; *guna*, excrement. All these words are originally proper to the Central group of the Southern languages, the only one which has exclusively vocalic final sounds. Other common characteristics are: lack of r and l as initials, occurrence of the combination ld (lt) as medial sound and preposition of the affixless genitive. This group as the youngest among the Southern languages has penetrated from the north-east (146° to 150° of eastern longitude) as far as the south coast (134° to 138° of eastern longitude) and has driven the older, originally independent linguistic groups towards the east, and west, and south-east to the coasts, producing among them a series of its own peculiarities in different degrees. Thus the present unity of the Southern languages is but secondary and later.

The Southern languages are divided into the following groups which are ordinated here by their age in Australia:

(1) the Central group with the North Central group and the languages belonging to it: Kogei, Barcoo; Puruga, Goa, Cook District language; Mamburra, Wakelburra, Burdekin R. language and with the South Central group and the languages belonging to it: Parnkalla, Tyura, Meyu; Nulla, Dieri, Yarrawurka, Wonkamarra, Evelyn Creek l.; hfarowra, Kurnu; Karawalla-Tunberri, Ulaolinya-Wonkajerra, Kana; Kungerri-Birria l. The discrimination of a transitive and intransitive form with the personal pronoun and the substantive as a subject of the sentence is a special feature here.

(2) The South-west group: Yungar, Ngaiarda, Kardu, Kanyara, Yamaidyi, Padu and Luridya. The peculiarities of the Central. group are here only partly preserved.

(3) The languages of the east coast, an exclusively geographic complex of languages (independent of each other): Murrawari; Thangatti-Yukumbul; Pikumbul; Kumbainggerri; Minpung; Turubul; Wakka-Kabi; Bieli-Kuinmurburra; Halifax Bay language; Bulponarra-Kokoyimidir; Bundyil language (to the South of the gulf of Carpentaria). Everywhere we find singular, plural, dual, with the personal pronoun. Discrimination of transitive and intransitive forms, of inclusive and exclusive forms is originally unknown. With the Minyung (and Kumbainggeri?) are found a division of the nouns into animate and inanimate beings, the first subdivided into male, female and animal, the latter into things and places and concordance of the adjectival and pronominal suffixes with the class of the substantive.

(4) The Narrinyeri group, along the course of Murray river; but insignificantly influenced by the Central group. To it belong: South and North Narrinyeri; Bangerang, Dhudhuroa, Pallangamiddah, the three latter greatly blended with Kulin, Kurnai, Yuin, Kuri. Here r- and l- occur as initials, ld (lt) as a medial sound and double consonantic final sound. Originally the dual and probably the difference between transitive and intransitive forms with the personal pronoun were absent. Comparative forms with the adjective are found.

(5) The Wiradjuri-Kamilaroi group, a blend of languages of the east coast with those of the Yuin-Kuri and the North Central group, divides into a South group: Wiradyuri, Wongaibon, Ngeumba, Burrabinya, Wailwun, and a North group: Kamilaroi, Yualeai (Euahlayi), Ngoorie, Wirriwirri. Affixal forms of the possessive and subjective pronouns are found here.

(6) The Yuin-Kuri group is related to the Eastern languages and to the Central group and, in its grammatical structure, to the Victoria languages. It comprises the Yuin sub-group (Yuin, Ngunawal, Thurga, Dyirringan, Tharumba, Wodi-Wodi, Illawarra, Thurawal) and the Kuri sub-group (Kuri, Gundunggura, Dharruk, Port Jackson language, Darkinñung, Awabakal, Kutthung, Biripi). Suffixing of the possessive and the subjective pronoun is more strongly pronounced in this group, the second in age of the Southern languages.

(7) The Victoria languages are the oldest group of the Southern languages and are the least influenced by the Central group. They are divided into an Eastern sub-group consisting of the Kurnai and a Western sub-group, comprising the Piangil, Buandik, Kolijon and Kulin, with the dialects Ngenngenwurro, Wuddyawurru, Bunurong, Woiwurru, Taunguwurru. It is the only Australian group that places the (affixless) genitive after the word governed and the possessive with the noun and the subjective pronoun with the verb are therefore suffixed. The personal pronoun possesses everywhere singular, plural, dual, in some languages also trial. A characteristic of these languages is the discrimination of inclusive and exclusive in the first person plural of the personal pronoun. Discrimination of transitive and intransitive, however, is lacking.

Relations to Languages. — There is a possibility that relations of the Victoria languages to the Tasmanian tongues may be demonstrated; both groups have in common r- and l- as initials and use possessive suffixes. Single groups of the Australian languages may show connections with single groups of the Papuan languages or with substrata of the Melanesian languages; but as yet no relationship has been conclusively proved.

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AUSTRALIAN LITERATURE. It has been described as an ironical commentary on Australian literature that the first writer on the subject should have borne the name of Barron Field. It is true, however, that when Field (he will be remembered as Charles Lamb's friend who emigrated to Australia and became judge of the supreme court of New South Wales) gathered together his *First Fruits of Australian Poetry* (1819) English civilization in Australia was scarcely more than 50 years old. With the early settlers in the late 18th century literature was, naturally, a slow growth, and when it did break into bud it was, equally naturally, with English soil clinging to its roots. The highly polished models of the 18th century and those of the romantic revival seem to have suffered little or no sea-change in transportation. The early Anglo-Australian versifiers adopted them as a matter of course. It was left to later poets, such as Charles Harpur and Adam Lindsay Gordon, to give the bush a place in literature, to experiment with new rhythms

Poetry. — Throughout the short history of literature in Australia we find poetry predominating with history and topography coming after. Charles Harpur (1813–68) may be regarded as the first Australian poet of any distinction. He was strongly influenced in his earlier work by Wordsworth and Shelley, and is now chiefly remembered for his *Creek of the Four Graves,* in which we see the bush vividly pictured for the first time. Very different, both as a man and as a poet was the once famous Richard Henry Horne (1803–84), that wild young Londoner, friend of Elizabeth Barrett Browning, who ran away from home to enlist in the Mexican navy and arrived in Australia in middle age to seek his fortune digging for gold. His contemporaries hailed Horne, in their excitement over his four poetic plays (*The Death of Marlowe* is the best known), as a new Elizabethan, but it is probably only for his narrative poem *Orion* that he is remembered to-day. Sold first at a farthing a copy, this blank-verse story of the loves of Orion for Merope, Artemis and Eos, contains many passages of sustained beauty, as well as some of the flattest lines in English literature. It was largely thanks to Horne that Henry Kendall (1841–82) received recognition during his life-time. The son of one of the earliest missionaries to New Zealand (an exceptionally intelligent and inquisitive cleric who compiled the first grammar of the Maori language) Kendall, at the age of 28 resigned his position in the colonial secretary's office to devote himself entirely (and, alas! unsuccessfully) to literature. He was rescued from poverty by the kindness of his friends, and though he died at 41, he lived long enough to write a considerable bulk of poetry (largely narrative) which was to rank in the judgment of later Australian readers beside that of his unfortunate friend Adam Lindsay Gordon. Kendall's best poem is his "Araluen," a poignant elegy on his daughter, though his "Hy-Brasil," "Cooranbean" and "After Many Years" still occupy an important position in Australian literature. He was one of the earliest Australian poets to receive recognition from England where many of his poems were printed in the *Athenaeum.*

The most eminent figure in Australian literature is undoubtedly Adam Lindsay Gordon (*q.v.*), whose romantic career is by now almost too well known to need re-telling. Born in the Azores in 1833, he was educated in England, but at the age of 20 was packed off to Australia in disgrace. His early occupations there included those of police constable and steeplechaser. After a variegated career he married, inherited a fortune of £7,000 and began his short-lived career as a politician by being elected in 1864 to the South Australian parliament. He resigned his seat after a few years, became the manager of a livery stable at Ballarat (he won three steeplechases in one day) and took up free-lance journalism, writing among other things, racing tips in rhyme. In 1867, he published his first book of verse *Sea Spray and Smoke Drift,* this was followed by *Bush Ballads.* In 1870 after having impoverished himself by his claims to the estate of Esslemont in Scotland (he believed himself to be the head of his branch of the Gordon clan), he corrected the proofs of his *Bush Ballads* and shot himself. Before he died, Gordon instructed a friend to burn a trunk containing all his remaining mss., and the instructions, unfortunately, were obeyed to the letter. In his verse, Gordon was strongly influenced by Byron, and, later, by Swinburne. In spite of this, however, and in spite of a remarkable memory (he was able to quote whole pages of Horace, Macaulay, Browning, and, much to the annoyance of his fellow members in parliament, Lemprière's *Classical Dictionary),* Gordon struck an original note in poetry. In such famous poems as "The Sick Stockrider" and "How we beat the Favourite" he has recaptured the joy of his favourite sport of steeplechasing and given us something of its rhythm. And yet in such a poem as "Whisperings in Wattle Boughs," while still maintaining his Swinburnisms, he can write movingly of his regrets for England and for the life of his boyhood. Gordon has had many imitators in Australia, but none has surpassed him for his unerring rhythms, his infectious delight in physical achievements and in the open air. It was most probably his bad sight which prevented him from giving us those touches of observation with which lesser poets have delighted us.

Since Gordon's time poetry in Australia has flourished, though we still wait for its full flowering. James Brunton Stephens, the author of a long narrative poem, "Convict Once," and of *The Dominion of Australia,* a fine piece of patriotic literature, was a Scot who came to Australia in 1866. His humorous poems, such as "Universally Respected" and "To a Black Gin" have caused him to be described as the Bret Harte of Australia. Equally patriotic, but considerably more sensitive, was George Essex Evans (1863–1909), the author of *The Australian Symphony,* and *The*

Repentance of Magdalene Despair, who successfully experimented with new metres. The 'eighties and 'nineties saw a renaissance in Australian poetry, with such men as Barcroft Boake (1866–92), a poet of the bush, strongly influenced by Gordon (his best known poem is "A Vision out West"); Victor James Daley (1858–190*j*), who reflects something of the glamour of the Celtic Twilight in his *At Dawn and At Dusk* and *Wine and Roses;* Andrew Barton Paterson (1864–1941), famous as "Banjo" Paterson for swinging ballads and lyrics; Henry Lawson (1867–1922), regarded by some as the national poet of modern Australia: Bernard O'Dowd. more severely disciplined than any of his forerunners, whose "The Bush" (1912) is full of fine imagery; John Farrell (1851–1904) author of "How he died" and "Australia to England"; and George Gordon McCrae, friend of Lindsay Gordon, and poet of aboriginal legendry. Among others worthy of mention are:—Philip Joseph Holdsworth, Francis Adams, Robert Richardson, James Lister Cuthbertson, William Gay, Grace Jennings Carmichael, W. H. Ogilvie, E. J. Brady, Roderic Quinn, C. J. Dennis, author of *The Sentimental Bloke,* Hugh McCrae, and more recently Shaw Neilson author of *The Heart of Spring,* Mary Gilmore (*Hound of the Road*) and Leon Geilert. Such Australian poets, however, as Francis Adams, and later, W. J. Turner belong to English rather than Australian literature.

Fiction.—Although the novelists have not been so prolific as either the poets or the historians, they have done some excellent work. Most famous of all Australian novels is Marcus Clarke's *For the Term of his Natural Life,* that vivid and sinister story of life in one of the early penal sertlements. Clarke, who came to Australia as a boy, and had a varied career as worker in the bush, banker and librarian, wrote plays, short stories, two novels *(Heavy Odds* is vastly inferior to his masterpiece) and a large amount of journalism. Henry Kingsley (1830–76), brother of the more famous Charles, wrote in *Geoffrey Hamlyn* a fine novel about an immigrant which has become something of a classic. Much more robust was "Rolf Boldrewood" (Thomas Alexander Browne) who died in 191*j.* His *Robbery under Arms (1888)* is one of the most famous stories of bush-ranging. His other novels *The Squatter's Dream* (1890) and *The Miner's Right* (1890), still enjoy great popularity. George Lewis Becke ("Louis Becke"), who died in 1913, was the author of many short stories about the southern Pacific, the best of which are to be found in *By Reef and Palm* (1894). A much abler short story-writer was Henry Lawson *(wide supra),* whose bush tales, such as *While the Billy Boils, Joe Wilson and his Mates* and *Children of the Bush,* have won for him in the affection of Australian readers a place beside Bret Harte and Maxim Gorki. Another writer of fine short stories, though in a quieter vein, is Barbara Baynton, the author of *Bush Studies.* In *The Little Black Princess* and *We of the Never-Never (1912)* Mrs. Aeneas Gunn has shown herself to be a writer of delicate fancy with her accounts of life in the backwoods of northern Australia, while realism is well represented by C. A. Bean, whose *The Dreadnought of the Darling* is a fine piece of writing.

In the sphere of literary criticism, such books as A. T. Strong's volume of essays, *Peradventtare* (1912) and T. G. Tucker's critical edition of Shakespeare's *Sonnets* (1924) may be mentioned. Gilbert Murray, though an Australian by birth, belongs both as critic and poet to English rather than to Australian literature.

History **and** Topography.—Like poetry, historical and topographical works have been hardy growths in Australia. As long ago as *1819* we find *A Statistical, Historical and Political Description of New South Wales,* by that passionate man of adventure, pioneer and journalist, William Charles Wentworth (1793–1872). This remarkable compilation, the first of its kind in Australian literature, which contains the germs of much of the economic theory of later writers on immigration, was responsible (it has been said) for the great influx of immigrants into Australia in the years immediately following its publication. An even more romantic figure was Edward Gibbon Wakefield (1796–1862), a Londoner, one of the most vigorous and important writers on colonization, who, while imprisoned in Newgate gaol on a charge of abduction, published anonymously *Letters from Sydney* (1829) in which he put forward a new system of colonizing Australia. On his release Wakefield gathered round him an enthusiastic group of supporters and formed the National Colonization Society which led to the Government attempting to establish two important colonies in New South Wales and South Australia. In *1834* Wakefield published his *New British Province of South Australia.* Another early historian of importance was the Scottish missionary and journalist, John Dunmore Lang (1799–1878), whose *Historical and Statistical Account of New South Wales* and *Origin and Migrations of the Polynesian Nation (1834)* are still a source of information for historians. A generation later came George William Rusden (1819–1903), whose monumental *History of Australia* and *History of New Zealand* were both published in England in 1883, revised editions not being published in Australia till 1895 and *1897.*

In more recent years a number of outstanding historical and topographical works have appeared, notably Henry Gyles Turner's *A History of the Colony of Victoria* and *The First Decade of the Australian Commonwealth* (1911); B. R. Wise's *The Making of the Australian Commonwealth* (1913); R. L. Jacks's *Northnzost Australia* (1921); Baldwin Spencer's *Across Australia* (1912); *The Colonisation of Australia* (1915) by R. C. Mills; Prof. Ernest Scott's *A Short History of Australia* (1916); G. Arnold Woods's *The Discovery of Australia* (1922); and T. Dundabin's *The Making of Australasia* (1922). Works dealing with the Aborigines are numerous. Among the most important may be mentioned Dr. A. W. Howitt's *The Native Tribes of South-East Australia* (1904); E. M. Curr's *The Australian Race* (1886); A. R. Wallace's *Australasia* (1880); G. T. Bettany's *The Red, Brown and Black Men of Australia* (1890); and *Native Tribes of Central Australia* (1899) by B. Spencer and F. J. Gillen.

(H. L. Mo.)

AUSTRAL ISLANDS: *see* PACIFIC ISLANDS.

AUSTRALITE: *see* TEKTITE.

AUSTRASIA, the name given to the easternmost part of the Frankish kingdom. It usually had Metz for its capital, and the inhabitants of the kingdom were known as the *Austrasii.* Retrospectively, later historians have given this name to the kingdom of Theuderich I. (511–534), of his son Theudebert (534–548), and of his grandson Theudebald (548–555); then, after the death of Clotaire I., to the kingdom of Sigebert (561–575), and of his son Childebert (575–597). They have even tried to interpret the long struggle between Fredegond and Brunhilda as a rivalry between the two kings of Neustria and Austrasia. When these two words are at last found in the texts in their precise signification, Austrasia is applied to that part of the Frankish kingdom which Clotaire II. entrusted to his son Dagobert, subject to the guardianship of Pippin and Arnulf (623–629), and which Dagobert in his turn handed on to his son Sigebert (634–639), under the guardianship of Cunibert, bishop of Cologne, and Ansegisel, mayor of the palace. After the death of Dagobert, Austrasia and Neustria almost always had separate kings, with their own mayors of the palace, and then there arose a real rivalry between these two provinces, which ended in the triumph of Austrasia. The Austrasian mayors of the palace succeeded in enforcing their authority in the western as well as in the eastern part, and in re-establishing to their own advantage the unity of the Frankish kingdom. The mayor Pippin the Short was even powerful enough to take the title of king over the whole.

At the time of Charlemagne, the word Austrasia underwent a change of meaning and became synonymous with *Francia orientalis,* and was applied to the Frankish dominions beyond the Rhine (Franconia). This Franconia was in 843 included in the kingdom of Louis the German, and was then increased by the addition of the territories of Mainz, Spires, and Worms, on the right bank of the river.

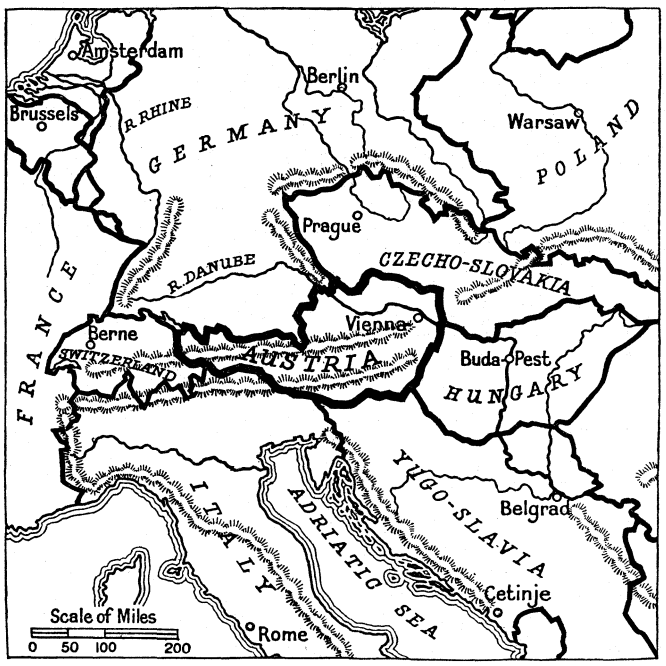
See A. Huguenin, *Histoire du royaume mérovingien d'Austrasie* (1857); Aug. Digot, *Nistoire du royaume d'Austrasie* (1863); L. Drapeyron, *Essai sur l'origine, le développement et les résultats de la lutte entre la Neustrie et l'Austrasie (1867);* Auguste Longnon, *Atlas historique,* 1st and 2nd parts. (C. PF.)

AUSTRIA, from Nov. *1918* to March 15, 1938, mas a Federal Republic formed from the predominantly German-speaking lands of the old Austrian empire. The new State thus returned in some measure to its original function as the Eastmark or frontier province, an outpost of Germanic speech and culture in the Slav and

Magyar worlds.

While danger threatened the mediaeval German empire from the East the frontier situation of the Eastmark contributed largely to its rise to greatness, and when the eyes of western Europe turned seawards a leading position was maintained by clever appreciation of political values.

The land routes to the Near East and beyond are recovering



BOUNDARIES OF THE AUSTRIAN REPUBLIC UNDER THE PEACE TREATY
Prior to the World War, Austria with Hungary, with an area of 240.456 sq. miles, was the largest of the European empires, excepting Russia. The union with Hungary was dissolved under the Peace Treaty, and its area reduced to 31,756 sq. miles. The republic dates from Nov. 12, 1918, the day after the abdication of the last emperor

something of their old importance

Austria, with its commanding situation astride several of the great European crossways, is the natural highway to the area of Southeastern Europe. Since its annexation to Germany by Chancellor Adolf Hitler in 1938 its economic and political importance in Germany's Drang *nach Osten* (push to the East) has been greatly enhanced.

Vienna, which used to be the cultural centre for the Lower Danube Valley and the Balkans, is spoken of by Germans as the Gateway to the East, as Hamburg and Bremen are the gateways to the sea.

Physical Structure. — The republic covered an area of 32.369 sq.m., *i.e.,* about equal to Scotland, and included much of the mountainous territory of the eastern Alps. From the Rhine valley, the western frontier of the country, these trend west-south-west, east-north-east to approximately 13° E., where the ranges commence to branch with loss in height and grandeur, and merge ultimately on the north and north-east into the accidented valley of the Danube and the open Vienna basin. On the east and south-east the ranges merge into the forested foothills overlooking the undulating countryland of western Hungary.

Northward, beyond the Danube, the former provinces of Upper and Lower Austria encroach upon the granite plateau that forms the southern flank of the Bohemian Massif, and the hilly plain of the lower Morava.

A remarkable feature of the Alpine system, significant in the human geography of Austria, is the zonal arrangement of its constituent formations; each zone shows a characteristic scenery and natural economy to nhich settlement has made a distinctive response.

Nevertheless, the excellent system of longitudinal and transverse valleys and low passes by which the highlands are broken has fostered currents of intercourse.

The central zone of the eastern Alps is a crystalline core of gneisses, schists and granites forming the highest ground In its western half it repeats, in subdued manner, the majestic features of the Swiss Alps, for large areas rise above the average height of the snowline (9,jooit.), *e.g.,* in the Silvretta Alps (Piz Bruin—10 88oft.). the Oetztal Alps (Wild Spitze—I2,309ft.) and the Hohe Tsuern (Gross Glockner—12,461ft.). Snowfields and glaciers *e.g.,* Pasterz, the finest example in the eastern Alps, stretching for 6m. down the slope of Gross Glockner, feed the streams of numerous radiating valleys that score the impervious rock, while there is ample evidence of heavier glaciation in the past. Below the zone of perpetual snow and ice, Alpine pastures clothe the rounded slopes giving place, below 7,000ft., to forests in which human effort has established vast clearings for pasture, cultivation and settlement. Isolated farms (*einzelhöfe*), hamlets and villages dot the sunny terraces, the gentler slopes and the valley floors; in suitable exposures even cereal cultivation is carried to a height of 4,000ft. Naturally, human activities increase in valleys leading to vital thoroughfares, such as the Brenner saddle, the most important route of the eastern Alps, lying at a level of 4 495ft., between the massive blocks of the Stubai and Zillertal Alps. For more than a hundred miles to the east no other carriage-way crosses the mighty watershed, but at the eastern limit of the Hohe Tauern the last snow peaks rise above the angle of the Mur valley, and the main range bifurcates north-east into the Niedere Tauern and south-west into the Gurktal Alps. Further branchings give rise to minor groups of heights, *e g.,* the Glein Alps, the Fischbach Alps and the Leitha mountains with progressive decrease of height accompanied by widening of valleys which often open out into sheltered, terraced basins, such as Klagenfurt, Judenburg and Graz, floored with thick deposits of fertile morainic and other débris. None of these mountains rises into the zone of snow; many are clothed almost to their summits by forest which everywhere dominates the landscape and plays an important rôle in the economic life of the highlands, while in clearings and above the tree belt rich, rain-nourished pastures supplement the varied agricultural activities of the valleys and basins. Valuable mineral deposits add to the natural wealth and impart an industrial stamp to the larger valleys, *e.g.,* the Mur-Murz depression; settlements are correspondingly more numerous and show a multiplicity of function generally absent in those of western Austria.

The central zone is flanked to the north by a broad limestone band that extends from the Rhine to the Vienna basin. This includes territory of two contrasted types; parallel ranges prevail to the west in the Allgauer and North Tirol Alps, but the Salzburg, Upper Austrian and Lower Austrian Alps are faulted and dissected into block masses. The prevalence of dolomite gives unity to the zone. Cold and barren surfaces broadening in the faulted regions to high plateaus, steep ruiniform slopes and poverty of surface drainage are the chief characteristics. On the tablelands, where water courses slowly, the stream channels are deeply incised (karrenfelder); in some cases the drainage becomes completely subterranean.

Though lower in the west than the corresponding crystalline blocks and losing height eastward, the rate of decrease is less than in the central zone so that the peaks of the latter are gradually overtopped by their limestone neighbours. Small plateau glaciers and snowfields are common and the most easterly Alpine glaciers are found in the Dachstein group (9,83oft.) of the Salzburg Alps. The precipitous slopes hinder the development of long ice streams, the old moraines with their rich meadowlands are a valuable economic asset in a limestone area; salt-bearing strata and timber are other desirable sources of wealth. The great chain of valleys, the Inn, Salzach and Enns, with initial subsequent and lower consequent reaches, forms a striking boundary between the central and northern Alps and makes both cross and through travel a comparatively easy matter.

From Innsbruck to the Mandling Pass on the upper Enns, and Salztbal on the Enns to the Semmering Pass, two lenticular belts of schist are intercalated between the crystalline and limestone zones, forming in the first the Kitzbühl Alps. and in the second the Eisenerz Alps, the eastern mass being celebrated for its deposits of iron ore.

North of the limestone Alps stretches the Flysch zone, a lower undulating region of sandstones, marls and schists that covers the northern half of Vorarlberg and reappears east of the Salzach as a narrow outcrop, culminating in the Wienerwald, where it plunges beneath the recent strata of the Vienna basin; except in Vorarlberg, where much clearing has occurred, it is a thinly-settled deciduous woodland. Between this and the Danube lies the true Alpine Foreland, a land of hill and plain carved out of Tertiary and Recent deposits, rising to its greatest height in the Hausruck (Göblberg—2,950ft.), a forested chain rich in lignite. The tributaries of the Danube have developed fine, terraced landscapes in the deep, fluvio-glacial debris. These are fertile and movement is easy; important development of agriculture has therefore resulted. Similar physical conditions are continued towards the north-east in the Morava-Danube angle. By contrast, the high granite plateau of Upper and Lower Austria is a region of forest and marsh, raw and inhospitable except where, as at Freistadt, outcrops of gneiss occasion depressions where farming is possible. Apart from such interruptions settlements hug the margin of the plateau along the line of the Danube.

Another limestone zone lies south of the Drava which acts as a dividing line between it and the crystalline Alps; only a portion of this lies within Austria, the Gailtal Alps, the northern flank of the Carnic Alps, separated from the former by the valley of the Gail, and the northern slopes of the Karawankas. From the source of the Drava the highlands stretch eastwards as a series of massive folds, with the customary progressive loss in height. Heavily forested and often with marshy valleys they do not encourage settlement, but are valuable for their lead and zinc ores. Both the Carnic Alps and Karawankas are deficient in easy passes, so that, although their situation relative to the Adriatic sea has necessitated the construction of important transverse routes, little local development has resulted.

Climate.— Variety is the keynote of Austrian climate. Uniformity is impossible in view of the strong contrasts in relief and only the most elevated areas are sufficiently unique and regular to be regarded as forming a distinct climatic region—the montane or Alpine type. Elsewhere the climatic conditions vary considerably within small distances according to the nature of the local topography, though the general characteristics in any particular area are due to its situation with reference to Atlantic, Continental and Mediterranean influences.

The whole of the region north of the central highland axis is under the influence of west and north-west winds, which convey modified Atlantic conditions along the line of the Danube and, by the north to south valleys, deep into the interior. The mean annual temperature ranges between 45" F and 48" F and no month has an average exceeding 68° F; the annual range, however, is high, 36° F, and marks the transition to the extremes of eastern Europe. Western influences are seen in the absence of a marked dry season but decrease in amount, and the nature of the general distribution of precipitation throughout the year are warnings of the growing strength of continental control; even at Innsbruck 43% of the annual fall occurs during the summer months. Farther east convectional overturnings of air above the Danubian lowlands are shown in violent summer storms. Snowfalls decrease westward often with important and serious effects upon the winter sowing of cereals. The climate of the northern valleys is appreciably modified by the *Föhn,* a warm wind particularly active in the valleys of the Rhine, Inn and Wipp. It raises the mean annual temperature and makes possible the growth of the vine in Vorarlberg and maize in North Tirol.

The climatic region of eastern Europe projects its influences up the valleys of the eastern borders, in Burgenland and east Styria. A decrease in total precipitation is accompanied by its greater incidence as summer storms and by a slight increase (2° F–4° F) in the difference of temperature between the hottest and coldest months. An important characteristic is the warm autumn.

A tendency towards a secondary maximum of precipitation during October in this region suggests a certain conflict with Mediterranean influences. These become more pronounced in the valleys that open south in Tirol where mild winters, and warm summers with temperatures often higher than 68" F, and maximum precipitation in spring and autumn prevail.

The greatest severities are experienced in the mountainous interior, in partially enclosed basins, *e.g.,* Klagenfurt, and in the deep, longitudinal valleys. The vertical fall of temperature is most rapid along the edges of the ranges and near isolated masses, a fact that is of importance in cultivation and settlement, which are further affected by a general retarding, often by several weeks, of vegetation. Against this must be placed the rapid growth of plants, under the stimulation of high air temperatures, where a suitable aspect occurs; the inevitable result is seen in the contrast between the desolate wastes and forests of the shaded slopes and the cleared and settled faces of the sunny sides. The enclosed basins and valleys are centres of extreme continentality, *e.g.,* the mean January temperature of Klagenfurt is less than that of Hammerfest, and winter severity is increased by the prevalence of temperature inversions with interesting consequences for cultivation and settlement, which avoid the valley floors thus escaping devastating frosts and obtaining a greater amount of sunshine than reaches the zone below the glacial shoulders.

The natural vegetation has been greatly altered by man. Where it exists undisturbed it is, like the climate, transitional in character. The mountain slopes bear the central Europe stamp; deciduous woods in which beech prevails flourish up to about 4,000 ft. and are succeeded by conifers, pine and larch, with a sub-Alpine ground flora. On the eastern and southern mountains oak-woods are common, *e.g.,* on the Wienerwald and the hills of East Styria while, except where planted, conifers are less abundant. The passage to Mediterranean latitudes is marked by the appearance in sheltered valleys of palm, lemon and olive groves.

The settled valleys customarily show a regular zonal arrangement of (1) cultivated land, (2) forests and (3) *almen* or "alp" pastures. The limiting heights of these belts vary with rainfall, aspect, soil and slope, being lowest in the east and in the limestone ranges but, generally speaking, the upper limit of tree growth lies about 800ft. below the snow line. Between is a region of high pasture whose richness varies with the rainfall and soil porosity.

	Altitude. Metres.	Temp. (Centigrade).				Rainfall. Cms.
		Jan.	July	Year	Range	
Innsbruck	373	— 3.3	17·8	7.9	21·1	99
Vienna	200	— 1·7	19·6	9·2	21·3	68
Graz	344	— 2·2	19·9	9·2	22·1	85
Bregenz	410	— 1·3	17·6	8.2	18·9	152
Salzburg	430	— 2·4	17·8	7.9	20·2	136
Klagenfurt	440	— 6.4	18·8	7·3	25·2	99
Sonnblick	3106	—13·0	1·3	—6.5	14·3	176
Linz	260	— 2·4	18·7	8·4	21·1	77

Human Activities.— The population is mainly representative of the broad-headed Alpine race typically associated with the mountain axis of central Europe. Despite their mountainous character the east Alps have been settled from prehistoric time, as discoveries at Hallstatt, the lakes of Salzkammergut and elsewhere clearly prove. These early peoples with a culture based on agriculture were fortunate in their situation astride the amber route across the Brenner Pass, with easy access later to salt and iron and other metals, and they made many valuable contacts. Their language, Celtic in affinity, ultimately came under the influence of both Latin and Teutonic tongues. The latter proved the stronger and more absorptive and finally the mixture crystallized into High German, which to-day prevails everywhere except in a narrow belt along the south-eastern frontier. Here the Slavonic tongue has spread along the valleys of Styria and Carinthia, and beyond its present limits the persistence of forms of settlement and other old social characteristics associated with Slav-speaking people points to a deeper penetration in the past; in Burgenland, islands of Magyars introduce an Asiastic element, different in speech yet closely allied in outlook to their German-speaking neighbours.

It has been suggested in the opening paragraph that Austria is essentially rural in foundation. Of the population of 6,759,062, (Census of March 1934), less than one-half is urban, and only in Vienna and its surrounding lowland does industry predominate. But the situation is changing. Reorganization of factories and the traditional position of Vienna as the intermediary between western Europe and the Danubian countries and as a great financial centre are multiplying the activities of Austria and altering its original economic structure.

From 1918 to 1938 the growth of raw material for industrial purposes was negligible because the whole arable area had to be used for the production of foodstuffs, and energetic efforts were made by the Ministry of Agriculture and Forests to put more land under the plough, particularly in Burgenland, Lower Austria, Salzburg and Styria, and to increase the yields of individual crops.

Since annexation to Germany, more attention has been given to timber production and especially to the extraction of iron ore. This can easily be brought down by gravity to Linz on the Danube, where the Hermann Goering Iron company is developing a great iron and steel plant. The character and extent of the cultivation vary considerably from place to place, for 92·3% of the country ranks as mountainous while only 4·5% is true plain. About 10·5% of the total area is unproductive but the proportion of barren surface rises to 25% in the Hohe Tauern, and to 34% in the central Alps. Of the productive territory 40·9% is intensively cultivated as ploughland, meadowland, gardens and vineyards, while 59·1% is covered by forests and natural pasture. Broadly speaking two regions may be recognized, viz.: the difficult Alpine lands (Vorarlberg, Tirol, Salzburg. Carinthia and Styria), where the rigorous climate shortens the vegetable period, and the very fertile territories of the Danube (Upper and Lower Austria, Vienna basin) and Burgenland. The Alpine regions are rich in forests and rough pastures, and therefore stock raising is the basis of the farm for arable land decreases to insignificant amounts, *e.g.*, 5·9% and 3·5% of the productive surface in Tirol and Vorarlberg respectively; on the other hand timber supplements stock though not to such an extent as in the countries of Inner Austria. In the more fertile loess lands of the lower districts arable land averages between 40% and 50% of the productive area, and yields are higher in response to better soil and more advanced methods of farming.

Dependence upon imported foodstuffs has stimulated agriculture in the direction of cereal production. Rve takes the leading place, followed in order by oats, wheat, barley and maize, but the production of wheat and rye is still unsatisfactory for only some one-third and three-fourths respectively of the country's needs can be supplied. For barley and oats the proportion is two-thirds and four-fifths respectively, so that large quantities of cereals and bread-flours are regularly imported from Hungary, Yugoslavia, Italy and Czechoslovakia. Yet there is an all-round approach to the pre-war yield. Maize is restricted in occurrence and area; it disappears entirely in the exposed Salzburg and Upper Austria, but thrives in the warmer eastern lowlands where minor amounts of millet and buckwheat are also grown. The cultivation of potatoes now suffices to meet home requirements and is general, reaching its greatest intensity in the Danube lands and Burgenland, but sugar-beet, though increasing in area and yield, does not yet satisfy more than half the demand; it is almost confined to the Vienna basin. Fodder crops are important on the lower foreland, therefore cattle are more numerous per unit of area than in the highlands, where, despite the rich crops of Alpine hay, difficulties of transport and scarcity of arable land reduce their numbers.

Other crops of importance are hops and rape (Middle Styria and Upper Austria); flax on the marshy granite plateau of Upper and Lower Austria, and, with hemp, on the Styrian hill lands; chicory in Upper Austria; stone fruits, which are replacing the vine, thrive everywhere except in Tirol and Salzburg, *i.e.*, the apple countries; leguminous plants in Lower Austria; tobacco in Tirol and the vine, absent only in Salzburg, Tirol and Upper Austria, reaches its finest quality in the sheltered Rhine valley and the warm eastern basins, notably that of Wiener-Neustadt

Nature, small properties and methods of settlement often retard the adoption of advanced methods of agriculture, particularly in the mountainous districts where a rotation of crop and grass is the rule, while even in the better lowlands the three-field system of cultivation is still widespread.

Livestock. — Like cultivation, stockraising shows sympathetic reaction to many physical and social circumstances. The great Alpine expanses of natural pasture are the basis of a thriving stock-farming yet, for reasons stated above, it is on the forelands of the North and East that animals are most thickly concentrated; the mountainous centre and West raise cattle to export for breeding, the supply of milk and meat to Vienna is the object on the lowlands of the east, e.g , Lower Austria, which is responsible for 90% of the milk used in the capital. But the example of Switzerland, already followed in Vorarlberg, is spreading and, by the help of co-operative organizations, Austria is slowly developing the dairying industry and has already succeeded in reducing considerably the heavy post-war imports of condensed milk.

Much can also be done in the breeding of pigs which have increased in numbers. They are most common on the mixed farms of the lowlands, for in the highlands their place is taken by goats. whose milk, rich in fat, is an important element in the peasant dietary, while everywhere on small-holdings and near large centres of population goat-keeping increases. Sheep-rearing is also of importance in the highlands where the coarse wool required for clothing and domestic purposes is supplied by the hardy Alpine breed, whose excellent meat quality has developed a brisk export, particularly to Switzerland, though the main object at present is to improve the wool by crossing with German breeds.

Before the World War Austria was a noted exporter of horses but war losses, the steep decline of the army demand and the increasing use of motors in agriculture and transport have ruined many studs and caused others to concentrate upon quality. Still, breeding of all kinds continues everywhere with a bias towards the heavy type (Pinzgau breed) in Salzburg and North Styria, the lighter types in the foremost breeding countries of Carinthia and Upper Austria.

In addition to domestic animals certain districts, notably Upper Styria are well stocked with game, *e.g.*, deer and chamois.

NUMBERS OF LIVESTOCK

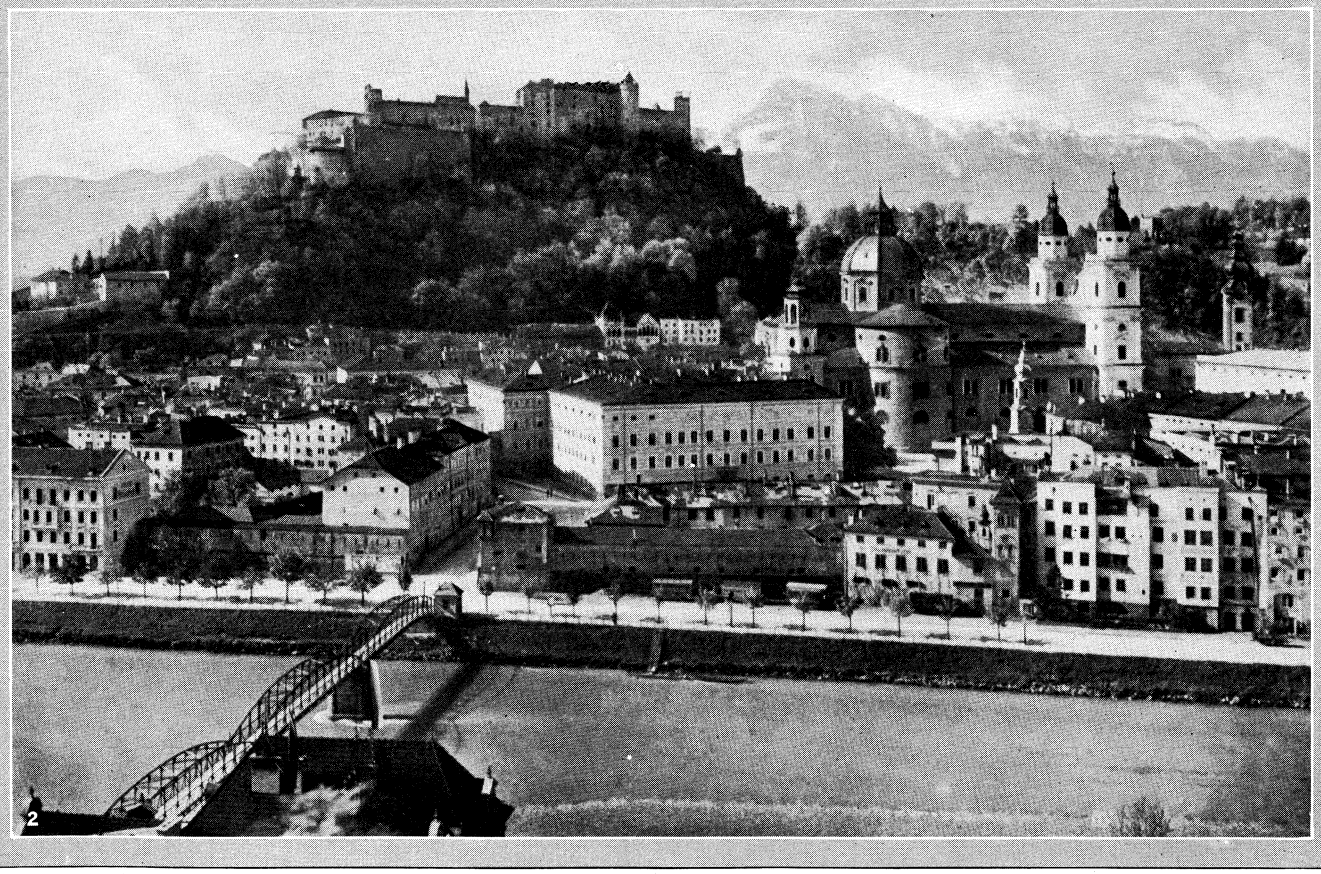
	1923.	1934.
Cattle including cows	2,162,385	2,348,600
Cows	1,074,865	1,209,900
Pigs	1,473,197	2,823,000
Goats	382,146	326,500
Sheep	597,413	263,400
Horses	282,651	261,200

Forestry. — The forests of Austria cover about 38% of the total, and 42% of the productive area, the latter figure being exceeded only in Finland and Sweden, and are an important national asset, for timber exports take first place in quantity and a high rank in value. Further, although the State controls a great portion of the forests and local authorities and large landowners most of the remainder, many peasants may claim, by interesting historic rights, supplies of free timber and more than 100,000 people are directly employed in forestry or sawmills.

Seventy-one per cent of the forest is coniferous in which pine predominates, 19% is deciduous and 10% mixed. The coniferous plays the most important rôle, particularly in the mountainous provinces of Carinthia, Styria, Salzburg and Tirol, and an annual output of timber approaching ten million cubic metres is the average; of this amount about six millions are available either for export or as the basis of wood and paper industries

Detailed study proves that Austria's basic industry, the exploitation of the land, is essentially sound and capable of great expansion by improved technical education of the rural population and the adoption, on a greater scale, of co-operative methods of farming.

Mineral Resources and Power. — Mining has a long and happy history but in modern times has undergone important



PHOTOGRAPHS, E.N.A.

BRENNER PASS AND SALZBURG CASTLE

1. The railway through Brenner Pass, which connects Innsbruck (Austria) and Verona (Italy)

2. Salzburg castle, on Monks' Hill, overlooking the city of Salzburg. In the foreground is the river Salzach

PHOTOGRAPHS, (1, 3, 4) BURTON HOLMES FROM EWING GALLOWAY, (2) EWING GALLOWAY

THE HOFBURG (FORMER IMPERIAL PALACE) AND OTHER PUBLIC BUILDINGS IN VIENNA

1. The Hofburg (former imperial palace) on the left and exhibition buildings on the right
2. Maria Theresa square, showing the Hofburg and art history museum
3. The Houses of Parliament on the left side of the Ring Strasse
4. A portion of the buildings that formerly housed Ministry of War

changes. Austria has always been noted for the variety of its mineral wealth, but the famous gold mines of the Hohe Tauern and the silver ores have ceded pride of place to those of iron, lead, zinc and copper. In the Eisenerz-Vordernberg range (Styria) lies one of the largest European deposits of iron-ore, exploited since the dawn of the iron age. It is quarried rather than mined so that production costs are low, and smaller accessible fields occur near Werfen (Salzburg); the annual output of iron-ore exceeded a million metric tons in 1936 and is rapidly increasing. In other ores variety, not quantity, is the rule. Copper is mined in Salzburg, Tirol and Lower Austria in the order of importance named. Lead and zinc are principally dug at Bleiberg (Carinthia), though minor amounts are obtained from the Tirol section of the northern limestone counterpart. In addition, small quantities of bauxite (Salzburg), graphite (Styria and Lower Austria), sulphur (Styria, Tirol and Salzburg) and manganese are of sufficient importance to figure in statistical returns.

The lower Triassic strata in the Salzkammergut region, at Hallein (Salzburg) and Hall (Tirol), are rich in salt layers famous from pre-historic times and still actively worked. Building-stone, marbles and rocks for cement are widely distributed.

The resources in fuel comprise small deposits of coal in Lower Austria and large quantities of lignite. The latter is fair in quality and is mixed everywhere, excepting the province of Salzburg, but the richest supplies lie in Styria, in the region of Graz and along the Mur-Murz valley. From these districts come nearly two-thirds of the annual output, the remaining third from Burgenland, Upper and Lower Austria, Carinthia and Tirol, in the order of importance detailed. Yet, even with the coal the home supply of fuel is scarcely 30% of the quantity needed and import of coal and coke is a heavy debit item on the annual balance sheet. Austria seeks to improve the trade balance and to obtain supplies of power by exploitation of its water resources. The existing water power may be set at about 3.7 million gross h.p. at low-water level, of which only 50% is considered worthy of development. This is more than sufficient to meet the requirements of the country and further, every province excepting Burgenland and Vorarlberg has more than 300,000 available h.p. So far not 20% of the available supply has been harnessed, but with the growing interest of foreign capital and an energetic State programme, development proceeds apace.

Manufacture.— In Austria modern production is still far below the pre-war scale, for many of the old markets are lost and post-war impoverishment has reduced purchasing capacity.

Most important are the metallurgical and engineering industries. Iron and steel manufacture, largely in the hands of the Alpine Montan-Gesellschaft, suffers from a shortage of suitable local fuel and depends upon imported coke but, nevertheless, is ample for home requirements. (Production, 1936, pig iron—248,000 metric tons; steel—424,000 metric tons.) Styria is responsible for 99% of the production. Upon these fundamentals have developed thriving engineering trades. These are concentrated in four districts, viz., the north Alpine Foreland centring on Steyr, the Mur-Murz valley, the Vienna-Wiener Neustadt region and the Klagenfurt basin. The first, distant from the raw materials, deals largely with small, valuable and highly-specialized articles, *e.g.*, cutlery, firearms, needles, screws, etc., or cycles and automobiles; the Mur-Murz valley handles heavy products such as locomotives and rolling stock, while machinery for agricultural and industrial purposes is naturally the output of Vienna and Wiener-Neustadt. Other metal industries include the working of copper in Salzburg and Tirol, lead in Carinthia, antimony in Burgenland and alloys such as German silver at Berndorf (Lower Austria). The rarer metals are handled in the capital where exists also an important manufacture of scientific and surgical instruments. Allied to the above trades is the electrical industry. Almost the whole output of electrical products of the old empire was concentrated in the present territory and recent developments towards electrification of the railways, utilization of water power and wireless have greatly enlarged the trade.

The working of timber and its derived products, *e.g.*, pulp, cellulose, furniture and musical instruments is second in importance. Wood products are widely manufactured both as factory and house industries. while the output of pulp, cellulose and paper exceeds the pre-war level. (Metric tons in **1936:** paper, 177,000; pulp, 52,000; cellulose, 253,000.) Paper products have suffered severely from import prohibitions and high tariffs devised by the new States and the situation for these is unsatisfactory. Saw mills and joineries, large and small, are widely scattered but the working of paper centres principally in the Wiener-Neustadt valley, in the valleys of the right bank tributaries of the Danube from the Traun to the Traisen and along the Mur, Drave and Inn valleys, while ornamental furniture and musical instruments are the specialities of the capital.

The textile industry is highly important, for it employs some 70,000 workers and is the basis of a number of finishing trades. In cotton-working, before the break-up of the empire, Bohemia specialized in weaving and the modern Austria concentrated upon spinning so that to-day, for the treatment of cotton, the country has a surplus of spindles but a deficiency of looms. This industry has grown up in three centres, viz., in the Wiener-Neustadt valley, aided by cheap labour and a large adjacent market, in the moist northern valleys, *e.g.*, of the Linz district, and, by spread from Switzerland, in Vorarlberg and North Tirol. Wool has never had great importance except for the working of coarse cloths (*Loden*) for home use, though Austria was able during the post-war inflation period to take advantage of the heavy world demand for fancy knitted goods. The position in finishing trades, *e.g.*, clothing, for which Vienna has always been famous, is not so hopeful owing to loss of overseas markets, luxury duties fixed by new countries and lack of capital. By contrast, the leather trade has exceeded its pre-war prosperity for the reputation of Vienna in fine goods has enabled it to meet foreign competition. Domestic supplies of the necessary raw materials, water power and the stimulation of war have fostered the vigorous chemical trade in all its varied aspects. The products range from soaps, perfumes and other delicate goods in Vienna to calcium carbide and aluminium in Vorarlberg and Tirol. Glass manufacture persists with difficulty on the flank of the Bohemian Massif, mainly by reason of its close association with the factories of Czechoslovakia.

The production of foods and drinks is largely dependent upon imported materials and is primarily intended to meet home consumption. Brewing is widespread with important concentration in the towns, distilling in Vienna, sugar manufacture in Lower Austria and Burgenland and the preparation of tobacco, a State monopoly, over the whole country.

Tourist traffic brings an ever-growing revenue in Tirol and Salzburg, though by reason of its later start and distance from western countries, it still lags behind that of Switzerland.

Communications.— Physical difficulties confront the construction and maintenance of roads and railways and therefore the network is not dense. Railway development has concentrated upon the important through routes, the northern longitudinal valleys carry the east to west traffic, the transverse bind north to south, while the slope unites both directions to the great focus of Vienna. There are more than 4,000m. of line, of which three-quarters are State-owned, and electrification, with the object **of** reducing costs and increasing the load and speed of trains, proceeds rapidly. Motor transport is still light but air services are growing in number. For these Vienna is an important junction on the Paris–Constantinople and Prague–Budapest through routes, and is also a terminus for subsidiary routes to Warsaw, Munich, Trieste and Venice. Water traffic, apart from a small canal from Klagenfurt to Lake Wörther, is restricted to the Danube. The traffic of Linz and Vienna, the two important river ports, has suffered severely in comparison with pre-war times. This is directly due to the decline of trade that has followed the break-up of the empire, whereby traffic policies and frontier formalities have replaced the original free trading conditions. Future recovery is bound up with a number of circumstances, *e.g.*, the revival of cereal exports from Rumania and the conclusion of satisfactory commercial treaties. The Danube must nevertheless continue to be an important artery of transport of increasing value with the development of the Rhine-Main-Danube deep-water canal.

In many ways the natural wealth of Austria is greater than that of Switzerland, a hopeful augury for the future, but, whereas Switzerland has elaborated its economic adjustment in an evolutionary manner through the centuries, Austria is faced with the more difficult problem of reorganization and re-equipment to meet a wholly new set of conditions.

Political Organization and Settlement. — The Federal republic comprised nine independent provinces, each of which had its own assembly *(Landtag)* for the control of regional affairs, the members being chosen by the provincial electorate. The assemblies sent deputies to a national higher chamber *(Bundesrat)* of 46 members, in proportion to the size of the populations they represented. This acted in an advisory capacity to a general chamber (*Nationalrat*) whose members were chosen by national election.

Province	Area Sq.m.	Population	Population per sq.m.	Percentage of total population
Vienna	107	1,861,856	17,400	27·78
Lower Austria	7,452	1,512,011	202·9	22·33
Upper Austria	4,626	906,025	195	13·35
Salzburg	2,762	248,188	89	3·64
Styria	6,323	1,016,585	160	15·00
Carinthia	3,680	407,529	110	6·01
Tirol	4,882	351,888	72	5·17
Vorarlberg	1,005	157,338	156	2·30
Burgenland	1,532	297,642	194	4·42

For the most part the provinces are inhabited by people of German speech, 97% of the total population, but dilution appears along the eastern border. Thus Vienna has about 80,000 Czechs, Carinthia some 40,000 Slovenes and Burgenland 42,000 Croats and 11,000 Magyars. The religious unity is almost as pronounced for 93.68% of the population are Roman Catholics; 3·11% and 2·93% are Protestant and Jewish respectively. Protestantism is strongest in Upper Carinthia, where the proportion rises to 6%, in the upper valleys of the Traun, Enns and Drava and in Vorarlberg, while the greatest numbers of Jews are found in Lower Austria and Vienna.

Naturally settlement is most dense in the fertile lowlands and in regions where industry supplements agriculture, *e.g.,* Vienna basin and the Rhine valley. The mountainous districts, particularly the inhospitable northern limestone zone, are thinly peopled; nearly 95% of the Austrian population lives permanently below 2,500ft. and over 50% below 1,000ft. The closing years of the nineteenth century were marked by a general valleyward drift of settlement in the highlands, quite independent of the seasonal pastoral movements, but post-war changes in social and economic conditions appear to have checked this.

A close relation exists between conditions of settlement and the possibilities of cultivation. In the highlands where terraces are narrow and slopes steep the isolated farmstead *(einzelhof)* built with due regard to suitable shelter, sunshine and soil, is common. Where terraces widen and slopes are softened by talus and alluvial fans the village becomes the typical unit, customarily after the characteristically German irregular grouping of houses *(haufendorf)* though, if the valley be a through route, a straggling arrangement along the line of movement appears *(strassendorf);* in all cases the fertile but dangerous marshy flood plain is avoided. Eastward in Burgenland and north of the Danube villages arranged regularly along the length of a ridge *(reihendorf)* suggest Frankish influences, while to the south-east typical Slav forms may be recognized. Apart from Vienna, only three towns, Graz, Linz and Innsbruck, exceed 50,000 in population and these, like the smaller towns, are fundamentally nodal points.

The structural forms and building materials of the individual house also vary considerably, the difference being partly physical and partly cultural in origin. For instance, the houses of Tirol and Salzburg, half wood, half stone, with verandas and flat stone-laden, wooden roofs are quite distinct from those of the eastern mountain zone where steep roofs of boards, shingles or straw thatch predominate.

Natural Divisions. — The spirit of unity that inspires the provinces of Austria is more the outcome of centuries of participation in a common history than of similar physical endowments. It has been shown that Austria may be divided into a number of longitudinal physical zones, most of which are distinctive in the possibilities they offer, yet so important are the transverse thoroughfares that they too have exercised a large measure of control upon the growth of the individual provinces, whose frontiers are in close relation to physical features. The exact nature of the relationship is analysed for each of the former provinces under its title where, too, are analysed the material and other contributions it has made to the national welfare.

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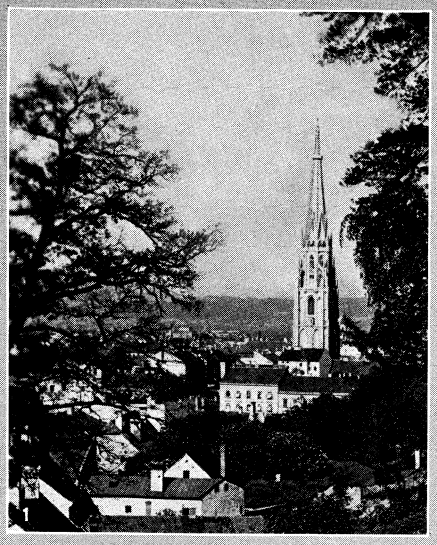
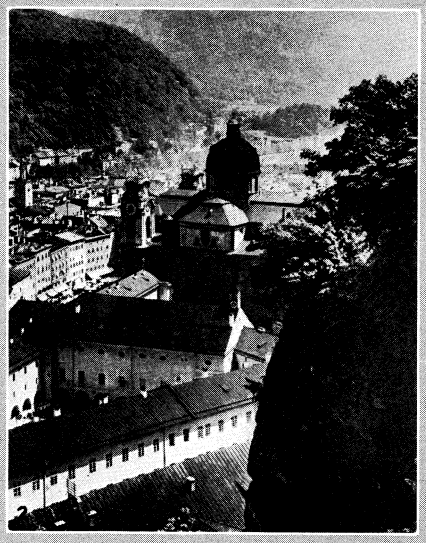
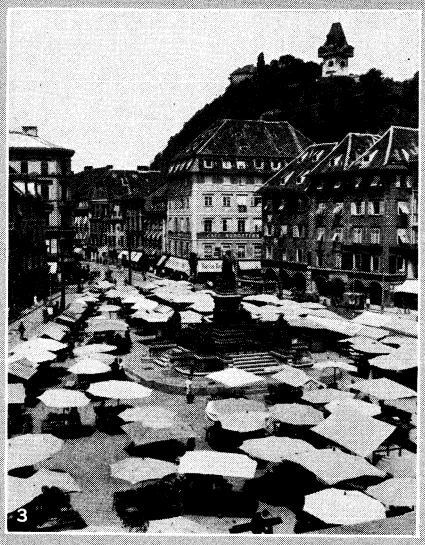
DEFENCE

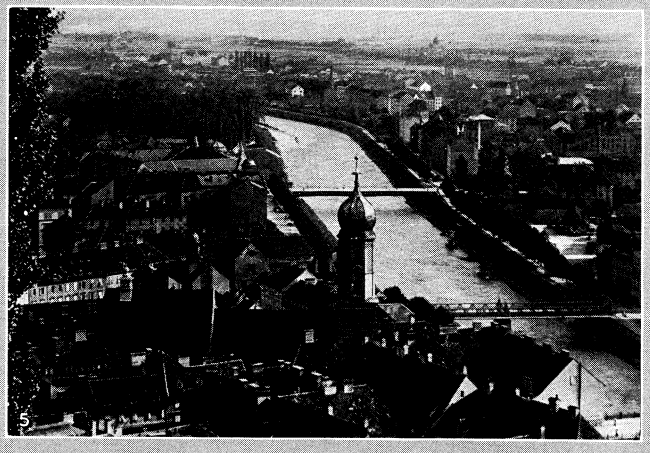
Army: I. Historical. — The *Landsknecht* infantry constituted the mainstay of the imperial armies in the 16th century. Maximilian I. and Charles V. are recorded to have marched and carried the "long pike" in their ranks. Maximilian also formed a corps of *Kyrisser,* who were the origin of the modern cuirassiers. It was not, however, until much later that the Austrian army came into existence as a permanent force. Rudolph II. formed a small standing force about 1600, but relied upon the "enlistment" system, like other sovereigns of the time, for the bulk of his armies. The Thirty Years' War produced the permanence of service which led in all the states of Europe to the rise of standing armies. In the empire it was Wallenstein who first raised a distinctly imperial army of soldiers owing no duty but to the sovereign; and it was the suspicion that he intended to use this army, which was raised largely at his own expense, to further his own ends, that led to his assassination. From that time the regiments belonged no longer to their colonels, but to the emperor; at the close of the Thirty Years' War Austria had 19 infantry, 6 cuirassier and 1 dragoon regiments. The almost continuous wars of Austria against France and the Turks (from 1495 to 1895 Austrian troops took part in 7,000 actions of all sorts) led to a continuous increase in her establishments. The wars of the time of Montecucculi and of Eugene were followed by that of the Polish Succession, the two Turkish wars, and the three great struggles against Frederick the Great. This, in conjunction with the fact that Austria took part in other Turkish campaigns subsequently, rendered this army the most formidable opponent of the forces of the French Revolution (1792). But the higher leading, organization and numbers of the emperor's forces were totally inadequate to the magnitude of the task of suppressing the Revolutionary forces, and though such victories as Neerwinden were sufficient proof of the efficiency and valour of the Austrians, they made no headway. In later campaigns, in which the enemy had acquired war experience, the tide turned against the Imperialists even on the field of battle. The archduke Charles's victories of 1796 were more than counterbalanced by Bonaparte's Italian campaign, and the temporary success of 1799 ended at Marengo and Hohenlinden. *(See* FRENCH REVOLUTIONARY WARS.)

The Austrians, during the short peace which preceded the war of 1805, suffered, in consequence of all this, from a feeling of distrust, not merely in their leaders, but also in the whole system upon which the army was raised, organized and trained. This was substantially the same as that of the Seven Years' War time.









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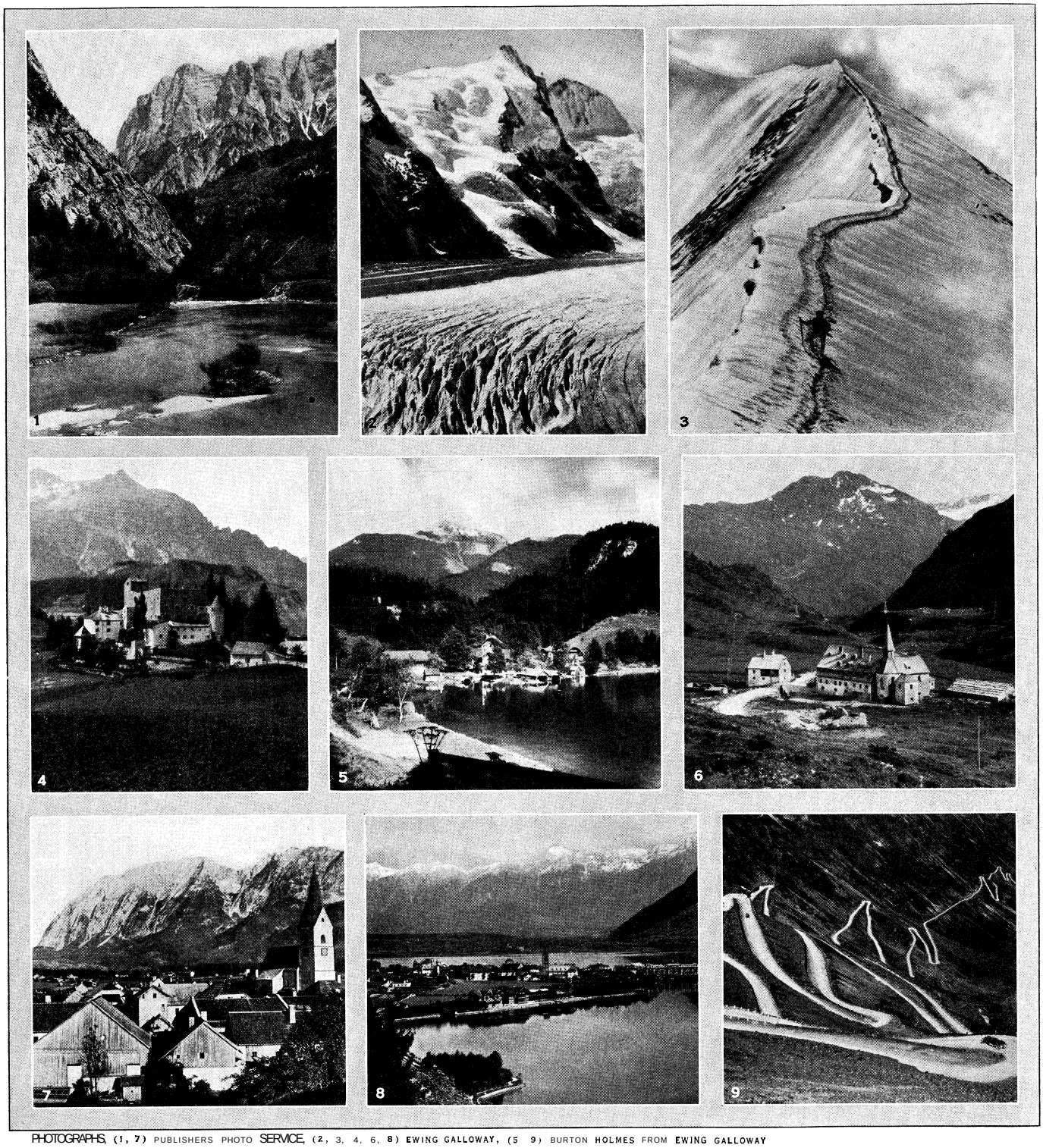
CITIES IN AUSTRIA

1. View over part of Linz, one of the largest cities of Austria, on the Danube
2. View of a section of Salzburg, on the Salzach river, about 195mi. from Vienna
3. Central square in the city of Graz, showing the market stalls under large umbrellas
4. Maria Theresa street, one of the wide thoroughfares in Innsbruck
5. General view of Graz
6. The Graben, the shopping centre of Vienna
7. The Heldenplatz, Vienna, viewed from a wing of the Hofburg as Hitler proclaimed the anschluss with Germany in 1938

AUSTRIA



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MOUNTAIN VIEWS IN AUSTRIA

1. View of the Gesause valley of the river Enns, in Styria, through which passes the railway line connecting Vienna and Innsbruck
2. View of the crest of the Grossalockner mountain, in Tirol, showing the Pasterze glacier
3. Snow trail on the Kandigrat, in the Tirolese Alps
4. Kandersberg, in the Tirol, which is at the junction of three national boundary lines. The castle, sometimes called Castle Kanders, houses the district law-courts and is on German territory. Mount Mondin, shown in the backaround. is in Switzerland, and the valley below borders Italy
5. A corner of one of the many small lakes in the Salzkammergut district. in Upper Austria
6. Summer view of the hospice of St. Christoph, on the Arlberg Pass, 6,000 feet above sea level. Mounts Madaunspitze and Kuchenspitze are seen in the background, the latter peak rising to a height of 10,000 feet
7. Mitterndorf, in the Styrian Salzkammergut, one of the well-known winter resorts in Austria
8. Zell-am-See, Salzburg, with the Tirolese Alps in the distance
9. The Stelvio road, formerly partly in Austria, but after World War I in Italy; the pass is thk highest carriage road in Europe

Enlistment being voluntary and for long service, the numbers necessary to cope with the output of the French conscription could not be raised, and the inner history of the Austrian headquarters in the Ulm campaign shows that the dissensions of the general officers had gone far towards the disintegration of an army which at that time had the most esprit de corps and the highest military qualities of any army in Europe. But the disasters of 1805 swept away good and bad alike in the abolition of the old system. Already the archduke Charles had designed a "nation in arms" after the French model, and on this basis the reconstruction was begun, The conscription was put in force and the necessary numbers thus obtained; the administration was at the same time reformed and the organization and supply services brought into line with modern requirements. The war of 1800 surprised Austria in the midst of her reorganization, yet the new army fought with the greatest spirit, and the work went on steadily until, in 1813, the Austrian armies worthily represented the combination of discipline with the "nation in arms" principle. Their intervention in the War of Liberation was decisive, and Austria, in spite of her territorial losses of the past years, put into the field well-drilled armies far exceeding in numbers those which had appeared in the wars of the Revolution (see NAPOLEONIC CAMPAIGNS). After the fall of Napoleon, Austria's hold on Italy necessitated the maintenance of a large army of occupation. This army, and in particular its cavalry, was admittedly the best in Europe, and, having to be ready to march at a few days' notice, it was saved from the deadening influence of undisturbed peace which affected every other service in Europe from 1815 to 1850. But it was employed in dynastic wars, and the conscription was modified by substitution; thus, when the war of 1859 resulted unfavourably, the army began to lose confidence, precisely as had been the case in 1805. Once more, in 1866, an army animated by the purely professional spirit, which was itself weakened by distrust, met a "nation in arms," and in this case a nation well trained in peace and armed with a breech-loader. Bad staff work, and tactics which can only be described as those of pique, precipitated disaster (*see* SEVEN WEEKS' WAR).

The result of the war, and of the constitutional changes about this time, was the re-adoption of the principles of 1806–13, the abolition of conscription and long service in favour of universal service for a short term, and reform in the methods of command and staff work. It was said of the Prussian army that "discipline is—the officers." This was more true of the "K.K." army[1] than of any other in Europe; the great bond of union between the heterogeneous levies of recruits of many races was the spirit of the corps of officers, which retained the personal and professional characteristics of the army of 1848, whose peculiar tone was well conveyed in George Meredith's Vittoria.

Between 1866 and 1914 the principal action taken by the Austrian army was the occupation in 1878 of the Turkish provinces of Bosnia and Hercegovina, with the support of the Concert of Europe. These countries were added to Austrian territory in 1908. The seat of Government was established at Serajevo which became the scene of the sinister murder of June 1914, immediately preceding the World War. The military effort of Austria-Hungary in that conflict is described elsewhere. The total ration strength of the Austro-Hungarian army at the Armistice (Nov. 1918) may be put at about 2,229,500, with about 500,000 in reserve if the 1920 class is included. Of this army, about 1,353,000 were on the Italian Front, the rest distributed in the Western, Eastern (329,000), Balkan and Asia Minor theatres of war and on the lines of communication. There were nearly 3,900 field and 1,760 heavy guns on the Italian Front. The field army stationed there included 757 battalions (54½ divisions, etc.) and 26 squadrons (6 divisions, etc.), totalling 408,500 rifles and 3,900 sabres. It is not possible to distinguish the Austrian figures from the Austro-Hungarian totals.

II. Post-War Army.—Under the terms of the Treaty of St. Germain which followed the World War (Sept. 10, 1919), compulsory service was forbidden in the Austrian army. The functions of that army were limited to the maintenance of internal order and to the control of the frontiers. A maximum strength was laid down for the army staff and both a maximum and a minimum strength for all formations. All methods of "mobilization" were forbidden. The gendarmerie was limited to the number maintained in 1913, and no military training was permitted for this force. Officers in the army served for at least 20 years; not more than one-twentieth of the number to retire in any one year. Enlistment for other ranks was to be for at least 12 years, of which six years or more were to be spent with the colours. The importation of arms and munitions of war was forbidden. A maximum of arms to be retained was prescribed, none to be imported. No gun exceeding 105mm. calibre was allowed, except in the normal armament of fortresses. Only three field-pieces were allowed for every 1,000 men of other arms. Manufacture or importation of armoured cars, tanks, or "any similar machines suitable for use in war" was forbidden; also flame-throwers, poison gas, etc.

In May 1936, Austria, following Hitler's example in Germany, announced that she would no longer abide by these military restrictions imposed by the treaty. She therefore adopted conscription with a short term of service and proposed to raise her army from the treaty limit of 30,000 to 150,000.

Recruiting was by voluntary enlistment of men between the ages of 18 and 26, the maximum number raised in the different districts being limited as follows: Vienna District, 9,000; Lower Austria, 6,500; Burgenland, 1,500; Upper Austria, 4,000; Styria, 4,000; Carinthia, 1,700; Salzburg, 1,000; Tyrol, 1,700; Vorarlberg, 600. Total 30,000. (G. G. A.; X.)

Navy.—Since the rearrangement of boundaries following the World War, Austria has no seaboard and the former Austro-Hungarian fleet is no longer in existence. Four patrol-boats on the Danube were the only war vessels belonging to Austria.

ECONOMIC CONDITIONS IN AUSTRIA, 1918–38

The old Austro-Hungarian empire consisted of the great fertile plains of the Danube, the Theiss, and the Elbe, the ring of mountains which surrounded them, and to the north-east the uplands and plateau which lie beyond those mountains. Of this somewhat amorphous, but geologically united area, post-war Austria formed a rough sector which ran from the extreme western boundary to Vienna, the sector which was left after the frontiers of the other succession states had been determined. Geologically, this new Austria consisted of the major part of the eastern wing of the Alps and of a stretch of the Danube valley to the north-east. The valley is rich, but over two-thirds of the total area, which amounts to 32,369sq.m., is mountainous. In 1934, when the last census was taken, the population was 6,759,062, of which about 65% were living in the relatively low-lying districts of Upper and Lower Austria and in Vienna. In Vienna itself there were 1,861,856 persons. The mountainous nature of the territory and the large proportion of the population resident in the capital city are the two factors which mainly determine and must determine the essential economic characteristics of the country.

Until the autumn of 1922 when the League of Nations formulated its reconstruction scheme, Austria lived a precarious existence with the aid of relief loans, private charity and the sales of her depreciating paper currency to unduly optimistic speculators. The population of Vienna was unable to procure the bare necessities of life. The State budget, burdened by relief expenditure and the salaries of a staff far in excess of the requirements of the reduced territory, was in chronic deficit. Her inflated currency lost day by day in value and her industries divorced at once from their sources of raw material and their former markets, battled vainly in a sea of tempestuous prices. The relief credits which were granted by the Allies proved to be of no value—save as temporary palliatives, and in the autumn of 1922 it was decided by the Assembly of the League of Nations that measures of relief must be replaced by a definite scheme of reconstruction. It is not necessary here to record the details of the League of Nations plan of reform. It involved the formal re-affirmation of the independence and sovereignty of Austria, a moratorium from reparation lia-

[1]The phrase "K. und K." (*Kaiserlich und Königlich*) was applied to all services common to the Austrian and Hungarian armies; "K.-K." (*Kaiserlich-Königlich*) only in the strict sense to the troops of Austria, the Hungarian army being known as the "K.Ung." (Royal Hungarian) service.

bilities for a period of 20 years, the raising of a foreign government guaranteed loan of 880 million schillings[1] (net), a precise and elaborate scheme of budget reform, tho reorganization of the national bank, the definitive stabilization of the currency, and finally the appointment of a high commissioner to supervise the execution of the reforms proposed. After the repayment of certain relief credits, a sum of 6j3 million schillings became available from the loan for utilization by Austria as required. and to this was added in the autumn of 1927 a further sum of approximately 27 million schillings on account of the postponed Swiss block.

Agriculture and Forestry. — Agriculture in Austria is of that mixed type which results inevitably from the formation of the land — in the plains mainly arable, in the mountain districts mainly dairy and stock breeding with patches of arable in the valleys and occasional orchards and vineyards. The percentage distribution of the total area according to the use to which it is put is approximately as follows:

	%
Arable	23·9
Meadows	110
Mountain pastures	155
Gardens	1·0
Vineyards	06
Forest5	37 4
Unproductive	106
	100

The amount under plough is relatively small (in Hungary over 59% and in Rumania 41·6% of the area is arable); and the greater part of it is in Upper and Lower Austria and Burgenland, where it accounts for over 40% of the available area. Only about 4% of the Tirol is under plough Most of the agricultural land is divided into peasants' holdings which vary in size. Large estates probably do not account for more than about 6% of the total On the other hand the forests, which are an Important source of wealth and cover over a third of the territory, are mainly owned by large landed proprietors, the State, and to a lesser extent the local authorities The peasants have, however, in many districts certain ancient privileges permitting them to cut firexood, etc

Of the crops the most important are rye and oats The yield of the major crops in thousands of metric tons was as follows —

Crops	Metric tons (000's) Average 1909–13	1930–34	1935	1936	1937
Wheat	271	344	422	368	400
Rye	568	576	620	460	476
Barley	169	277	270	253	288
Oats	405	418	390	403	287
Maize	73	134	127	135	..
Potatoes	1,296	2,628	2,392	2,500	3,612
Sugar-beet	320	1,089	1,150	889	1,008

During the World War agriculture suffered severely from lack of labour and lack of fertilizers. and during the inflation period the peasant had little inducement to produce more than he required for his own needs. Inflation, however, relieved him of practically the whole of his mortgage debt, and although the high rates of interest which ruled in Austria until about 1926 made borrowing for land betterment or indeed on short term extremely difficult the ultimate gain to agriculture must not be overlooked.

In spite of the progress which has been achieved in recent years Austrian agriculture can only cover a relatively small proportion of the cereal requirements of the population. The relationship of production to consumption In 1926 was as follows:—

Production as Percentage of Total Quantities Available for Consumption

Wheat	Rye	Barley	Oats	Potatoes
33·0	80·7	63·8	84·6	90·6

Although the stockbreeding and dairy-farming of the Alpine districts are rapidly developing. Austria still imports considerable quantities of meat in addition to other foodstuffs This import is required almost wholly for the needs of Vienna.

Austria is thus largely dependent on foreign sources of food supply and that fact determines and must continue to determine her general economic structure. In 1926 about 37% of her gross imports consisted of live animals and articles of food and drink. These imports are mainly paid for by the export of manufactured goods and by the services of middlemen, although the largest single article of export is building timber.

Industry. — The old Austro-Hungarian empire was to an exceptional degree a self-contained economic unit. Its trade per head amounted to less than $1 5 and a large proportion of the raw materials of its industries was obtained within its frontiers. The Austrian republic of 1918–38 was at once essentially dependent on her export trade and relatively poor in raw materials. Her forests supplied the wood required for her paper mills She had more than enough iron ore for her steel and engineering works. and there are deposits of magnesite, salt and graphite. But she had to purchase abroad over three-quarters of her coal requirements and nearly all the raw materials for her textile industries The relative importance of her various industries may be very roughly gauged by the statistics of numbers employed in 1925:—

Industry	No.		Industry	No.	
Metallurgy and engineering	188,532	21 4	Hotels, etc.	35,659	4·0
			Paper	30,060	3·4
Building	140,541	15·9	Chemicals	26,778	3·0
Clothing and shoemaking	75,644	9 0	Printing, etc.	25,683	2·9
			Stone and		
Woodwork	70,946	8·0	earthenware	24,537	2·8
Textile,	67,476	7·7	Leather	13,166	1·5
Food	60,397	6 8	Rubber	5,660	0·6
Mining	52,998	6 0	Electrical supply	3,209	0·4

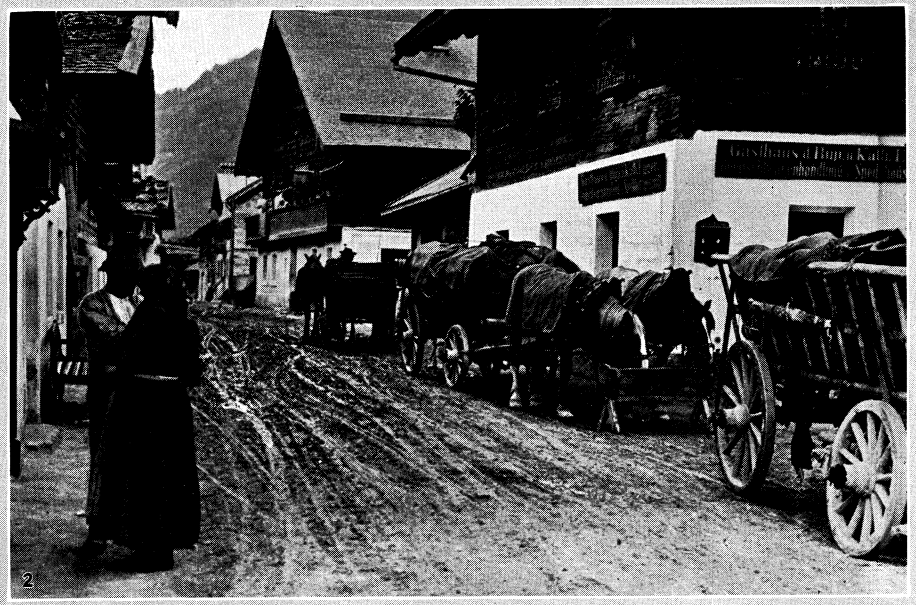
These particular industries employed labour in the proportions indicated largely owing to historical causes — only to a limited extent do they depend on existing natural advantages. They were grouped in part round their market and distributing centre. Vienna. in part round the Styrian ore-fields. and they were closely connected with what is now the German Protectorate of Bohemia and Moravia. Cotton yarn was spun in Austria and woven in Bohemia. and Bohemian piece goods were made up in Austrian clothing factories. The steel works in Styria employed Moravian coke and those in Moravia Styrian ore. Modern Austria found herself with an excess of spindles and a lack of looms. an excess of ore and lack of hard coal. The result of these conditions has been to stimulate the use of water power and create a certain shift in the relative importance of the different industries in favour of those such as paper for which the raw materials were available at home. of those such as hosiery and motor-cars which have enjoyed a general prosperity in post-war years, and more recently in favour of the typical Viennese luxury industries. The development of those industries for which data exist may he judged from the following figures:

AUSTRIAN PRODUCTION (Metric tons; 000's omitted)

	Hard coal	Lignite	Iron ore	Pig iron	Steel	Lead	Paper	Cellulose
1923	158	2,685	1,211	342	500			
1926	157	2,958	1,094	332	550			
1930	216	3,063	1,180	297	468	6 9		213
1931	228	2,982	512	145	323	6·1		216
1932	221	3,104	307	94	205	2 0	201	200
1933	239	3,014	267	88	226	4 6	201	222
1	251	2,851	467	134	309	5·6	199	239
1935	261	2,971	775	193	364	8·0	197	254
1936	244	2,897	1 024	248	418	8 7	177	253
1937	230	3,242	1 880	389	650	8 7	232	304

Trade and Commerce. — The foreign trade of Austria per head of population was remarkably high, amounting in 1924 to nearly $116, and in 192 j to $93. But it fell disastrously during the world depression, being only $23 in 1934, and $25 in 1936. Imports

[1] The schilling (=10,000 paper crowns=·73 gold franc) was introduced in the spring of 1925.

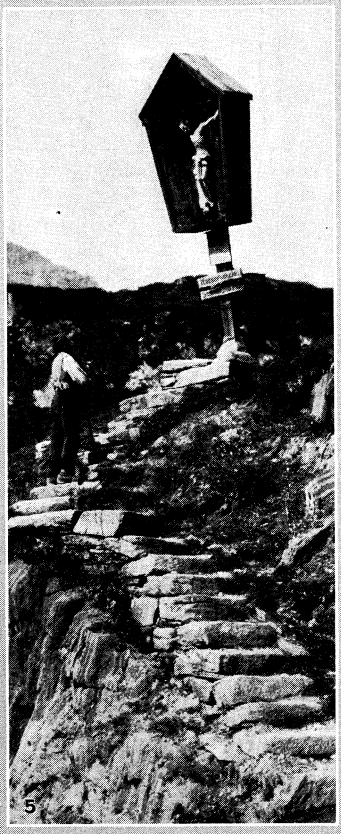


PHOTOGRAPHS, (1) BURTON HOLMES FROM EWING GALLOWAY, (2, 3, 4) PUBLISHERS PHOTO SERVICE

PEASANT LIFE IN AUSTRIA

1. Village home of a mountaineer family in the River Inn valley near Innsbruck
2. Dorfgastein, a typical Alpine village in the Province of Salzburg
3. Interior of peasant's home in lower Austria near Vienna
4. Farmhouse in north Styria, the birthplace of Rosegger, the poet of the Austrian Alps

AUSTRIA



PHOTOGRAPHS, (1, 3, 5, 7) EWING GALLOWAY, (2, 4, 6) BURTON HOLMES FROM EWING GALLOWAY

PEOPLE AND SCENES IN THE ALPINE REGIONS OF AUSTRIA

1. Peasants of the region of Salzburg in fête day costume, the man carrying a tobacco pipe
2. Austrian guides leading tourists up the Zugspitze, on the Austro-Bavarian frontier, the highest peak in the Northern Tirolese or Bavarian Alps
3. Two natives of a village in the Carinthian Alps, just below Salzburg and east of the Tirol, wearing the national costume for church on Easter Sunday
4. People of the Tirol, the most southerly province in Austria, who have bicycled to town from a mountain village for supplies. Bicycling is a favourite mode of travel in this province, where the roads are excellent
5. A wayside shrine on the top of the Arlberg Pass, one of the chief passes of the Silvretta and Rhätikon ranges, in the Austrian Alps. Beneath the carriage road a railway tunnel runs between Landeck and Bludenz. Valluga Spitze, 8,000 feet high, can be seen in the background of the picture
6. Sand beach by the Millstater See, an Alpine lake in one of the valleys of the Carinthian Alps, which is a favourite bathing place and holiday resort
7. An Austrian mountaineer in characteristic short jacket and feathered hat, carrying the rope and pick equipment necessary for mountain-climbing

have always considerably exceeded exports, causing an unfavourable balance of trade. This unfavourable balance has been partly met from the proceeds of large international loans to Austria, and partly by the services which Austrians perform for citizens (notably tourists) of other countries. The decline in Austrian foreign trade which became sharp with the world depression may be seen from the following figures:—

AUSTRIAN FOREIGN TRADE (000,000's omitted)

Year	Imports	Exports	Total	Balance
1929	$458*	$302	$760	$−156
1932	169	93	262	− 76
1933	131	88	219	− 43
1934	129	95	224	− 34
1935	134	101	235	− 33
1936	138	106	244	− 32
1937	162	136	298	− 26

*Throughout the table the gold dollar is of the old value before 1933.

International **Services.**—Vienna before the World War was much more than a political capital. It was the commercial and banking and cultural centre of the whole Austro-Hungarian empire. Although independent money markets have grown up in the other Succession States, and tariffs and the desire for economic self-dependence have greatly restricted the distribution of goods over the new frontiers, Vienna has maintained a large part of its former business. Its bankers and merchants are still the natural intermediaries between eastern and western Europe, and it is still a transit depot. Before the World War Viennese banks directly owned or controlled the main industrial undertakings of the country and they have gradually acquired since the Austrian currency was stabilized in 1922 an increasing interest in industries in the other Succession States.

Moreover, the importance of Vienna as an international mart to-day is not due only to the special skill and experience of her bankers and her merchants, but to the fact that Austria is a transit country (by river and by rail) between south-eastern and western Europe It has been estimated that in 1924 the earnings of middlemen on transit trade alone amounted to 216 million schillings, to which must be added receipts by railways on international traffic which exceeded 4; millions. Almost as important as a source of income is the expenditure of foreign tourists which in the same year was estimated at 200 million schillings.

Further, private citizens in Austria as well as the great Viennese banks had large interests in industries in Czechoslovakia, Hungary and other neighbouring states. and according to reliable estimates, despite the magnitude of her foreign borrowings, Austria received more in interest and dividends from abroad than she was liable to pay on the loans she had effected.

General Characteristics of Austrian Economy.—From what has already been said it is clear that Austrian economy is to an unusual degree mixed in character. According to the census returns of 1920, just under one-third of the gainfully employed persons were engaged in agriculture, almost exactly one-third in mining and industry, and just under one-third in other occupations, including transport, trade, domestic services, liberal professions, etc. It is at once an industrial area. a transit country. and a banking and commercial centre. Its mountainous districts afford a playground for foreign tourists. and Vienna is a centre of culture and of trade—in the retail shops of the Ring especially of luxury trade. It is in this mixed character of its economy and in the adaptability and artistic powers of its population that the potential strength of the country lies.

Commercial Policy.—Just as in the case of Austria, the other Succession States found themselves in 1919 each with a fragment of the total economic mechanism of the former Austro-Hungarian empire. Each accordingly endeavoured to supply the missing parts in its own machinery, and with that object in view protected itself from foreign competition by import prohibitions and high tariff walls. Austria therefore found herself hemmed in and cut off from her former markets. Until the end of 1922 she endeavoured to find an opening for her exports by the arrangement of commercial conventions providing for exemptions from foreign import prohibitions for defined import quotas, and from the beginning of 1923 by the conclusion of bilateral commercial treaties stipulating a reciprocal reduction in tariff rates.

In Jan. 1925 she introduced a new tariff, better adapted to her economic needs than the old Austro-Hungarian tariff of 1900 on which she had worked up to then. This tariff was substantially lower than those applied in any of the other Succession States. But the difficulties from which her trade suffered in common with that of other countries in central and eastern Europe in 1923, and the feeling that the concessions obtained by commercial treaty were inadequate, brought about a reversal of policy in 1926, and a series of amendments to the tariff law were introduced, by which the rates were substantially raised. They remained, however, lower than those of the majority of her neighbours.

Public **Finance.**—The state of the public finances of Austria before the introduction of the League of Nations reconstruction scheme is strikingly portrayed in the report of the financial committee of the league dated Sept. 1924. In the autumn of 1922 it is stated "Austria was undoubtedly one of the countries in Europe which seemed nearest to ruin. The State had no proper budget. All that could be said was that only one-third of the total expenditure seemed covered by normal revenue. The remaining funds required by the treasury were obtained from the printing-press of the bank of issue. Between Jan. and Aug. 1922, the currency fell from 1/1,000 of its pre-war value to 1/15,000. The monthly deficit had risen to about 40 million gold crowns. The complete financial chaos and total absence of any supervision over the administration of the various departments obviously made the task to be accomplished one of almost insuperable difficulty. The number of officials was out of all proportion to the size and importance of post-war Austria. Those who believed in the political stability and financial improvement of Austria dreaded the grave economic crisis which appeared to be imminent. Industry and commerce did not dare to re-adapt themselves to a sound currency system."

In accordance with the general scheme of reform which was initiated in Oct 1922, the Government was empowered to take any measures necessary for the establishment and maintenance of budgetary equilibrium by means of decrees. As early as 1924 the current outgoings and revenue were made to balance, and in 1925 actual revenue covered not only total current expenditure but the whole capital expenditure The progress achieved during the five years since the initiation of the scheme may be judged from the following figures:—

SCHILLINGS (000,000's omitted)

	1923 Closed accounts	1924 Closed accounts	1925 Closed accounts	1926 Estimates (voted)	1927 Estimates submitted to Parliament
Current account: Revenue	697.4	900·6	908·5	760.2	921.9
Expenditure	779·6	810·	741·4	724·3	877·6
Balance	−82·2	+90·6	+167·1	+35·9	+44·3
Investments:	76·—	103.6	90·6	157·7	179·8
Total balance of current and investment accounts	−158·2	−13·—	+76·5	−121·8	−135·5
Repayment of debt from the current account	24·4	65·5	68·4	53·5	55·6

In June 1926 the Council of the League of Nations decided that the financial stability of Austria could be considered assured within the meaning of the protocol. The purposes for which the proceeds of the international loan were used during the period of the operation of the scheme were as follows:—

	Schillings (000,000's omitted)
a. Repayment of credit granted during the inflation period	175·6
b. Security of the service of the loan for six months	51·5
c. Cover for investment expenditure	332·6
d. Cover for deficits on current account in 1922 and 1923 (about 13% of the total loan)	115·4
	675·1

The result of inflation was practically to eliminate the domestic debt, and the greater part of the existing public debt is foreign.

Public Debt, Schillings (000,000's omitted)

General Conclusions. — The economic press of central and western Europe has concerned itself largely in recent years with the problem whether Austria can exist economically without continued help from outside — with the so-called question of her *Lebensfähigkeit*. On this point an interesting comparison with Switzerland is made in the report of Messrs. Layton and Rist.

"It is natural," they state, "that in Vienna, which was recently the capital of a great empire, the idea should be prevalent that a tiny country can with difficulty exist in the present economic world. A comparison with Switzerland, however, suggests that this assumption is too hasty a one.

The geographical position of the two countries is in many respects similar. But it has often been observed that Switzerland's economic resources are more limited. In proportion to its population its cultivated area is smaller and its dependence upon foreign food supplies is greater than is the case with Austria. It possesses no coal resources, whereas Austria supplies nearly a quarter of her requirements from her own mines. While Austria is self-supporting in iron ore, Switzerland depends entirely for its supply upon foreign sources. As regards water-power, nature's most generous gift to Switzerland, Austria is almost as well equipped as that country and better than most other countries in Europe. The urban population of Switzerland is a larger percentage of the total population than is the case in Austria. The foreign assets of Austria are probably not lower per head than are those of Switzerland. Even the tourist earnings of Switzerland do not suffice to restore the balance, for the latter constitute less than 7% of the national income of the country. In spite of the fact that Switzerland is lacking in some of the most important raw materials, that country had in 1913 the highest average accumulated wealth per head of population of any political unit in Europe."

The problem indeed is not one of Austria's power to live, but of her probable degree of prosperity in the immediate future. The answer to that problem depends on the progress which is achieved in the surrounding countries and the importance which they attach to the development of their foreign trade by the free exchange of goods. **(A.** Lov.; X.)

HISTORY

Declaration of Austrian Republic. — (For Austrian history prior to 1918, *see* Austria-Hungary.) Nov. 12, 1918, the day after the last Habsburg emperor abdicated in Vienna, is also the day from which the new Austrian republic dates its birth. On Oct. 21 the assembly of all the German members of the Lower House (Abgeordnetenhaus) of the former Austrian parliament, basing their action on the Emperor Charles's manifesto issued on Oct. 16, had already determined to declare the German-Austrian portion of the Austrian territories, formerly under Habsburg rule, an independent state, and had constituted itself the Provisional National Assembly.

On Oct. 30 this Assembly assumed the supreme independent authority in those Austrian territories claimed by it to be predominantly German, and appointed a State Council **as** executive under the leadership of the three presidents of the Assembly. who then nominated secretaries of state as heads of the administrative departments simultaneously organized for German-Austria. But the revolutionary movement, which broke out in Vienna at this moment as a consequence of the general military breakdown of the Central Powers, led to the declaration of an independent German-Austrian republic on Nov. 12. This declaration, which was in accordance with the right of self-determination, was the result of revolutionary action, and expressly repudiated any legal descent from the broken-up empire. The law promulgated by the Provisional National Assembly on Nov. 12, 1918, explicitly declared in its first article "German-Austria is a democratic republic," and in its second "German-Austria is a component part of the German republic." Thus in the proclamation itself of the new state. there was adumbrated its cessation by a future treaty uniting it with the German Reich.

Ten days later, in a special law, on Nov. 22, 1918, the National Assembly defined its territory. It claimed the ancient hereditary Austrian lands (Crown lands), except the districts inhabited by the Yugoslav and Italian races, and also a large number of predominantly German districts in Moravia and Bohemia. Simultaneously with the constitution of the republic, administration was taken over in the separate provinces (the former Crown lands), of which it was composed. The provincial diets, resolving themselves into provisional assemblies, carried out corresponding changes, the presidents being entrusted with the conduct of the provisional administration and the executive power in their provinces. Thus the autonomous organization and provincial self-government, established by the constitution of the Austrian empire of Feb. 26, 1861, was perpetuated as a real popular self-government in the separate provinces, this time on a really democratic foundation.

Treaty of St. **Germain.**—The Treaty of St. Germain (*q.v.*) finally defined the frontiers and extent of the new republic. All districts occupied by the Czechs in 1919, even the German-speaking, nere allotted to Czechoslovakia. The frontier with Yugoslavia near Klagenfurt was drawn in accordance with the plebiscite (Oct. 10, 1920) ordered by the treaty; in south-east Carinthia it was essentially according to the ancient frontier of that province. The treaty also laid down that the republic was in future not to bear its own chosen name, but that of Austria. The principle already laid down in the Treaty of Versailles, that the Austrian republic must preserve her independence, and that union with Germany could only take place with the consent of the League of Nations, was also laid down in the dictated peace of St. Germain. But the treaty awarded a large part of the old German-settled territories in West Hungary to Austria; and Hungary was obliged by the Treaty of Trianon (*q.v*) to evacuate and transfer them. The execution of these decisions of the Paris treaties was not complete until well on into 1921, after meeting with much opposition from Hungary *(see* Burgenland).

Difficulties of the **New** State. — The law of Oct. 1, 1919, definitely and finally drew Austria's frontiers in accordance with the treaty. The carrying into effect of the onerous and complicated terms of the treaty became the chief task of Austria's foreign policy, which was prevented from following any independent line by weak economic conditions and ever-increasing financial difficulties. In 1919 and 1920, only credits from the United States, granted largely in kind, made it possible to maintain the town population, which had been reduced to destitution by the World War and the effects of the blockade. The most important agencies in relieving this extreme misery and suffering were the American relief organized by Mr. Herbert Hoover, which fed the children, and the work of the Society of Friends for the starving population of Vienna and other towns. Thus at that time the whole political life of the republic was absorbed in the efforts to assure the existence of the republic under the burdens imposed on it by the consequences of the War and by the division of the great and ancient empire into independent economic and political units, in the fulfilment of Austria's obligations, and in the task of maintaining public order in the face of internal and external dangers. The chancellor, Karl Renner (*q.v.*), who had been at the

head of the Government since the revolution, nevertheless succeeded in 1920 in establishing friendly relations with the Czechoslovak republic. Numerous problems arising out of the execution of the treaty were harmoniously solved in an agreement concluded with the Prague Government at Brno (Briinn), (June 7, 1920), and a supplementary agreement at Karlovy Vary (Carlsbad), (Aug. 23, 1920).

The Constituent Assembly. — The revolutionary decisions of Nov.–Dec. 1918 had provided for the summoning of a National Constituent Assembly, elected on the broadest democratic franchise and by proportional representation, which met at Vienna on hfarch 4, 1919. The result of the elections was again to divide political power between the three parties which together had carried through the revolution, but in considerably altered proportions. Of 159 deputies, 69 belonged to the Social Democratic party, 63 to the Christian Socialists, and 26 to the Pan-Germans (Nationalists). In accordance with the two laws of March 14, 1919, on the franchise and on the Government the Constituent Assembly retained for the time being the provisional constitution of the republic of 1918, but introduced fundamental changes. The Council of State (Staatsrat) and its three presidents were abolished.

The ministry, consisting of the state chancellor, the vice-chancellor and the secretaries of state, now received full executive and administrative powers, and was henceforward to be elected on nomination of the main committee of the National Assembly, the permanent link between legislative and executive, consisting of the president, two vice-presidents and eleven deputies. Several former functions of the Council of State were now transferred to the ministry; some of its prerogatives, such as the appointment of judges and higher officials, were, however, transferred to the president of the National Assembly acting in agreement with his vice-presidents. He became the representative of the republic abroad and treaties must be ratified by him. He represented the supreme power in the republic, although with strictly limited functions. The Constituent Assembly, elected for two years, was to be in continuous session for this period.

Centralized or Federal Government. — The central problem for the republic, as for imperial Austria, was the relation to the State of the historic provinces. From the first the idea of centralization had been most strongly emphasized by the Social Democrat leaders. Opposition in the provinces increased. In the laws of March 14, 1919, certain provisions were therefore inserted to meet the case of conflicts between the decisions of the provincial assemblies and the federal laws, the central authority being empowered to challenge such decisions before the new Constitutional Court.

Coalition and "Proportional" Governments. — On March 15, 1919, the Government was reconstituted by election from the National Assembly. The Social Democrats; as the strongest party, filled almost all the important posts — the ministries of the interior, of foreign affairs, and of war. The first chancellor. Dr. Renner, presided over the new ministry, and was appointed head of the peace delegation to Paris.

The Social Democratic Party found its main support in the trade unions and party organizations, which in Vienna and in all industrial districts included almost the whole of the working classes. The revolutionary feeling born of the War and the downfall of the monarchy was a strong auxiliary. Part of the official class and of the lower middle class also supported it. On the other hand, the Christian Socialist Party included all the agricultural class, and the overwhelming majority of the upper and middle classes in Vienna and the provincial towns. The Social Democrat leaders regarded the coalition, from which the first constitutional government was formed, as a union of workers and peasants, from which a complete democratic republic would emerge through the legislation to be passed by the National Assembly. The party, under the leadership of Dr. Renner, President Seitz and Dr. Otto Bauer (foreign minister), was able to preserve its unity by successfully combating those activities of its own Left wing, which had been inspired by the establishment of the Bolshevist republic in Russia and by the temporary success of Bolshevism in Hungary.

In the spring of 1919, when the Soviet republic in Hungary was exercising increasing pressure on Austrian Social Democracy, the situation became at times highly critical, but the policy and tactics of the Social Democrat leaders directed against Bolshevism were successful in restraining the population of Vienna. The armed police easily repressed the isolated attempts by the extremist elements to disturb by violence the quiet development of Austria's republican democracy, and despite the vast and ever-increasing difficulties, public order was preserved.

The gradual cooling of revolutionary sentiment in the masses did not therefore lead to any change in Social Democratic policy, which was directed to the maintenance and development of the democratic republic, nor to any reactionary movement against democracy by the Christian Socialists. This relative stability was further demonstrated by the united opposition from both the great parties in the country to the attempts made by the ex-emperor Charles, on March 13 and Oct. 26, 1921, to restore the dynasty by his return to Hungary. Nevertheless the second coalition, formed on Oct. 17, 1919, with Dr. Renner at its head, was felt to be an undesirable hindrance to normal political developments, while the agricultural and urban middle classes began to resist the predominance of socialistic ideas in government and administration. These tendencies emerged most clearly on the question of the new army organization.

The coalition was formally dissolved, and a "proportional" Government formed which accomplished its tasks of completing and introducing the new federal constitution (Oct. 1, 1920). On Oct. 17 new elections were held.

Dr. Mayr's Ministry. — As the Christian Socialists had gained nearly 200,000 votes from the Social Democrats, securing 82 seats in the National Council against 66 Social Democrats, 20 German nationalists, 6 Peasants' Party and 1 Workers' Party, a new ministry was formed under Dr. Michael Mayr, generally supported by the German Nationalists, the Social Democrats retiring into the opposition.

The constitutional problem of centralization or federation — the provinces, particularly the farmers, demanding the wider administrative and financial independence, while the German Nationalists and Christian Socialists of Vienna and the whole Social Democrat party urged the retention of the "Centralist" constitution — was solved by a compromise on the principle of an eventual administrative reform on federal lines, the execution of which was deferred for future legislation. The opposition of the Social Democrats was removed by the assurance that the city of Vienna, containing little less than one-third of the total population of the State, in whose city council Social Democracy had had an overwhelming majority since 1919, should be legally severed from the province of Lower Austria, and be declared an independent province (*Bundesland*). The city council thus became the Provincial Diet, and received all the legislative and administrative powers which the constitution gives to the provinces. It became a provincial government, and the burgomaster the governor of a province. Some minor modifications of the principle were conceded to the Christian Socialists.

Austria's internal policy was, from this time onward, dominated by the dangerous economic situation, above all by the rapid depreciation of the Austrian exchange consequent on continuous currency inflation to stop the gaps in the federal budget and provincial revenue. The yield of the taxes disappeared, and the capital levy of 1920 remained inoperative. The embarrassment of the Mayr government was heightened by the pressure of the popular movement, instigated by the Tirolese and other provincial governments, under the influence of the Conservatives and Nationalists in Bavaria, for union with Germany. The Government under pressure of French intervention opposed the movement when its strength was evidenced in plebiscites.

In the spring of 1921 the chancellor tried unsuccessfully to obtain financial help in London and America. The reviving industry needed credits and foreign currency to pay for imports of raw materials; the Government had immediate and similar needs, and the result was a further fall in the Austrian exchange.

The Schober, Seipel, and Ramek **Ministries.**—Unwilling to shoulder alone the inevitable unpopularity of Government, the Christian Socialists combined with the German Nationalists to elect a cabinet of officials, with J. Schober (*q.v.*), the police president of Vienna, as chancellor (June 21, 1921). The cost of living, however, continued to rise, especially in Vienna.

Schober resigned on May 31, 1922, in favour of an anti-Socialist coalition of Christian Socialists and German Nationalists under Monsignore Ignaz Seipel. Meanwhile, an English loan had been rapidly exhausted and the Austrian exchange was dropping headlong. Dr. Seipel determined to treat the collapse of Austria as a European problem, to be solved only by a broad policy of long date and adequate credits. He undertook diplomatic journeys to Prague, Berlin and Verona, and finally obtained the desired loan which stopped the financial collapse (see section, *Economic Conditions, 1918–38*). It was not popular as it imposed many sacrifices on the Government servants and others; but Seipel retained his majority in the 1923 elections which altered the party figures little. He resigned in November 1924 after an attempt on his life had injured his health. His successor, Dr. Rudolf Ramek, completed the Constitution, in agreement with the Socialists, further strengthening the federal principle. In December 1925 the League Council held Austria's budget to be permanently balanced, although at a level higher than anticipated, and transferred the remainder of the loan to the Government. In March 1926 the controller-general left Vienna.

In 1926 the Government's position was weakened by two scandals: the collapse of a bank with which various Christian Social leaders had been connected, and the discovery of irregularities in the conduct of the Austrian Post Office Savings Bank. In November 1926 Seipel again became chancellor.

Growth of the Private Armies.— Inter-party political tension was growing rapidly. Immediately after the War various provinces had formed local defence forces (Heimwehren), partly for defence against Austria's neighbours, but afterwards increasingly against Socialism. The Socialists, on losing control of the Army—which, in the first months, had been a "Red Party Guard"—had formed their own force, the "Republikanischer Schutzbund," while the National Socialists had small troops of their own. In January 1927 some of the last-named had in an affray killed a child and an old man. In July a Viennese jury acquitted the persons concerned. Radical elements utilized the popular anger for a mass demonstration in which the police were assailed and the Palace of Justice burned. The police then opened fire, and order was restored only after 89 persons had been killed. The Socialists proclaimed a general strike, but this was crushed in the provinces by the Heimwehr and called off after four days. The result was a great strengthening of anti-Socialist feeling in the provinces and an impetus to the Heimwehr organization. A Socialist proposal for general disarmament was rejected, and the situation as between the rival elements continued serious throughout 1928. On one occasion only heavy rain prevented probably a pitched battle in Wiener Neustadt between the Heimwehr and the Schutzbund. The chancellor now declared himself openly on the side of the Heimwehr, while the Socialists were further embittered by the election of the clerical W. Miklas as president of the republic. The tension increased in 1929 The Heimwehr passed to open threats. Although Seipel resigned on April 3rd, his successor, Dr. Ernst Streeruwitz, was powerless in the face of the Heimwehr, whose leaders, Steidle and Prince Starhemberg, openly defied the Constitution. To the political crisis was added a financial one, when in September the largest Austrian bank, the Bodenkreditanstalt, was found to be on the verge of failure. Seipel forced the resignation of Streeruwitz, but on September 26th Schober took office again and temporarily saved the situation. The Bodenkreditanstalt was merged in the Credit Anstalt, and a constitutional reform act was passed on December 7th, being accepted by the Socialists as less reactionary than anything to be anticipated from Seipel Vienna remained a federal province, but the president of the republic received increased powers. In foreign affairs Dr. Schober at first succeeded in relaxing the tension between Austria and Italy, and concluded a commercial treaty with Germany (April 12th, 1930) besides negotiating at The Hague Austria's release from her reparations obligations. He also managed for some months to hold the Heimwehr in check, but his measures so infuriated them that they successfully intrigued him out of office (September 25th). A Heimwehr Government under Vaugouin took charge and held elections in November; but these giving the Socialists 72 seats against 66 to the Clericals, 7 to the Heimwehr and 20 to Schober, the Clericals were forced to accept a coalition with Dr. Otto Ender as chancellor and Schober as vice chancellor and foreign minister.

The Austro-German Customs **Union.**—On March 20, 1931, it was stated that Austria had concluded a customs union with Germany. A storm of protest arose from France and her allies, who regarded this as tantamount to political union. The atmosphere of uncertainty was increased by the announcemect that the Credit Anstalt, now far the biggest Austrian bank, was in its turn threatened with failure. France insisted on political conditions in return for help, and although British intervention postponed the day, Schober was forced to resign and Austria had to renounce the customs union a day before The Hague Court, by a majority of one, declared the plan incompatible with Austria's international obligations. A new Government was now formed under Dr. Buresch, who was succeeded on May 20th, 1932, by Dr. Dollfuss. The Government had a majority of only one vote, but in August just secured the adoption of the Lausanne Protocol which gave Austria a new loan of £9,000,000 under humiliating conditions, including the renunciation for 20 years of a customs union with Germany, and strict financial control.

The Rise of National Socialism. —Meanwhile, the National Socialist movement had made sudden and rapid strides in Austria, and at the provincial elections the Nazis practically wiped out the Pan-Germans, also making gains at the expense of the Socialists and moderate Conservatives. The Nazi propaganda redoubled in vigour when Hitler came into power in Germany in 1933, with a policy which included the early absorption of Austria. The whole political alignment in Austria was now changed, for the Socialists at once renounced the idea of Anschluss so long as the Nazis remained in power, while the Jews, to a man, supported the Government in its anti-Nazi activities. On the other hand, many of the Heimwehr were Nazi in sympathies.

A temporary breakdown in the Austrian Constitution in March, 1933, gave Dollfuss a legal excuse to rule thereafter by arbitrary decree. He now found himself absorbed in a violent struggle with Germany, which attacked the Austrian Government with scurrilous broadcasts and leaflets, dropped by aeroplane, while a tax of 1,000 marks imposed on June 1st on all German visitors to Austria was designed to ruin her tourist traffic. A legion was formed of Nazi deserters and fugitives from Austria, and frequent acts of terrorism were perpetrated. The Bavarian minister of justice visiting Austria in the spring, attacked the Government violently Dollfuss took strong measures against the Nazis. He enjoyed much sympathy from France and Britain. He flew to Italy, and seems to have received a guarantee that Italy would defend Austria's "independence" if she would adopt the Fascist form, crush the Socialists and refrain from appealing to the League. Dollfuss now made definite terms with the Heimwehr (which had largely been reconstituted) making Emil Fey, a Heimwehr leader, vice-chancellor.

The Revolts of 1934.—The Socialists offered to co-operate with the Government, on moderate terms, against the Nazis, but Dollfuss rejected their offer.

When the Socialists resisted by force, they were crushed in a battle which broke out on February 12 and lasted for several days with heavy casualties. Many Socialists were thrown into concentration camps and the movement driven underground.

Nazi violence continued, and on July 25 a *coup d'état* was attempted. It failed, although Dollfuss was killed. Italy mobilized on the Brenner, Yugoslavia made counter-preparations. However, Dollfuss's successor, Kurt Schuschnigg, had a quieter time, particularly when Hitler sent Herr Franz von Papen to Austria to initiate a rapprochement. Schuschnigg, however, remained true to Dollfuss's pro-Italian policy. Meanwhile, a new Constitution was adopted, based on the corporate system. (J. RE.)

Union of Austria with Germany. — From the World War to the advent of Hitler as chancellor in Germany there was a strong feeling in both Germany and Austria that the two countries ought to be politically united. Historic sentiment favoured union. For nearly nine centuries they had been united, first in the Holy Roman Empire, and then in the German Confederation irom 181j to 1866. Bismarck, to be sure, had expelled Austria from the German Confederation in order to found a new German state under Prussian leadership. But after defeating Austria in 1866 he had the rare wisdom to treat her so generously that Austria quickly overlooked the defeat and became the friend, and in 1879 even the ally, of Germany. It was to bolster up and protect her Austrian ally that Germany entered the World War in 1914. But the Peace Treaties at the close of the War foolishly forbade the union. although informal plebiscites in Austria showed that probably 90% of the people at that time desired reunion with Germany.

With Hitler's seizure of power in 1933 the Austrian desire for union largely evaporated Austrian Socialists abhorred Hitler's destruction of the German Social Democratic Party and its trade unions. Austrian Roman Catholics rightly distrusted the Nazi promises given to the German Catholics in the Concordat of 1933. Austrian Jews were horror-stricken at the anti-Semitism across the border. And most easy-going Austrians disliked the brutal totalitarian regimentation taking place in the Nazi Third Reich. The only persons in Austria then favouring union with Germany were the Austrian Nazis. They were organized by Hitler as a division of the larger Nazi Party, and they were secretly encouraged with money and advice from Germany to work for union by undermining Austrian independence in defiance of the Peace Treaties. Under instigation from Germany they made the abortive revolt of 1934 which resulted in the assassination of Chancellor Dollfuss.

Dr. Kurt Schuschnigg, the successor of Dollfuss as Austrian chancellor, made an earnest and hopeful struggle to maintain Austrian independence for nearly four years. He greatly improved the country's economic and financial condition, so that Austria was able to balance her budget and to pay interest on her foreign loans. He dismissed some of his strongest potential rivals and became virtually dictator. The dangerous private armies were dissolved or forced to enter his o n loyal Fatherland Front. But he was guided by strongly clerical interests, and he made the mistake of not making concessions to secure the co-operation of the Socialists who had revolted and been suppressed in 1934.

Schuschnigg also had to meet continued danger from Germany, which kept on inciting Austrian Nazis to stir up disorders which might give Hitler a pretext for intervention. In the hope of ending this intolerable situation Schuschnigg consented to sign with Germany the agreement of July 11, 1936. The German Government "recognized the full sovereignty of Austria, including the question of National Socialism in Austria, which is to be regarded as exclusively an Austrian question, in which the German Government promises to exert no interference either directly or indirectly." Austria on her part would "respect the internal organization of Germany, and conduct her policy in general, and especially as regards Germany, in accord with the fundamental basis which corresponds with the fact that Austria acknowledges herself to be a German state." This agreement was followed by diplomatic conversations for the removal of friction on both sides. Schuschnigg promised an amnesty to political prisoners except those convicted for serious crimes. He also agreed at a future suitable time to take into the Austrian Government some representatives of the Austrian Nazi group, if he could find persons whom he could trust.

The agreement of July 11, 1936, unfortunately did not bring the internal quiet in Austria nor the good relations with Germany that had been hoped for. Schuschnigg delayed to take Kazis into his cabinet. The Nazis in turn continued to foment disorders and were arrested and sent to concentration camps. So, after a year and a half, Hitler's followers reverted to the "putsch" policy of 1934 when Dollfuss was assassinated. A plot was organized to kill the German military attaché in Vienna or even the German ambassador, Franz von Papen; the blame mould be laid on the Austrian Legitimists; and Hitler would then have a pretext for intervening. But in Jan. 1938, Schuschnigg's police nipped the plot in the bud and seized incriminating documents. To prevent their disclosure and to induce Schuschnigg to make concessions to the Nazis, the Austrian chancellor was persuaded to come to a meeting with Hitler at the latter's Bavarian mountain chalet.

At the Schuschnigg-Hitler conference at Berchtesgaden on Feb. 12, 1938, Hitler put strong pressure on his guest and intimated that German troops might force compliance. Alone and defenceless, Schuschnigg felt compelled, in order to prevent greater dangers to Austrian independence, to promise that he would urge concessions upon President Miklas. Great was the gloom among loyal Austrians when he returned to Vienna, for he seemed to have capitulated pretty completely to the demands of the German dictator who had at his call immense military forces and a population ten times that of Austria. On February 15 Schuschnigg and Miklas did in fact grant a general amnesty to the Austrian Nazis. suppressed the incriminating evidence, and took several Nazi sympathizers into the cabinet, including Arthur Seyss-Inquart.

Dr. Seyss-Inquart thus became minister of the Interior, which meant that he would have control of the Austrian police. Within a few hours of his appointment he hurried to Berlin to confer with Hitler and with Heinrich Himmler, the head of the Elite Guard and the secret police of Germany Upon his return he pretended to be loyal to Schuschnigg and Austrian independence, but winked at and tolerated wide-spread Nazi activities. It was apparently arranged between him and the Berlin leaders that German Nazi propaganda and money should be poured into Austria and that after some months, when these had done their work, Hitler would insist on a plebiscite in Austria to decide whether it should be united with Germany.

When Schuschnigg learned of this plan he decided to forestall it by holding a plebiscite at once. He announced by radio on March 9 that the vote would be held on Sunday, March 13. In accordance with the Austrian Constitution, only those who were twenty-four years of age could vote; this provision was unfavourable to the Nazis who had relatively more adherents among the young than the old. Certain other of Schuschnigg's plebiscite arrangements would also work against the Nazis, so Schuschnigg could reasonably count on getting a clear majority in favour of himself and Austrian independence. Hitler, at first nonplussed at Schuschnigg's manoeuvre, then acted quickly before Austria could get support from other countries. He moved troops to the Austrian frontier and on March 11 despatched two ultimatums to Vienna demanding the postponement of the plebiscite and the resignation of Schuschnigg.

Threatened by an overwhelming invasion of German troops and police, Schuschnigg, to avoid bloodshed, yielded. He resigned after ordering the Austrian troops to offer no resistance to the Germans who crossed the frontier on March 12 and occupied Vienna next day. Hitler came in with the troops, and on March 13 proclaimed the union of Austria with Germany. He thus united the land of his birth with the land of his adoption, and created a "Greater Germany" of nearly 75,000,000 population. On April 10 he held a vote throughout Greater Germany to ratify his action and to elect a new Reichstag for the enlarged state. In Old Germany he received a 99% endorsement, and in Austria a shade higher endorsement. This remarkable "yes" vote in Austria did not of course give a true picture: all Jews were disfranchised; the presence of German troops and police exercised an inevitable pressure; and terrorized Socialists, Communists, and Catholics conspicuously voted "yes" for fear of the consequences if they did not do so.

The German **"Ostmark."**—With Hitler's annexation of the land of his birth, the name "Austria" (Oesterreich) was replaced by that of "Ostmark" (East Mark), thus recalling the mediaeval period when Austria had stood as a defensive frontier against the Magyars, Slavs, and Turks.

Austria thus ceased to exist as a political entity The former Austrian territory was soon divided up into seven districts (*Gaue*) which follow fairly closely historic provincial lines. At the head of each district is a leader (Gauleiter) who is both the head of the Nazi Party in the district and also the chief Government official

of the district. The seven new Gaue, with the capital of each in parentheses, are as follows: (1) Upper Danube (Linz); (2) Lower Danube (Krems), these two replacing the former provinces of Upper and Lower Austria; (3) Vienna, which has been somewhat enlarged in order to be the "portal" to the south-east just as Hamburg was recently enlarged to be the "portal" to the north; (4) Styria (Graz); (5) Carinthia (Klagenfurt); (6) Salzburg (Salzburg), and (7) Tirol-Vornrlberg (Innsbruck). (See, for the character and history of each of these former Austrian provinces, the articles on AUSTRIA. UPPER; AUSTRIA, LOWER; STYRIA; CARINTHIA; SALZBURG: TIROL.)

Immediately after the annexation Hitler accomplished rapidly the political and economic co-ordination of Austria into "Greater Germany." Joseph Buerckel, an ardent Nazi who had had experience in organizing the Nazi vote at the time of the Saar plebiscite, was transferred from the Saar to Vienna, made commissioner for the Ostmark for a year, and was charged with preparing the plebiscite in new territory. In order to get the vote of the Roman Catholics, who form the great majority of the population, Buerckel had several conferences with Cardinal Innitzer, Archbishop of Vienna, and his brother bishops. He held out assurances to them of favourable treatment for the Catholic Church. The assurances were very welcome, since the Austrian Concordat of 1855, more favourable to the Catholics than the German Concordat of 1933, was declared to have automatically lapsed with Austria's extinction as a sovereign State. Cardinal Innitzer, being a native of the Sudeten territory and strongly German nationalist, and his brother prelates, apparently trusting in Buerckel's assurances, and without consulting the Pope, then issued the declaration desired by Buerckel. They stated that "as a result of their innermost convictions and of their own free will" they had joyfully decided to recognize National Socialism, and to vote "Yes" as a national duty, and that they expected all good Austrian Catholics to do likewise. Their statement was read from all the Austrian pulpits, and a copy of it was sent to Buerckel in a note that Cardinal Innitzer signed in his own hand with "Heil Hitler"—certainly the first time that a German bishop had used the Hitler greeting. These documents were published in facsimile very widely in the Austrian newspapers. The plebiscite resulted in a more than 99% endorsement of the annexation to Germany. Of course this did not register the real feeling of the people, because a great many persons, just as in the plebiscites in Germany, voted "Yes" out of fear of what might happen to them if they should show opposition to the Nazis.

Buerckel's assurances were not kept by the Gestapo (German secret police) and by the more radical German Nazis who poured into the Ostmark. Many of the Catholic religious orders were deprived of their buildings, and the residence of the Archbishop of Salzburg was seized for Nazi uses. In Jan. 1939, all Catholic property was inventoried, which was thought to be a preliminary step to its eventual confiscation. In July 1939, Cardinal Innitzer, who had previously been attacked and had the windows of his palace broken, was insulted with a shower of rotten eggs and cries of "murderer" while making a rural tour, because he did not intervene in 1934 to prevent the execution of two Nazis connected with an abortive "putsch" and the assassination of Chancellor Dollfuss.

The so-called "Nuremberg Laws" were introduced and resulted in even greater hardships and misery to the Austrian Jews than that already suffered by the Jews in Germany. Of the approximately 180,000 Austrian Jews who were members of Hebrew religious communities before the annexation, 99,672, or more than half, had emigrated from Austria in little over a year, according to figures published on May 15, 1939, by the official Nazi Central Bureau for Jewish Emigration. By a decree of the following July, emigration was made more difficult by an order that thereafter all emigrating Jews must pay half the cost of their steamship tickets in foreign currency supplied by their relatives or friends abroad. In addition to the Jews who are members of Hebrew religious conimunities, there is a large number of other Jews, many of them baptized, but exact figures as to how many have ernigrated and how many still remain in Austria have not been published. It is the Nazi hope to have all the Jews out of Austria within three years Already they have almost completely disappeared from the provinces, those that remain being mainly concentrated in Vienna where they can more easily escape notice.

In the economic field German efficiency and hard work replaced the easy-going life of the Austrians. In the early summer of 1938 many thousand Austrian unemployed were despatched in special trains to work on the triple line of fortifications, or "Westwall," against the French frontier. Within a month after annexation, as a symbol of the new employment which the Germans would bring to Austria, Hitler turned the sod near the frontier town of Wels for the new Austro-German highway which would connect Vienna with the super-highways of the old Reich. To add spectacular emphasis, as Hitler finished his speech at the spade ceremony, the crowd was thrilled to see a forest of birch and oak fall with a terrific roar along the path of the new road.

In his report at the end of a year Commissioner Buerckel claimed that 650,000 unemployed had been put back to work, the skilled in munition factories, and the majority at building new motor highways, bridges, streets, waterways, and houses. Ore-mining in Styria was expanded to supply the great Hermann Goering Iron Works under construction at Linz. Idle mines of gold, silver, lead, antimony, and other metals, abandoned previously as uneconomic in view of the world prices, began to be worked again to serve an economy wherein world prices were disregarded. The Austrian schilling was replaced by the German mark at the ratio of two marks for every three schillings, an arrangement favourable to Austria. The Austrian banks were co-ordinated under the Reichsbank, and some $60,000,000 in gold belonging to the Austrian National Bank was transferred to the Reich. Similarly the Austrian railway, tariff, and insurance systems were assimilated by those of Germany. The German rigid control over prices and wages and service in the army, Labour Front and other German organizations was introduced.

The administration of the Ostmark was given a definite form by a decree which went into effect on May 1, 1939. In each of the seven new Gaue, or districts which correspond closely with the former historic provinces of Austria, there is a supreme administrator known as the Reichsstatthalter. He is both the representative of the central government of Greater Germany and the head of the Gau administration. He is also the head of all the other special Reich administrations within his Gau (except the army, which has its own centralized organization) like the forestry, insurance, peasant, employment, etc., organizations. He naturally leaves these organizations to function according to their own rules. but he is kept informed of all their doings, and may, if he sees fit, step in and give orders. He is also the *Gauleiter,* or Leader of the Nazi Party, for his district. In his person the Party and the State are united in one supreme district head.

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AUSTRIA, LOWER, or "Austria below the river Enns." formerly a province of Austria, in 1938 became the *Niederdonau Gau* of "Greater Germany." It is divided by the Danube into a northern more agricultural and a southern more industrial half, and each may be further subdivided into structural regions with distinct economic contrasts. The northern half falls naturally into two districts, almost equal in area, the "Waldviertel" and the "Weinviertel." The former coincides with the extension of the Bohemian and Moravian igneous plateau which here slopes gently from the Weinsberger Wald (3.478 ft.) to the Manhartsberg (1 758 ft.). Westward it resembles the parent mass of Upper

Austria, but towards the east lithological and climatic changes cause the forest to be confined to the deep, winding valleys, and the high tableland shows an increase of cultivation and a greater number of large villages while in the north-west corner small textile and glass factories raise the density of settlement. The long north-east-south-west scarp of the Manhartsberg falls quickly to the wide valleys and soft, swelling hills of the "Weinviertel." Here all sunny slopes are terraced with vineyards while a mantle of Tertiary sediments and loess, and ease of movement, combine to encourage cultivation and settlement. Only in the centre, nhere forested offshoots of the Alps, *e.g.*, the Leisser mountains (1,615ft.), form a connecting link with the Carpathians, is the network of fields and routes broken. East of these spurs the land sinks to the alluvial basin of Vienna and to the intensively cultivated valley of the Morava along which stretches a continuation of the Moravian sugar-beet belt.

South of the Danube three zones may be distinguished, viz.: (1) a narrow and hilly prolongation of the Alpine Foreland, (2) the north-eastern extension of the Flysch and Limestone Alps culminating in the Wienerwald, and (3) the southern half of the Vienna basin thrust as a wedge south-west beyond Wiener-Neustadt. The Foreland is more hilly than in Upper Austria but maintains its importance for stock-farming and offers little hindrance to communication. Rail and road avoid the river which between Grein and Ybbs and again between Melk and Krems (the "Wachau") follows a deep, tortuous course between steep walls of crystalline rock. Crowned by ruined castles and terraced with vineyards and orchards, these gorges are reminiscent of the Rhine but lack its volume of industry and traffic though water-power and communications have stimulated the former at Krems and Waidhofen. East of the Traisen, a right bank tributary of the Danube, the isolated farmsteads and small hamlets surrounded by orchards typical of the West Foreland are replaced by large nucleated villages of Germanic form as in the "Waldviertel" and "Weinviertel." The forested Alpine promontory thrusts a thinly-peopled zone between the Foreland and the busy Vienna basin where agriculture and industry mingle. Settlement is most dense in the western half of the basin, *i.e.*, in association with the great route to the Semmering Pass and along the tectonic thermal "fall line" of separation from the Alps, where rich vineyards cover the slopes and prosperous spas and factories, fed by local water-power, line the foot of the scarp. East and north the basin is floored with impermeable strata favouring maize, wheat and sugar-beet; southward permeable gravels cause a change to woodland. But the overwhelming aspect of human activity is industry; more than half of the manufacture of Austria is concentrated in Vienna (*q.v.*) and its basin, particularly between the capital and Wiener-Neustadt. Smaller centres have arisen where, as on the Foreland, local advantages of situation or resources of materials and power assure their prosperity; the paper. iron and cellulose factories of the Ybbs and Erlauf valleys and the cotton-spinning of St. Pölten are examples. Area, 9,091 sq mi.; pop. (1939), 1,699,302. (W. S. L.)

AUSTRIA, UPPER, or "Austria above the river Enns," formerly a province of Austria and now the Oberdonau *Gau* of Greater Germany, is situated in the north-west of the country, and divided by the Danube into two unequal parts. The smaller northern part is a portion of the S. flank of the Bohemian massif, a granite plateau sloping gently south-east from a height varying between 4,500ft. and 3,500ft. to a steep scarp overlooking the Danube. As its soil is thin and the climate raw and wet, forests and rough pasture prevail, though in the sheltered valleys and depressions hardy cereals, potatoes and flax are successfully grown. Communication is poor and only one important railway crosses the plateau, that from Linz through the Kerschbaum Gate to Budejovice. The southern part belongs to the Eastern Alps and falls naturally into two divisions, the Alpine Foreland and the limestone and Flysch zones forming the Outer Alps (see AUSTRIA) The former is a richly-cultivated region of arable slopes and pastoral valley floors to which Upper Austria owes much of its high agricultural reputation; of the productive surface, *i e*, 95% of the total area, 46·5% is arable. garden and vineyard, 35·2% is forest, 14·5% meadowland and 3·8% rough pasture. It is a land of long tradition in which prehistoric and Roman remains are scattered amongst large and imposing farms, prosperous towns and stately monasteries, and it contributes heavily to Austrian resources through its large cereal production, extensive orchards and advanced cattle-breeding. Between the fertile valleys of the Inn and Traun lies the Hausruck range with rich beds of lignite, which are associated with the small iron and textile manufactures of Linz and Steyr (*q.v.*). Brewing. milling, distilling (Linz) and leather factories (Wels) are important and handle all the local produce. The Outer Alps offer few opportunities to agriculture and settlement, but the magnificent scenery of the western lakeland of Salzkammergut (*q.v.*) and the numerous thermal springs, *e.g.*, at Ischl, attract a large tourist population. Further, their wealth of salt, timber and water has originated chemical, paper and small iron industries in the Traun and Enns valleys.

Population is most dense upon the Foreland where small, evenly-distributed market towns along the streams are the rule. These local centres, however, are dwarfed by Linz, Steyr and Wels, each largely the product of its situation. Linz, which with its industrial suburb of Kleinmiinchen has a population of 131,423, is the third largest town of Austria and capital of the province. Situated where the old Bohemian "Salt" road crossed the Danube, it has developed extensive trading interests and important river activities. Wels (26,656), another nodal point, is the recognized market for the cattle and cereals of the Foreland. while Steyr (31.165), situated at the junction of Foreland and Alps, is the natural centre of gravitation for the trade of the whole of the south-eastem highlands. A secondary group of small towns, *e g.*, Gmunden (10,909), Ischl (11,062) and Ebensee (8,533), thrives upon the exploitation of salt, water-power and scenery in the lakeland district, but the true heart of Upper Austria is that great thoroughfare of peoples and ideas — the Foreland and its waterway the Danube, towards which the life and interests of the province converge, and by which a large proportion of its heavy exports of salt, stone, timber, iron and paper finds outlet.

AUSTRIA-HUNGARY. Under this heading an account is given of the history of those territories in central and eastern Europe, since 1918 partitioned among Italy, Austria, Czechoslovakia, Poland, Hungary, Rumania and Yugoslavia, which were accumulated by the dynasties of Babenberg and Habsburg round the nucleus of the "Ostmark" established in A.D. 976. The generation which saw the dissolution of this empire in 1918 knew it as "Austria-Hungary"; but this title was of recent date, and represented (and inadequately) only one phase of this venerable but singularly unstable organism. To call the whole "Austria" is admittedly inexact; but an exact definition of the term is equivalent to an examination of its whole history. The word represents, at any rate. the spiritual idea of an eastern bulwark and defense of the German nation and of Christendom itself, in which Austria lived. In proportion as it became untrue to this task, or as the need for it disappeared, Austria withered, and at last perished. The following article will describe the rise of the original Ostmark and its development into a European power of the first magnitude, together nith the international or internal events affecting the countries which at various times composed the Austrian empire as a whole; the internal histories of these countries being given under the appropriate headings (see HUNGARY; POLAND; BOHEMIA; CROATIA-SLAVONIA, etc.).

Earliest History. — The territories later to be known as Austria were inhabited by man from a very early date. Remarkable relics of prehistoric civilizations have been found at Hallstatt (q *v.*) and elsewhere in Austria. About 400 B C, Celtic tribes, the most powerful of which were the Taurisci, later known as the Norici, and the Boii, invaded and occupied the eastern Alps, Bohemia and the Hungarian plain. The Romans directed their arms across the Alps in the first century B C., completing the conquest of the land south of the Danube nith the subjugation of the Norici in 15-14 B C Their efforts to subjugate the territory north of this linr from which the Celts had been rxpelled by an

invasion of Germanic tribes, notably the Marcomanni and Quadi, proved unavailing. The Danube was therefore fixed as the frontier of Roman occupation, and the territories south of it were organized in the three provinces of Raetia, Noricum and Pannonia. Vindobona, afterwards Vienna, was already a place of importance under the Romans. This era was closed by the great national migrations of the 5th century AD. In 432 the Huns settled in the plains of Pannonia, which were next occupied, after Attila's death (453) by the Ostro-goths. Hitherto Noricum had been ravaged by the barbarians on their forays into Italy, but not chosen by any for their home; but in 487 Odoacer, who was then master of Italy, abandoned his possessions north of the Alps and withdrew his garrisons, which were accompanied by the richer elements of the native population. The empire of the Heruli, which followed him, was short lived. The mountain lands west of the Enns were occupied by a Germanic tribe, the Bajuvari, the descendants of the earlier Marcomanni. The territory east of this line was occupied by the Lombards and, after their invasion of Italy in 568, by the Avars, who remained its overlords for three and a half centuries. Themselves numerically few, the Avars drove before them, or brought in their train, many Slavonic tribes, who gradually peopled the Alpine valleys as far west as Raetia and Istria: Austria thus became the ethnographical meeting point of the Germans and the Slavs. In 622, one Samo, said to be a Frankish merchant, united a number of Slavonic tribes on the western frontier of the Avars and led them to freedom. After his death in 668, the territories of Bohemia and Moravia in the north and Carantania in the south were semi-independent of the Avars.

The Germanic tribes, meanwhile, were laying the foundations of their later civilization. Shortly after settling in their new homes, the Bajuvari had acknowledged the supremacy of the Franks, while retaining a considerable degree of independence under their ducal house, the Aglolfingi; an independence which became very full on the death of the Frank king Dagobert in 638. In 738 they became an important power when Boruch, duke of Carantania, acknowledged their suzerainty and accepted the Christian faith in return for help against the Avars. The rise of Bavaria was unwelcome to the ambitious Frank kings, and after the Saxons and Lombards had been subjugated, they turned against Bavaria in 787–788. Tassilo, the Bavarian duke, appealed to the Avars for help; but he was deserted by his own subjects and forced to surrender to Charlemagne, who bestowed Bavaria on his brother-in-law, Gerold, and went on to destroy the Avars (791–797). Having thus pushed the frontiers of his empire far to the east, Charlcmagne organized the newly-won territory in two large Marks, the "Mark im Ostland" north of the Drave and the "Mark of Friuli" south of that river (811).

The territories remained part of the German Reich for 100 years. Their most powerful neighbour, with whom there were frequent wars, was the empire of Great Moravia, which was founded about 828 and defied all efforts made to subjugate it, but was also not dangerous to the existence of the Mark. In 894, however, a more dangerous enemy appeared in the Danube valley in the shape of the Magyars. In 906 this formidable nation destroyed the Moravian empire, and in 907 defeated the German forces gathered to resist them, slew Luitpold, the markgraf of the Ostmark, and overran his land. All trace of German civilization and colonization seems to have disappeared before them; for although the mountains of Carantania escaped their forays, these wild recesses had probably been little affected by the German rule.

After ravaging central Europe, the Magyars were defeated on the Unstrut by King Henry (933); but they were only definitively driven back into Hungary after the crushing defeat inflicted on them in 955 by King Otto the Great. Otto's step-son, Henry, was duke of Bavaria; and after the Battle of the Lech, Henry's son, Henry the Quarrelsome, organized a fresh Ostmark on the eastern frontiers of his duchy, and bestowed it on a member of his house. On the death of Otto the Great, however, Henry the Quarrelsome unsuccessfully disputed tho German throne with Otto II., who deprived him of his duchy in favour of Otto of Swabia, and bestowed the Ostmark on a partisan of his own, Luitpold or Leopold of Babenberg (976).

Austria Under the **Babenbergs.**—This year (976) is celebrated by tradition, and justly, as marking the true birth of Austria, for it was under the Babenbergs that it began its long and steady rise to power. The position of the first Babenbergs was, however, modest enough, Their frontiers extended only from the Enns to the fringes of the Wienerwald and from Retz to the valley of the Piesting. Even within these narrow limits many enclaves were under other jurisdiction than theirs, since during previous centuries gifts of land or office had been liberally made in this district. The most important of these were the properties of the bishopric of Passau, which included such places as Mautern, St. Pölten and Stockerau Other enclaves belonged to the bishopric of Regensburg or the Bavarian church, and to the great monasteries, of which Salzburg was the chief, and others, again, to lay families of Bavarian origin. Jurisdiction was exercised on many points, and claimed on more still throughout the whole Mark, by the great bishoprics of Salzburg, Aquileia and Passau, all of which lay outside its frontiers. Moreover the markgraf, like all vassals under the feudal system, held his Mark only in virtue of the office which he performed for the German king; he could at any time be deprived of it, and had no legal right to transmit it to his son. While the office was granted by the king, the land comprising the Ostmark was still regarded as pertaining to the dukes of Bavaria of which the markgrafs held three counties on their western frontiers.

On the other hand, the very dangers of Austria's exposed situation (the name Ostarrich is mentioned for the first time in 996 as its "popular appellation") proved a source of strength to its rulers. Unlike the holders of the northern marches, who were faced only by scattered, incoherent and heathen Slavonic tribes, they had as their neighbours the strong State of Bohemia, which had survived the collapse of the Moravian empire, and the new Magyar State, which showed an unexpected power of resistance, even in defeat, and consolidated its position by its timely conversion to Christianity. These two States barred the way to any premature expansion of Ostmark. A small advance of the eastern frontier was checked in 1031 by the defeat of King Conrad II. by Stephen of Hungary, to whom the contested strip of land was restored. It was recovered for Germany in 1043 by Henry III., and a new and independent Mark, the "Neumark Oesterreich," was set up between the old frontier and the Leitha. In 1063 these lands were incorporated into the older Ostmark, being the first important acquisitions made by the Babenbergs.

The necessity of keeping a strong defence on the eastern frontier against Bohemia, and more especially Hungary, obliged the German kings to grant the markgrafs of Austria exceptional privileges. Few exemptions were made from their authority in the Mark, and their hereditary right to the office, though not admitted in law, was in practice unquestioned from the first.

As markgrafs they held the further advantage of not being obliged to grant out the counties attached to their Mark in fee, but were allowed to hold them in person, or administer them through officials appointed by themselves. At a time when the rights and privileges of other fiefs were falling into decay, those of the Babenbergs remained undiminished; and meanwhile, as the other land-owning families in the district died out, they consolidated their position by securing the reversion of these estates, by purchase, marriage or investiture. Personally, too, they were bold, tenacious and hard-working, and able guardians of the marches. In a long series of forays with the Magyars they kept their frontiers intact, just as at home they held their own successfully in the constant struggle for power. In addition they earned the gratitude of a succession of German kings by their constant and loyal support.

The Duchies **of** Austria and Styria.—Of the earlier Babenbergs, only Leopold II. (1075–95) deserted the Emperor Henry IV. in the investiture struggle, and was deprived of his fief in consequence (1081). It was given to Vratislav II., duke of Bohemia, but soon after Leopold was reconciled with the emperor and received his fief back (1083). Leopold III. (1095–1136) supported Henry V. against his father, Henry IV., and was rewarded with the hand of the young king's sister Agnes, widow **of**

the Hohenstaufen Frederick and mother of the later king, Conrad III. Through this marriage the house of Babenberg became allied with the Hohenstaufens, while through his sisters Leopold was also connected with the dukes of Bohemia and Carinthia, the markgraf of Steyr, the prince of Znaim, and other influential families. He had, indeed, raised his house to such eminence that on the death of Henry V., his name was put forward for the German throne; but he declined this dangerous honour. and both he and his son and successor, Leopold IV. (1136–41), proved remarkably successful in holding aloof from the great feud between the Welfs and the Hohenstaufen which divided Germany. From it, indeed, they reaped only advantage; for Conrad III., the stepbrother of Leopold V., bestowed on him in 1138 the duchy of Bavaria, of which he had deprived the Welf, Henry the Proud. After Leopold's death, his brother, Henry "Jasomirgott," so called from his favourite oath, held the duchy from 1143 to 1154, when it was restored to the Welf, Henry the Lion, by Frederick Barbarossa. The Babenbergs were now strong enough to press for compensation; and at the Investiture of Regensburg (Sept. 17, 1156) Henry renounced all rights of Bavaria over Austria, which Frederick thereupon raised to the rank of a duchy, investing it in Henry and his wife Theodora as a hereditary fief, capable of transmission in the female line, in default of heirs male; while should the succession fail altogether, the duke received the right to nominate his successor. At the same time the dukes of Austria, being now the titular equals of those of Bavaria, incorporated in their domains the counties which they had formerly held from Bavaria, and thus extended their western frontier up to the present boundary east of Passau. The duke now held exclusive jurisdiction in his territories, and his duties towards the emperor were limited to appearing at any Diet held in Bavaria, and to contributing a contingent for the imperial army in any campaign waged in the countries bordering on Austria (*privilegium minus*).

These very notable privileges aroused the jealousy of the markgrafs of Steyr, the wealthy and powerful house of Chiemgau, who had succeeded to the fiefs of the perished dynasty of Eppensteiner in 1122, and had since been pursuing a policy of patient and successful acquisition which had made their dominions hardly less extensive than those of the Babenbergs. Ottakar III. of Steyr obtained for himself the ducal title in 1180; but being childless, he made a secret compact six years later with the Austrian duke, Leopold V., to whom he was related through his great-grandmother Elizabeth, daughter of Leopold II. of Austria, granting the latter his domains after his own death, subject to the king's approval. In 1192, Leopold V. duly entered into possession of this rich territory; and although on his death in 1194 the two duchies were partitioned between his two sons, on the death of the older, Frederick I., they were again united in the person of the younger son, Leopold VI. (1198). The union, like all the later unions with territories of any magnitude, was personal only; the Estates of each duchy retained their own especial and varying privileges and organization.

Leopold VI. acquired, by purchase or treaty, a number of smaller territories within or adjacent to his now stately domains. His son, Duke Frederick the Quarrelsome, was brought by his wife another important acquisition, whence he took the title of lord of Carniola. But he came near losing his whole domains, for after he had involved himself in disputes with his neighbours, his Estates and the emperor, he was placed under the ban, his domains invaded by the imperial armies, and his territory reduced at one time to the town of Wiener Neustadt and the adjacent castle of Starhemberg. Thanks to the disunity of his adversaries, he won back all he had lost, and negotiations were actually proceeding for the elevation of Austria and Styria into a single kingdom, and Carniola into a duchy, when he was killed in a battle against the Hungarians (June 15, 1246), and with him the male line of Babenberg became extinct.

The Interregnum. — On the extinction of the Babenbergs, the Emperor Frederick II. claimed their duchies as vacant fiefs of the empire, and entrusted them to the administration, first of Count Eberstein, later of Otto II., duke of Bavaria, in Austria, and of Count Meinhardt of Gorizia in Styria. Pope Innocent IV., on the contrary, espoused the cause of Frederick the Quarrelsome's surviving niece, Gertrude, wife of the markgraf of Moravia, and after his death, that of her second husband, Hermann, markgraf of Baden. When both Hermann and the emperor died in 1250, the Estates of Austria met at Triibensee in 1251, and elected Ottakar, son of Wenceslaus I., king of Bohemia, while those of Styria elected Bela IV., king of Hungary. Although the rivals swore peace at Ofen (Buda) in 1254, Ottakar expelled Bela in 1260 and reunited the two duchies, with which he was invested (though not in legal form) by the German king, Richard earl of Cornwall, in 1262. Ottakar, who had become king of Bohemia in 1253, ruled his domain wisely, being a particular patron of the towns, and added to it, in 1270, Carinthia, Carniola, and the Windisch Mark, by virtue of a compact made in 1268 with Ulrich III., duke of Carinthia, who died childless two years later. But his great power frightened the Electors of the Rhine, who saw the probability that the centre of gravity of central Europe would be shifted permanently to the east; and on the death of Richard in 1272, they rejected Ottakar's nominee and chose instead a man of great abilities but few possessions: Count Rudolph of Habsburg. Rudolph was crowned German king on Aug. 24, 1273.

The **Habsburgs** in Austria. — Rudolph's primary mission was to break the power of the king of Bohemia, and he probably aspired from the first to secure the Austrian duchies for his own house, whose possessions, in Switzerland and Alsace, were modest. He proceeded with caution. In 1274 he questioned Ottakar's claims to the duchies, and in 1276, having twice summoned him to appear before the Imperial Diet, placed him under the ban. In 1276 he led the imperial forces into Austria and defeated Ottakar, who renounced his claims to the three duchies, and did homage to Rudolph for Bohemia and Moravia. Attempting two years later to recover his possessions, he was defeated and slain. In 1281, Rudolph appointed Albert, his eldest son, governor of Austria and Styria, retaining Carinthia in his own hand. On Dec. 27, 1282, he raised his two sons, Albert and Rudolph, to the ranks of princes of the empire, and invested them with Austria, Styria, Carniola, the Windisch Mark and Carinthia. In the following year the dual sovereignty was abolished, Albert, with his descendants, receiving the lands. while Rudolph was compensated by a sum of money. Finally, in 1286, Carinthia was separated from the other provinces and bestowed on Count Meinhardt of Gorizia, who was also count of Tirol.

Development of the Estates. — The position of the first Habsburgs was in appearance much stronger than that of the Babenbergs, but in reality far less secure. The old feudal system under which the earlier dynasty had grown strong was in complete decay. The power of the German king had followed that of the Holy Roman emperor into practical extinction. Little by little the kings had been forced into making, first the higher fiefs, and then the lower, hereditary. The power of landed nobles had replaced the old hierarchy of service; and all that remained to the king was some small control over his weaker vassals, with the possibility of mediating in the quarrels of the stronger, together with the right of bestowing titles which were merely nominal. From 1438 until its abolition in 1804, the title of Holy Roman emperor was held, with one exception, only by the rulers of Austria; but it was a shadow whence the life had departed. Nor did the Habsburgs recover as dukes the authority which they had lost as kings. As the feudal system decayed, that of Estates came into being; the internal history of the next centuries is that of struggle of the great divisions of society to secure power and privilege for themselves and to defend them against attack from above and below. By the close of the 13th century this process was already well advanced in Austria. The belief of the privileged classes in their right to a voice in affairs was shown by the revolts with which Albert had to deal; the revolt of the burghers of Vienna in 1288, of the Styrian nobles in 1292, and of the Austrian nobles in 1295. Albert, who was a strong and a hard man, dealt with these risings successfully; but throughout the 14th and 15th centuries the power of the Estates steadily increased. This was due to two main causes: to family dissensions

among the Habsburgs themselves, and above all, to their chronic penury. Whatever the legal position, the fresh funds of which they were continually in need could be obtained only with the consent of the Estates, who made each application the occasion for exacting confirmation or extension of their privileges. By the beginning of the 15th century the process of evolution was complete. The Estates of the church, the landed nobility, the burghers, and (in the Tirol alone) the free peasants had acquired a definite status and organization, and a considerable control over public affairs. The power of the sovereign was correspondingly diminished, while the unprivileged classes were sinking into increasing misery. For most of the inhabitants of Austria, the later middle ages were a time of great wretchedness, full of class warfare, oppression and hatred, which found their outlet at last in the religious wars which filled much of the period. Nor was this all. The advance of the Turks cut away Vienna's eastern trade, besides threatening more directly the Austrian provinces themselves. The Black Death ravaged Austria in 1348, 1349, 1369 and 1381; the transition to the more general use of currency, instead of payment in kind, caused a prolonged economic crisis of the utmost severity; and the degeneration of the free peasantry into a class of oppressed and exploited serfs was disastrous, not only for themselves, but for the whole country.

Expansion of Austria Under the Early Habsburgs.—Over other German States Austria preserved, indeed, the advantage which had been hers under the Babenbergs. Less than ever was it possible now for the crowded States of the west to expand to any real extent; but the east remained a more promising field. The Habsburgs themselves chiefly retarded the growth of their own power by their unfortunate family policy; the system of primogeniture was unknown among them, and at first attempts were made to establish a common rule of two or more brothers. This proving impracticable, in 1355 Albert II. issued a family ordinance which admitted the right of all members of the family to rule. For over a century the Austrian lands were divided between different members of the family (for details *see* HABSBURG), and they were only reunited by Maximilian I. The quarrels between the brothers occupied much of their time, and meanwhile the title of German king, although held by Albert I. and his son Frederick, then passed for a century to the house of Luxembourg. The first real advance made by the Habsburgs was in 1335, when, as a result of a secret agreement made five years previously, Albert II. (1314–58) and Otto (1314–39) who were then ruling Austria and Styria in common, obtained definite possession of Carinthia, as of Carniola, which had been pawned to the count of Gorizia, and of south Tirol. The *privilegium de non evocando,* which was obtained by Duke Albert, gave the dukes of Austria further privileges in the empire; but these were too little for Otto's ambitious successor, ,Rudolph IV. (1339–65). Irritated by the omission of Austria in the Golden Bull of 1356 from the list of Electoral States, Rudolph produced a series of forged privileges, purporting to go back to Roman times, designed to give the duke of Austria a status superior to that of any other vassal of the empire. The Emperor Charles IV., while confirming in general fashion the rights of the Habsburgs, refused to acknowledge the forged *privilegium majus,* and the result was a breach between him and Rudolph, who, however, gained a solid success in 1363 when Margaret Maultasch, duchess of Tirol, made over her dominions to him and his brothers.

A dark period followed Rudolph's death. His succession was divided between his brothers Albert III. (1365–95) and Leopold III. (1365–86), and this partition led to a long and devastating dispute between the two lines which they founded. The disunion in the ruling house led to a formidable increase in the power of the nobles, and civil wars from which the Tirol and Vienna suffered particularly heavily. Leopold, indeed, secured the possessions of the counts of Gorizia in Istria and the Windisch Mark (1374) and of parts of Vorarlberg (1375), while in 1382 Trieste submitted voluntarily, to escape the encroachments of Venice: but his defeat at Sempach in 1386 presaged the loss of the Habsburg dominions in Switzerland. The glory of the dynasty, but not the prosperity of the lands, was suddenly restored in 1437 by the death of Sigismund of Luxembourg, king of Germany, Bohemia and Hungary, who bequeathed all three crowns to his son-in-law, Albert V. Albert, however, died two years later. His heir, Ladislaus Postumus, was born after his death, and his second cousin Frederick, of the Styrian line, acted as guardian both for Ladislaus and his first cousin, Sigismund of Tirol, who was also a minor.

Frederick III.—Frederick's prolonged reign was one of almost ceaseless strife with the Estates, his neighbours and his jealous family. In 1446 a revolt of the nobles of the Tirol forced him to release Sigismund from tutelage, and a similar and more serious movement broke out in Ladislaus' domains in 1451, headed by the wealthy adventurer Rudolph Eitzing and Ladislaus' uncle, Count Ulrich Cilli, and supported by strong parties among the Estates of Austria, Bohemia and Hungary. In 1452 this league besieged the emperor in Wiener Neustadt and forced him to release Ladislaus, who now became nominal ruler over his wide domains, while the actual power was wielded in Austria by Ulrich, and in Bohemia and Hungary by national regents in the persons of George Podiebrad and John Hunyadi respectively. When Ulrich was killed in 1456, the emperor succeeded to the wide estates of his house; but the death of Ladislaus in the following year opened up a period of strife and civil war between Frederick and his brother Albert, which was only ended by Albert's death in 1463. The Styrian and Austrian possessions were now at last reunited under Frederick; but Hungary and Bohemia, on the death of Ladislaus, had broken away and had elected national kings: George Podiebrad in Bohemia and Matthias Corvinus, the son of Hunyadi, in Hungary. The latter, a ruler of exceptional ability, actually drove Frederick from Vienna in 1485, established his own residence there, and incorporated large parts of Austria, Styria and Carinthia in the kingdom of Hungary.

Although treated with so little consideration in Austria, Frederick had enhanced its dignity by confirming, as emperor, the forged privileges put forward by Rudolph 100 years previously. Thus in 1453 Austria received the title of an archduchy, with many privileges within the empire, and was declared indivisible, the principle of primogeniture being introduced into the succession. The beneficiary of these innovations, Frederick's son and successor, Maximilian (1459–1519), was as brilliant a figure as his father had been a pathetic one, and inaugurated an entirely new era in Austrian history.

Maximilian I.—The rise of the duchy of Burgundy under Philip the Good and Charles the Bold had inspired Frederick with the idea of using this new power as a counterweight against the increasing unruliness of the princes of the empire. To this end, Maximilian had been married in 1477 to Maria, daughter and heiress of Charles the Bold, to whose lands in Burgundy, Flanders and Luxembourg he succeeded on the death of his father-in-law in 1482. The position of the Habsburgs on the two flanks of Germany was now commanding indeed; but it was also dangerous; and Maximilian's early years were spent in constant struggles in the west, not only with the Flemish Estates, but also with France, whose long hostility towards Austria dates from the Burgundian marriage. Fortunately he was able rapidly to consolidate his position in Austria. Elected German king in 1486, in 1490, on the death of Matthias Corvinus, he drove the Hungarians out of Austria and restored the old frontier, and in the same year his cousin, Sigismund of Tirol, abdicated in his favour. On the death of his father he was elected emperor, and united all the Austrian possessions in his own hand, later augmenting them slightly by the heritage of the counts of Gorizia, whose line became extinct (1500), some districts in north Tirol, the prize of the War of the Bavarian Succession (1505) and some small districts won by war from Venice (1516).

It was largely with the purpose of making his Austrian dominions into a compact and reliable base for his more ambitious plans elsewhere that Maximilian introduced the administrative reforms which were his abiding legacy to Austria proper. "Austria," as he found it, consisted of an agglomeration of provinces, united only in the person of their common sovereign, whose relations towards, and authority in, each were governed by the

varying rights of the several Estates. For this system—the outcome of mediaeval evolution—Maximilian attempted to introduce government by permanent State officials in the provinces, linked up to a central authority; while matters of common interest to several provinces should be discussed by deputies of each at a "brotherly union." To some degree, Maximilian was successful: but after his provincial "colleges" had been made a permanent institution in 1501, the Estates awoke to the threat to their particularism and privileges. Their suspicious hostility was aroused. At the Innsbruck Diet of 1518, Maximilian was forced to retract some of his reforms, and his successor reaped the fruit of the animosity he had aroused.

Yet the march of time was with the emperor; and the chief reason why Austria failed to develop into a compact German State was Maximilian's own preference for grandiose schemes to shed lustre on his house and justify his imperial title. Yet in these projects, in which he exhausted his dominions, he was seldom successful. His reforms in Germany were opposed by the Electors, who frustrated his plan to get the Tirol made into an Electorate. The Swiss Federation, after a long struggle, broke finally away from the empire. The Italian campaigns ended with minute territorial gains, and the deep hostility of Venice—an important matter in view of the advance of the Turks. France had become an implacable enemy, and the attempt to rouse Europe to a crusade against the Turks ended in failure. The transformation of Austria into a super-national world-power was due only to Maximilian's own marriage and that of his children and grandchildren. The marriage of his son Philip to Joan, infanta of Castille (1496) and of his daughter Margeret to John of Aragon (1497) made the Habsburgs heirs to the new power of Spain; while at the congress of Vienna (1 j1 j) Maximilian arranged marriages (which were consummated in 1521 and 1522 respectively) between his grandchildren, Maria and Ferdinand and Louis and Anna, the children and heirs of Vladislav III., king of Bohemia and Hungary. Thus when he died, on Jan. 12, 1519, Maximilian had already prepared the way for the great transformation which was to follow.

(C. A. M.)

AUSTRIA AS A GREAT POWER: 1519–1740

Ferdinand I. 1526-64.—Maximilian's grandson, Charles, king of Spain, 1516, emperor 1519, was also co-ruler of the Habsburg dominions in Eastern Germany, but relinquished them to his brother Ferdinand by the partitions of Worms (1521) and Brussels (1522). When Louis II., king of Bohemia and Hungary, died childless (1526), Ferdinand claimed the succession to the two kingdoms in the name of his wife Anna, Louis's sister, and his own. The Bohemian Estates denied the validity of his title, and claimed the right themselves to elect their king. On Oct. 23, 1526, they then unanimously elected Ferdinand king of Bohemia, while demanding from him considerable diminutions of his sovereign rights. Ferdinand admitted that the Estates had elected him of free will, but conceded only part of the limitations demanded. The Estates of the other lands of the Bohemian crown (Moravia, Silesia, Lusatia) recognized Ferdinand's title, through his wife. In Hungary the difficulties were greater. No alternative to election was recognized. The opposition elected John Zápolya, Voivode of Transylvania (Nov. 1526), while the Habsburg party elected Ferdinand (Dec. 1526); but he had to accept important restrictions on his sovereign rights. The diet of Croatia voted for Ferdinand, the Estates of Slavonia elected Zápolya. War broke out between the two candidates. Zipolya appealed for help to the Sultan Suleiman, who advanced and besieged Vienna in 1529. In 1538 peace was concluded at Grosswardein; Zápolya retained the title of king, with that part of Hungary then in his possession; but on his death the whole kingdom was to fall to Ferdinand. When, however, Zápolya died (1540) his councillors secured the sultan's recognition and support for his son, John Sigismund. War broke out afresh, and the Turks occupied a great part of Hungary. Ferdinand even had to undertake to pay the sultan an annual tribute for the remnant of Hungary left him (1547).

In the severe struggles in which Ferdinand's brother, Charles V., was involved with the Protestant princes of Germany and their allies abroad, Ferdinand did not directly intervene, although his sympathies were unfeignedly Catholic. Elected German king in 1530, he repeatedly advocated reconciliation between the two religious parties and attempted, although vainly, at the Council of Trent, to modify the demands of the Catholics. He was largely instrumental in the conclusion of the treaties of Passau (1552) and Augsburg (1 j55). In 1 j56 he was crowned emperor in succession to Charles V.

Ferdinand's reign was of great and lasting importance for the internal administrative history of the Austrian districts. He continued the centralizing policy of Maximilian I., and gradually established a number of administrative bodies common to all his lands, assisted by the circumstance that the constitutions of the lands of the Hungarian and Bohemian crowns did not bind him to consult the Estates in many important questions; *e.g.,* decision on war and peace, the raising and application of the regular income from the crown property and revenues, etc. He thus prepared the way for the efforts of his successors to rule their different kingdoms and lands on a common basis, and to create a real unity between them in foreign, military and financial respects. These central organs comprised the Privy Council (Geheimer Rat), created in 1527, for foreign affairs and general administration, the General Court Chancelry (*Allgemeine* Hofkanzlei) for execution of decisions taken by the Privy Council and the sovereign, the Court Council of War (Hofkriegsrat), established 1 j56 to deal with military recruiting, equipment and supplies and maintenance of fortresses and arsenals, and the Court Treasury (*Hof*-kammer), established 1527 as a central financial organ.

The development of the Habsburg power was severely hampered by the fact that in the German-Austrian provinces, where the hereditary title of the dynasty was unquestioned, the principle of primogeniture was sanctioned neither by law nor tradition. Ferdinand I. himself only owed his possession of these territories to the principle that all male members of the Habsburg dynasty had a claim to the government and revenues of all territories. Despite his better judgment, Ferdinand could not free himself from the traditional view. To avoid a partition of the hereditary provinces, in his will (1543) he appointed his eldest son, Maximilian, his successor in Hungary and Bohemia, and expressed the wish that his three sons should rule the German-Austrian territories without partition. Yet at last tradition proved too strong. In 1 j54 he decreed a partition of the Austrian dominions. Maximilian, as eldest, received the duchies of Upper and Lower Austria and certain other smaller territories; Ferdinand, Tirol and the "Vorlande"; Charles, Styria, including the county of Cilli, Carinthia, Carniola, Gorizia, Trieste and Austrian Istria. The revenues were to be divided as equally as possible between the three. On the extinction of the male line of any brother the survivors inherited his possessions. This partition came into force on Ferdinand's death (1564) The resultant weakening of the dynasty was only temporary, as Tirol and the "Vorlande" reverted to the Styrian line in 1595 (definitively, after a new partition, 166 j) and the Inner Austrian territories were united with the Duchy of Upper and Lower Austria in 1619.

Maximilian II. 1564–76.—War with Turkey again broke out towards the end of Ferdinand's reign. An eight years' truce (1562) left the Turks in possession of their recent conquests. On Ferdinand's death (1564) a new conflict broke out between his successor, Maximilian II. and the Turks, whose assistance the Prince of Transylvania had invoked. Sziget, heroically defended by Nicholas Zriny, defied Sultan Suleiman II.'s assaults, but after his death (1566) the fortress fell and Maximilian lost also his last strongholds beyond the middle Theiss and Unna. In 1568 a fresh eight years' truce (afterwards repeatedly renewed) was concluded.

Maximilian's attitude towards the religious question (see REFORMATION) seemed likely to affect decisively the destinies of both Austria and Germany. He had been educated in a more or less Protestant atmosphere. Charles V.'s plan to secure the imperial succession for his son Philip had brought Maximilian in oppo-

sition to the Spanish Habsburgs, and confirmed his conciliatory feelings towards the Protestants. Consequently, Protestantism spread widely through the old estates of Austria, particularly the nobles. However, the antagonism between the two Protestant creeds in Germany, consideration for dynastic tradition, his family connections with the Catholic dynasties of France and Spain, and also purely political motives combined to keep Maximilian, personally, true to Catholicism. He therefore accorded the Protestant nobles religious liberty only, but not a legal establishment of their church. Even so, on his death the Protestants formed an overwhelming majority in most of his lands.

Rudolph II. and the Counter-Reformation. — Under Rudolph II. (1576–1612), whose succession to the thrones of Germany, Bohemia and Hungary had been ensured in his father's lifetime, the Catholic reaction began. Rudolph refused to grant legal recognition of religious liberty, and issued severe edicts against the prevalent heresies. He was, however, too weak and indolent to carry through the measures he planned, and Protestantism made further progress, especially in the towns.

Rudolph's brother, Ernest, as governor of Upper and Lower Austria, was more successful in defending the Catholic faith against the repeated assaults of the Protestant preachers; especially after finding in Melchior Klesl (*q.v.*) an ardent advocate of the policy of Catholic restoration, who applied the religious edicts ruthlessly. Klesl's severity led to unrest in Upper Austria, which presently turned into a social struggle against the landed proprietors; this spread into Lower Austria and was suppressed with difficulty and only imperfectly. The counter-reformation proved most successful in Inner Austria. The Archduke Charles, needing the help of the Estates against the Turks, at first had to make concessions (Brucker Libell 1578), but the counter-reformation soon set in strongly, its headquarters being the Jesuit university of Graz. Charles's son Ferdinand succeeded his father as independent ruler in 1596 and carried on his work. Commissions appointed by him eradicated Protestantism among the townspeople and peasants. Obstinate heretics were forced to emigrate. In a few years the majority of the population was thus restored to Catholicism.

The success of the counter-reformation in Austria inspired the Government to attempt a similar reaction in Bohemia, hforavia and Hungary; but their efforts failed, especially after Stephen Bocskay (*q.v.*) became leader of the anti-Habsburg party. The towns and nobles of Upper Hungary joined him, as Archduke Matthew, as representative of his brother Rudolph, persecuted the Protestants and attempted to infringe the rights of the Hungarian diet. Bocskay allied himself with the Sultan; the imperial troops were repulsed and several towns conquered by the Turks. Simultaneously the discontented Protestant Estates in Austria formed a league in defence of their religious and political liberties, the unrest among the Bohemian Estates grew, and anti-Habsburg feeling increased among the evangelical Estates of the empire. The emperor's insanity had become increasingly obvious since 1598; his brother thought energetic action imperative to save the territory and repute of the dynasty. Rudolph proved obstinate in the main question, but empowered Matthew to treat with the Turks and Bocskay. By the treaty of Vienna (June 1606), Transylvania remained under the suzerainty of the Hungarian king, but Bocskay was recognized as prince and his dominions enlarged. The Hungarian Estates (magnates, nobles and free towns) and royal markets were guaranteed free practice of their religion. In Nov. 1606 the negotiations with the Turks were concluded at Szitvatorok. The territorial status *quo* was accepted, but the sultan for the first time recognized the emperor as his equal.

As the emperor, whose health had further deteriorated, refused to recognize his brothers' arrangements, the archdukes determined to recognize Matthew as head of the house (April 1607). Rudolph objected; a family quarrel broke out. After complex negotiations, the Hungarian, Austrian and Moravian Estates agreed with Matthew to maintain peace on the basis of the treaties concluded by him in 1606. Rudolph, however, refused to grant these demands. War seemed inevitable, but a compact was concluded at Lieben, Bohemia (June 1608), whereby Rudolph resigned Hungary, Moravia and Austria to Matthew and promised him the succession to the Bohemian crown, while Matthew renounced his share of the Tirol and the Vorlande in his brother's favour.

This dispute had greatly increased the power of the Estates, whose demands the two Habsburgs were obliged to concede. In March 1609 Matthew concluded a compact with the Estates of Hungary, Austria and Moravia; the guarantees given by Maximilian II. were taken as basis and extended in favour of the Protestants. In Sept. 1609 Rudolph signed a royal patent (*Majestätsbrief*), assuring liberty of conscience to all inhabitants of Bohemia, and granting certain further rights to the nobles, knights and free cities. Yet the discords between Matthew and Rudolph and between them and the Estates continued. The formation of the Protestant Union (1608) and Catholic League (1609) in the empire reacted on conditions in the Habsburg dominions. The great danger for the imperial power lay in the fact that each of these federations sought supporters abroad — the Union France, the League Spain and the pope. The fatal fraternal struggle in the Habsburg territories thus led to increased agitation among the Estates, reinforced in Bohemia by nationalist feeling. In Hungary Matthew, who had succeeded his brother as emperor in 1612, was involved in new struggles with Bethlen Gabor (*q.v.*) and the Turks, and, receiving insufficient support from the Estates, was forced to recognize Bethlen as Prince of Transylvania and prolong the peace of Szitvatorok for 20 years (1615). The danger of a combination of the Estates of Matthew's dominions against the crown was averted by increasing and irreconcilable differences between the Estates of Hungary, Bohemia and Austria. The internal conflicts in the Habsburg dominions, however, prevented Matthew from active intervention in European politics, to the detriment of his prestige in the empire and Europe.

The Thirty Years' War. — Fortunately for the dynasty, the succession question, which had grown acute on the extinction of the main line, was settled peaceably by agreement (1617), Archduke Ferdinand, the representative of the Inner Austrian line, being recognized as heir to the Austrian territories, Bohemia and Hungary; the other Austrian Habsburgs renounced their claims and a settlement was also concluded with the Spanish line. Ferdinand was recognized as king in 1617 by Bohemia, in 1618 by Hungary. His immediate and active prosecution of the counter-reformation and attacks on local self-government led to severe conflicts. A rising in Bohemia (1618) led to a war which lasted thirty years. The details of this war are found elsewhere (see THIRTY YEARS' WAR); here we need only state that the Bohemian diet in Aug. 1619 passed a new constitution, declared Bohemia an electoral kingdom, granted greater independence to the adjunct provinces, disclaimed the house of Habsburg, and elected as king Frederick V. of the Palatinate, who was duly crowned in Prague.

By his victory on the White Mountain (Nov. 8, 1620) Ferdinand forced his opponent to flee and became master of the situation. He acted against his enemies with extraordinary severity; their estates were confiscated; many were forced to emigrate; the Catholic religion was restored. Meanwhile Ferdinand seized the opportunity to establish an autocratic and centralized system and crush the excessive power of the Estates. To secure the future a radical alteration of the constitution was planned. The *Verneuerte Landesordnung* issued on March 10, 1627, as royal decree for the Bohemian lands greatly increased the sovereign's prerogatives. Elsewhere in the Habsburg dominions Catholicism and autocracy triumphed similarly. The interdependence of religious and economic motives was particularly obvious in the Peasant War of 1625.

While the Jesuitical and autocratic system was everywhere victorious over Protestantism and the power of the Estates west of the March and Leitha, the general situation, conditions in Germany, consideration for Bethlen Gabor, and fear of Turkish intervention prevented the imperial government from acting with equal vigour in Hungary. Here, too, Catholicism made great progress; yet the sovereign's position remained quite different in

Hungary and in the rest of his dominions. Henceforward the political individuality of the German and Bohemian provinces was repressed, while their relations to the dynasty were broadly uniform. The Hungarians, on the other hand, preserved their separate status.

The Thirty Years' War seemed at first likely to end in victory for the emperor and the complete triumph of Catholicism. The situation changed, however, when Gustavus Adolphus of Sweden entered the struggle (1630), and still more with the participation of France (1635). The war ceased to be a religious one, and became essentially a struggle between the two branches of the Habsburg dynasty and France for continental supremacy. It was still raging when Ferdinand died (1637).

Strangely enough, Ferdinand, who had done so much to strengthen the imperial power and centralize its authority, could not quite throw off the idea of a partition of his dominions. Although in a will dated 1621 he maintained the principle of primogeniture and decreed the indivisibility of the dominions united under him, soon after he abandoned the principle of indivisibility, and granted his brother Leopold Tirol and the Vorlande. This new Tirolean secundogeniture became extinct, however, in the male line in 1665, whereupon all Austrian lands were again united.

Momentous for the administration of the Habsburg possessions was the establishment by Ferdinand of a special "Austrian Chancelry," side by side with the imperial chancelry (1620). This organ became also the family chancelry for the German line of the Habsburgs, and dealt with "all matters aifecting the Austrian lands and secreta of the Archducal house." Gradually relations with foreign powers came to be regulated by the "Austrian Court Chancelry" under a "Court Chancellor." Thus the Austrian dominions were permanently distinguished from the imperial.

Ferdinand **III.** and **Leopold** 1.—Under Ferdinand III. (1637–57) peace with Sweden and France was concluded (1648), after long negotiations. Ratifications were exchanged at Münster on Oct. 24 (see WESTPHALIA, TREATY OF). The emperor had to abandon his father's imperialist and Catholicizing plans, to recognize freedom of religion arid conscience, at least de *facto*, for the empire, and allow the Estates of the empire extensive rights. including that of concluding treaties with foreign powers. France obtained a large part of the Habsburg Vorlande, Breisach, the counties of Upper and Lower Alsace, the Sundgau, the bailiwick in the ten imperial cities in Alsace. The position of the Habsburgs in the empire was shaken. While the value of the imperial crown for the Habsburg dynasty, even after this date, must not be underestimated, it is true that henceforward their European influence was due primarily to their sovereignty in those great territories out of which the Austro-Hungarian monarchy was evolved. In this respect the long 'rule of Leopold I. (1658–1705) was of decisive importance. The Danube monarchy was created under him, principally by his triumphs over the Turks, who had again penetrated to Vienna in 1683, and over the Hungarian malcontents, followed by the capture of Buda-Pest, the recognition by Hungary (Diet of Pressburg, 1687) of the male line of Habsburgs in primogeniture as Hungarian kings, and shortly afterwards the incorporation of Transylvania. Further decisive victories by the imperial armies under Prince Eugene of Savoy (*q.v.*) led to the peace of Karlowitz (1699). The Porte ceded to the emperor Transylvania, the districts north of the Maros and between the Theiss and Danube, and part of Slavonia.

The Balance of Power.——Leopold's successes were the more remarkable in that part of his forces were engaged simultaneously in severe battles with other powers, especially in his prolonged struggle to defend the rights of his crown and of the German nation against the attacks of Louis XIV. (see FRANCE; EUROPE) Attempts to conclude a peaceful arrangement nith Louis XIV on the partition of the Spanish territories of the Habsburg dynasty, whose ruler, Charles II was childless and weak. had no lasting success.

Louis's endeavours to secure a share of the booty increased the conflicts between him and the Emperor. A number of wars followed (see DEVOLUTION, WAR OF; GRAND ALLIANCE, WAR OF THE), in which France mas at first successful.

A change came with the intervention of William III. of Orange, king of England since Feb. 1689. In May 1689 the "Grand Alliance" was formed between the emperor and the States General, William III. as king of England, adhering. The allies gained, indeed, no decisive victory over Louis XIV., and were eventually parted by the skilful French diplomacy; yet the Peace of Ryswick (1697) was a defeat for France. The changed situation appeared more clearly when Louis XIV., disregarding his agreements with England and the States General, claimed (1700) the whole Spanish succession for his grandson, Philip of Anjou, on the strength of Charles II.'s will. The "Grand Alliance." concluded in 1701, won a succession of decisive victories under the brilliant commandership of Marlborough and Prince-Eugene. (See SPANISH SUCCESSION, WAR OF.)

But the change of régime in England, the quarrel between Queen Anne and the Whigs, and her growing dislike of Marlborough was disastrous for the allies' conduct of the war. The greatest change was, however, brought about by the death of Joseph I. (April 1; 11) and the succession of Charles VI. (1711–40). The same danger to the balance of power which had led the maritime powers to oppose the estahlishment of the Bourbons in France and Spain, now threatened them from the Habsburgs in Spain and Central Europe. England signed a separate treaty with France (Treaty of Utrecht, April 11, 1713); and the emperor had finally to submit to a compromise. On March 7, 1714, the Peace of Rastatt was signed. Charles finally renounced the territories in Alsace, but received Naples, Milan, Sardinia, the Tuscan sea-board and the Spanish Netherlands. The recognition by the emperor of the Bourbon Philip V. in Spain was not expressed in the treaty, but was implicit in it. When Philip, secretly supported by the duke of Savoy, attempted in 1717 to recover part of the Italian possessions, the emperor, in 1718, joined the alliance concluded in 1716 between England, Holland and France. The duke of Savoy was forced to cede Sicily to the emperor, receiving Sardinia in return. The support of the Saxon candidature in Poland (1733) led Charles VI. to war with France, Savoy and Spain. Charles, abandoned by the maritime powers, his allies, and supported too late by Russia, was defeated, and ceded Novara and Tortona to Savoy, the kingdoms of Naples and Sicily and the sea-board in Tuscany to Don Carlos, receiving in return the duchies of Parma and Piacenza (preliminary peace of Vienna with the king of France, Oct. 3, 1735; Peace of Vienna, Nov. 1738).

A war with Turkey (1736–39), in which Charles was allied with Russia, brought still graver losses: Bosnia, Serbia and the two Walachias. The Peace of Belgrade (Sept. 1739) defined the lower Unna, the Save, and the Danube as far as Orsova as the Austro-Turkish frontier.

Internal Reforms.—In the 92 years between the Peace of Westphalia and the death of Charles VI. (1740) the constant effort of the rulers of Austria had been to strengthen the monarchical power against the Estates and increase the influence of the central organs on the conduct of the state. Their continuous wars and consequent unrelieved financial distress, which forced them again and again to apply for funds to the provincial Estates, gravely impeded these autocratic and centralist ambitions. Nevertheless, they succeeded in diminishing the power of the Estates considerably in the German and Bohemian lands, and increasing the influence of the government over affairs throughout their dominions by re-organization of the central offices (formation of the Conference for Foreign Affairs *c.* 1660, establishment of the Permanent Conference, 1709, abolition of the Central Offices in Inner Austria and Tirol 1705, reorganization of the Austrian Court Chancelry 1 jog). The sovereigns and their advisers also adopted a definite commercial and industrial policy, and endeavoured, although unsuccessfully, to put order in the finances. The mercantile system was brilliantly represented in Austria; Charles VI. founded trading companies in Ostend and Trieste, established Commercial Courts in various provinces, and formed a Board of Trade (1718). Joseph I. founded the Vienna city bank (1706); Charles VI. established a central revenue office for the majority of the state revenues (1715).

Charles VI. and the Pragmatic Sanction. — The question of succession gave Charles VI. much anxiety. When Charles had appeared likely to become ruler of Spain, an agreement had been made between Leopold I. and his sons, Joseph and Charles, that Joseph should renounce the Spanish possessions and become sole ruler of the Austrian. As, however, Charles's prospects did not materialize, Leopold, in his will (April 1705), provided, Joseph consenting, that Charles, if the peace left him none of the Spanish possessions, should receive Tirol with the Swabian and other territories in the west. Still earlier (Sept. 12, 1703) the *Pactum Mutuae Successionis* had laid down regarding the succession that the principle of primogeniture should hold, the legitimate male line always taking precedence of the female both in Spain and Austria, and that should either branch become extinct in its male line, its possessions should fall to the nearest male member of the other line; the female line and their descendants always coming after the male line. Charles's daughters should retain their rights to the lands of both branches if all male members of the dynasty and Joseph's female descendants, which should always take precedence over those of Charles, died out. This pact, however, lost its importance when Joseph I. died in 1711 without male issue, Charles becoming heir to the Habsburg dominions. The weakness of all these arrangements was that they were binding only on the Habsburgs, being merely unilateral expressions of the sovereign's will, and not that of the territories, in particular of Hungary, whose Estates in 1687 had reserved to themselves the right of election in case of the extinction of the entire male line of Habsburgs. Charles VI. therefore attempted to regulate the succession. On April 19, 1713, acting on his own prerogative, he informed his privy councillors and dignitaries of his wish that his kingdoms and territories should pass undivided, first to his male heirs on the principle of primogeniture, and in default of male line to his daughters, and in default again of any legitimate descendants of himself, to the daughters of Joseph I. and their legitimate descendants, and after them to the descendants of his sisters and all other lines of the archducal house, according to the principle of primogeniture. This declaration was not issued until March 1720, after Charles VI.'s son, born 1716, had died in the same year, his only other children being two daughters, born in 1717 and 1718. The Estates of the German-Austrian territories accepted this settlement in 1720 and 1721, those of Transylvania and Hungary in 1722; the Hungarian Estates reserved their electoral right in case of extinction of the male line. Joseph I.'s daughters on marriage, and their husbands also, were obliged explicitly to renounce any claims to the Austrian lands so long as issue of Charles VI. lived. Charles VI. made tireless efforts to secure for this law international recognition and the guarantee of the European powers. His whole foreign policy up to the end of his reign was directed to this endeavour, to which he sacrificed important interests of his dominions. In fact, Spain, Russia, Prussia, England, Holland, the German empire, Denmark, France and Sardinia recognized the Pragmatic Sanction.

1740-1848

Maria Theresa; the Wars of the Austrian Succession. — On the death of Charles VI. (Oct. 1740) the male line of the Habsburgs became extinct. He was succeeded in Austria, Bohemia and Hungary by his daughter, Maria Theresa (1740–80) (b. 1717) who, in 1736 married Francis Stephen of Lorraine (which he exchanged against Tuscany in 1737). The Estates of her dominions recognized Maria Theresa's succession unreservedly, but Bavaria, Saxony and Spain laid claim to Habsburg territories, and Frederick II. of Prussia, claiming that old treaties entitled his house to parts of Silesia, declared war His first great victory at Mollwitz (1741), encouragrd France, Bavaria, Spain, Saxony and Sardinia to attack Maria Theresa, who, allied with the Maritime Powers, resisted with varying success. (See AUSTRIAN SUCCESSION, WAR OF.) At the Peace of Breslau (June 1742), concluded at England's advice, she ceded most of Silesia to Prussia. In 1743, hoping to compensate herself in Bavaria for this loss, she occupied that state, but Prussia intervened (1744), and the war was again victorious. The Treaty of Dresden (Dec. 1745) confirmed the provisions of the Treaty of Breslau without territorial alterations. Fortunately for Maria Theresa, the Elector Charles of Bavaria (as Emperor Charles VII.) died early in 1745; his son concluded peace in April and in September Maria Theresa's husband, Francis I., was crowned emperor (1745–65).

The other enemies prosecuted the war in the Spanish Netherlands and Italy. But despite successes, won chiefly by the French commander, Maurice of Saxony (*q.v.*) in the Spanish Netherlands in 1746–7, France inclined to peace, as Russia had been induced by the Maritime Powers to help Austria, and England prosecuted the war against France at sea with increasing success. By the treaty of Aix-la-Chapelle (Oct. 18, 1748) Austria ceded Parma, Piacenza and Guastalla to the Spanish Infante, Philip.

Despite her territorial losses in these wars, Austria's prestige had risen. She had shown unexpected vitality, and in some respects, notably the improved quality of her army and greater experience of her generals, was stronger than at the beginning of the struggle.

The period 1748–58 was occupied in preparations for carrying into effect Maria Theresa's determination to recover her lost possessions. The influence of Wenzel, Prince Kaunitz (*q.v.*) was predominant in convincing the cautious, hesitating empress that a reversal of Austria's foreign policy was necessary to the fulfilment of these ambitions. Increasing differences, mainly of commercial policy, with the Maritime Powers made the continuance of the old alliance impracticable, and Kaunitz, recognizing that Prussia, not France, was now Austria's chief enemy, persuaded Maria Theresa to ally herself with France. The Treaty of May 1, 1756, confirmed and extended in 1757, ended the long Bourbon-Habsburg rivalry. In the Seven Years' War (*q.v.*), France and Austria were ranged against England and Prussia. Despite the alliance with France and (later) Russia and some smaller powers, and the support of the empire, Maria Theresa failed to recover Silesia. The Peace of Hubertusberg (Feb. 15, 1763) restored the *status* quo ante *bellum*. Austro-Prussian rivalry, however, subsisted, and led to fresh conflicts when Joseph II., who succeeded his father as emperor in 1765, becoming simultaneously co-regent with his mother in the Habsburg dominions, planned on the death, without children of the Bavarian Elector (1777) to annex Bavaria as compensation for Silesia. Frederick II., however, advanced into Bohemia, and as Maria Theresa shrank from another campaign against Frederick, the Peace of Teschen was concluded (May 1779), whereby Austria received the Inn district, renouncing all other claims on Bavaria.

First Partition of Poland. — The efforts of Catherine of Russia to extend her influence over Poland put Maria Theresa in a difficult position. She would gladly have supported the Poles, but found no encouragement from England or France, while Prussia had become Russia's ally in 1764. Neither could Austria intervene on Turkey's side in the Russo-Turkish war, which commenced in 1768, as Kaunitz, particularly, wished, since Joseph II. in his meetings with Frederick (1769 and 1770, the latter attended by Kaunitz), failed to persuade Frederick to adopt a hostile attitude to Russia. Frederick considered a partition of Poland the best way to reconcile the interests of Prussia, Russia and Austria, and sought to win Catherine for this plan. At first unsuccessful, he eventually convinced her, and Maria Theresa, although her sense of justice revolted against the plan, had no alternative but to share the booty. By the Treaty of Aug. 5, 1772 Austria received Zips and the districts included under the names of Galicia and Lodomeria. To make these acquisitions directly contiguous with Transylvania, Joseph occupied the Bukovina, part of the Turkish principality of Moldavia, in 1774, which Turkey, incapable of recovering it, ceded to him in May 1775.

Maria Theresa's Internal Reforms. — Maria Theresa's internal reforms were momentous. Having asserted her right in the wars of succession to her father's dominions, she felt the necessity of giving these territories which had hitherto had little in common but the dynasty, an inner unity and firmer administration. While leaving the Estates intact, she reduced their rights and seldom convoked them. To unify the administration of the

German-Bohemian territories and introduce some harmony of principle into the existing offices, the Austrian State Council (Staatsrat) was established in 1760, at Kaunitz's suggestion, to report on all questions submitted to Maria Theresa. The Council covered the whole state and thus debated questions concerning Hungary, the Spanish Netherlands and the Italian possessions as well as the German-Bohemian territory. The *Directorium* in *publicis* et *cameralibus,* which was charged with the political and part of the financial administration of the German and Bohemian territories, was established in 1749, but proving unsatisfactory, was abolished in 1761; the political and financial administrations were again separated, the former entrusted to the German-Bohemian Court Chancellery, the latter distributed among three central organs, the chief being the Hofkammer (Court Chamber). A "Credit Deputation" was formed for the national debt of the German-Austrian territories. The *Kommerzienrat* (Commercial Council) was an independent body for the promotion of trade and industry. In 1760 a Commission of Studies was established to supervise education, which was now considered definitely the concern of the state. The Government now not only organized the primary schools and drew up the syllabus for the upper schools and lay faculties of the universities, but after 1774 also settled syllabuses and text books for the theological faculties and monastic schools.

The contemporary theories of state supremacy and anti-papal feeling (Febronianism), wide-spread in the monarchy, in ecclesiastical as well as lay circles, deeply influenced the Government's relations with the Catholic Church. Various measures were devised to strengthen the state in clerical questions. A new law forbade publication of papal bulls without the consent of the crown, and direct intercourse between the bishops and Rome; the privileges of the religious orders were curtailed. Maria Theresa herself was a devout Catholic, distinctly hostile towards the Jews, against whom she issued several severe decrees, including decrees of expulsion, a fate shared on occasions by the Protestants. Her government devoted particular attention to taxation. Negotiations with the Estates led to a considerable increase in the provincial contributions; the basis of the land tax was revised, the estates of nobles and the Church submitted to the regular taxation. The customs system was revised (1775), although still inadequately. Maria Theresa also claimed the codification of the law as her prerogative, wishing to replace the extraordinarily numerous systems current by a single, unified code. In 1768 a unified criminal code and procedure (the *Theresianische Halsgerichtsordnung*) was introduced for the German-Bohemian lands. Torture, retained here, was abolished in 1776. A civil code was completed in 1767, but not approved by the sovereign.

Joseph II. (1780–90).—Joseph II. became sole ruler on Maria Theresa's death (Nov. 29, 1780), and proceded vigorously to enforce his theories of enlightened despotism and *étatisme.* Above all, he airned at completest centralization, not only in the German and Bohemian provinces, but throughout his territories, regardless of historic rights and tradition. The Hungarian Estates were never convoked. Outside Hungary the rights of the Estates were reduced, the principal affairs entrusted to the provincial governments. The diets were at first convoked frequently, but only to grant the Government's financial requirements. The financial and political administrations were reorganized (1782) and Joseph refrained only at the urgent representation of the State Council from uniting the judicature with the executive. Directories of police were established in all large towns on the model of Vienna, to supervise the population, and the secret police began its work in Vienna. The city charters were reorganized on bureaucratic lines. His centralistic tendencies and desire to accelerate the administration induced Joseph in 1784 to introduce German as the administrative language in all his dominions, including Hungary. As regards the judicial system, he attempted to organize the courts with greater simplicity and uniformity, to concentrate judicial authority in the hands of the sovereign, and to create a competent magistrature. The civil procedure was organized in three stages: local courts, courts of appeal, supreme court. The criminal procedure was organized by the patent of 1787. Maria Theresa's unfinished codification was carried further. A "General Judicial Decree" (Allgemeine *Gerichtsordnung*) was issued 1781 for the German-Bohemian lands, simultaneously with a bankruptcy law. The civil code was not completed, but portions of it, notably marriage law, were regulated. On Jan. 1, 1787 the first part of the general legal code (private law) came into force for the German-Bohemian lands; 1788 the criminal procedure. Without consulting the Estates, Joseph re-modelled the systems of direct and indirect taxation in the direction of equal taxation for all classes (land tax Patent of 1785). In 1781 he issued his "subjects' patent" (*Untertanspatent*) for the protection of peasants, regulating relations between them and their masters, to the advantage of the former, in the German-Bohemian lands. Most important of all was the patent of Nov. 1, 1781, abolishing serfdom and giving all subjects the right of marriage, free movement and instruction in any handicraft in Bohemia, Moravia and Silesia, soon after in Galicia, and in Hungary in 1785. Corvées and other contributions were left to the land owner as "urgent rights," but were reduced by further patents.

Joseph's intervention in ecclesiastical conditions in his dominions was drastic. The Patent of Tolerance (Oct. 1781) granted extensive concessions to the non-Catholic Christian creeds, while the Jews were freed from many restrictions imposed on them from earlier centuries. Joseph maintained the absolute power of the State even in ecclesiastical matters and wished to exclude the pope from influence over internal ecclesiastical conditions in his domains. No papal bull might be published without previous permission from the Government. Appeals to Rome and the procural of dispensations were forbidden. In 1782 the abolition of all purely contemplative monasteries was decreed and their property confiscated by the State, which assumed control over the remaining monasteries. Theological instruction was completely taken over by the State and State general seminaries established. The Marriage Patent (1783) declared marriage a civil contract validated only by civil law. The pope's personal intervention with Joseph proved fruitless.

Both the revolutionary contents of these reforms and the autocratic severity of their execution elicited wide-spread resistance, particularly among influential circles. Hungary resented deeply the violation of the Estates' traditional rights and the attempts at Germanization, and Belgium the anti-Catholic measures. In both countries there were revolts which the emperor could possibly have repressed, had he not been engaged simultaneously on an ambitious foreign policy as impracticable as his internal reforms. His hope of exchanging Bavaria for the Spanish Netherlands had to be abandoned when Frederick II. of Prussia founded a League of Princes (1785). He was equally unlucky in his attempt to expand his territories eastwards, allied with Russia. Loudon's Turkish campaign of 1789 reversed the Austrian armies' ill-success in 1788 and Belgrade was captured, but the foreign and internal situation made it impossible to follow up the victories. Prussia, allied since 1788 with the Maritime Powers, concluded treaties with Turkey and Poland and armed. Russia, Austria's ally was weakened by an attack by Sweden, France by her revolution. Simultaneously open revolt broke out in the Austrian Netherlands against Joseph's ecclesiastical and administrative innovations. The discontent in Hungary also became formidable and the Galician nobles were preparing a movement with Prussia's connivance, and opposition to Joseph's methods was growing even in the Austrian and Bohemian territories. Further, the treasury was empty. Joseph had to recognize that his plans were premature. He revoked most of his reforms in Hungary and the Austrian Netherlands.

Leopold II. (1790–921.—On Feb. 20, 1790, Joseph died, leaving his brother, Leopold II., a dangerous situation at home and abroad. Leopold, who was far less talented than his brother, had been a liberal ruler as grand duke of Tuscany. In Austria, warned by his brother's failure, and intimidated by the Revolution in France, he reverted to the traditional conservative policy of Joseph's predecessors. His first efforts were to restore peace abroad and internal tranquillity. Abroad he was successful by renouncing all territorial acquisitions. On Aug. 27, 1790, he under-

took in the Convention of Reichenbach with Prussia to conclude an armistice with Turkey on the basis of the territorial *status quo ante bellum,* and to conclude peace with the mediation of Prussia and the Maritime Powers. The armistice was concluded Sept. 1790, the peace signed at Sistova, Aug. 5, 1791. The *status* quo *ante bellum* was, roughly, re-established.

Leopold's attitude towards the French Revolution was dictated by the wish to preserve peace and avoid implications in European entanglements. To restore internal tranquillity he revoked almost all Joseph's reforms. In Hungary he sanctioned a number of laws framed to guarantee the Hungarian constitution against further violations and safeguard the independence of the internal administration. Latin was introduced as the official language of administration in Hungary, the office of Palatine restored. Here and in the German-Bohemian territories, the diets were again convoked, and many of their demands granted. The central administration also reverted to Maria Theresa's system; their activities were reduced, the co-operation between different offices became less close. Leopold held most firmly to his brother's ecclesiastical policy The State retained control over schools; toleration, etc. was maintained intact. Although Leopold restored theological education to the bishops, abolished the General Seminary and re-instituted some of the monasteries, priests were still looked on as servants of the State.

The Napoleonic Wars.—By caution and reserve, Leopold escaped an armed conflict with France. His son Francis (II. as Roman Emperor, 1792–1806, I. as Emperor of Austria, 1804–35) was forced by France's declaration of war (April 20, 1792) into a war which lasted intermittently till 1815 (*see* NAPOLEONIC CAMPAIGNS). Disunity between the Prussian and Austrian statesmen and generals, mutual jealousy and ambition influenced the attitude of the two powers and were largely responsible for the unsuccessful course of the war in which, in 1793, England and Holland had united against France to be joined later by Spain; especially after Russia and Prussia had concluded the Treaty of Jan. 1793, whereby both powers annexed large districts of Poland, while Austria was only to receive Bavaria instead of Belgium, as compensation. In consequence of Prussia's conduct, Baron Thugut (*q.v.*), a convinced opponent of Prussia, and determined to allow her no important enlargement except against a corresponding increase for Austria. took over Austrian foreign policy (March 1793). He attained his object. On Jan. 3, 1795, the treaty on the third partition of Poland was concluded, after Russia had suppressed the Polish rebellion and taken Warsaw. Austria received West Galicia. Prussia having concluded the Treaty of Basle with France (April 1795) and Tuscany and Spain having followed her example, the chief burden of the war with France rested on Austria. Her commanders were victorious on the Rhine, but defeated by Bonaparte in Italy.

An armistice, followed by a preliminary peace (April 18) was concluded at Leoben, the definitive peace being signed on Oct. 17 at Campo Formio. Austria renounced Belgium, which was united to France, and the duchies of Milan and Mantua, incorporated in the new Cisalpine republic, but received a great part of the territory of the Venetian republic (whose independence was abolished by Bonaparte), including Venetian Istria and Dalmatia. The Emperor further consented that France should receive most of the left bank of the Rhine on concluding peace with the empire. At the cangrcss of Rastatt, opened Dec. 1797, France obtained the cession from the empire of the whole left bank of the Rhine. Before the indemnification due to the imperial estates concerned had been determined, war broke out again (Second Coalition War, 1798–1801). Austria at first won considerable successes in Germany and Switzerland, and, allied with Russia, in Italy; but their effect was nullified through the disunity of the commanders. The Tsar Paul, imputing egotistical motives to the Austrians, recalled his troops, and Austria was left (1800) alone to face the French, whose troops in Italy were now again commanded by Bonaparte, returned from Egypt. Bonaparte's victory at Marengo (*q.v.*) (June 14), and Moreau's at Hohenlinden (Dec. 3, 1800) forced Francis to conclude the treaty of Lunéville (Feb. g, 1801), in his own name and that of the empire. This treaty repeated in essence the provisions of Campo Formio and Rastatl.

The Austrian Empire, 1804.—The transformation of France into a hereditary monarchy under the emperor Napoleon I. (1804), caused Francis also to assume the title of hereditary emperor of Austria (Aug. 10, 1804), a title designed also to express the essential unity of the different Austrian territories. In 1805 Francis, principally in view of Napoleon's policy in Italy, joined the Anglo-Russian alliance against France, but after the crushing defeat suffered by his own and the Russian troops at Austerlitz (*q.v.*) on Dec. 2, he was forsaken by the Russians and forced to accept the humiliating peace of Presburg (Dec. 26, 1805). Austria was cut off from Germany and Italy, and forced to relinquish territories which had long been hers to Napoleon. Her position as head of the German empire was gone. The formal dissolution of the empire followed when 16 princes in southern and western Germany concluded the Rhenish league under the protectorate of Napoleon (July 1806). Under pressure and threats from Napoleon, Francis declared, on Aug. 6, 1806, that he considered the tie which had hitherto united him with the empire as broken, and renounced the dignity of Roman-German emperor.

Austria took no part in the Napoleonic wars of the following years; but the patriotic feelings of her inhabitants (and especially of the Germans) awoke. This movement was encouraged by the new foreign minister, Count Philip Stadion (*q.v.*), and assisted by the Archdukes Charles (*q.v.*) and John. Although here, and always, Francis remained cold and averse from any popular movement, he recognized the necessity of providing against future dangers. Austria's greatest difficulty, which seemed irreparable, was financial. The value of the paper currency sank continually; and a severe commercial crisis broke out in 1808. Nevertheless, Stadion accomplished sundry reforms, and the Archduke Charles attempted to raise the morale of the standing army, by the side of which he created a national force or *Landwehr,* to include all able-bodied men between 18 and 25. In 1809 Stadion and his supporters persuaded the emperor to undertake a fresh campaign against Napoleon. After initial reverses, the Austrian army, led by Charles, inflicted his first defeat on Napoleon at Aspern (May 21 and 22, 1809); but Austria's hopes were destroyed at Wagram (July 6). An armistice was concluded. After hesitating long between the rival parties of war and peace in his *entourage* Francis declared for the latter. Stadion fell, his successor, Count (later Prince) Clemens Wenzel Lothar Metternich (*q.v.*), undertook negotiations with Napoleon, which, after long parleying, led to the Peace of Schonbrunn (Oct. 14, 1809), which imposed on Austria the severest sacrifices, including the loss of Salzburg, the Inn district and West Galicia.

Metternich and the French Alliance.—An immediate resumption of hostilities was unthinkable; clever diplomacy was the essential, until the hour came to recover these losses. Metternich won over his sovereign for this policy. Austria courted Napoleon's friendship; his marriage to the emperor's daughter Marie Louise enabled Metternich in Paris to get alleviations for the payment of the indemnity, although these were insufficient to ward off the state bankruptcy in Austria admitted by the Patent of Feb. 20, 1811. The financial crisis, mistrust in Austria's forces, the deep conflicts between Austria and Russia, and the hope that a French alliance would bring compensation for past losses induced Metternich to recommend the emperor to conclude a treaty with Napoleon (March 14, 1812), whereby Austria undertook to supply 30.000 men for the Russian campaign, Napoleon promising his ally an indemnity and territorial gains should the campaign prove successful. Whether Metternich, convinced of Napoleon's invincibility, wished to link Austria's fate permanently with France, or only awaited a suitable moment to strike for freedom, is still undecided. Recent research tends to the latter assumption. It is certain that even after Napoleon's disastrous Russian campaign, Metternich still advocated caution for Austria. He concluded an armistice with Russia and armed, but would not join the Russo-Prussian alliance of March 1813. The French alliance was, however, denounced (April 6, 1813), and simultaneously Austria's armed neutrality proclaimed. Another step was taken when Napoleon,

after his victories at Liitzen and Bautzen (May 1813), concluded an armistice with his opponents (early June) to gain time for further armaments. Austria armed, concentrated large masses of troops in Bohemia and assumed the part of intermediary. As, however, Napoleon refused to accept the sacrifices suggested to him, involving the overthrow of his entire political system in central Europe, Austria declared her adherence to the Russo-Prussian alliance (Aug. 10, 1813) and soon after declared war. The battle of Leipzig (Oct. 16–18, 1813) brought Napoleon's defeat. As, however, he refused to make peace, the war continued until his abdication and the first Peace of Paris (May 30, 1814).

Treaty of Paris and Congress of Vienna. — This treaty laid down the Po, the Ticino and Lago Maggiore as Austria's frontier in Italy, whereupon the incorporation of Lombardy and Venice in the Austrian monarchy was proclaimed (July 12). On June 3 Bavaria restored Tirol, Vorarlberg, Salzburg and, later, the Hausruck and the Inn districts. The other questions were settled at the Congress of Vienna (Sept. 1814–July 1815). Austria received the "Illyrian provinces" ceded in 1805 and 1809, with Dalmatia and the Republic of Ragusa, the district of Tarnopol, Wieliczka and the Veltlin. The secundogeniture of the Habsburgs in Tuscany and the tertiogeniture in Modena were restored. Austria renounced all other territory lost since 1792. At Metternich's advice, Francis did not re-assume the title of Roman Emperor, since Metternich thought that a loose association of sovereign states under Austrian presidency, "powerful for defence, powerless for offence" would form a guarantee of the peace of central Europe and of Austrian preponderance, and in its councils Austrian diplomacy, backed by the weight of the Habsburg power outside Germany, would exercise more influence than any possible prestige derived from a venerable title that had become a byword for the union of unlimited pretensions with practical impotence. By renouncing Belgium and minor possessions in Western Germany, Metternich thought he was increasing the power of the Habsburgs, which now rested on a coherent territorial complex. He failed to see, however, that by this action, and by acquiescing in the establishment of Prussia in the Rhine provinces, Austria abdicated to Prussia her position as the bulwark against France.

Metternich's **Sway (1815–48).**—From 1815–48 Metternich controlled Austria's foreign policy. The great successes he had achieved against Napoleon, and the predominant position assumed by him, and thus by Austria, at the Congress of Vienna, induced Francis, although he sometimes disagreed with his minister's political views, to leave the conduct of foreign affairs almost entirely to him, especially as Metternich was an adept at clothing his advice in such a form as to enable Francis to look on the decisions he took as the outcome of his own initiative. The principles followed by Metternich have been described as "stability and legitimacy." Metternich wished to preserve the *status quo* formulated at the Congress of Vienna, because he saw no other certain way of insuring lasting peace in Europe, which he thought indispensable for her war-weary and exhausted states, particularly Austria. Sufficient measures should be taken against revolution from without, or any possible upheaval from within. This preservation of the existing order in the foreign and internal organization of the states of Europe was the essence of what Metternich called the "stability of things," and as progress and change in any direction seemed to him an unjustified attempt against the legitimate rights of existing authorities, he became the champion of "legitimacy." The alliance of Chaumont uniting the four powers, Austria, Russia, Prussia and England, renewed in Nov. 1815 and adhered to after 1818 by France, was to ensure the balance of power as restored in 1815. The great powers were to avoid conflicts with one another and prevent them between the other states, and between rulers and ruled within them, by their intervention, armed if necessary. He attempted to instill this principle into the congresses held on his initiative between 1818 and 1822, and on later occasions. Even the unrest which followed the French July revolution in many parts of Germany, and increased the power of the democratic parties where constitutions were already in force, failed to alter Metternich's conviction that his methods alone could be the salvation of all proper-thinking persons He found confirmation in the apparent success of this policy within the Austrian monarchy. The occasional meetings of the Estates were mere forms, and the Hungarian diet, which functioned again after 1825, was not yet troublesome. The police, under Count Leopold Sedlnitzki, were everywhere supreme. Paid or voluntary spies reported every utterance made at meetings; any person of importance was under regular supervision; all letters were opened. The draconic censorship suppressed any free literary activity. The government paid special attention to the upper schools, and saw that the instruction conformed with conservative principles.

Francis I.: Internal Stagnation. — Francis's influence in the inner affairs of Austria was much stronger than in foreign policy, which he left increasingly to Metternich. Convinced that a reorganization of the administration was necessary, and determined to create order, he began reforms, principally in the central government offices, soon after his accession. His first, ill-considered experiments, proved unsuccessful. Only in Aug. 1802, were the arrangements perfected, which then remained practically unchanged till 1848. The political administration of all the German and Bohemian hereditary provinces, Galicia and the Italian districts, was entrusted to the "United court chancelry" *(Vereinzgte Hofkanzlez)*, while the supreme judicial instance was revived for the judicature in those territories; the court chamber (*Hofkammer*) and *Banco-Deputation* took charge of all the state economic action throughout the monarchy. The State Council was replaced in Aug. 1801 by an advisory Ministry (Staats- *und Konferenzministerium*), over whose debates the emperor presided, as highest instance for all state affairs. This institution, however, proved unsatisfactory, as the other central authorities had no direct communication with one another, all matters submitted for imperial decision being sent to the imperial cabinet under a *chef de cabinet.* As Francis also preferred, rather than attending conferences, to discuss questions with individual members, or to call for written opinions from the councillors, the conferences became ever rarer. In 1808 this Ministry was abolished, and the Council of State restored. In 1814 a further "advisory council" *(Konferenzrat)* was established, where especially important questions were treated after discussion in the Council of State. Nevertheless, the administration remained most imperfect. Its conduct still lacked any uniformity. The jurisdiction of the departmental heads was strictly defined, and whatever lay outside this was reserved for imperial decision. Thus the emperor came gradually to represent alone any synthesis of the various administrative departments, while the officials, high or low, avoided any responsibility, and the minutest questions were handed up through all the stages of the bureaucratic hierarchy, to be shelved and forgotten in the imperial cabinet; for, industrious as he was, Francis could not permanently fulfil his self-imposed task. The re-organization of the provincial administration was equally unsuccessful. The introduction, on Jan. 1, 1812, of the general civil code, was beneficial for justice. Metternich recognized the dangers inherent in the slow, inconsistent working of the machine of state, and would have liked to introduce reforms, where compatible with his "system." But Francis, naturally mistrustful, shrank more and more from radical changes. He contented himself with meeting immediate necessities, buried himself in details, and thus as Metternich said, "Austria was administered, but not ruled."

Francis's ever-growing terror of popular movements made him averse from any tendency to give the people larger participation in political life. Thus Metternich's attempt in 1832 to persuade the emperor to grant a new constitution, to reconcile the "opposition between the monarchist principle and the democratic" failed. Accordingly, although the forms of the Estates remained unchanged, their activity was steadily reduced. The diets were allowed to enact no legislation; taxes were raised without consulting them; the rights of the Estates in the recovered provinces of Tirol and Carniola reduced. Even in Hungary, whose constitution was unaltered, Francis attempted, from 1813 to 1825, to rule without a diet, demanding subsidies and troops direct from the counties. Only when the counties refused compliance with their king's commands, was the diet again convoked (1825), and promised regular convocation every three years, and the sole right of approving taxes and recruits.

Fear of the influence of oppositional politicians and liberal writers on the popular mind was the cause of Francis's severe repression of all assaults on the existing organization of the state and society. Political prisoners were tortured, not out of vindictiveness, but in the expectation that the "criminal spirit of enlightenment" could thus be brought into the right path. All attempts to convince the emperor that these methods could never permanently improve public conditions — a view shared by Metternich — remained unsuccessful. Francis became ever deafer to such advice. In his will he warned his successor, Ferdinand I. (1835–48) to "displace nothing of the foundations of the edifice of state. Rule, and change nothing."

Ferdinand I. — The new sovereign, weak-minded and incapable of really ruling, followed his father's advice so far as to leave to Metternich the conduct of foreign affairs. He was, however, induced by court circles to establish the Conference of State (1836), as supreme administrative body. Its members were the Archdukes Louis and Francis Charles, Metternich and Count Francis Anton Kolowrat. The ever-increasing rivalry between the two last-named impeded business, and Archduke Louis's dislike of novelty thwarted any reforms proposed by the ministers, or at best delayed their execution. Nevertheless, Austria followed other civilized States, although hesitatingly, in building railways, improving communications, concluding commercial treaties, abolishing many customs barriers, etc.

Internal Unrest. — Elsewhere, however, the governmental tradition of passive waiting subsisted, even when signs of popular impatience multiplied. The meetings of the Estates began to be lively; those of Bohemia, Styria and Galicia advanced complaints and demands. The opposition to the central government was reinforced by the rapidly-growing nationalist movement among the non-German nationalities. In Bohemia the Czech nationalist elements united into a literary opposition; in the Yugoslav districts "Illyrianism" was the catch-word; in Hungary Count Stephen Szechényi inaugurated a national liberal opposition; in the Italian provinces dislike of the Austrian régime, despite the many administrative reforms introduced by Austria, grew boundless. Even where nationalist influences were absent, as in the German-Austrian districts, discontent increased. The Styrian Diet discussed the necessity of agrarian reform. The Estates of Lower Austria demanded greater participation in public affairs, publication of the budget, and abolition of corvées, and in Vienna, despite all threats of the police, the demand of the upper circles for greater liberty grew louder. The works of Anastasius Grün and Lenau's songs of liberty, Heine's and Börne's writings were read with enthusiasm. Liberal periodicals, smuggled in from Germany, were devoured. The impression made by Andrian von Werburg's anonymous pamphlet, "Austria and her Future" (1841) proved that many good Austrians agreed with him, that "the anarchy of a studied despotism was intolerable." The masses, less affected by the spiritual tyranny, were goaded by the severe economic depression. Peasants, artisans, traders and the growing number of industrial labourers, demanded reforms and grew increasingly embittered as they were forced to realize that no help would come from above. Riots occurred among the workmen and populace. Some of the responsible statesmen recognized the imperative necessity of timely reform; even some members of the imperial house, especially Archduke John, advocated sensible reforms, but Archduke Louis remained obdurately averse from change, and Metternich lacked energy to press his better judgment on his powerful opponents. Such was the situation when revolution broke out in France (Feb. 1848) and the universal discontent found a vent.

1848-1918

The Revolution of 1848. — The revolt against the system of government in Vienna commenced in Hungary, where Louis Kossuth (*q.v.*), for some years leader of the Radical party, made the "inaugural speech of the Austrian revolution," on March 3, in the Hungarian Diet. Prague followed. On March 13 there was a rising in Vienna, led by the students Views at Court were divided; the opposition (now of long standing) turned against Metternich; the Archduchess Sophie, mother of the late Emperor, Francis Joseph, also belonged to it. On the evening of the 13th the abdication of the chancellor was announced, to the general joy; it was hoped that his system would fall with him. As further concessions, the students were armed, the middle-class constabulary reinforced, committees convoked to consider what reforms should be introduced. On the following day the censorship was abolished and freedom of the press granted. On the 15th it was announced that deputies would shortly be summoned "to give the country a constitution." A few days later, a responsible ministry was appointed, at first under the aged Kolowrat, who was soon succeeded by Count Charles Louis Ficquelmont, later (May 4) by Francis Xavier Freiherr von Pillersdorf, an old opponent of the old system. All their hands were, however, tied, as the troops were in Italy, which had risen against Austrian rule. The Czechs, who seized the occasion to press their national demands, were promised a responsible central organ in Bohemia and equality of rights for Czech and German nationals (April 8). In Galicia the abolition of all dues and obligations arising out of the condition of servitude was promised. In Vienna, the National Guard, led by the Radicals and students' representatives was in charge, and established a Political Central Committee to safeguard the rights of the people. On April 25 the new constitution, on the model of the Belgian, was published. It broke completely with the past, granted liberty, introduced ministerial responsibility, a parliament of two chambers and juries. Nevertheless, the Government's conditions appeared insufficient to the democratic-feeling middle classes and students. They objected to the imposition of the constitution from above, and to the two-chamber system. The proletariat condemned the indirect franchise and the exclusion of workmen and servants from suffrage. When the Government decreed the dissolution of the Viennese Central Committee and the National Guard (May 13), riots followed (May 15). Pillersdorf yielded. The dissolution was revoked, and a revised suffrage and the convocation of a single-chambered diet promised. After fresh riots, the Government allowed the formation of a committee of safety and abolished the limitations on the suffrage. Meanwhile Ferdinand and his family had left Vienna for Innsbruck. Archduke John was appointed plenipotentiary regent during the Emperor's absence (June 1j). Under pressure from the Committee of Safety, he dismissed Pillersdorf and called the Liberal leader, Anton von Doblhoff, who included in his ministry Freiherr Johann Wessenberg and also democrats such as A. Bach and Ernst Schwarzer. This ministry was to create a "popular monarchy based on the legally expressed will of the people" in co-operation with the first Austrian diet, which was opened July 22, 1848. The 383 deputies from the German and Slavonic lands formed national groups, rather than stable political parties. The burning question was the liberation of the peasants who had sent 94 members to the diet. Hans Kudlich's motion to abolish serfdom and all rights and duties deduced therefrom (July 26) was debated; on Sept. 7, after excited debates and tenacious opposition from the Conservatives, a law was passed relieving the peasants of their burdens. The landowners were promised indemnification. Meanwhile the Government had gained successes in the provinces against the revolutionaries. A Czech rebellion which broke out in Prague in connection with the Slavonic Congress (June 12), was repressed by Prince Alfred Windischgratz. In Italy Radetzky defeated the Sardinian armies at Custozza (July 25). On August 5 Charles Albert evacuated Milan (see ITALIAN WARS). The court returned to Vienna (August 12), receiving an enthusiastic welcome which, however, soon cooled when conditions remained unimproved. In September there were workmen's riots in Vienna. Events in Hungary increased the unrest. The gap widened between the Radicals in the Hungarian diet under Kossuth and the Viennese Government. The former aimed at complete separation of Hungary from the monarchy; the latter at incorporating it with Austria as a province and abolishing all especial powers and rights possessed by the Hungarian nation. In Sept. 1848, the Viennese Government determined to act against the Hungarian opposition. Joseph Count Jellačić (*q.v.*), Ban of Croatia, who had been first dismissed from his post as a traitor, but later reinstated because he wished to break the Magyars and

establish a uniform Habsburg kingdom, led his troops against the Magyars. Complaints lodged in Vienna by deputies of the Hungarian diet found sympathy among the Viennese democrats, but could not be brought before the Austrian Reichstag on account of the opposition of its Slav majority. The flight of the Palatine and the murder of Count Lamberg made the breach irremediable. German-Austrian troops were ordered to march from Vienna against the hlagyars on Oct. 6th; some of them, incited by the people, mutinied and remained victors in the consequent fighting. The revolt spread; the minister of war, Count Latour, was murdered and the Arsenal stormed (Oct. 6). The proletariat and lower middle-classes now seized the power; the diet, municipality and students' committee had little authority. The court fled to Olmutz (Oct. 7), leaving behind them a manifesto sharply condemning the behaviour of the Viennese and adjuring all right-minded persons to combat the revolutionaries. Jellačić and Windischgratz marched on Vienna. Incompetently led, abandoned by the provinces, supported too late by the Magyars, the revolutionaries could not long hold the city against Windischgrätz's troops, especially as provisions soon ran short. On Oct. 31st Windischgratz entered Vienna, which surrendered to him. Some of the revolutionary leaders were executed; others imprisoned. The population accepted the dictates of the Government, now led by Prince Felix Schwarzenberg, ably supported by Francis Count Stadion, Bach and Karl Freiherr von Bruck.

Accession of Francis Joseph.—Parliament was convoked at Kremsier for Nov. 1j, there to work undisturbed by the discords of the capital. On Nov. 27 a proclamation announced that the continuation of Austria as a united State was necessary for Germany and Europe. On Dec. 2 Ferdinand abdicated, and his nephew, Francis Joseph (*q.v.*) (1848–1916) ascended the throne. In his inaugural proclamation he expressed the hope that he would succeed in uniting "all lands and races of the monarchy in one great body politic," while guaranteeing the peoples' rights to participate in the legislature. The deputies in Kremsier debated, indeed, on a new constitution and on "fundamental rights." The former aimed at establishing a modern, multi-national state after the wishes and with the consent of the nations of Austria proper; the "fundamental rights" were to include freedom of religion, press and speech, equality before the law, equal rights for all nationalities, juries, etc. The negotiations were still proceeding when Schwarzenberg, encouraged by the armies' successes in Italy and Hungary, dissolved the diet and published a constitution, dated March 4th, elaborated by Stadion. This was to be applicable also to the lands of the Hungarian crown. It was based on the Kremsier draft, but was less democratic. A number of juridical and administrative reforms followed. The arrangements for the extension of the agrarian reform was favourable to the peasantry.

Hungary answered the imposition of the constitution by convoking a Rump Parliament at Debreczin (April 14, 1848) which declared Hungary, with its *partes* adnexae, an independent State and the dynasty of Habsburg-Lorraine dethroned. Francis Joseph thereupon asked Tsar Nicolas I. for help, which was readily granted. The united Austrian and Russian forces proved too strong for the Hungarians. On Aug. 13, 1849, Arthur Gorgei (*q.v.*), with the main army, capitulated to Russia at Vilagos. Russia delivered the Hungarians to the discretion of the Viennese Government, which took severe reprisals. The Hungarian constitution was declared annulled, Hungary reduced to an Austrian crownland, its partes adnexae created independent crownlands (see HUNGARY).

Austria was completely successful in Italy without foreign assistance. Sardinia having again declared war (March 1849), Austria was victorious at Novara; in August Venice was retaken. Austria again ruled directly over the Lombard-Venetian kingdom; indirectly in Parma, Modena, Tuscany and the Romagna. These successes enabled Schwarzenberg to restore Austria's hegemony in Germany The struggle between Grossdeutsch and *Kleindeutsch* in Frankfurt is discussed elsewhere (*see* GERMANY: History). Here it suffices to remark that Schwarzenberg's ambition of a seventy-million state in Central Europe, including all peoples of the Austrian empire and Germany under Austrian leadership, was not realized. The plan of the majority of the Frankfurt Parliament, a German feudal state under Prussia, excluding Austria, was also frustrated through Frederick William IV.'s refusal of the crown. All other schemes to weaken Austria in Germany were thwarted by Schwarzenberg. Prussia dared not embark on war in support of her policy of unification, and submitted at Olmütz (Nov. 1850). The problem of Germany's future constitution remained, for the time, open; but soon after, the old German federal constitution and diet were restored.

The Period of Absolutism.—The ex-democrat Bach, Stadion's successor, and Freiherr Baron Max Carl Kubeck, a former Liberal, did their best to make Austria into a unified, but absolutist, state. In April 1851, the Reichsrat (Imperial Council), a consultative body nominated by the emperor, was established. Its leading figure was Kiibeck. at whose instance the constitution of March 4, 1849, was suspended on Dec. 31, 1851 together with the fundamental laws and jury system. Judicature and executive were then united in the lower instances. Even after Schwarzenberg's death (April 1852), the reaction continued, as exemplified in the penal law of 1852, the Law of the Right of Free Assembly and the Press regulations. In education, clerical influence predominated, though Count Leopold Thun admittedly introduced many reforms. Economic reforms were also not lacking. The internal customs barrier between Austria and Hungary was abolished (Nov. 1850). The customs tariff of Nov. 1851 replaced the system of prohibition by moderate protection. Bruck, the minister of commerce, tried to accomplish economic union with Germany, but Prussian opposition wrecked his proposed customs union, although he concluded a commercial and customs treaty with Prussia (Feb. 1853), whereby each party accorded the other certain benefits. The financial situation, however, continued gloomy; the deficit grew; while the system of espionage and police suspension reached its climax. hleanwhile the bishops, led in Austria by Cardinal Joseph Othmar Rauscher, one of Francis Joseph's tutors, convinced the court that the revolution had only been the consequence of national unbelief. Various decrees granted the clergy increased rights and influence; finally a concordat was concluded (Aug. 18, 1855) which ensured the Catholic Church and clergy a privileged position, entrusted education to the clergy, and contained an assurance to the Vatican that Austria would alter no confessional or inter-confessional laws without its previous consent. Further concessions to the Church followed, especially regarding marriage law.

The **Crimean War.**—Whether the autocratic régime evolved in the 1850s could prove permanent inevitably depended mainly on foreign policy. If Austria could maintain the position she had achieved in the early '50s in Germany and Europe, no revolt need be feared from the discontented peoples. This was, however, not the case. Francis Joseph's foreign policy was unfortunate. In the Crimean War (*q.v.*) (1854–56) his attitude was vacillating, and pleased no party. At the Congress of Paris (Feb. and hlarch, 1856) Austria paid for her vacillation. She had to renounce the acquisition of the Danube principalities, which she had occupied and hoped to incorporate, and withdraw her troops.

More unlucky still was the outcome of Austria's conflict with Sardinia in 1859 (see ITALIAN WARS). The Austrian troops were defeated, Lombardy was lost (Treaty of Villa-franca: Peace of Zürich). This great victory for the movement for Italian unity, led by the house of Savoy, was succeeded by the declaration of Parma, Modena, the Romagna and Tuscany that they wished to unite themselves with Sardinia. Austria retained only Venice.

Constitutional Experiments.—These reverses abroad necessitated abandoning the discredited absolutist system. Slowly and reluctantly Francis Joseph consented to change the constitution. In August 1859, the ministry of Count Johann Bernhard Rechberg and Count Agenor Goluchowski was formed. The first attempt at reorganization consisted in the convocation of a "reinforced Reichstag" (reinforced by comparison with that of 1851). It sat from May 31 to Sept. 28, 1860, but without result, agreement proving impossible between the "federalist" majority who wished to strengthen the "historical and political individuality of

the provinces," against the central authority, and the "centralist" minority who championed the unity of the empire. All parties condemned the previous methods of government. The attitude of Hungary, where discontent with the Bach system was general, turned the scale. Hungary's old constitution had been revoked, her traditions violated, Austrians ruled in the land. The numerous emigrants fanned the flames, demanding restoration of her independence, while the Conservatives urged an advantageous compromise with the emperor. Francis Joseph, who attached great importance to the warnings of this party, decided to meet the spirit of the times. The "October Diploma" (Oct. 20, 1860) divided the legislative power between the Crown and diets and a Reichsrat, to deal with legislative questions affecting all kingdoms and provinces of the State alike. The Reichsrat, however, enjoyed only an advisory vote in legislation, but taxation had to be submitted to it. The lands of the Hungarian Crown were promised a new constitution. For questions concerning Austria proper only, a smaller council (engerer Reichsrat), excluding the Hungarians, was to be competent.

The new constitution, in its attempt to reconcile provincial autonomy with Imperial unity, satisfied no parties. The German "centralists" thought themselves disregarded. The discontent among the Liberal middle classes of German Austria grew when the provincial statutes compiled by Goluchowski, the new "minister of State." gave small rights to the diets but large ones to the nobles and clergy. The Czechs welcomed the concessions to the lands of the Bohemian Crown, but like the Germans, they (the feudal nobility excepted) condemned the favours shown to the nobles and clergy. In Hungary, too. only the Conservatives were content, while the Liberals grumbled because the old rights of the Hungarian diet to pass taxation and vote recruits were transferred to the Vienna Reichsrat. Led by Franz Deák (q *v.*) they demanded unrestricted restoration of the 1848 laws.

The ill success of the *rapprochement* with the "federalists" brought a reaction towards "centralism." Goluchowski was dismissed, and replaced (Dec. 1860) by the Liberal Anton Ritter von Schmerling. In Feb. 1861. the ministry of Archduke Rainer (president) and Schmerling (minister of State) was formed. Rechberg remained minister for foreign affairs, Joseph Freiherr von Lasser, an excellent administrator, became minister of the interior. **A** new constitution, largely the work of Hans von Perthaler and Freiherr Tadaus von Lichtenfels, was issued on Feb. 26, 1861. The reinforced Reichsrat was replaced by a Staatsrat dnd a Reichsrat. The latter consisted of two houses: the Upper House (*Herrenhaus*) and the House of Deputies (*Abgeordnetehaus*). The Reichsrat was to represent the whole State; a "narrower Reichsrat," was to include only representatives of Austria proper and deal only with questions common to its various Crownlands. The competence of the provincial diets was restricted, the central parliament given the chief weight. In this parliament the electoral system was weighted to give the Germans the predominant position, and among them the great landed proprietors; franchise was indirect, members being deputed by the provincial diets, which were composed on the system of representation of interests. Schmerling hoped thus to establish a unified centralist State under German control at the expense of the provinces and other nationalities. But the constitution satisfied only the German Liberals; the advocates of absolutism in the army and bureaucracy and the supporters of feudalism and clericalism protested against its Liberal principles. The Slavonic provinces were violently opposed to it. The Bohemian diet condemned the electoral system and demanded that Francis Joseph be crowned king of Bohemia. The Poles, Slovenes and Italians also attacked the constitution as dangerous to nationalist ambitions. The elections to the Reichsrat were consequently widely boycotted.

The opposition was strongest in Hungary, where the diet rejected the constitution decisively. Deák still maintained that the Hungarian constitution was still legally valid, while the Government of Vienna declared it had been annulled by the revolution. The Hungarians now determined not to attend the Reichsrat. When the House of Deputies was opened (April 1861), the representatives of Hungary, Croatia, Transylvania and Venice were absent. The various German Liberal groups, known as the "Constitutional Party," dominated the assembly, which, the Hungarian representatives being absent, was taken as a "narrower Reichsrat." In 1863 the Czechs, disappointed in their expectations, withdrew from the parliament. The Reichsrat and Government made praiseworthy attempts to reconstruct the State finances. The deficit was not abolished, but considerable economies were introduced and trade improved.

The grant of constitutional conditions was acclaimed enthusiastically by the Liberal parties in Germany; the more so when the constitutional conflict broke out soon after in Prussia. Schmerling hoped to utilize this feeling to reform the Bund on "Grossdeutsch" lines, giving Austria the preponderance in Germany, and the German nation in Austria. He gained Francis Joseph for this plan, despite Rechberg's opposition. Francis Joseph convoked and opened a diet of Princes in Frankfurt (1863), but the reform was not effected, Bismarck (*q.v.*) having persuaded William I. of Prussia not to attend. The tension between Prussia and Austria grew, although they were reconciled once more (1864) over the Schleswig-Holstein question (*q.v.*).

Meanwhile Rechberg had resigned (Oct. 1864). His Schleswig-Holstein policy was unpopular among the Liberals of Austria and Germany and his failure to win concessions from Germany in the customs question entailed his fall. Schmerling soon followed. Francis Joseph, who disliked him personally, abandoned him as soon as he lost the support of the Constitution21 party; especially as the emperor had drawn closer to the Magyars after visiting Hungary (June 1865) and Debk's proposals offered hope of a compromise including the recognition of matters common to the whole State. Schmerling was replaced, at the instance of the influential Count hloritz Esterhazy, by Count Richard Belcredi, who aimed at restoring the old absolutism with a diet for each province, and maintenance of the Concordat. To this end the 17 provincial diets were convoked for November, and on Sept. 20, the Reichsrat was suspended by manifesto, the Government being empowered by Patent to conduct necessary business in the interim. The Government's new course was recognized and strongly approved by the diets of Bohemia, Galicia, Istria and Bukovina, while the diets of the German provinces protested, though unsuccessfully, against the suspension of the constitution. In Hungary a diet was opened by Francis Joseph in person (Dec. 186;). The speech from the throne recognized the validity of the 1848 laws. but demanded their prior revision on the lines of the October Diploma, while the Hungarians made any change conditional on prior reintroduction of the lams. Agreement was not quickly reached; but Debk prevented a rupture and obtained the appointment of 67 members (March 1, 1866) of a Parliamentary Commission of Compromise. In June a sub-committee presented a memorandum formulating conditions for the regulation of relations between Hungary and Austria. Deák and Julius Andrássy were the principal advocates of this compromise. (See HUNGARY.)

Negotiations were stiil proceeding when war broke out with Italy and Prussia. Austria, though victorious on land and sea against Italy (Custozza, Lissa) was decisively defeated by Prussia at Koniggratz (July 3, 1866) and forced to yield. The negotiations at Nikolsburg, terminating in the Peace of Prague (Aug. 1866), led to Austria's exit from the German federation and the cession of Venice to Italy; thus she lost for ever the hegemony in Germany and Italy conquered in 1815 and re-conquered in 1849–50.

The Hungarian Compromise. — The military disasters inevitably reacted on internal conditions. The policy of suspension was abandoned, for the disordered finances could not be reorganized nor the indispensable reforms achieved without restoration of the constitution. All parties agreed in this; but disagreed entirely on the next step. The "federalists" demanded equal rights for all nationalities; the extreme "centralists" a unified state under German leadership; others a compromise between these extremes. For some time Belcredi's plan of a feudal-conservative, federative State with an absolute monarch at the head. seemed most probable. But the opposition of the Hungarian moderates under Deák and Andrássy, and the German and Liberal parties in the German

and Slavonic provinces, was too strong. Belcredi was replaced as minister president (Feb. 7, 1867) by the Saxon statesman Ferdinand, Freiherr, later Count, Beust, who had succeeded Count Alexander Mensdorff-Pouilly as foreign minister in Oct. 1866. Beust convinced Francis Joseph of the necessity of satisfying the Hungarians and Germans, convoked the "Narrower Reichsrat" in Austria and simultaneously appointed a ministry in Hungary to conclude the negotiations for a compromise, already far advanced. A responsible ministry was appointed in Hungary in Feb. 17, 1867, with Julius Andrássy as president, with whom, and with Deák, the conditions of the compromise were agreed. Francis Joseph made peace with the dominant party in Hungary on a basis which left his dominions a remnant of unity and left him complete control of the armed forces. By this compromise which, after receiving the emperor's sanction, was issued in various rescripts, the Habsburg dominions received the name of the Austro-Hungarian monarchy. They fell into the Austrian and Hungarian halves, which were united only in the person of the sovereign and their common institutions, which included the ministries of foreign affairs, war and finance (the two last-named only for affairs of common interest) and the Austrian and Hungarian delegations composed of representatives of both halves of the empire, which were to debate on common affairs in Vienna and Budapest alternately.

These institutions were to be permanent, but the financial concessions and customs and commercial accord were to be revised every ten years. Austria was to bear 70%, Hungary 30% of the common expenditure. The coronation of Francis Joseph as king of Hungary (June 1867) was the outward token of his reconciliation with the Hungarians.

Austria After the Compromise. — In Austria proper the compromise was vigorously opposed by the Slavs; the Germans approved it, hoping now to be able to maintain permanently the supremacy in Austria; all Liberals acquiesced, as they now hoped to achieve a liberal constitution. Indeed, the Government met the wishes of the parliament convoked in May 1867 in this respect. while parliament approved the compromise with Hungary, also passing the Government's budget without important alterations. Thus the Government accepted four fundamental State laws elaborated by the Constitutional Committee of the House of Deputies on the general rights of citizens, the execution of governmental and executive power, the judicial power and the establishment of a Supreme Court (Dec. 21, 1867). The first of these laws ensured all citizens equality before the law and in the holding of public office, complete freedom of confession and conscience, and liberty of knowledge and teaching. All this meant a break with the past and abandonment of Rome and the Concordat. The Supreme Court was to decide in conflicts concerning competence and questions of public right. Ministerial responsibility was a further governmental concession to the form of constitutional government. As a sop to the German autonomists and Slav and clerical "federalists," all matters not falling within the competence of the Reichsrat, which was exactly defined, were assigned to the provincial diets — the opposite principle from that of 1861.

The Reichsrat having approved the Hungarian compromise, the first common ministers were appointed (Dec. 1867) and the first Delegations met in Jan. 1868. Meanwhile a new ministry had been formed in Austria (Dec. 1, 1867) composed of leaders of the Liberal majority of the House of Deputies with two aristocrats, and Prince Carlos Auersperg as president. Its first important act (March 1868) was to bring forward in the upper house a Liberal marriage law already passed by the lower house (Oct. 1867), restoring the civil marriage law suspended by the Concordat, and civil judicature in marriage questions. Two further laws, the relation between school and church and the regulation oi inter-confessional conditions, were passed by both houses. All three Liberal laws received the emperor's sanction on May 25, 1868. The State was recognized as enjoying supreme control and supervision over all education and instruction, and inter-confessional conditions regulated on the lines of equality of rights. The Government disregarded the sharp protests of the pope; recalcitrant bishops were punished.

Parliament also attacked administrative reform. The judicature was separated from the executive, the political service reorganized and the provinces divided into smaller units (*Bezirkshauptmannschaften*). Peasant entails, where still existing, were everywhere abolished in favour of free disposal, unless the provincial legislation prohibited the partition of peasant properties. Energetic measures were taken to improve the State finances; some, as the Ground Tax Law, were carried through, others were still incomplete when the ministry resigned. In 1868 a Military Service Law was passed, increasing the armed forces considerably; in 1869 a law introducing juries for political and press offences, and the Primary Schools Law.

The ecclesiastical and educational activities of the German Liberals were strongly opposed by the Clericals, and their centralizing tendencies by the Slavonic peoples. The national struggle, which henceforward, until the monarchy fell, absorbed unremittingly the best powers of all nationalities in Austria-Hungary, took open form after the institution of Dualism. Galicia was abandoned to the Poles, Polish introduced as the internal official language of most authorities, and other concessions granted which gave Galicia a separate status in Austria proper. Still the Poles were discontented; the Galician diet demanded a separate minister, responsible to the Galician diet, and entirely independent national administration and legislation. The Czechs aimed higher still. They denied the legality of the Reichsrat, and the 81 Czech deputies who abstained from the Bohemian diet, presented a declaration (Aug. 23) denying the competence of the Reichsrat to pass laws valid for Bohemia, and demanded the restoration of the unified kingdom of the crown of King Wenceslaus (Bohemia, Moravia and Silesia). The Czechs of Moravia proceeded on similar lines. Counter-measures by the German majority — rejection of the declaration and suspension of Belcredi's Language Law of January, 1866 — led to Czech excesses, which were repressed by force (Oct. 1868).

Differences between Beust and Auersperg had led meanwhile to Auersperg's dismissal (Sept. 26, 1868), and Taaffe, a childhood's friend of the emperor, became minister-president. Yet discord continued in Bohemia, in Carniola and in Trieste. In Dalmatia there was an open rebellion in 1869; the Bocchesi refused to enrol in the Austrian *Landwehr*. To meet all these centrifugal tendencies a strong and harmonious Government was needed; whereas, actually, the cabinet was divided; the majority advocated centralism and the methods hitherto adopted; the minority (Taaffe, Potocki and Berger), reconciliation with the nationalist opposition. Both parties submitted their opinions in a memorandum to the emperor (Dec. 1869). He decided for the majority; Taaffe and his supporters resigned. Hasner became minister-president.

To survive, the new cabinet had to make the Reichsrat independent of the provincial diets, the centre of the opposition. The two-thirds majority necessary to introduce direct election to the Reichsrat was, however, unobtainable. Giskra, the chief supporter of parliamentary reform, thereupon resigned (March 20, 1870). A few days later the Poles, Rumanians, Slovenes and Italians left the Parliament, which the Clericals had already forsaken The cabinet asked the emperor to dissolve those diets whose members had left the Reichsrat, and when he refused, resigned (April 1870). At Beust's suggestion, Francis Joseph invited Count Alfred Potocki to form a new cabinet. This was formed with difficulty and consisted principally of officials.

Potocki's efforts to reach a friendly compromise with the Czechs and Poles on the basis of the memorandum of December, 1869, to which he had been a signatory, broke down on the increasing demands of the two nations. As the Germans were hostile to the new ministry from the first, the latter dissolved the House of Deputies (May 1870) and all diets (the Bohemian not till late July), and convoked the new diets for late August, the Reichsrat for mid-September. The Government attempted to conciliate the national parties, but could not grant the extensive demands of the Czechs, who demanded recognition of the Bohemian State rights. The Czechs of both Bohemia and Moravia thereupon refused to attend the House of Deputies. In the new House

of Deputies the Constitutional Party and the Federals were evenly balanced; but new direct elections in Bohemia, over the head of the diet, gave the former the majority. It opposed the federalist ambitions of the Czechs, but also attacked the Government for attempting a coinpromise at the expense of the constitution. The ministry resigned (Nov. 24, 1870), but remained in office till Feb. 1871.

Two important events occurred during this ministry; the Franco-German War (*q.v.*) and the abolition of the Concordat. After 1866 an influential party in Austria still hoped to recover Austria's hegemony in Germany, and was prepared to try a new campaign with Prussia. Not only the military party under Archduke Albert (*q.v.*), but also politicians, notably Prince Richard Metternich, the Austrian ambassador in Paris, held this view. Beust, too, hoped for revenge; but in the negotiations with Napoleon III., which lasted till the outbreak of the Franco-German War, he watched over Austria's interests, which did not always coincide with Napoleon's. Francis Joseph was cautious, although he, too, cherished hopes of recovering Austria's hegemony in Germany. When the war broke out, the negotiations between Austria, France and Italy, were almost complete; but the peace party in Vienna, headed by the Hungarian minister-president, Julius Andrássy, prevailed at the decisive Crown Council (July 1870); it was resolved to remain neutral, provisionally. After the great military success of the Germans, this party definitely conquered; Austria remained a neutral spectator of the foundation of united Germany.

The abolition of the Concordat followed Pope Pius IX.'s declaration of the dogma of infallibility. In July 1870 the Government, urged by the minister of cults, Karl Stremayr, announced that the Concordat was not to be maintained, and that Beust had informed the pope of its formal abolition. Simultaneously, Stremayr was empowered to draft the necessary legislation for the Reichsrat.

On Feb. 5, 1871, the cabinet of Count Karl Albert Hohenwart-Schaffle took office, after long private negotiations, kept secret even from Beust, with the aim of adapting the constitution to the demands of the Slavs and satisfying the feudal and clerical parties. On April 25, 1871, the first of a series of bills for increasing considerably the legislative and administrative autonomy of the provinces was submitted to the Reichsrat; the provincial diets were to receive the right of initiative in legislation. As this bill was rejected by the House of Deputies, Hohenwart resorted to other expedients. To placate the Poles, he appointed a minister for Galicia, and in April introduced a bill giving Galicia great independence. In May he offered to allow the Czech opposition an equal measure of autonomy. The protests of the German majority of the House of Deputies were disregarded, as the emperor supported the Government's action. The Reichsrat was prorogued; the negotiations of the Czech opposition leaders, Heinrich, Count Clam-Martinitz and Francis Ladislaus Rieger, were carried further. The seven "constitutional" diets were dissolved and the Government, by manipulating the elections, got the two-thirds majority in the House of Deputies, necessary for constitutional alterations. The negotiations in Bohemia were now concluded. In an imperial Rescript issued Sept. 12, 1871, Francis Joseph offered to revive the rights of Bohemia with its coronation oath. Simultaneously, a bill was introduced guaranteeing Czechs and Germans equal rights in all questions, especially language, and the preservation of their national individuality. The diet was required to consider a settlement of Bohemia's constitutional status. Thereupon a committee drafted the "Eighteen Fundamental Articles." They recognized the compromise with Hungary, but demanded for Bohemia a status similar to Hungary's. All questions concerning Bohemia, and not common to Austria and Hungary, should be decided by the Bohemian diet. Austria should be dismembered into separate States, with a congress of delegates and a senate as common representation. On Oct. 10 these articles were submitted to the emperor, who refused his assent, as not only the German Liberal Ministers, including Beust, but Andrássy also declared Hohenwart's plan a menace to the unity of the empire. Attempts to induce the Czech leaders to decrease their demands failed. This sealed the fate of Hohenwart's ministry, which fell on Oct. 27, 1871. Beust was also dismissed (Nov. 8) and replaced by Julius Andrássy.

After a short provisional ministry, a new Liberal Government took office under Prince Adolph Auersperg, which after first assuring itself a constitutional majority in parliament, set about an electoral reform, with direct franchise, independent of the diets, for the house of deputies, whose membership was raised to 353. The bill was brought in in Feb. 1873. The high franchise qualification admitted only a limited circle of voters, the large landowners, chambers of industry and commerce, and towns, being favoured. The Liberal Government, co-operating with both houses of the Reichsrat, carried through several reforms. A new criminal procedure was introduced (1873) and a special court (*Verwaltungsgerichthof*) established (1875), to which any citizen might appeal for legal redress against encroachments by the administrative authorities. In Jan. 1874, the Government introduced its substitute for the provisions of the Concordat. An abortive attempt at marriage law reform was also made in 1875. Financially, the period of the Liberal régime is noteworthy for the financial crisis (May 1873), which necessitated state intervention. It was followed by a commercial crisis. The campaign for protective tariffs began. The Government's reputation was damaged by the implication of some of its members in the scandals attending the financial crisis of 1873. It was, moreover, weakened by disunity in its own camp, and was often openly opposed by its own partisans. At the same time, the Slavs renewed their attacks.

The result of the protracted negotiations with Hungary, skilfully led by Koloman Tisza, over the revision of the financial compromise of 1867, was most unsatisfactory to Austria. The two ministries agreed (1877), indeed, to renew the customs agreement for ten years and leave the quota of contributions unaltered; but in the bank question, the Dualist principle being introduced in the control of the Austro-Hungarian Bank, and in fixing the tariffs, Hungary exacted concessions which were approved by the Austrian Constitutional party only with the greatest reluctance.

The Eastern Question. — The Government had also to face a crisis in foreign policy. As foreign minister, Count Andrássy had, from the first, worked for permanently friendly relations with the new German empire, and Bismarck had met him half way. In Sept. 1872, the rulers of Germany, Austria and Russia had exchanged verbal declarations in Berlin, which in 1873 were set down in treaties directed towards the preservation of peace and, in particular, providing for common action in questions concerning the Near East. Andrássy's attitude was dictated rather by desire not to thwart Bismarck's plans, than by confidence in his Russian policy. When the Eastern crisis of 1875 broke out (see EASTERN QUESTION), Andrássy was put into a difficult position. Opinion in the monarchy was divided: the Hungarians were Turcophile, the Poles Russophobe; all the other Slavs were filled with pan-Slavonic enthusiasm; the Germans wanted peace. Andrássy favoured utilizing the occasion to extend the monarchy's power eastward, if possible by agreement with Russia. The two secret agreements of Reichstadt (July 1876) and Budapest (Jan. 1877), supplemented at Vienna (March 1877) were the outcome of this policy; they promised Austria-Hungary the annexation of Bosnia and the Hercegovina under certain conditions. After defeating Turkey, however, Russia, disregarding her engagements towards Austria, concluded the Treaty of San Stefano (March 1878), establishing a Greater Bulgaria, entirely dependent on Russia, with autonomy for Bosnia and the Hercegovina. Andrássy, supported by the emperor, and by England, determined to protest energetically against these conditions and prepared to support his decision, if necessary, by force. At the Congress of Berlin (June 13–July 13, 1878) Austria received a European mandate to occupy Bosnia and the Hercegovina, with the right to station garrisons in the Sanjak of Novi Pazar. Andrássy had originally intended to annex Bosnia and the Hercegovina, but the energetic resistance of the Turkish delegates, the anticipation of opposition from the Magyars to annexation, and the inevitability of conflicts between the two halves of the empire over the attribu-

tion of the provinces induced him to accept occupation; a convention concluded with the Sultan furthermore described the occupation as temporary only; the Sultan retained his sovereignty. The Austrian troops occupying Bosnia (July to Sept. 1878) met stubborn resistance, which was only overcome after severe fighting.

The Germans of Austria and the Magyars had disapproved of Andrássy's policy of occupation from the first. The considerable sacrifices in blood and money entailed by its execution increased their discontent. While, however, Tisza convinced the Magyars that the satisfaction of their own national ambitions depended on their retaining the favour of the court, the leaders of the Austrian Constitutional party attacked the Government vigorously, and thus estranging themselves from the emperor, who declared their opposition "factious," and accepted the resignation of Auersperg's cabinet (Oct. 1878), although leaving it in office pending appointment of its successor. The Constitutional party continued its opposition during this period, and by their impractical struggles drove the emperor into the camp of the Federalists and Ultramontanes, who had supported the occupation and agreed to all financial demands.

Formation **of** the Triple Alliance.—The increasing influence of the Slavs, Ultramontanes and feudal party in the German-Bohemian lands threatened to entail a change in the monarchy's foreign policy, which had been based on close and friendly relations with Germany. Andrássy, the chief exponent of this principle, therefore seized an opportunity to link Germany closer with the monarchy. Bismarck, who recognized the danger of the Germanophobe tendencies, which became very apparent after the Berlin Congress, of the dynasty in Russia, and feared a coalition between Russia, France and Austria-Hungary, took the initiative towards negotiations with Andrissy, which led on Oct. 7, 1879, to the conclusion of a secret treaty, whereby both States guaranteed one another mutual support in case of attack by Russia. Austria-Hungary was not, however, pledged to more than benevolent neutrality towards Germany in case of a Franco-German war. Only if Russia co-operated with the adversary of one contracting party was the other pledged to assist with its complete armed forces. The treaty, to which Bismarck only gained William I.'s consent with great difficulty, was a victory for Andrássy and for that party in Austria-Hungary which saw salvation in the continuance of closest relations with Germany. At first concluded for 5 years, later automatically prolonged, the treaty became inoperative only on the fall of the two monarchies. Soon after its conclusion, Andrássy resigned, but his two first successors, Baron Heinrich Haymerle (1881) and Count Gustav Ralnoky (1881–95) remained true to the fundamental principles of his policy. A series of treaties concluded in their terms of office before Bismarck's dismissal in March 1890, served to strengthen the Austro-German alliance, which was defensive and dimed at the preservation of peace, while safeguarding the interests of both contracting parties. Although Austro-Hungarian statesmen doubted the possibility of permanently reconciling the conflicting Balkan policies of their own State and Russia, a treaty was concluded through Bismarck's mediation (June 1881) between Russia, Austria-Hungary and Germany, which temporarily averted the threatened conflict between the two rivals. At about the same time Austria-Hungary drew Serbia into its sphere of influence. One year later (May 20, 1882) the first Triple Alliance treaty was signed, whereby Italy became an ally, although not a permanently reliable one, of the Central Powers. In 1883 Charles I., King of Rumania, adhered thereto. Austria-Hungary was then in the centre of this powerful international league, which not only safeguarded its foreign position, but also formed an effective protection against the growth of those currents which aimed at the unification of the nationalities other than German and Magyar in the monarchy with their co-nationals in the neighbouring foreign States. As allies of Austria-Hungary, the governments of Russia, Italy, Serbia and Rumania must try to curb—repress, they could not had they willed—the irredentist movements in their States. In 1884 the League of the Three Emperors was renewed. When it next expired (1887) the differences between Austria-Hungary and Russia, due chiefly to the changes in Bulgaria, had so increased as to make its renewal impossible. Bismarck, who, in view of the threat of a Franco-German war, wished to maintain tolerable relations with Russia, coilcluded a secret treaty with Russia, unknown to Austria-Hungary (June 1887), granting Russia important concessions, but not breaking his obligations towards Austria-Hungary. The same policy had determined the renewal of the Triple Alliance in Feb 1887; on the same principle, Bismarck sponsored the conclusion of the two treaties between England, Austria and Italy (March and Dec. 1887), which aimed at protecting the Mediterranean and Constantinople against possible Russian aggression. He endeavoured to prevent the outbreak of an Austro-Russian War, with conspicuous success in 1887 and 1888, when the danger of such a conflict was greatest. His pertinacious efforts to create a real reconciliation between Austria-Hungary and Russia through a partition of their spheres of interest in the Balkans were, however, unsuccessful.

Taaffe Minister-President, 1879.—The continuance of a Germanophile foreign policy was impeded by the changed situ ation in Austria proper in 1879. In August of that year Edouard Count Taaffe, the leading figure in Stremayr's provisional cabinet became head of the new ministry, which included Ultramontanes Poles and Czechs, and also German Liberals. The Germans, however, obstinately refused to come to a real compromise and left the cabinet (the last of them in June 1880) which thus became a ministry of the Right. The Czechs dropped their policy of abstention, and returned to the House of Deputies; then the Czechs, Poles and the Feudal Party formed the majority which offered the Government its support, which rewarded them with liberal concessions. Chief of these was the language decree of April 1880 for Bohemia, Moravia and Galicia, which established the bilingual system in communications of the courts and administration with the public; a measure which affected especially the officials in the solidly German linguistic districts of Eohemia. The German parties, the Clericals excepted, opposed this violently but fruitlessly. Their proposal that the Government should introduce a bill establishing German as the language of state, and regulating the use of the language locally current, was rejected. In 1882 Prague university was divided into two parts: Czech and German.

The two groups of the Constitutional party, the Liberals and the Progressives, united to defend the unity of the State, and their own nationality, and constituted themselves the "United Left" (1881). In 1882, however, the Clerical-Czech majority granted the vote to all payers of five guldens direct taxation in towns and markets. In the elections of 1885 the German parties lost ground and split again. The Government leaned even more on the Right, whose wishes it had to meet. The discontent of the Austrian Germans grew; but their influence was weakened by their own increasing disunity.

In 1832 a "German national league" had been founded on the basis of the "Linz programme," which proposed that Galicia and Dalmatia should be detached and Austria become a predominantly Germanic state, in closer connection with Germany. **A** few years later, however, this party split. The liberal thinking members were estranged by the increase of anti-Semitism, and the anti-Semites themselves divided, as a party of them, under Karl Lueger (*q.v.*), disapproved of the German nationalist tendencies. In 1887 the "Christian socialist league" was founded. Lueger, whose influence over the masses, especially the lower middle classes, was growing, approved Schonerer's anti-Semitism, but not the increasing German nationalist tendencies in his party.

The Labour Movement.——At the same time a strong movement was spreading among the industrial labourers. Excluded from the legislation and administration of the State, they sought to gain influence through their own organizations and street demonstrations. The severity and repression of the Government envenomed their discontent. The radicals among them, who advocated countering force by force, got the upper hand. Outrages were committed and led to very severe repressive legislation by the Government. In June 1886, the "Anarchist Bill," initiated in the House of Deputies, received imperial sanction. It

was not revoked until 1891, after the sagacious leadership of Victor Adler (*q.v.*), at the Hainfeld party meeting (Dec. 1888) had reconciled the moderates and radicals among the workmen. Meanwhile similar movements abroad had helped to show wide circles in parliament and outside, that the lower middle classes, who were suffering under the increasing pressure of capitalism, needed assistance. Various measures were passed for the benefit of artisans, a reform of industrial conditions undertaken, insurance against sickness and accidents introduced. The Government concluded the fresh compromise with Hungary (1887) without difficulties or basic alterations. It met the wishes of industrialists and peasants by raising tariffs. To improve the chaotic position of finances, new taxes were introduced, which were heavily felt by wide circles; yet the state revenues increased so much that in 1889 and 1890 the budget estimates showed no deficit, although several private railways had been taken over by the State, others built, and large sums voted for expanding the military forces.

Rise **of** the Young Czechs.—The successes of the Young Czech Party forced the Government to alter its attitude to national questions. In the elections to the diet of 1889 this party had almost annihilated the moderate Old Czech Party, and now commanded a majority in the Bohemian diet. The energetic opposition of the Germans to the extensive demands put forward by this party in the language question and that of Bohemian State rights induced Taaffe to attempt a compromise, which broke down, however, on the opposition of the Young Czechs. This failure induced Taaffe and the majority of the ministers to approach the German Liberals. Julian von Dunajewski, the finance minister, an enemy of the Germans, who thought the altered policy unnecessary, was out-voted, and resigned (Jan. 1889). His successor, Emil Steinbach, was an advocate of social reform, an enemy of the old Liberalism, and a Clerical sympathizer. The new elections to the House of Deputies did not bring the Government the expected gains for the moderate parties. Taaffe attempted, nevertheless, to unite them and form another government with their support. He failed, mainly owing to differences between the German Liberals and the Clericals, but relations between the three great parties, the United German Left, the Poles and the Hohenwart group, were tolerable, and Taaffe was able to remain in office. Fresh commercial treaties were now concluded with several states; certain tariffs were consequently reduced considerably. The financial situation improved. In 1892 the currency was regulated, the gold currency introduced, and a reform of direct taxation commenced.

Renewed attempts in 1891–93 to achieve a compromise in Bohemia again proved fruitless, neither party accepting the Government's proposals. When, in 1893, the Government attempted to delineate the judiciary districts in Bohemia on national lines, riots occurred, fostered by the Young Czechs; these provoked the Government to energetic measures, culminating in the proclamation of a state of siege in Prague and district (Sept. 1893). The Government believed that these and other disturbances could best be countered by wide extension of the franchise. For years past, franchise reform bills had occupied parliament's attention, some of them advocating general, equal and direct franchise. The growth of Social Democracy in Austria and the victories of the sister parties in Belgium and Germany helped to strengthen the movement in Austria towards enfranchising the workman. On Oct. 10, 1893, a bill was introduced in the House of Deputies, drafted by Steinbach and approved by Taaffe, abolishing the privileges of the electoral colleges of municipal and country districts, and granting the franchise to almost all men of 24 years. The party leaders had not been informed of this bill, which created great astonishment and still greater aversion among the overwhelming majority of deputies. The German Left, Poles and Conservatives, united against it. On Oct. 28, Parliament was adjourned; on the following day Taaffe tendered his resignation. On Nov. 11, 1893, he left office.

The new ministry, under Prince Alfred Windischgratz, rested on the three great parties in the House of Deputies, Liberals, Poles and Clericals, led by Ernst von Plener, Apolinar von Jaworski and Count Karl Hohenwart respectively. Permanent co-operation between such dissimilar interests and personalities was improbable from the first. They at first united in defence of the privileged basis of parliament; but dissension soon broke out between them, and even more between the three parties. Agreement proved impossible, either in the question of electoral reform, which had to be reopened in deference to public opinion, or in the language question. The breach came on a question trivial in itself: the Government's proposal to establish an upper school with instruction in German and Slovene, in Cilli. The German Left seceded from the coalition, whereupan the ministry resigned (June 1895). A provisional ministry, consisting mainly of high officials, under the Governor of Lower Austria, Count Erich Kielmansegg, carried on. Two important acts, long debated and widely demanded, the new civil procedure and the new income-tax law, were passed in this period.

Badeni's Ministry, 1895–1897.—In late Sept., 1895, the definitive ministry was appointed under the ex-governor of Galicia, Count Casimir Badeni. Badeni attempted at first to please all parties. The state of siege, proclaimed in Prague in 1893, was removed. In 1896 Badeni carried a franchise reform bill, which satisfied nearly all parties, except the advocates of general and equal franchise. All the old electoral categories were maintained, but a fifth curia was added, embracing almost anyone who had resided six months in one place and was not in domestic service; the membership of the House of Deputies was increased by 72. But the new elections (March 1897) strengthened the radical elements in all parties. The United German Left almost disappeared. The Germans fell into several mutually antagonistic groups; the majority put questions of nationality first, and had deserted the constitutional standpoint. The Right, too, had split. The Social Democrats secured 14 seats. Badeni was unable to secure a firm parliamentary majority, but got a temporary majority by concessions to the Clericals and thus, although he had offered his resignation, continued in charge. Francis Joseph now confirmed Lueger's election as burgomaster of Vienna, which he had long refused to sanction. To attract the Czechs, Badeni issued new language legislation under which, *inter alia,* all offices in Bohemia and Moravia were obliged to reply to the public in the language in which they had been addressed. After a short grace, all officials must prove their knowledge of both languages current. These proposals evoked violent opposition from the Germans, leading to uproar in parliament, obstruction and great public demonstrations. The attempt forcibly to break the Germans' parliamentary obstruction failed. When the movement reached a climax the emperor intervened and dismissed Badeni. A provisional ministry under Paul Freiherr von Gautsch (Nov. 28, 1897–March 1898) revoked Badeni's language laws and replaced them (March 1898) by others, dividing Bohemia into a Czech, a German and a mixed linguistic district. Neither Germans nor Bohemians were satisfied, and Gautsch resigned. Francis, Count Thun replaced him (March 1898). He attempted strong action, but was unsuccessful. The language controversy continued; peasant unrest broke out in Galicia; new taxation, a consequence of the new provisional compromise with Hungary, increased the discontent. At last the Government put through the increase of indirect taxation and renewal of the customs and commercial agreement with Hungary by application of paragraph 14 of the Constitution of 1867. This paragraph provided that in case of urgent necessity, legislation for which the assent of the Reichsrat was required might, if the Reichsrat was not in session, be proclaimed by the Emperor. It must be signed by the whole Ministry, and if not submitted to the Reichsrat within four months of its meeting, or if failing to receive the approval of both houses, it ceased to be valid. The Germans contended that the application of this clause to the Compromise was invalid, and demanded its repeal. Thun fell (Oct. 1899).

Clary and **Korber.**—His successor, Manfred, Count Clary-Aldringen, issued two language decrees for Bohemia and Moravia (Oct. 14, 1899), re-establishing the status *quo ante* of Badeni's bills pending completion of the projected legal settlement of the language question. The Germans consented; the Czechs, however. deeply indignant, began obstruction. Their attempt to carry the language struggle into the army offended the emperor, who was

determined to allow no tampering with the unity of the language in the army. The Czechs, however, continued their attacks upon the Government, and prevented it from passing an excise bill, which was a necessary part of the Hungarian Compromise. Unwilling to break his word towards Hungary, Clary resigned (Dec. 1899). After a short provisional ministry, Ernst von Korber became minister-president (Jan. 1900). His efforts to achieve a lasting compromise in the language question remained as fruitless as his predecessors'. The Czechs were bitterly hostile, the Poles and Italians discontented also. Nevertheless, Korber succeeded in his first years of office in abolishing obstruction and passing the votes on the budget, recruiting, and "other necessities of state" through parliament, by proposing large public works in which Czechs and Germans alike were interested, and passed the Compromise with Hungary (Jan. 1903) by the help of mutual concessions—a great success. Nevertheless, opposition increased in the Austrian parliament, and Korber, failing to induce parliament to vote the budgets for 1903, 1904 and 1905, was driven, like his predecessors, to apply "paragraph 14." Thus discontent grew and grew. The old opponents were reinforced by new; the Clericals, frightened by the progress of the *Los von Rom* movement against which Korber refused to take strong action, joined the opposition. In Dec. 1904 Korber resigned.

Struggle with Hungary.— Under Korber falls the struggle of the Hungarian party of independence *(see* HUNGARY) against the throne, manifested chiefly in the demand for the Magyar word of command in the Hungarian regiments (a preliminary to their complete Magyarization). The emperor, ordinarily very pliant to the Magyars' wishes, refused to yield an inch here, and declared (army order of Chlopy, Sept. 1903) his intention of maintaining the single language in the army. Stephen Tisza (*q.v.*) the Hungarian minister-president, proved unable to control the growing violence of the opposition. The Party of Independence was victorious in the new elections (early 1904). Tisza fell. Under his successor, Fejervari (June 1905), the parliamentary struggle in Hungary reached a climax. The Hungarian minister of the interior, Kristoffy, considered a plan of replacing the existing narrow franchise by universal franchise. The discussion of this question had some influence on the corresponding movement in Austria.

Suffrage Reform.—Gautsch, who had succeeded Körber on Jan. 1, 1905, certainly had no intention, at first, of a violent alteration in the constitution. His ambition was to reconcile the German-Czech differences, or at least to achieve a temporary compromise. In the former ambition he was successful in Moravia (autumn, 1905), in the latter in Bohemia. Meanwhile franchise reform was debated within and without the Reichsrat. Gautsch, who had originally declared that the introduction of general franchise in Austria must be preceded by a settlement of the national problem, gradually changed his attitude under the influence of public opinion, and particularly of the emperor's espousal of electoral reform, and on Feb. 23, 1906, laid sundry bills before the House of Deputies, aiming at the introduction of general, equal and direct voting. The details of these bills, however, were not unreservedly supported by any party. The opponents of general suffrage objected on principle, and the partition of mandates among the different nations caused insurmountable difficulties among the other deputies. Gautsch therefore resigned. His successor, Prince Conrad von Hohenlohe (March 1906), was equally unsuccessful in uniting the parliamentary parties by a new proposed compromise in the mandate question, and resigned in June.

His successor, Freiherr Max Vladimir Beck, managed by skilful tactics to secure an agreement regarding electoral reform (Oct. 1906). In early December the House of Deputies passed the bill. Fresh opposition was encountered in the upper house, but, before the end of 1906, the government's concession of the *numerus clausus* bought the passage of the bill for the general, equal and direct suffrage for parliamentary elections. It was sanctioned on Jan. 26, 1907, by Francis Joseph who hoped, by these concessions to modernity, to strengthen the dynasty, and to preserve the unity of his dominions, as expressed in the unified control of the common army and of foreign policy against the separatist ambitions of the Hungarian "'48" party. This seemed to him and his ministers the more urgent in that relations between the monarchy and foreign powers had become so threatening that an appeal to arms seemed not impossible.

Foreign Policy.— Austria-Hungary had held to the German alliance of Oct. 7, 1879, and renewed the Triple Alliance of 1882, in 1891 and 1902, for six and twelve years respectively, although confidence in Italy's sincerity grew ever less, and the irredentist movement in the Italian districts of Austria received both sympathy and active support in Italy itself. Relations with Russia had improved during the '90s after the critical period in the late '80s, although the conclusion of the Franco-Russian alliance (1891, Military Convention 1892, definite formulation 1893–94) directed largely against Germany and her allies, boded future danger. Count Agenor Goluchowski, who succeeded Kalnoky in May 1895, reached an understanding with Russia in 1897 on Balkan questions which, although not definitely reconciling to the divergent interests of the two Powers in the Balkans, yet enabled temporary cooperation on the basis of preservation of the *status quo*, and, in the event of unavoidable territorial changes, the understanding that these should go to enlarge the Christian Balkan states, while maintaining the balance of power. This compromise was the more welcome to Austria-Hungary as the treaty concluded with Serbia (1881) and renewed in 1889 was not renewed on expiration in 1895, neither was the agreement of 1887 with England and Italy *(see* above). Russia's increasing interest since the middle '90s in the Far East as a possible maritime outlet enabled Austria to cooperate with her in the Balkan unrest in Macedonia and elsewhere. The Mürzsteg programme (Oct. 1903), aimed at restoring order in Macedonia under Russian and Austrian supervision, on the lines of previous understandings. Permanent success was, indeed, impracticable, but the wish to maintain the best relations possible with Russia determined Austria-Hungary's benevolent attitude during the Russo-Japanese war. The secret treaty of 1883 with the king of Rumania was renewed (1892 and 1902) and, despite many differences, arising mainly over the oppression of the Rumanians in Transylvania, relations with Rumania remained good, largely thanks to her jealousy of Bulgaria and of the ambitious Prince of Bulgaria, Ferdinand of Coburg. In the conflicts which arose out of the Cretan rising (1896) and led to the Turco-Greek War, Goluchowski held aloof, swayed principally by the wish to preserve peace. Similarly he aimed at amicable settlement of the differences between Austria-Hungary and Italy in Albania, and achieved it by the agreements of 1897 and 1901. For the same reason he did not hesitate to recognize Peter Karageorgević, who ascended the Serbian throne after the murder of the last Obrenović (1903). He could not, however, prevent economic differences, due chiefly to Hungary's objections to the importation of Serbian live-stock, from occasioning repeated conflicts which resulted in a tariff war between the two States.

The Annexation of Bosnia and **the Hercegovina.**—Austria-Hungary's foreign policy changed when Baron, later Count, Aloys Lexa Aehrenthal (*q.v.*) succeeded Goluchowski (Oct. 1906). As ambassador in Petersburg, Aehrenthal had believed it possible to establish permanently good relations with Russia, especially when her attention was concentrated on the Far East. When, however, Russia, defeated by Japan, returned to her earlier policy, planned to reach the coveted outlet in Europe by seizing the Dardanelles, and to this purpose endeavoured to extend her influence in the Balkans, Aehrenthal saw the danger threatening Austria-Hungary. This danger became ever greater as the internal affairs of the Turkish empire became more critical. Aehrenthal wished to preserve this empire, but in the event of its final liquidation, he was firmly determined to safeguard Austria-Hungary's interests. It was necessary, above all, to secure permanent possession of Bosnia and Hercegovina. The Young Turks' revolution of July 1908, offered an immediate occasion to annex these territories. Without consulting the co-signatories of the Treaty of Berlin, Francis Joseph proclaimed the annexation (Oct. 6, 1908), at the same time announcing the withdrawal of the Austro-Hungarian troops from the Sanjak of Novi Pazar. Aehrenthal thought this move possible as he had previously made arrangements with the Russian foreign

minister, Isvolski, whereby Isvolski had promised his consent to the annexation in return for a promise of a free hand for Russia in the Dardanelles question. Aehrenthal's action evoked violent and widespread objection, and led to ominous complications, especially as Isvolski, whose Dardanelles plan had found no favour in France and England, now declared he had been deceived by Aehrenthal and never consented to the annexation. Encouraged by the attitude of certain Great Powers, Serbia protested against the annexation, demanded autonomy for the territories under the guarantee of the Great Powers, and a port on the Adriatic with a strip of territory to connect it with Serbia. As Aehrenthal did not consent, Serbia armed. Turkey, too, assumed a threatening attitude, and in Bulgaria the inclination to join Austria-Hungary's enemies grew, Aehrenthal, however, remained firm and reached his end, principally through Germany's intervention in Austria's favour. The differences with Turkey were composed (Feb. 1909), the signatories of Berlin recognized the annexation and Serbia had to submit and promise to further no more machinations against Austria-Hungary. It was a victory for Aehrenthal, but a Pyrrhic one, since it intensified the cleavage of Europe into two hostile camps, the Triple Alliance and the Triple Entente (see EUROPE).

One party in Austria, led by the chief of the general staff, Franz Conrad (later Count) Hotzendorf, even at this time favoured a decision by arms. After a violent conflict, however, Aehrenthal, supported by the emperor, who also advocated the maintenance of peace, carried his point. Aehrenthal attempted accordingly to improve relations with Russia and to settle amicably the fresh differences with Italy regarding Albania. In every way Aehrenthal worked for peace in 1910 and 1911. He attempted to reconcile the ever-recurrent differences between England and Germany. In the Moroccan question, indeed, he supported his ally, but carefully abstained from irritating the other side. He also prevented Austria-Hungary from intervening actively in the Italian-Turkish war of 1911, although the war party in Vienna wished to settle with the unreliable ally, Italy, as it had with Serbia in 1909.

The Balkan Question. — The Italian-Turkish War was followed by the Balkan War (Oct. 1912), in which the allied armies of Bulgaria, Serbia and Greece proved victorious. Count Leopold Berchtold, who succeeded Aehrenthal on his death (Feb. 1912), recognized the danger if the Balkan states, especially Serbia and Montenegro, were strengthened, but failed to prevent it. A strong party, again led by Conrad, once more urged armed intervention against the enemy in the Balkans, but again the peace party carried the day, especially as Austria's allies, Germany as well as Italy, were opposed to the war (1913). So Austria-Hungary had to watch the Balkan powers renew the war with Turkey and, despite unexpectedly stubborn resistance, again prove victorious. The outcome of the Second Balkan War (1913) brought another loss of prestige for Austria-Hungary. Serbia and Montenegro, especially the former, had extended their frontiers considerably, and henceforth, being no longer separated by the Sanjak of Novi Pazar, were in a position to join forces against the Habsburg monarchy when the time came. Bulgaria mas discontented with Austria's attitude, having expected active support in her war against the other Balkan states, while Rumania resented Berchtold's attempts to revise the Treaty of Bucharest in Bulgaria's favour. Anti-Austrian feeling made rapid headway every month. The agitation in Bucharest in favour of the Hungarian Rumanians became ever more active. Rumania drew closer to the Entente Powers, and although King Carol renewed the secret treaty with the Triple Alliance (Feb. 1913) and could not be persuaded definitely to break with the Central Powers, yet the pro-Entente party in the Rumanian government won the upper hand. So the danger increased that a new Balkan alliance under the aegis of Russia and France might be formed against Xustria-Hungary.

To hinder this encirclement became the principal endeavour of Viennese statesmen, who worked untiringly to compose Bulgaria's outstanding differences with Turkey and Rumania and, if possible, to win Greece to a closer adhesion to the Central Powers. All their efforts, however, were frustrated by the divergent interests and mutual distrust of the Balkan States, which were revealed during the negotiations conducted under the mediation of the Central Powers in the winter of 1913–14.

These failures were the more disappointing as the general situation during 1912–13 had become ever less favourable to the Central Powers. Relations with Italy were increasingly strained, although the Italian foreign minister, San Giuliano, maintained a correct attitude towards the Viennese Government, and although the Triple Alliance was renewed (for the last time) in Dec. 1912. But the attitude of the press and deputies with nationalist sympathies showed that influential circles were endeavouring to lead Italy into the Entente camp. Relations between England, France and Russia were also visibly growing ever closer, and all three powers were taking steps to increase their own military strength; while Germany and Austria-Hungary did likewise.

Internal Conditions 1907–14. — An early outbreak of a world war was not, however, expected in either capital, as relations between Germany and England began to imprcve, and a settlement of many outstanding points seemed promised. The Viennese statesmen, therefore, thought they might turn their attention to the Balkans, where conditions grew daily more intolerable, and seriously threatened the existence of the Danube monarchy, as the irredentist movement among the Slav inhabitants of the Monarchy had grown steadily, and was warmly encouraged by their co-nationals abroad. The Government was powerless. Despite the electoral reform, parliament was as disinclined as ever to allow proper government or a permanent settlement between the nationalities. The successive ministries between 1907 and 1914 were not parliamentary and did not express the majority of the house. Their successive programmes thus always aimed at an objective, non-party application of the Iaw and equal rights for all nationalities; but in order to gain a majority for necessary bills, they were obliged to negotiate with the parties, make them concessions, and take representatives of the different nations into their ministries. Their hopes thus to achieve a permanent national reconciliation proved unfounded. Centrifugal tendencies grew ever stronger. Fresh conflicts broke out between the Czechs and Germans in the Bohemian diet and in the House of Deputies, each in turn resorting to obstruction. Under Beck the Germans made work hopeless in the Bohemian diet, after riots had occurred in Prague and Laibach. The Czech ministers thereupon left the cabinet, and Beck, deserted by Germans and Czechs, resigned (Nov. 1908). His successor, Baron, later Count, Richard Bienerth, tried taking a representative of each of the three great parties, Germans, Czechs and Poles, as "provincial ministers." In vain. The Germans opposed any alteration in the Language Law of Bohemia unfavourable to themselves and resorted to obstruction when the ministry opened negotiations with the Czechs. At the same time discontent grew increasingly apparent among the Yugoslavs and Italians, while the Germans quarrelled among themselves. As the Christian Socialists, the chief support of the Government, lost heavily in the 1911 elections, Bienerth resigned (June 1911). His successor, Gautsch, was faced with the same difficulties. He failed to satisfy the extensive demands of the Czechs, but, by negotiating with them, aroused the suspicions of the Germans. He was succeeded (Nov. 1911) by Carl, Count Stiirgkh, who pursued the same policy with similar ill-success. In March, 1914, he adjourned parliament; thus the people were unrepresented when the War broke out in consequence of the murder of the Archduke Francis Ferdinand (*q.v.*) (June 28, 1914).

Southern Slav Agitation. — Following the example of the Magyars, Ruthenes, Czechs and Italians, who had urged their national claims with waxing energy, and endeavoured with increasing zeal, though with varying success, to loosen the bond which held them together, the Yugoslavs also had put forward their national demands. against the Germans and Magyars. Finding insufficientresponse from the central Government, especially against the increasing aggressiveness of the Magyars, they looked ever more towards their brothers in Serbia, and listened to the propagandists of the greater-Serbia idea. The danger increased when the Russophil Karageorgević dynasty succeeded the Obrenović in Serbia. Henceforth Belgrade became the centre of pan-Serb agitation against the Danubian monarchy, whose commanding

position in the Balkans was described as the only obstacle to the realization of the national desires of all southern Slavs. The Governments of Vienna and Budapest saw that this danger must be met, but still hesitated whether to use force or conciliation towards the southern Slavs. Time passed, and nothing was done. The southern Slav sore was allowed to fester on the body of the empire, and spread over it until it brought about its death.

Outbreak of ***World War*** I.—The murderers of Francis Ferdinand were citizens of the Habsburg monarchy, of Serbian nationality. Their act gave the supremacy in Vienna to the party under Conrad which had long advocated a bloody reckoning with the Serbs. Gradually they convinced the emperor and the advocates of a diplomatic settlement (who included Stephen Tisza, the Hungarian premier) that only force could effecta permanently satisfactory solution of the Serbian question. Accordingly, the Austro-Hungarian Government put forward demands in its ultimatum to Serbia (July 23, 1914) which it did not expect to see accepted. Although Serbia's answer was most conciliatory, the Vienna Government rejected it as insufficient. War was declared on July 28, after the efforts of the Great Powers, including Germany, to negotiate a settlement had failed. Equally fruitless remained the further attempts by these Powers to localize the war. World War I (*q.v.*) broke out.

At the outset of the war Austria-Hungary and Germany were joined by Turkey, and in Sept. 1915, after long hesitation, by Bulgaria. The Central Powers' efforts to gain further allies were fruitless; their two peace-time allies, indeed, Italy and Rumania, joined the increasing number of their enemies, the former in April 1915 (Treaty of London, April 26; declaration of war on Austria-Hungary, May 23, 1915), the latter on Aug. 27, 1916. In vain had the two Foreign Ministers, Berchtold (up to Jan. 1915) and Count Stephen Burian (Jan. 1915 to Dec. 1916) attempted by ever more extensive concessions to prevent Italy from entering the enemy's camp. Their t o-year long negotiations with Rumania were equally unsuccessful, chiefly owing to the refusal of the Hungarians, led by Tisza, to consent to the cession of Hungarian territory demanded by Rumania. The struggle against the increasing superiority of the enemy was carried on with varying success throughout the world. Austro-Hungarian troops were engaged chiefly against Russia and Italy. An Italian offensive was repelled after heavy fighting (1915) but attempts to win a decisive victory over Italy failed, although initial successes were often gained. Lasting success against the superior forces of the Russians was achieved only when the German army joined the Austro-Hungarian and Rumania's rapid defeat was chiefly its work.

In judging the achievements of the Austro-Hungarian army, the increasing unwillingness of many troops, especially the Czechs, to fight for interests directly opposed to their own, must not be overlooked. Further, there was the increasing shortage of foodstuffs in the monarchy, especially in the towns of Austria proper, and the enlistment of the youngest and oldest categories into the army brought into it subversive elements which corrupted the morale of the war-weary soldiers. Under these circumstances the party which advocated peace, even at the price of sacrifice, grew. Francis Joseph had never been disinclined for peace, but had insisted that it must be made in concert with his allies, especially Germany, and without serious territorial losses to himself. All efforts to reach a result on this basis broke down, however, on the irreconcilability of the peace conditions of the Central Powers with the demands of their enemies. The difficulty of these negotiations was increased by the discord between the allied Governments. Berlin wished Vienna to meet Italy's claims for Austrian territory generously, while Vienna wished Berlin to make concessions to France in Alsace-Lorraine. There was the further complication of the Polish question, after Congress Poland had been conquered, and Warsaw occupied by the Central Powers (Aug. 1916). None of the various proposals made by one or other of the Central Powers was fully accepted by both parties. Definite settlement was, therefore, postponed, but a proclamation issued to the Poles (Nov. 1916), in the vain hope of securing their active assistance in the war, promised the restoration of independent Poland as a hereditary constitutional monarchy.

Shortly before this, conversations had taken place between Austria and Germany, at Burian's suggestion, with the purpose of presenting the concrete peace conditions of the four allies to their enemies. No agreement had, however, been reached when Francis Joseph died on Nov. 21, 1916, after a reign of nearly 68 years. His successor, his grand-nephew Charles (*q.v.*), took over a perilous heritage. The military and economic resources of the monarchy mere beginning to fail. The blockade, the loss of supplies from Hungary and Galicia, and the diminution of home production consequent on shortage of human and animal labour made the food situation in Austria desperate, especially in the towns; the country districts shut themselves off, held up supplies and put up prices, in defiance of the law. Anti-dynastic feeling was spreading, especially in the non-German and non-Magyar territories. The young emperor's programme was to combat this feeling, to renew the splendour of the dynasty, to give his peoples the longed-for peace and to reconcile their mutual differences. The first step, he thought, was to end the war. The negotiations with Germany were pursued energetically; on Dec. 12, 1916, the peace offer of the Quadruple Alliance was made public. It was ill received by their enemies, who, in their answer, made claims which were brusquely rejected, especially by Germany, and led to the decision to continue the war by the employment of extreme measures, the most important and most promising of which was indicated to be unlimited submarine warfare.

Neither Count Ottokar Czernin, who had succeeded Burian (Dec. 1916), nor Charles shared the hope of the German statesmen, but they submitted to their allies' urgency. As, however, the submarine warfare failed to achieve the expected success, and the land warfare brought no decisive victory, while, by the revolution, the United States took the place of Russia against the Central Powers, Charles and Czernin were increasingly anxious for peace. All efforts to achieve it failed, however, although Charles, under the influence of his wife and her brother Sixtus of Parma, had taken steps in the spring of 1917 which, when revealed in 1918, evoked much indignation in Germany and forced Charles to make agreements with William II. which, if realized, would have made Austria-Hungary practically a vassal state of Germany. The Sixtus negotiations broke down on Italy's insistence on the claims admitted by her allies in the Treaty of London, which Charles refused to grant. Further negotiations in 1917 (Revertera-Armand and Mensdorff-Smuts) brought no result, as Czernin refused the offer of a separate peace.

World War I: Second Phase.—Successes in the East, leading to the Treaties of Brest-Litovsk with Russia (March 3, 1918), and the preliminary Peace of Buftea (March 6) with Rumania, though gratifying, did not blind the Government to the critical situation. They knew that the difficulties of filling up the depleted ranks, raising arms and ammunition, and provisioning troops and population, would increase monthly. Wholly convincing reports came in of the increasing war-weariness of the troops and the ever more openly expressed anti-dynastic sentiments of the non-German and non-Magyar nationalities. Even in Francis Joseph's lifetime the convocaticn of parliament, muzzled since 1914, had been considered, but Stiirgkh objected, fearing an ever stronger manifestation of national differences. Stürgkh's murder (Oct. 1916) was a demonstration against the absolutist régime. Yet his successor, Korber, also ruled without parliament. His efforts to curb centrifugal tendencies by concessions to the nationalities, while preserving the interests of the Germans of Austria, failed, and Charles dropped him the more willingly (Dec. 1916) as he disagreed with Korber over the conduct of the war, the Hungarian Compromise and the question of taking the oath to the constitution. Korber's successor, Count Richard Clam-Martinitz, after overcoming many difficulties, convoked the Reichsrat (May 1917). The Southern Slavs and Czechs immediately issued declarations incompatible with the unity of the empire, while the Germans resolutely opposed any reorganization of the monarchy on federative lines. Clam-Martinitz thereupon resigned (June 1917), but his successor, Ernst von Seidler, failed to accomplish the desired reconciliation of the nationalities, despite the emperor's action in amnestying the Slav leaders (Kramař and others) con-

demned in 1915, and promising huge social reforms and a reorganization of Austria on national lines. Seidler accordingly resigned (July 22, 1918).

His successor, Max Freiherr Hussarek, made fresh attempts to settle the internal differences, while preserving the unity of Austria, through granting extensive autonomy to the nationalities; but the military situation now made the idea of preserving the Habsburg monarchy, though in changed form, quite hopeless.

Czernin's efforts to secure peace on the basis of Wilson's Fourteen Points (*q.v.*) failed, as the Allies laid down conditions inacceptable to Germany, who now hoped for victory. All attempts of the Viennese Government, which had become ever more dependent on Berlin, or rather, on the military party predominant in Germany, especially since the revelation of Charles's separate negotiations with the western Powers, broke down on this resistance. Only when Germany's anticipated victory in the West did not materialize, the Allies advanced and Ludendorff, the leader of the military party, declared that the military spirit of the enemy could not be broken by arms (Aug. 1918), did Burian, who had replaced Czernin in April, find no opposition on principle in Germany; differences of method still remained, which induced Burian to disregard Germany's opposition and ask all belligerents to attend a peace conference. The only result of his efforts was to redouble the enemies' vigour. The recognition (Aug. 1918) by the Entente of the Czechs, who had formed legions and rendered the Entente great services, especially in the East, as a belligerent and allied Power, was momentous to the fate of Austria-Hungary. All Slavs of the monarchy now began to see that the break-up of Austria would give them more than its continued existence. They, therefore, now based their calculation on a break-up. The Austrian Social Democrats had adapted their programme in their party conference, and that party in Hungary which demanded complete independence with democratic reforms and immediate peace grew very strong.

Break-up of the Habsburg Monarchy. — On Sept. 15 the Bulgarian line broke; on Sept. 29 Bulgaria concluded an armistice, leaving Hungary exposed; Hungary demanded the recall of her own troops to defend their home. The Viennese ministers were powerless before the centrifugal demands of the Slavs and the insistence of the Magyars on Hungarian integrity. They determined to make important concessions to the Slavs. On Oct. 1 they announced that they recognized the rights of the nationalities to free self-determination, adopted the standpoint of national autonomy, championed Polish independence and announced the union of all the Southern Slavs of Austria by constitutional means. This step, however, contented no nationality. The Poles proclaimed their independence in Warsaw on Oct.7, the Ruthenians summoned their National Council for Oct. 19, and the Czech Government was formed in Paris on Oct. 14.

As a last attempt, the emperor issued a manifesto (Oct. 16) proclaiming that Austria should be transformed, in accordance with the will of her peoples, into a federal state, in which every race would be free to establish its own form of body politic on the territory occupied by it. For Hungary, the manifesto laid stress on the integrity of the Hungarian kingdom. But even this last attempt to preserve the monarchy, although with diminished territory and as a loose aggregation of separate territorial groups under the Habsburg-Lorraine dynasty, failed. In the course of the following weeks autonomous governments were formed in Prague, Laibach, Sarajevo, Trieste, Cracow and Lemberg. On Oct. 27 Heinrich Lammasch took over the government in Austria with the task of liquidating the central administration. Count Julius Andrássy, who had followed Burian as foreign minister (Oct. 24), recognized Wilson's claims regarding the rights of the nationalities, especially the Czechs, Slovaks and Yugoslavs He immediately opened negotiations for a separate peace, but these were as fruitless as the rest. On October 30 a national Hungarian government was formed in Budapest. As the troops, the Germans excepted, were leaving the front to return home, the Austro-Hungarian supreme command was forced to beg the Italians, who now advanced victoriously, for an armistice. which was granted on Nov. 3 under the severest conditions.

The process of dissolution ran its course in the old monarchy. On Nov. 11 the emperor renounced all share in the business of government in Austria, not, however, renouncing his crown, and the Lammasch government resigned. On the following day the Austrian National Assembly proclaimed a republic, which was at first intended to form a component part of the new German republic. On Nov. 16 the republican form was introduced in Hungary. The ancient Austro-Hungarian monarchy thereupon ceased to exist. See AUSTRIA; HUNGARY.

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(A. F. P.)

AUSTRIAN LITERATURE. This literature has been closely bound up with that of the German people as a whole. Yet Austrian literature has preserved characteristics of its own, partly because of the outlying position of the country, partly because of the special position which the Habsburg provinces occupied in the empire, partly because of the close, albeit often hostile, relations of the Austrian Germans to so many other nations, and partly also owing to the Counter-Reformation. In consequence of the latter movement, Austria was, from the end of the 16th century, divided by religious differences from south-western, central and northern Germany and became the centre of a baroque culture peculiar to itself, though largely derived from Spanish and Italian sources. Catholicism has continued down to the present day to be one of the most important elements of specifically Austrian literature. Contributory factors are the different variations of the Bajuvaric, or, in the case of Vorarlberg, the Alemannic national character, and the various territorial and local traditions. Above all, the temperament and mentality of the people of Vienna, which received its definitive stamp in the era of the Counter-Reformation, have modified the Austrian development of German tendencies in general. The Viennese have a vivid perception of beauty as well as of sentiment and of fun; they love music, nature and everything spectacular; they are endowed with a subtle taste in art. On the other hand they take life as easily as possible, avoiding everything unpleasant. They dislike extremes, are prone to compromise and usually take little interest in metaphysical problems. Since 1914 this mentality has undergone some change, but it will be found faithfully expressed in a great part of pre-war and post-war Austrian literature.

Owing to the outlying position of Austria, literary movements have often been late in reaching it from Germany; and though there has from the earliest times down to the present day been a constant literary give-and-take between the south-east section of the German-speaking people and the bulk of the race, it has seldom happened, and only for short periods, that the Germans of the Danube and the Alps have taken the lead in literary matters. Until the Counter-Reformation at least, the general lines of literary development are the same in both lands.

The Austrian literature of the middle ages included the religious lyric and the religious epic (the latter particularly in Carinthia and Styria), as well as the lyric of chivalry. The last-named *genre* enjoyed the same patronage in the court of Vienna as in the Wartburg; its Austrian representatives include such masters of different styles as Walther von der Vogelweide (*q.v.*) and Nithart. In the development of the great national epic of the middle ages the principal part was played by Austria proper, Styria and Tirol; the courtly epic being but scantily developed. Towards the end of the middle ages Austrian literature began to take on a realistic and comic colouring; but the lyric of chivalry continued to be written far longer than elsewhere, and the life of the mediaeval epic was artificially prolonged by the Emperor Maximilian I. (d. 1519). It is to Maximilian that Austria owed its brief efflorescence of humanism, and the first, though transient, period of prosperity of the University of Vienna (founded in 1365). The university, however, derived most of its fame from the foreign scholars who taught there.

A long period of literary sterility followed, owing to constant religious conflicts and the difficulties of internal and foreign affairs. This was succeeded by the baroque period, which was specially characteristic of south Germany. The baroque style appeared simultaneously in literature, architecture, sculpture, painting and music. It was the time of the supremacy of the Jesuits, and of the rigid absolutism of the emperors, who stood in close relation to Spain. These factors help to account for the movement. There was also a marked Italian influence, affecting more particularly the popular drama. The latter *genre* now appeared for the first time in literary form, and continued its long and brilliant course until well into the 19th century.

About the middle of the 18th century the *Aufklärung* (enlightenment) movement gradually began to penetrate Austria. This movement tended to minimize the acute difference between north and south Germany which had existed since the Counter-Reformation. Its principal figure was Sonnenfels (1733–1817) who, though far less significant, may be compared with Lessing. The literature produced by his school was well intentioned though not of great permanent value. Another result of the movement was the creation (1776) of the famous *Burgtheater*. In the classical period, Collin (*q.v.*) stands in about the same relation to Schiller as Sonnenfels to Lessing.

The Romantic movement was introduced into Austria comparatively early by its initiators, the brothers Schlegel. Austrian literature now enjoyed its second period of brilliance, known as the *Vormärz*. The most famous names of the period are those of Bauernfeld, Raimund, Nestroy, Grun, Lenau, Stelzhamer, and—most famous of all—Grillparzer (d. 1872) and Stifter (d. 1868). The lifetime and work of the latter writers form a connecting link with the next era, the period of constitutional liberalism, in which the best-known names are those of Hebbel, Laube and Wilbrandt—all immigrants from Germany—and, among native authors, Kurnberger, Schindler, Hamerling, Ebner-Eschenbach, Saar, Rosegger, Anzengruber, David.

Modern Austrian Literature.—In order to get a correct perspective of the subject during the years between 1910 and 1926 one must bear in mind the chief phases through which German literature has passed in the same period, viz., (1) naturalism, not the uncompromising and aggressive naturalisin of Holz and Schlaf, but a mitigated and domesticated species; (2) neo-romanticism, which from about 1910 was also made to suit the average public; and finally (3) expressionism, a movement that is opposed to, and yet is linked up with its predecessors.

There are three distinct periods in modern Austrian literature. In the first period are to be found those authors who in the '80s and '90s laid the foundations of the Austrian "Moderne" on the basis of realistic or neo-romantic principles. These men have either completed their life-work or at least are not likely to reveal any new features, although their former leader, Hermann Bahr, was a perfect Proteus in versatility. There are, secondly, those writers who, bet een 1900 and the World War, represented various aspects or combinations of realism and romanticism; and lastly, the authors of the war and post-war period; most of them, but not all, influenced by expressionism.

Lyrics.—Leadership among the "old moderns" may be awarded to Hugo Hofmannsthal. He is pre-eminent in the school originated by the Rhinelander Stefan George in opposition to the crude naturalism of the early '90s. His style may best be conceived by thinking of him as a reincarnation of Swinburne. There is the same exuberance of language, the same gorgeous imagery, the same quest for subtle beauty and the same interest in complicated or abnormal psychical phenomena, but blended with an elegant weariness, an aristocratic aloofness from everyday matters.

The next group consists of lyric poets, more or less under the influence of Hofmannsthal: Wladimir Hartlieb, Hans Muller, Alfred Grunewald, Stefan Zweig, Otto Hauser, Felix Braun, Paul Wertheimer, Max Mell and the passionate Anton Wildgans. But the third group follows the banner of expressionism, and is characterized by deliberate disregard of the laws of logic and of metre, and an all-embracing love of the universe and of mankind as a part of it, reminiscent of Whitman and the French unanimists.

Albert Ehrenstein, Franz Werfel, Georg Trakl (d 1914), Karl Schossleitner, Friedrich Schreyvogl, the painter Uriel Birnbaum may be mentioned here; and there is a certain affinity in matter and thought between their poems and those of the powerful satirist, Karl Kraus, and of the labour poet, Alfons Petzold (d. 1923), although in age both belong to an earlier period, as well as Peter Altenberg (d. 1919), equally original in life and art, whose short "prose poems" sometimes possess an irresistible charm and a childlike wisdom. A somewhat similar form has been adopted by the eminent thinker Josef Popper-Lynkeus (d. 1921).

Independent of these groups are Richard Kralik, Karl F. Ginzkey, Richard Schaukal, the religious poetess Enrica Handel-Mazzetti, Erika Spann-Rheinsch, and the Tyrolese poets Arthur Wallpach, Karl Dallago, Heinrich Schullern, all belonging to the school of the old romantics rather than to the new.

The Novel.—Here, too. the "moderns" of the '90s have held their own with their juniors. In the forefront have been Arthur Schnitzler (1862–1931) and Jacob Wassermann (1873–1934). Both these writers mastered the technique of fiction, and never quite lost touch with naturalism. The novels of both deal especially with the modern life of great cities, Schnitzler devoting himself chiefly to personal problems, Wassermann, with no common imaginative power, to social questions, too. Among Schnitzler's rivals were: Bahr, Raoul Auernheimer, Felix Salten, Hans Müller, Paul Zifferer, Robert Musil and among the younger generation, Ernst Lothar; while Otto Stoessl's measured and thoughtful style is somewhat reminiscent of Wassermann.

The next group, which appeared about 1908, adopted an attitude of tacit or outspoken opposition to the Schnitzler school; the scenes of their novels are laid for the most part, not in Vienna, but in the provinces, and the leader of this "Kailyard" movement was Rudolf Hans Bartsch of Styria, an emotional writer with a fervid imagination and a florid, sometimes ecstatic style, a master in word painting of landscapes. He had numerous followers, who shared his power of giving speech to nature, and his sympathy with the life of the countryside and the provinces. These were Ginzkey, Karl H. Strobl, Franz Nabl, Robert Hohlbaum, Josef F. Perkonig, Gustav Renker, Hans Sterneder, Hans Hammerstein, Paula Grogger—and again a separate group of Tyrolese: Hans Hoffensthal (d. 1915), Dallago, Schullern, Albert Trentini.

The historical fiction of Austria, after having been boycotted by "thoroughgoing" naturalism, received a fresh impetus before the war from the philosophic writers, Erwin G. Rolbenheyer and Emil Lucka—both excelling in technique, vividness of style and depth of thought. It was also influenced by the devout Handel-Mazzetti and the learned Otto Hauser—and in their wake Alma J. Koenig, Hermann Graedener, Braun and Egmont Colerus have followed. Hohlbaum wrote successful novels giving, if considered as a series, the historical development of the German "Geist." The last generation of novelists, the writers of the war and post-war period, are characterized either by weary resignation, or by passionate negation or assertion of the life force. Spiritualism, occultism and religion have become fashionable again, and are trying to find expression in novels of terror and in Wellsian Utopias. Otto Soyka, Franz Spunda, Paul Busson (d. 1924), Franz Rebiczek and Rudolf J. Kreutz, a no-more-war novelist, may be included in this category. The eminent proswork of Kraus, begun as early as 1899, stands apart from the main stream.

Drama.—During the period under review the naturalism of the Schnitzler school and the new romantic or neo-baroque style of Hofmannsthal had to share the leadership with the primitive strength of the Tyrolese dramatist, Karl Schonherr Society comedy, gracefully discussing erotic problems, continued to be cultivated in the Schnitzler manner by Bahr, Salten, Müller, Wertheimer, Auernheimer, the Shaw apostle Siegfried Trebitsch and Kurt Frieberger; and, later, by Hofmannsthal too. On the other hand. Mell and Georg Terramare attempted to revive the mediaeval morality play, suggested by Hofmannsthal's arrangement of *Everyman* in 1912. Otherwise the neo-romantic drama shows only a scant harvest (Richard Beer-Hofmann, Braun, Zweig, Colerus). Next to Schönherr's super-realistic plays are to be mentioned the dramas of Wildgans, whose style indicates clearly the transition from unrelentingly cruel naturalism to ecstatic expressionism. This reaction, directed against the mere exact rendering of visual and acoustic phenomena as well as against the academic and somewhat anaemic ideals of the neo-romantics, was begun in the pre-war empire and eagerly followed in post-war Austria; it restored and enhanced the poet's ego and liberated the drama from all the conventions hitherto determining form and subject. The young dramatists Arnolt Bronnen, Franz Th. Csokor, Oskar M. Fontana, Hans Kaltneker (d. 1919), Walter Eidlitz, Otto Marbach, Friedrich Lichtnecker, Richard Billinger, Alexander Lernet-Holenia, are all followers of this school, in which Werfel shines by creative power.

The Vienna Burgtheater, which formerly gave the lead to theatrical and, in some degree, to dramatic art in Germany, had already been deprived of its hegemony before 1900, and now has a dangerous rival in Max Reinhardt's *Theater* in *Der Josefstadt*. The annual summer festivals in Salzburg are also due to Reinhardt's initiative.

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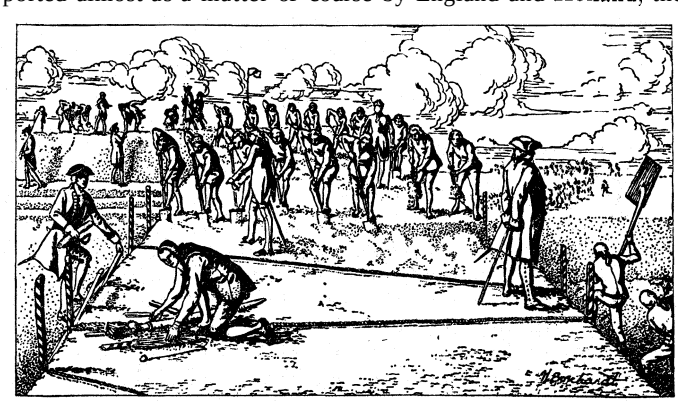
AUSTRIAN SUCCESSION, WAR OF THE (1740–1748). This war began with the invasion of Silesia by Frederick II. of Prussia in 1740, and was ended by the peace of Aix-la-Chapelle (Aachen) in 1748. After 1741 nearly all the powers of Europe were involved in the struggle, but the most enduring interest of the war lies in the struggle of Prussia and Austria for Silesia. South-west Germany, the Low Countries and Italy were, as usual, the battle-grounds of France and Austria. The constant allies of France and Prussia were Spain and Bavaria; various other powers at intervals joined them. The cause of Austria was supported almost as a matter of course by England and Holland, the traditional enemies of France. Of Austria's allies from time to time Sardinia and Saxony were the most important.



PRUSSIAN SOLDIERS CONSTRUCTING FORTIFICATIONS. FROM ADOLPHE MENZEL'S ILLUSTRATIONS TO FREDERICK THE GREAT'S "HISTOIRE DE MON TEMPS"

1. Frederick's Invasion of Silesia, 1740.—Prussia in 1740, was a small, compact and thoroughly organized power, with an army 100,000 strong. The only recent war service of this army had been in the desultory Rhine campaign of 1733–35. It was therefore regarded as one of the minor armies of Europe, and few thought that it could rival the forces of Austria and France. But it was drilled to a perfection not hitherto attained, and the Prussian infantry soldier was so well trained and equipped that he could fire five shots to the Austrian's three, though the cavalry and artillery were less efficient. But the initial advantage of Frederick's army was that it had, undisturbed by wars, developed the standing army theory to full effect. While the Austrians had to

wait for drafts to complete the field forces, Prussian regiments could take the field at once, and thus Frederick was able to overrun Silesia almost unopposed. His army was concentrated quietly upon the Oder, and without declaration of war, on Dec. 16, 1740, it crossed the frontier into Silesia. The Austrian generals could do no more than garrison a few fortresses, and with the small remnant of their available forces fell back to the mountain frontier of Bohemia and Moravia. The Prussian army was soon able to go into winter quarters, holding all Silesia and investing the strong places of Glogau, Brieg and Neisse.

2. **Silesian** Campaign of 1741.—In Feb. 1741 the Austrians collected a field army under Count Neipperg (1684–1774) and made preparations to reconquer Silesia. The Austrians in Neisse and Brieg still held out. Glogau, however, was stormed on the night of March 9, the Prussians, under Prince Leopold (the younger) of Anhalt-Dessau, executing their task in one hour with a mathematical precision which excited universal admiration. But the Austrian army in Moravia was now in the field, and Frederick's cantonments were dispersed over all Upper Silesia. It was a work of the greatest difficulty to collect the army, for the ground was deep in snow, and before it was completed Neisse was relieved and the Prussians cut off from their own country by the march of Neipperg from Neisse on Brieg; a few days of slow manoeuvring between these places ended in the battle of Mollwitz (April 10, 1741), the first pitched battle fought by Frederick and his army. The Prussian right wing of cavalry was speedily routed, but the day was retrieved by the magnificent discipline and tenacity of the infantry. The Austrian cavalry was shattered in repeated attempts to ride them down, and before the Prussian volleys the Austrian infantry, in spite of all that Neipperg and his officers could do, gradually melted away. After a stubborn contest the Prussians remained masters of the field. Frederick himself was far away. He had fought in the cavalry mêlée, but after this, when the battle seemed lost, he had been persuaded by Field-Marshal Schwerin to ride away. Schwerin thus, like Marshal Saxe at Fontenoy, remained behind to win the victory, and the king narrowly escaped being captured by wandering Austrian hussars. The immediate result of the battle was that the king secured Brieg, and Neipperg fell back to Neisse, where he maintained himself and engaged in a war of manoeuvre during the summer. But Europe realized suddenly that a new military power had arisen, and France sent Marshal Belleisle to Frederick's camp to negotiate an alliance. Thenceforward the "Silesian adventure" became the War of the Austrian Succession. The elector of Bavaria's candidature for the imperial dignity was to be supported by a French "auxiliary" army, and other French forces were sent to observe Hanover. Saxony was already watched by a Prussian army under Prince Leopold of Anhalt-Dessau, the "old Dessauer," who had trained the Prussian army to its present perfection. The task of Sweden was to prevent Russia from attacking Prussia, but her troops were defeated, on Sept. 3, 1741, at Wilmanstrand by a greatly superior Russian army, and in 1742 another great reverse was sustained in the capitulation of Helsingfors. In central Italy an army of Neapolitans and Spaniards was collected for the conquest of the Milanese.

3. **The** Allies in Bohemia.—The French duly joined the elector's forces on the Danube and advanced on Vienna; but the objective was suddenly changed, and after many counter-marches the allies advanced, in three widely separated corps, on Prague. A French corps moved via Amberg and Pilsen. The elector marched on Budweis, and the Saxons (who had now joined the allies) invaded Bohemia by the Elbe valley. The Austrians could at first offer little resistance, but before long a considerable force intervened at Tabor between the Danube and the allies, and Neipperg was now on the march from Neisse to join in the campaign. He had made with Frederick the curious agreement of Klein Schnellendorf (Oct. 9, 1741), by which Neisse was surrendered after a mock siege, and the Austrians undertook to leave Frederick unmolested in return for his releasing Neipperg's army for service elsewhere. At the same time the Hungarians, moved to enthusiasm by the personal appeal of Maria Theresa, had put into the field a *levée* en *masse*, or "insurrection," which furnished the regular army with an invaluable force of light troops. A fresh army was collected under Field-Marshal Khevenhiiller at Vienna, and the Austrians planned an offensive winter campaign against the Franco-Bavarian forces in Bohemia and the small Bavarian army that remained on the Danube to defend the electorate. The French in the meantime had stormed Prague on Nov. 26, the Grand-duke Francis, consort of Maria Theresa, who commanded the Austrians in Bohemia, moving too slowly to save the fortress The elector of Bavaria, who now styled himself archduke of Austria, was crowned king of Bohemia (Dec. 19, 1741) and elected to the imperial throne as Charles VII. (Jan. 24, 1742), but no active measures were undertaken. In Bohemia the month of December was occupied in mere skirmishes. On the Danube, Khevenhuller, the best general in the Austrian service, advanced on Dec. 27, swiftly drove back the allies, shut them up in Linz, and pressed on into Bavaria. Munich itself surrendered to the Austrians on the coronation day of Charles VII. At the close of this first act of the campaign the French, under the old Marshal de Broglie, maintained a precarious foothold in central Bohemia, menaced by the main army of the Austrians, and Rhevenhuller was ranging unopposed in Bavaria, while Frederick, in pursuance of his secret obligations, lay inactive in Silesia. In Italy the allied Neapolitans and Spaniards had advanced towards Modena, the duke of which state had allied himself with them, but the vigilant Austrian commander Count Traun had outmarched them, captured Modena and forced the duke to make a separate peace.

4. Campaign of **1742.**—Frederick had hoped by the truce to secure Silesia, for which alone he was fighting. But with the successes of Khevenhuller and the enthusiastic "insurrection" of Hungary, Maria Theresa's opposition became firmer, and she divulged the provisions of the truce, in order to compromise Frederick with his allies. The war recommenced. Frederick had not rested on his laurels; in the uneventful summer campaign of 1741 he had found time to begin that reorganization of his cavalry which was before long to make it even more efficient than his infantry. Charles VII., whose territories were overrun by the Austrians, asked him to create a diversion by invading Moravia. In Dec. 1741, therefore, Schwerin had crossed the border and captured Olmutz. Glatz also was invested, and the Prussian army was concentrated about Olmutz in Jan. 1742 A combined plan of operations was made by the French, Saxons and Prussians for the rescue of Linz. But Linz soon fell; Broglie on the Moldau, weakened by the departure of the Bavarians to oppose Khevenhuller, and of the Saxons to join forces with Frederick, was in no condition to take the offensive, and large forces under Prince Charles of Lorraine lay in his front from Budweis to Iglau. Frederick's march was made towards Iglau in the first place. Brunn was invested about the same time (February), but the direction of the march was changed, and instead of moving against Prince Charles, Frederick pushed on southwards by Znaim and Nikolsburg. The extreme outposts of the Prussians appeared before Vienna. But Frederick's advance was a mere foray, and Prince Charles. leaving a screen of troops in front of Broglie, marched to cut off the Prussians from Silesia, while the Hungarian levies poured into Upper Silesia by the Jablunka Pass. The Saxons, discontented and demoralized, soon marched off to their own country, and Frederick with his Prussians fell back by Zwittau and Leutomischl to Kuttenberg in Bohemia, uhere he was in touch with Broglie on the cine hand and (Glatz having now surrendered) with Silesia on the other. No defence of Olmutz was attempted, and the small Prussian corps remaining in Moravia fell back towards Upper Silesia Prince Charles, in pursuit of the king, marched by Iglau and Teutsch (Deutsch) Brod on Kuttenberg, and on May 17 was fought the battle of Chotusitz or Czaslau, in which after a severe struggle the king was victorious. His cavalry on this occasion retrieved its previous failure, and its conduct gave an earnest of its future glory not only by its charges on the battlefield, but its vigorous pursuit of the defeated Austrians. Almost at the same time Broglie fell upon a part of the Austrians left on the Moldau and won a small, but morally and politically important, success in the action of Sahay, near Budweis (May 24, 1742). Frederick did not propose another combinecl movement. His victory and

that of Broglie disposed Maria Theresa to cede Silesia in order to make good her position elsewhere, and the separate peace between Prussia and Austria, signed at Breslau on June 11, closed the First Silesian War. The War of the Austrian Succession continued.

5. **The French at** Prague. — The return of Prince Charles, released by the peace of Breslau, put an end to Broglie's offensive. The prince pushed back the French posts everywhere, and his army converged upon Prague, where, towards the end of June 1742, the French were to all intents and purposes surrounded. Broglie had made the best resistance possible with his inferior forces, and still displayed great activity, but his position was one of great peril. The French Government realized at last that it had given its general inadequate forces. The French army on the lower Rhine, hitherto in observation of Hanover and other possibly hostile states, was hurried into Franconia. Prince Charles at once raised the siege of Prague (Sept. 14), called up Khevenhuller with the greater part of the Austrian army on the Danube, and marched towards Amberg to meet the new opponent. Marshal Maillebois (1682–1762), its commander, then manoeuvred from Amberg towards the Eger valley, to gain touch with Broglie. Marshal Belle-Isle, the political head of French affairs in Germany and a very capable general, had accompanied Broglie throughout, and it seems that Belle-Isle and Broglie believed that Maillebois' mission was to regain a permanent foothold for the army in Bohemia; Mailiebois, on the contrary, conceived that his work was simply to disengage the army of Broglie from its dangerous position, and to cover its retreat. His operations were no more than a demonstration, and had so little effect that Broglie was sent for in haste to take over the command from him, Belle-Isle at the same time taking over charge of the army at Prague. Broglie's command was now on the Danube, east of Regensburg, and the imperial (chiefly Bavarian) army of Charles VII. under Seckendorf aided him to clear Bavaria of the Austrians. This was effected with ease, for Khevenhüller and most of his troops had gone to Bohemia. Prince Charles and Khevenhuller now took post between Linz and Passau, leaving a strong force to deal with Belle-Isle in Prague. This, under Prince Lobkowitz, was little superior in numbers or quality to the troops under Belle-Isle, under whom served Saxe and the best of the younger French generals, but its light cavalry swept the country clear of provisions. The French were quickly on the verge of starvation, winter had come, and the marshal resolved to retreat. On the night of Dec. 16, 1742, the army left Prague to be defended by a small garrison under Chevert, and took the route of Eger. The retreat (Dec. 16–26) was accounted a triumph of generalship, but the weather made it painful and costly. The brave Chevert displayed such confidence that the Austrians were glad to allow him freedom to join the main army. The cause of the new emperor was now sustained only in the valley of the Danube, where Broglie and Seckendorf opposed Prince Charles and Khevenhiiller, who were soon joined by the force lately opposing Belle-Isle.

In Italy, Traun held his own with ease against the Spaniards and Neapolitans. Naples was forced by a British squadron to withdraw her troops for home defense, and Spain, now too weak to advance in the Po valley, sent a second army to Italy via France. Sardinia had allied herself with Austria, and at the same time neither State was at war with France, and this led to curious complications, combats being fought in the Isère valley between the troops of Sardinia and of Spain, in which the French took no part.

6. **The Campaign of** 1743 opened disastrously for the emperor. The French and Bavarian armies were not working well together, and Broglie and Seckendorf had actually quarrelled. No connected resistance was offered to the converging march of Prince Charles's army along the Danube, Khevenhuller from Salzburg towards southern Bavaria, and Prince Lobkowitz (1685–1755) from Bohemia towards the Naab. The Bavarians suffered a severe reverse near Braunau (May 9, 1743), and now an Anglo-allied army commanded by King George II., which had been formed on the lower Rhine on the withdrawal of Maillebois, was advancing southward to the Main and Neckar country. A French army, under Marshal Noailles, was being collected on the middle Rhine to deal with this new force. But Broglie was now in full retreat, and the strong places of Bavaria surrendered one after the other to Prince Charles. The French and Bavarians had been driven almost to the Rhine when Noailles and the king came to battle. George, completely outmanoeuvred by his veteran antagonist, was in a position of the greatest danger between Aschaffenburg and Hanau in the defile formed by the Spessart Hills and the river Main. Noailles blocked the outlet and had posts all around, but the allied troops forced their way through and inflicted heavy losses on the French, and the battle of Dettingen is justly reckoned as a notable victory of the British arms (June 27). Both Broglie, who, worn out by age and exertions, was soon replaced by Marshal Coigny (1670–1759), and Noailles were now on the strict defensive behind the Rhine. Not a single French soldier remained in Germany, and Prince Charles prepared to force the passage of the great river in the Breisgau while the king of England moved forward via Mainz to co-operate by drawing upon himself the attention of both the French marshals. The Anglo-allied army took Worms, but, after several unsuccessful attempts to cross, Prince Charles went into winter quarters. The king followed his example, drawing in his troops to the northward, to deal, if necessary, with the army which the French were collecting on the frontier of Flanders. Austria, England, Holland and Sardinia were now allied. Saxony changed sides and Sweden and Russia neutralized each other (peace of Åbö, August 1743) Frederick was still quiescent; France, Spain and Bavaria alone continued actively the struggle against Maria Theresa.

In Italy, the Spaniards on the Panaro had achieved a Pyrrhic victory over Traun at Campo Santo (Feb. 8, 1743), but the next six months were wasted in inaction, and Lobkowitz, joining Traun with reinforcements from Germany, drove back the enemy to Rimini. The Spanish-Piedmontese war in the Alps continued without much result, the only incident of note being a combat at Casteldelfino won by the king of Sardinia in person.

7. **Campaign of** 1744. — With 1744 began the Second Silesian War. Frederick, disquieted by the universal success of the Austrian cause, secretly concluded a fresh alliance with Louis XV. France had posed hitherto as an auxiliary, her officers in Germany had worn the Bavarian cockade, and only with England was she officially at war. She now declared war direct upon Austria and Sardinia (April 1744). A corps was assembled at Dunkirk to support the cause of the Pretender in Great Britain, and Louis in person, with 90,000 men, prepared to invade the Austrian Netherlands, and took Menin and Ypres. His presumed opponent was the allied army previously under King George and composed of English, Dutch, Germans and Austrians. On the Rhine, Coigny was to make head against Prince Charles, and a fresh army under the prince de Conti was to assist the Spaniards in Piedmont and Lombardy. This plan was, however, at once dislocated by the advance of Charles, who, assisted by the veteran Traun, skilfully manoeuvred his army over the Rhine near Philipsburg (July 1), captured the lines of Weissenburg, and cut off the French marshal from Alsace. Coigny, however, cut his way through the enemy at Weissenburg and posted himself near Strasbourg. Louis XV. now abandoned the invasion of Flanders, and his army moved down to take a decisive part in the war in Alsace and Lorraine. At the same time Frederick crossed the Austrian frontier (August).

The attention and resources of Austria were fully occupied, and the Prussians were almost unopposed. One column passed through Saxony, another through Lusatia, while a third advanced from Silcsia. Prague, the objective, was reached on Sept. 2. Six days later the Austrian garrison was compelled to surrender, and the Prussians advanced to Budweis. Maria Theresa once again rose to the emergency, a new "insurrection" took the field in Hungary, and a corps of regulars was assembled to cover Vienna, while the diplomatists won over Saxony to the Austrian side. Prince Charles withdrew from Alsace, unmolested by the French, who had been thrown into confusion by the sudden and dangerous illness of Louis XV. at Metz. Only Seckendorf with the Bavarians pursued him. No move was made by the French, and Frederick thus found himself after all isolated and exposed to the combined attack of the Austrians and Saxons, Marshal Traun, summoned from the

Rhine, held the king in check in Bohemia, the Hungarian irregulars inflicted numerous minor reverses on the Prussians, and finally Prince Charles arrived with the main army. The campaign resembled that of 1742; the Prussian retreat was closely watched, and the rearguard pressed hard. Prague fell, and Frederick, completely outmanoeuvred by the united forces of Prince Charles and Traun, regained Silesia with heavy losses. At the same time, the Austrians gained no foothold in Silesia itself. On the Rhine, Louis, now recovered, had besieged and taken Freiburg, after which the forces left in the north were reinforced and besieged the strong places of Flanders. There was also a slight war of manoeuvre on the middle Rhine.

In 1744 the Italian war became for the first time serious. A grandiose plan of campaign was formed, and as usual the French and Spanish generals at the front were hampered by the orders of their respective governments. The object was to unite the army in Dauphiné with that on the lower Po. The adhesion of Genoa was secured, and a road thereby obtained into central Italy. But Lobkowitz had already taken the offensive and driven back the Spanish army of Count de Gages towards the Neapolitan frontier. The king of Naples at this juncture was compelled to assist the Spaniards at all hazards. A combined army was formed at Velletri, and defeated Lobkowitz there on Aug. 11. The crisis past, Lobkowitz then went to Piedmont to assist the king against Conti, the king of Naples returned home, and de Gages followed the Austrians with a weak force. The war in the Alps and the Apennines was keenly contested. Villefranche and Montalban were stormed by Conti on April 20, a desperate fight took place at Peyre-Longue on July 18, and the king of Sardinia was defeated in a great battle at Madonna del Olmo (Sept. 30) near Coni (Cuneo). Conti did not, however, succeed in taking this fortress, and had to retire into Dauphiné for his winter quarters. The two armies had, therefore, failed in their attempt to combine, and the Austro-Sardinians still lay between them.

8. Campaign of 1745.—The interest of the next campaign centres in the three greatest battles of the war—Hohenfriedberg, Kesselsdorf and Fontenoy. The first event of the year was the Quadruple Alliance of England, Austria, Holland and Saxony, concluded at Warsaw on Jan. 8. Twelve days previously, the death of Charles VII. submitted the imperial title to a new election, and his successor in Bavaria was not a candidate. The Bavarian army was again unfortunate; caught in its scattered winter quarters (action of Amberg, Jan. 7), it was driven from point to point, and the young elector had to abandon Munich once more. The peace of Fiissen followed on April 22, by which he secured his hereditary states on condition of supporting the candidature of the grand-duke Francis, consort of Maria Theresa. The "imperial" army ceased *ipso facto* to exist, and Frederick was again isolated. No help was to be expected from France, whose efforts this year were centred in the Flanders campaign. In effect, on May 10, before Frederick took the field, Louis XV. and Saxe had besieged Tournay, and inflicted upon the relieving army of the duke of Cumberland the great defeat of Fontenoy (*q.v.*). In Silesia the customary small war had been going on for some time, and the concentration of the Prussian army was not effected without severe fighting. At the end of May, Frederick, with about 65,000 men, lay in the camp of Frankenstein, between Glatz and Neisse, while behind the Riesengebirge about Landshut Prince Charles had 85,000 Austrians and Saxons. On June 4 mas fought the battle of Hohenfriedberg (*q.v.*) or Striegau, the greatest victory as yet of Frederick's career, and, of all his battles, excelled perhaps by Leuthen and Rossbach only. Prince Charles suffered a complete defeat and withdrew through the mountains as he had come. Frederick's pursuit was methodical, for the country was difficult and barren, and he did not know the extent to which the enemy was demoralized. The manoeuvres of both leaders on the upper Elbe occupied all the summer, while the political questions of the imperial election and of an understanding between Prussia and England were pending. The chief efforts of Austria were directed towards the valleys of the Main and Lahn and Frankfort, where the French and Austrian armies manoeuvred for a position from which to overawe the electoral body. Marshal Traun was successful, and the grand-duke became the Emperor Francis I. on Sept. 13. Frederick agreed with England to recognize the election a few days later, but Maria Theresa would not conform to the Treaty of Breslau without a further appeal to the fortune of war. Saxony joined in this last attempt. A new advance of Prince Charles quickly brought on the battle of Soor, fought on ground destined to be famous in the war of 1866. Frederick was at first in a position of great peril, but his army changed front in the face of the advancing enemy and by its boldness and tenacity won a remarkable victory (Sept. 30). But the campaign was not ended. An Austrian contingent from the Main joined the Saxons under Marshal Rutowski, and a combined movement was made in the direction of Berlin by Rutowski from Saxony and Prince Charles from Bohemia. The danger was very great. Frederick hurried up his forces from Silesia and marched as rapidly as possible on Dresden, winning the actions of Katholisch-Hennersdorf (Nov. 24) and Gorlitz (Nov. 25). Prince Charles was thereby forced back, and now a second Prussian army under the old Dessauer advanced up the Elbe from Magdeburg to meet Rutowski. The latter took up a strong position at Resselsdorf between Meissen and Dresden, but the veteran Leopold attacked him directly and without hesitation (Dec. 14). The Saxons and their allies were completely routed after a hard struggle, and Maria Theresa at last gave way. In the peace of Dresden (Dec. 25) Frederick recognized the imperial election, and retained Silesia, as at the peace of Breslau.

g. Operations in Italy, 1745–1747.—The campaign in Italy this year was also no mere war of posts. In March 1745 a secret treaty allied the Genoese republic with France, Spain and Naples. A change in the command of the Austrians favoured the first move of the allies. De Gages moved from Modene towards Lucca, the French and Spaniards in the Alps under Marshal Maillebois advanced through the Riviera to the Tanaro, and in the middle of July the two armies were at last concentrated between the Scrivia and the Tanaro, to the unusually large number of 80,000. A swift march on Piacenza drew the Austrian commander thither, and in his absence the allies fell upon and completely defeated the Sardinians at Bassignano (Sept. 27), a victory which was quickly followed by the capture of Alessandria, Valenza and Casale. Jomini calls the concentration of forces which effected the victory "le plus rémarquable de toute la guerre." But the complicated politics of Italy brought it about that Maillebois was ultimately unable to turn his victory to account. Indeed, early in 1746, Austrian troops, freed by the peace with Frederick, passed through Tirol into Italy; the Franco-Spanish winter quarters were brusquely attacked, and a French garrison of 6,000 men at Asti was forced to capitulate,. At the same time Count Browne with an Austrian corps struck at the allies on the lower Po, and cut off their communication with the main body in Piedmont. A series of minor actions thus completely destroyed the great concentration. The allies separated, Maillebois covering Liguria, the Spaniards marching against Browne. The latter was promptly and heavily reinforced, and all that the Spaniards could do was to entrench themselves at Piacenza; the Spanish Infant as supreme commander calling up hfaillcbois to his aid. The French, skilfully conducted and marching rapidly, joined forces once more, but their situation was critical, for only two marches behind them the army of the king of Sardinia was in pursuit, and before them lay the principal army of the Austrians. The pitched battle of Piacenza (June 16) was hard fought, and Maillebois had nearly achieved a victory when orders from the Infant compelled him to retire. That the army escaped at all was in the highest degree creditable to Maillebois and to his son and chief of staff, under whose leadership it eluded both the Austrians and the Sardinians, defeated an Austrian corps in the battle of Rottofreddo (Aug. 12), and made good its retreat on Genoa. It was, however, a mere remnant of the allied army which returned, and the Austrians were soon masters of north Italy, including Genoa (September). But they met with no success in their forays towards the Alps. Soon Genoa revolted from the oppressive rule of the victors, rose and drove out the Austrians (Dec. 5–11), and the French, now commanded by Belleisle, took the offensive (1747). Genoa held out against a second Austrian siege, and after the plan of campaign

had as usual been referred to Paris and Madrid, it was relieved, though a picked corps of the French army under the chevalier de Belleisle, brother of the marshal, was defeated in the almost impossible attempt (July 19) to storm the entrenched pass of Exiles (Col di Assietta), the chevalier, and with him the *élite* of the French nobility, being killed at the barricades. Before the steady advance of Marshal Belleisle the Austrians retired into Lombardy and a desultory campaign was waged up to the conclusion of peace.

In North America the most remarkable incident of what has been called "King George's War" was the capture of the French Canadian fortress of Louisburg by a British expedition (April 29–June 16, 1745), of which the military portion was furnished by the colonial militia under Col. (afterwards Lieut.-Gen. Sir William) Pepperell (1696–1759) of Maine. Louisburg was then regarded merely as a nest of privateers, and at the peace it was given up, but in the Seven Years' War it came within the domain of grand strategy, and its second capture was the preliminary step to the British conquest of Canada. For the war in India, *see* INDIA: *History*.

10. **Later** Campaigns. — The last three campaigns of the war in the Netherlands were illuminated by the now fully developed genius of Marshal Saxe. After Fontenoy the French carried all before them. The withdrawal of most of the English to aid in suppressing the 'Forty-five rebellion at home left their allies in a helpless position. In 1746 the Dutch and the Austrians were driven back towards the line of the Meuse, and most of the important fortresses were taken by the French. The battle of Roucoux (or Raucourt) near Liége, fought on Oct. 11 between the allies under Prince Charles of Lorraine and the French under Saxe, resulted in a victory for the latter. Holland itself was now in danger, and when in April 1747 Saxe's army, which had now conquered the Austrian Netherlands up to the Meuse, turned its attention to the United Provinces, the old fortresses on the frontier offered but slight resistance. The prince of Orange and the duke of Cumberland underwent a severe defeat at Lauffeld on July 2, 1747, and Saxe, after his victory, promptly and secretly despatched a corps under Lowendahl to besiege Bergen-op-Zoom. On Sept. 18 Bergen-op-Zoom was stormed by the French, and in the last year of the war Maestricht, attacked by the entire forces of Saxe and Lowendahl, surrendered on May 7, 1748. A large Russian army arrived on the Meuse to join the allies, but too late to be of use. The quarrel of Russia and Sweden had been settled by the peace of Abo in 1743, and in 1746 Russia had allied herself with Austria. Eventually a large army marched from Moscow to the Rhine, an event which was not without military significance, and in a manner preluded the great invasiops of 1813–14 and 1815. The general peace of Aix-la-Chapelle (Aachen) was signed on Oct. 18, 1748.

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(C. F. A.)

NAVAL OPERATIONS

The naval operations of this war are entangled with those of the Spanish War which broke out in 1739 in consequence of long-standing disputes between England and Spain in the West Indies. The British navy, after a long period of neglect during Walpole's administration, was in an unsatisfactory condition, and this, coupled with the lack of interest displayed by France and Spain in any but the continental aspects of the war, explains the languid nature of the movements at sea, for the greater part of the war at any rate.

It was believed in England that the Spanish colonies had only to be attacked to be captured, and a plan was laid for conducting combined operations against them from east and west. One force, under Admiral Vernon, was to attack them in the West Indies, while another, commanded by Commodore, afterwards Lord Anson was to fall upon the Pacific Coast. Delays and bad administration caused the failure of a hopeful scheme. In Nov. 1739 Vernon did succeed in capturing Porto Bello, but he had to wait a long time for the reinforcements necessary for an attack on Cartagena which was not carried out till March of the next year. The delay had given the Spanish admiral time to prepare, and Vernon was further handicapped by the near approach of a French force, the neutrality of which, in view of the growing hostility between England and France, could not be relied on, and by some impatience of, if not incapacity for, combined operations. He was thus unable to give his undivided attention to Cartagena, as he would have liked, with the result that the siege failed, and the war in the West Indies, except for isolated instances, died down till 1748. Anson also suffered from the effects of maladministration. His ships numbered six only and were ill-found. He left England in Sept. 1740 and returned in July 1744 with the "Centurion," carrying his broad pendant, alone. His other ships had either failed to round the Horn or had been lost, but he himself had harried the west coast of Spanish America, captured an immensely rich Spanish treasure-ship near the Philippines, and circumnavigated the globe.

In the meantime a Spanish fleet which was to conduct an army to Italy was fitting out at Cadiz whence it sailed and joined with a French squadron under M. de Court (Dec. 1741). This combined fleet was shortly faced by a British squadron which had failed to blockade the Spaniards in Cadiz, and which now hesitated to attack when the French admiral, though England and France were not yet at war, declared that he would support his Spanish allies, if necessity arose. The combined fleet eventually put into Toulon, where they were watched by a British squadron, while England and France gradually drifted into war, the declaration of which was actually anticipated by a collision between the fleets. As England regarded herself more and more as the ally of Austria, feeling against the French naturally increased, and the cutting of communications between Toulon and north Italy thus became a matter of more urgent necessity. So when M. de Court was ordered out of Toulon in Feb. 1744 to maintain these communications, the British admiral, Thomas Mathews, decided to attack him. The subsequent battle was most unsatisfactory from the British standpoint. Lestock, the second-in-command, who was on bad terms with Mathews, failed to engage the enemy, afterwards alleging that his commander's orders were contradictory and incomprehensible. After damaging the British, the Allies broke off the action, and such a storm of dissension broke out amongst the former that the vital issues in the Mediterranean became obscured by a multitude of courts martial.

In the same month the French tried to put into effect an invasion scheme which had been prepared in consultation with Jacobite leaders. Like many others, it failed, though on this occasion the omens were more than usually favourable. A French force of 20 sail actually got to sea before the British fleet in the channel was ready to meet it, but the winter gales militated against success, and the French admiral was without correct knowledge of his adversary's whereabouts. He came up nearly as far as the Downs, but finding himself faced by Admiral Norris, with a fleet of 25, he immediately retreated, and nothing further was heard of the military expedition waiting for his protection at Dunkirk.

At this time the British were joined by the Dutch (an accession to their naval strength that was welcome but not large) and

in 1745 Commodore Sir Peter Warren, with Sir William Pepperrell and an American volunteer force, conducted highly successful combined operations against Louisburg in Cape Breton Isle, capturing it, and thus threatening the French position in Canada. Unfortunately, as a set-off to this, in the East Indies Mahé de la Bourdonnais, making vigorous use of a small squadron to which the British opposed no very effective resistance, captured Madras (1746), and made the British position in India exceedingly uncomfortable, while in the same year a British combined naval and military expedition, which was to attempt the capture of the French East India Company's dockyard at L'Orient, failed to attain its object. In the closing years of the war, however, England made better use of her opportunities. A closer watch was kept on communications between France and her American possessions, which led to two successful sea-fights off Finisterre in 1747, which did something to atone for the earlier failures. In May Anson, with 14 ships, met a French convoy protected by a force of similar size, but including some inferior ships, under La' Jonquière. Most of the convoy escaped under cover of night, but Anson, chasing the protecting ships, accounted for them all. In October Admiral Sir Edward Hawke, who had first attracted notice by capturing the only prize at Toulon, now in command of 14 ships, came upon another French convoy, protected by Admiral L'Entenduère with nine battleships. The French admiral ordered the convoy to scatter, while he attempted to cover their retreat. Hawke, signalling the general chase, came up with him and sank or took six of his battleships. The merchant ships escaped, but arrived unprotected in the West Indies where the British were on the look-out for them, acting on information sent out by Hawke. Most of them were captured. These disasters convinced the French of their helplessness at sea, and they made no further effort.

The last naval operations of the war took place in the West Indies where the British and Spanish were trying to intercept one another's trade, while protecting their own, the former being particularly anxious to seize the richly-laden homewardbound convoys of the latter, and to break through their monopoly. In the course of such movements an English squadron under Sir Charles Knowles encountered a Spanish force under Admiral Regio in the Bahama Channel (Oct. 1748), and a somewhat indecisive action followed in which Knowles could claim the advantage. Had he been able to follow up this partial success with vigour, Spanish trade might have found itself in an unpleasant position, but he was prevented from this by the news that peace had been signed in Europe. England could claim to have established a definite superiority at sea, but unfortunately this was counter-balanced by France's conquests in India and her military successes in Flanders, while from Spain hardly anything had been taken. England handed over Louisburg in exchange for Madras, and the French evacuated the Netherlands.

This war was remarkable for privateering activity carried on at home and in more distant waters by all the naval belligerents. It may be true that the total number of captures by the French and Spanish exceeded those of the British who had not yet begun to enforce the use of convoy as strictly as they did later, but Voltaire's remark (that there were more British ships to capture) may also supply a reason for this state of affairs. Anyhow, it is certainly true that large numbers of French and Spanish were taken (especially after the battles of Finisterre) including a very fair total of French battleships, the capture of which led to a distinct improvement in ship-building in England after the war.

The War of the Austrian Succession should not be left without at least a reference to Anson's reforms. This administrative genius was appointed to the Admiralty on his return from his voyage round the world. The first-fruits of his efforts may be seen in the two battles of Finisterre. It was fitting that he should have been in command at one of them himself.

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(G. A. R. C.; J. G. B.)

AUSTRIC LANGUAGES. Conformities in vocabulary, phonetics, word-formation (prefixing, infixing), in the (post-) position of the genitive in the inclusive and exclusive forms of the pronoun, and others, demonstrate the genetic relation of the Austronesian to the Austroasiatic Languages. By omitting the differentia specific to the two main divisions Schmidt termed them the "Austric Languages." They stretch from the Western Himalayas to Easter Island in the Pacific. A. Conrady would relate this widespread family of languages to the Indo-Chinese family and he adduces interesting evidence in support of his contention.

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AUSTROASIATIC LANGUAGES. This family of languages must once have extended over nearly all Indo-China and the north-east of India.

Structure. — The phonetic system is very simple. It contains the three simple explosives with their spirants and nasals, besides a sort of cerebral. Final sounds may be vocalic and (one–)consonantic; also as medial sounds consonants—save muta cum liquida—are rather frequently inadmissible.

Suffixes—save in the Munda Languages and the Nicobarese—are completely missing. All the simple consonants except *n,* y, *r* may form suffixes the functions of which are, however, not yet fully ascertained. The prefix may be augmented by infixing a (secondary) nasal (n, *nt,* n) or a liquid *(r, l).* The (primary) infixes which even invade the stem of the word are characteristic: *n* for the forming of instrumental substantiva and abstracta and adjectiva—in the Nicobarese of a comparative; *p* and *m* for forming abstracts of the action—in Santali also of superlativa; *m* for the forming of substantives of the actor, of participles and adjectives.

All languages place the genitive after the word to be defined snd consequently use possessive suffixes. The Munda Languages now place the genitive before—but use possessive suffixes—due to their being influenced by the Dravida and Tibeto-Burman Languages surrounding them. The accusative of the objective substantive is placed after the verb.

Some of these languages have a plural and a dual in the personal pronoun; with some of the languages the plural seems to be an ancient trial. Munda, Nicobarese, Bahnar discriminate in the first person plural (dual) between inclusive and exclusive.

The grammar and syntax of these languages is of the utmost simplicity.

The main groups are

(1) Older Malacca Group: Semang, Sakai (Senoi).
(2) South-eastern Mixed Group: Cam, Rade, Djarai, Sedang, Raglai.
(3) South-eastern Flank Group (Mon-Khmer): Mon (Peguan); Khmer (Cambodgian); Bahnar; Moi-dialects; Bersisi, Jakun.
(4) Central Group: Nicobar; Wa, Palong, Riang; Khasi.
(5) North-western Flank Group (Munda): Eastern Group, Santali, Mundari, Bhumij, Birhar, Koda, Ho, Turi, Asuri, Koura; Western Group, Kurku, Kharia, Juang and the mixed languages Savara, Andaba.

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AUSTRONESIAN LANGUAGES. The name "Malayo-Polynesian languages" was applied to this family of languages by W. von Humboldt in his work, *Ueber die Kawi-Sprache auf der Insel Java* (2 vols., Berlin, 1836, 1839). But when the affinity of the Melanesian languages was ascertained, W. Schmidt in his treatise *Die sprachlichen Verhältnisse Ozeaniens, . . .* in ihrer *Bedeutung für die Ethnologie* (Vienna, 1899, p. 32 ff.), applied the collective term "Austronesian languages" to the languages of this vast area. The Polynesian languages have arisen from a certain group of the Melanesian languages, those of the central Solomon islands among others. The Melanesian languages for

their part are descendants of the Indonesian languages, distinguishable from them on the one hand by phonetic decay, petrification of the pre- and in-fixes, and reduction of the syntax; on the other hand by innovations chiefly in a more copious formation of numeri with the personal pronoun. The rise of the Polynesian from the Melanesian languages continued and completed this process, especially by reduction of the phonetic system. Thus we are here dealing with a regressive development starting from the Indonesian languages through the Melanesian languages to the Polynesian languages—a development effected by the fact that the dark-skinned ulotrichous Melanesians were different from and much more primitive than the Indonesians.

General Characteristics.— All Austronesian languages use post-position of the genitive and are therefore in substance prefix languages, and use prepositions; suffixes are considerably rarer. Only on the Little Sunda islands and the Moluccas, on the coasts of New Guinea and in some languages of New Britain and the Solomon islands preposition of the genitive is found in consequence of a blending with the Papuan languages (formerly and now) native there. The first person plural (dual, trial) has an inclusive form (if the person addressed is included) and an exclusive form (if he is excluded). The Indonesian languages use in word-formation, declension and conjugation an amply developed system of pre- and in-fixes that is petrified almost everywhere in the Melanesian and Polynesian languages.

Indonesian Languages.— The Indonesian languages are divided into a greater western group and a smaller eastern group. The western group comprises the Malagasy and a northern division and a southern division. To the northern division belong: Formosan, Philippine languages (Tagalog, Bisaya, Ilokano, Igorot Biko, etc.), Chamorro (Marian islands), Pelew, Sangir (northeast Celebes). To the southern division belong: Malay, Batak, Nias, Madura-Bali, Makassar-Bugis, Mentawei-Engano; Java, Sunda, Dayak; Toradja, Bimba-Sumba. The eastern group contains the languages of the Little Sunda islands and the Moluccas: Sikka, Tettum, Kupong-Galoli (East Flores), Solor, Rotti, Kisser, Letti, Watubela, Aru, Kei, Ceram.

Melanesian Languages.— The Melanesian languages are divided into a southern group: New Caledonian, Loyalty islands, Aneityum, Eromanga; a central group: New Hebrides, Banks islands, Fiji, southern Solomons; a northern group: northern Solomons, New Britain, Admiralty islands, Santa Cruz; Micronesian languages: Caroline islands, Yap, Ponape, Gilbert islands, Marshall islands, Nauru; languages mixed with Papuan: Barriai. Kilenge, Mengen (New Britain), Mono, Uruava, Torau (South Bougainville), coast languages of New Guinea; transitory languages: South coast of New Guinea, central New Hebrides, central Solomon islands.

Polynesian Languages.— The Polynesian languages are divided into a western group with the languages of Fakaafo, Futuna, Samoa, Tonga, Uvea, Niue and an eastern group with the languages of New Zealand (Maori), Mangarewa, Marquesas islands, Rarotonga, Hawaii.

See W. Schmidt, *Die Sprachfamilien und Sprachenkreise der Erde* (Heidelberg, 1926, p. 144–146); S. H. Ray, *Comparative Studies in the Melanesian Island Languages* (Cambridge, *1926*).

AUTHENTIC, genuine (from Gr. *αὐθέντης*, one who does a thing himself), true or original. In music it is one of the terms used for the ecclesiastical modes. The title of *Authentics* was also used for Justinian's *Novellae.*

AUTHOR. In its widest sense the word means an originator; in practice it connotes a writer of original books or articles. The author's calling, as distinct from the scribe's, was recognized from very remote times in the community. There is a reference in the *Apocrypha* (II. Maccabees) to "the first author of the story," and Egyptian and Chinese literature takes the record an era farther back. The status of the author or, as Dr. Johnson has it, "the *first* writer of a book," in the sense of an originator or creative agent, is not always clear, as compared with the scribe's or copyist's, but his higher function and fuller responsibility are distinctly indicated. In China, towards the end of the 3rd century B.C., Huang-ti, "the Napoleon of China," not only ordered all books without exception to be destroyed, but all authors of books to be put to death. This was not, however, a reactionary step. It came of the intense conservatism of the scholars and authors who were the depositaries and the rigid maintainers of the ancient tradition. They had resisted Huang-ti's reforms, and he swept them away, and the caste of the *literati* perished with them. But the cult of the past was too ingrained to be destroyed. The Sacred Books were recovered from men's memories, and rewritten; and the name of Huang-ti became an author's byword in China. The story of this massacre in the 3rd century B.C. may have reached these shores and helped to foster the legend of Edward I.'s massacre of the Welsh bards, as recited in Gray's poem.

Among the Celtic peoples the official recognition of the bards was partly based on their service as rhyming chroniclers and keepers of the old tradition, or of the family or tribal records, quite apart from their more original function. As a class, jealous of their rights, they even sought legal powers in Wales to put down any irregular followers of their art, with a touch of the jealousy shown by Shakespeare's contemporary, who spoke of him as "an upstart crow beautified with our feathers." But the honour paid to the scholars and bards and even the scribes in ancient Britain and Ireland marks an implicit reverence for learning and a sense of a high tradition to be observed and reinforced by the old writers, as is shown in the title, The *Book of the Four Masters.*

The author's rights and his pride in his craft, with a suspicion of caste feeling in the background, were vigorously asserted on the Elizabethan stage. Ben Jonson's play *The Poetaster,* under the disguise of the Latin poets, and with his rival Dekker satirized as the literary cobbler Crispinus, turns from "poet apes" to the true authors whom "envy" wishes to put down. In this satire occurs what is probably the first use of the phrase "to damn the author."

In what is sometimes called the Augustan age of English literature, when poet or proseman had to resort to a titled patron for the backing needed to produce a book, he was apt to sink his corporate sense in his individual need and personal ambition. We catch echoes of this petitioner's suit and self-assertion in the prefaces and dedications of Dryden, in Swift and in Pope, in the allusions to my lord's ante-chamber and to Grub street (now Milton street by a strange conversion). Among the writers who mark the signs of a coming change were Daniel Defoe and Dr. Johnson. The change was when the patronal gave way to the popular support of the author.

That came with the enlarging of the audience, when at the end of the 18th century Burns's songs won a national hearing; when at the opening of the 19th century Walter Scott and Byron captured the fashionable public; when again the Waverley Novels prepared the way for the Victorian novelists, Dickens and Thackeray.

Dickens himself was a stout maintainer of the author's rights and legal sanctions. He was one of the first to insist on international copyright.

Dickens reminds us that the novel, which is not the highest form of the author's art, has done more than any other to win him both his market price and his public honour. But the full recognition was not won without a struggle, the evidences of which are to be traced in the corporate activity of such bodies as the Society of Authors (*q.v.*), the P.E.N. Club and the Royal Society of Literature. (E. RH.)

AUTHORS, SOCIETY OF. The Incorporated Society of Authors, Playwrights and Composers, founded in 1884, is a British institution which, embracing all authors as the term "author" is defined in the British Copyright Act, guards them in the protection of their property, and advises them of the various markets at their disposal. The details of a contract for publishing a book, for producing a play, for the sale of a serial, or for the purposes of cinema production, are exceedingly technical; the members are advised on all these things. The society also keeps itself informed as to the cost of production of books, etc., as this point is constantly arising. Of the various literary and dramatic agencies, the society has intimate knowledge, and advises upon their status and value. With representatives all over the world, the

society can protect its members in respect of infringements of copyright. In legal disputes, the society takes action in suitable cases at its own expense. This alone costs the society between £1,000 and £2,000 a year. In 1928 the society had 4,000 members.

In the United States the official national organization of authors, artists, dramatists and screen writers is known as The Authors' League of America, Inc. It was organized in 1912, to procure adequate copyright legislation, both international and domestic; to protect the rights and property of all those who create copyrightable material of whatever kind or nature; to advise and assist all such in the disposal of their productions and to obtain for them prompt remuneration therefor; to disseminate information among them as to their rights and remedies. Any author of any kind, dramatist, artist, composer or scenario writer of recognized position in his or her profession may be admitted to the league upon proper application duly approved by the membership committee. The term "recognized position in his or her profession" is intended to include all who regularly earn money in, and make a business of, such profession. Membership in 1939 was approximately 4,000.

AUTOBIOGRAPHY, as the suggestive nomenclature of Southey implies, is the biography of a person written by himself. Its motivations are various—among others self-scrutiny for self-edification; self-justification, as Cardinal Newman's beautifully written *Apologia pro Sua Vita* (1864); a nostalgic desire to linger over enchanting memories, as Selma Lagerlof's *Marbäcka* (1922); belief that one's experiences may be helpful to others, as Helen Keller's *The Story of My Life* (1903); an earnest attempt to orient self amid a world of confusion, as *The Education of Henry Adams* (1906); the urge for artistic expression; or the purely commercial desire to capitalize on fame or position.

Naturally the emphases and contents are equally varied although apparently in harmony with the age—in the epoch that saw Paganism crumbling before Christianity, spiritual struggles in the book by which the genre passed beyond embryonic stages. th *Confessions* of St. Augustine; in the lusty, beauty-loving, adventurous Renaissance the swash-buckling *Life of Benvenuto Cellini* with autobiographical glints in the dramatic narratives of explorers or the Platonic love revealed. for example, by Dante in the *Divine Comedy* and *Vita Nuova;* in Puritan England, John Bunyan's *Grace Abounding to the Worst of Sinners* and Milton's noble self-dedicatory sonnets; in the cynical 18th century, the shameless *Mémoires* of the Italian adventurer Casanova or the practical ascent of Benjamin Franklin. From that emotional pot-pourri, Romanticism, came one of the most influential of all autobiographies, the candid *Confessions* of Jean Jacques Rousseau, as well as Goethe's popular autobiographical romance *Die Leiden des jungen Werthers,* the romantic impulse being reflected, too, in the latter's *Aus Meinem Leben, Dichtung und Wahrheit.* In the 19th century some of the most distinguished autobiographies continued to be by men of letters, as Tolstoi, Dostoievski, or Ruskin, although the new science was mirrored in Thomas Huxley's brief self-description, the new political economy in J. S Mill's *Autobiography,* the changing spheres of women in the brilliant *Journal* of Maria Bashkirtseff, and military exploits in the *Personal Memoirs of U S. Grant* or the records revolving around Napoleon.

Perhaps nothing so dramatically illustrates the extraordinary diversity of modern life as the *mélange* of autobiography that has poured from the presses in the 20th century—by captains of industry, as Carnegie or Henry Ford; by men of letters, as Rudyard Kipling or Henry James; by artists in other fields, as Isadora Duncan, Paderewski, George Arliss, Eva Le Gallienne; by professional men. as Axel Munthe or A. E Hertzler in his popular *Horse and Buggy Doctor;* by social crusaders, as Jane Addams, Lillian Wald, Brand Whitlock, Kagahwa, and Lincoln Steffens. Aviation is reflected in C. A. Lindbergh's *We;* exploration in Byrd's *Little America;* nature study in W H. Hudson's *Far Away and Long Ago* or John Muir's *Story of My Boyhood and Youth.* Gandhi wrote *The Story of My Experiments with Truth,* and Hitler preluded his thrust for world dominion nith the fateful *Mein Kampf*

In the United States are several distinctive types—the immigrant autobiography such as Mary Antin's *The Promised Land;* that resulting from race problems, as Booker T. Washington's *Up from Slavery* (1901); or those inspired by the advancing frontier, as Hamlin Garland's colourful *Son of the Middle Border.*

Valuable social panoramas as these recent books present, no student can fail to feel, however, that their popularity has intensified the frailties inherent in the form. Reticences and obligations of position are cast aside; ghost writers are employed in a lucrative type of literary forgery. In time these excesses will bring about their own correction; but at present they seern to lend some justification to George Bernard Shaw's generalization, "All autobiographies are lies."

Meanwhile, among all nations, as long as the capacity for hero worship endures, as long as human beings desire to draw near to other souls, as long as they wish vicariously to broaden experience, the narrative of another's life at first-hand by himself will remain one of the most popular literary forms.

BIBLIOGRAPHY.—A. R. Burr, *The Autobiography* (1909); *A. M.* Clark, *Autobiography* (1935); G. Bradford, "Biography by Mirror" in his *Biography and the Human Heart* (1932); *E. S.* Bates, *Inside Out* (1937). *(D.* **A. D.)**

AUTOCEPHALOUS (from Gr. *αὐτός,* self, and *κεφαλή,* head), of independent headship, a term used of certain ecclesiastical functionaries and organizations.

AUTOCHTHONES, sons of the soil, the original inhabitants of a country as opposed to settlers (Gr. *αὐτός,* self, and *χθών,* earth; Lat. *terrigenae*). The idea that they were *autochthones* was *a* great source of pride to the Athenians, who wore golden grasshoppers (unless *tettiges* means pins for fastening it) in their hair in token that they were born from the soil and had always lived in Attica (Thucydides i. 6). So also, in Thebes, the race of *Spartoi* were believed to have sprung from a field sown with dragons' teeth *(see* ABORIGINES).

AUTOCLAVE, a strong closed vessel of metal in which liquids can be heated above their boiling points under pressure. Etymologically the word indicates a self-closing vessel (*αὐτός,* self, and *clavis,* key, or *clavus,* nail), in which the tightness of the joints is maintained by the internal pressure, but this characteristic is frequently wanting in the actual apparatus to which the name is applied. The prototype of the autoclave was the digester of Denis Papin, invented in 1681, which is still used in cooking, but the appliance finds a much wider range of employment in chemical industry, where it is utilized in various forms in the manufacture of candles, coal-tar colours, etc.

Frequently an agitator, passing through a stuffing-box, is fitted so that the contents may be stirred, and renewable linings are provided in cases where the substances under treatment exert a corrosive action on metal

AUTOCRACY, a term applied to that form of government which is absolute and vested in one single person (from Gr. *αὐτός,* self, and *κράτος,* power).

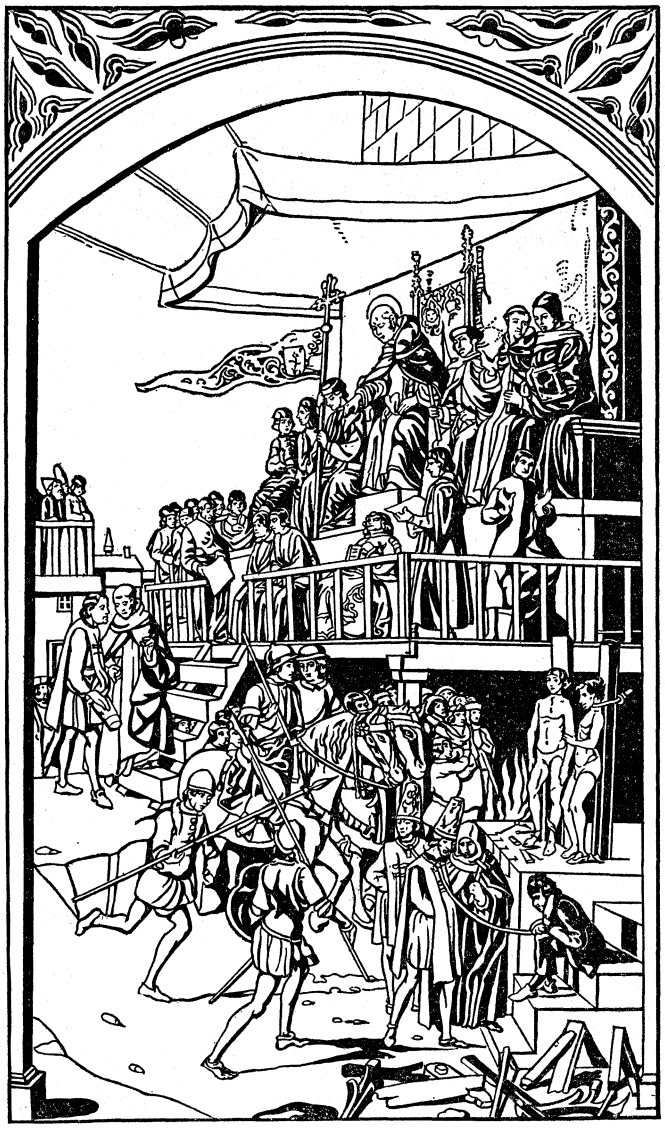
AUTO-DA-FE, more correctly AUTO-DE-FE (act of faith), the name of the ceremony during the course of which the sentences of the Spanish inquisition were read and executed. The ceremony comprised-a procession in which the members of the Holy Office, with its familiars and agents, the condemned persons and the penitents took part; a solemn mass; an oath of obedience to the inquisition, taken by the king and all the lay functionaries; a sermon by the Grand Inquisitor; and the reading of the sentences, either of condemnation or acquittal, delivered by the Holy Office. The handing over of impenitent persons, and those who had relapsed, to the secular power, and their punishment, did not usually take place on the occasion of an auto-da-fé, properly so called. The first great auto-da-fés were celebrated when Thomas de Torquemada was at the head of the Spanish inquisition (Seville 1482, Toledo 1486, etc.). The last, subsequent to the time of Charles III., were held in secret, and dealt with only a small number of sentences. *See* illustration on next page.

AUTOGAMY (from Gr. *αὐτός,* self, and *γαμία,* marriage), a botanical term for self-pollination. *(See* ANGIOSPERMS.)

AUTOGENY, AUTOGENOUS, spontaneous generation, self-produced. In "autogenous soldering" two pieces of metal are united by the melting of the opposing surfaces, without the use of a separate fusible alloy or solder as a cementing material. (*See* ABIOGENESIS.)

AUTOGIRO: see GYROPLANE.

AUTOGRAPHS. Autograph is a term applied by common usage either to a document signed by the person from whom it emanates, or to one written entirely by the hand of such person (which, however, is also more technically described as *holograph*), or simply to an independent signature. The object of the present article is to differentiate between collections of original manuscript



FROM "THE LEGACY OF ISRAEL." BY PERMISSION OF THE CLARENDON *PRESS*

AUTO-DA-FÉ, AFTER A PAINTING OF ABOUT A.D. 1500 IN MADRID

A contemporary Picture showing the ceremony with which the sentences of the Inquisition were executed. The Grand Inquisitor enthroned with members of the Holy Office, presides, and the sentences of condemnation are carried out in his Presence. A stake with victims about to be burnt is shown at the right. (See descriptive article on page preceding.)

material, the values and interest of which may be, on the one hand, literary and historical, and on the other, mainly personal.

The series of original documents which were gathered in such a library as that of Sir Robert Cotton, now in the British Museum, found their way thither on account of their literary or historic interest, and not merely as specimens of the handwriting of distinguished men. Such a series also as that formed by Philippe de Béthune, Comte de Selles et Charost, and his son, in the reign of Louis XIV., consisting for the most part of original letters and papers, now in the Bibliothèque Nptionale, might have been regarded as the result of autograph collecting did we not know that it was brought together for historical purposes. Such collections are necessarily of the greatest importance and carry back their origin to the early years of national hislory, ever adding to their numbers as auxiliary to the public records

To turn to the other extreme and seek the origin of personal autograph collecting, we find, perhaps to our surprise, that that pursuit also has its claim to antiquity. We read that it was in Germany and the Low Countries that the practice appears to have originated, chiefly among students and other members of the universities, of collecting autograph inscriptions and signatures of friends in albums, *alba amicorum,* little oblong pocket volumes of which a considerable number has survived from the latter half of the 16th century. A fair collection is in the British Museum. In one of these little *alba* we discover an entry by the poet, John Milton, who doubtless fell a victim to an importunate member of a university.

The fate of the original manuscripts of the works of great authors is an interesting subject of study and there is none of greater interest than that of Shakespeare. We deplore the loss of all the original manuscripts of his plays and poems; and even of his authentic signatures there are only six that can be accounted for. It is no doubt a fact that he set no great store by his draft manuscripts, and there is sufficient literary evidence that in some instances at least he entrusted them to the "stationers" whom he employed to publish them. Of the signatures only five were known down to a quite recent date, two being subscribed to the purchase and mortgage deeds of a house in Elackfriars, London, in 1613, and three being attached to the three separate sheets of his will, in 1616. The sixth signature was discovered as recently as 1910 in the Public Record Office. It is attached to a deposition in a lawsuit in 1612. The literary importance of the signatures is that they are written in the Old English hand which Shakespeare was taught when a boy at school in Stratford, and that he employed the English hand down to the end of his life, having never learned to use the new Italian script which was coming into general use among the better educated classes in England. The most celebrated collection formed in England in recent years is that of the late Mr. Alfred Morrison, which still remains intact, and which is well known by means of the sumptuous catalogue, with its many facsimiles, compiled by the owner.

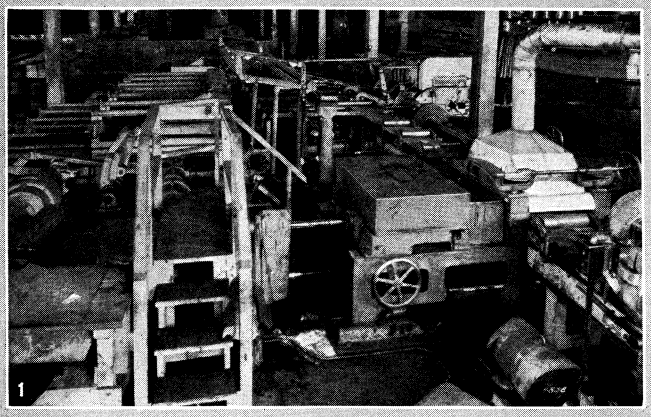
There are many published collections of facsimiles of autographs of different nations. Among those published in England the following may be *named:— British Autography,* by J. Thane (1788–1793, with supplement by Daniell, 1854); *Autographs of Royal, Noble, Learned and Remarkable Personages in English History,* by J. G. Nichols (1829); *Autographs of the Rings and Queens and Eminent Men of Great Britain,* by J. Netherclift (1835); *One Hundred Characteristic Autograph Letters,* by J. Netherclift and Son (1849); *Facsimiles of Original Documents of Eminent Literary Characters,* by C. J. Smith (1852); *The Autograph Miscellany, by* F. Netherclift (1855); *The Handbook of Autographs,* by *F. G.* Netherclift (1862); *The Autograph Souvenir,* by *F. G.* Netherclift and R. Sims (1865); *The Autographic Mirror* (1864–66); *The Autograph Album* by *L. B.* Phillips (1866). Facsimiles of autographs also *at* last appear in official publications, *Facsimiles of National mss. from William the Conqueror to Queen Anne* (Master of the Rolls) (1865–68); *Facsimiles of National mss. of Scotland* (Lord Clerk Register) (1867–71); *Facsimiles of National mss. of Ireland* (Public Record Office, Ireland) (1874–84); and *Facsimiles of Autographs* (British Museum publication), five series (1896–1900). (E. M. T.)

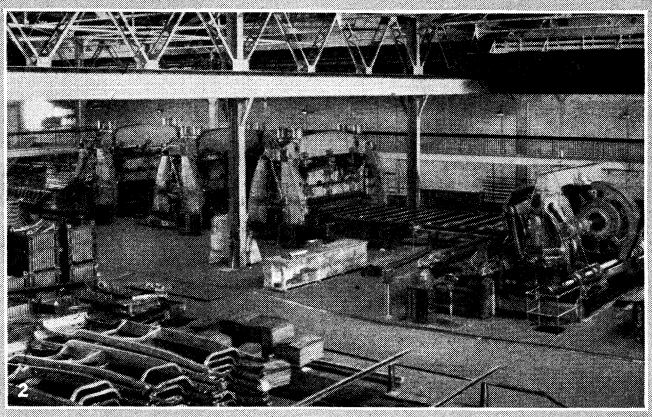
AUTOLYCUS, in Greek mythology, the father of Anticleia, mother of Odysseus. Later authors make Hermes his father. He lived at the foot of Mt. Parnassus, and was famous as a thief and swindler. On one occasion he met his match. Sisyphus, who had lost some cattle, suspected Autolycus of being the thief, but was unable to bring it home to him, since he possessed the power of changing everything that was touched by his hands. Sisyphus accordingly burned his name into the hoofs of his cattle and, during a visit to Autolycus, recognized his property. It is said that on this occasion Sisyphus seduced Autolycus's daughter Anticleia and that Odysseus was really the son of Sisyphus, not of Laertes, whom Anticleia afterwards married. The object of the story is to establish the close connection between Hermes, the god of theft and cunning, and the three persons— Sisyphus, Odysseus, Autolycus—who are the incarnate representations of these practices.

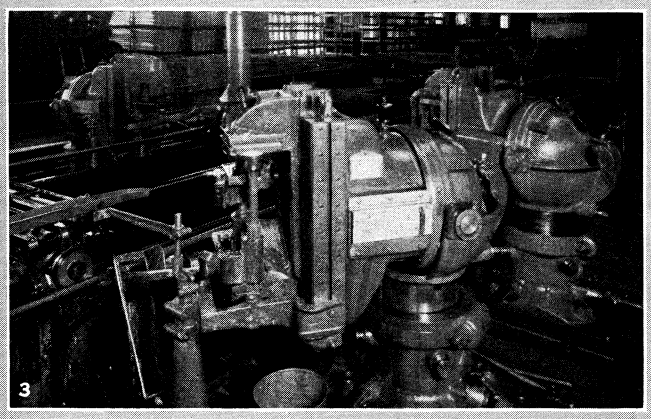
See *Odyssey,* xix. 394; Ovid, *Metam.* xi. 313; Apollodorus i. 112; ii. 63; Hyginus, *Fab.* 201.

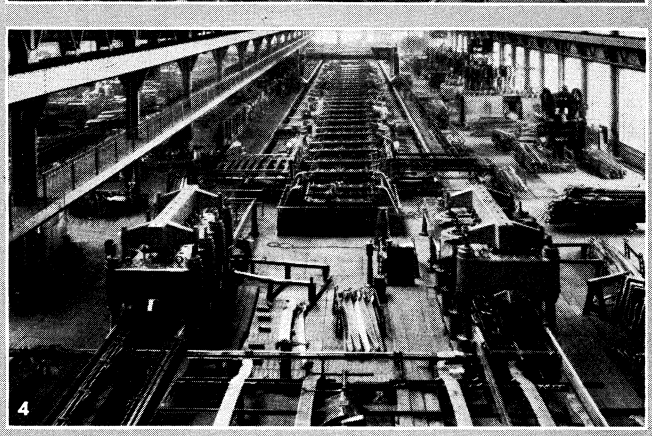
AUTOLYCUS, of Pitane in Aeolia, Greek mathematician and astronomer, flourished about 310 B.C. His extant works are: *Peri Kinoumenēs Sphairas,* the oldest Greek mathematical treatise

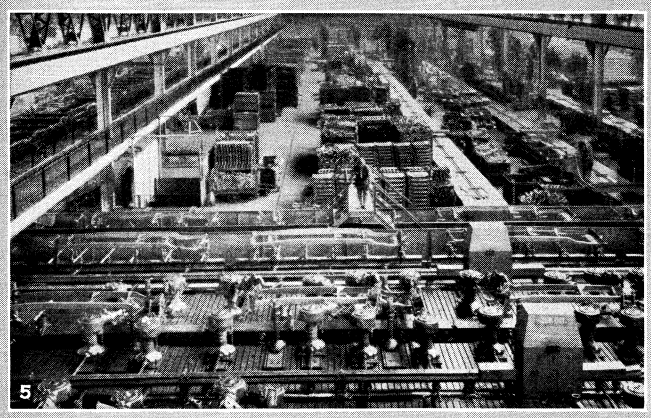
AUTOMATIC MACHINES

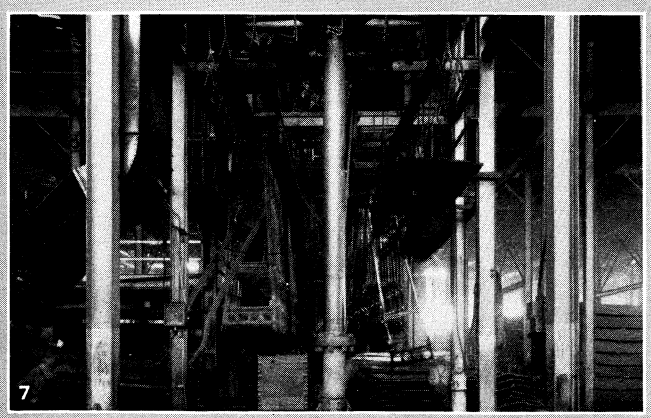


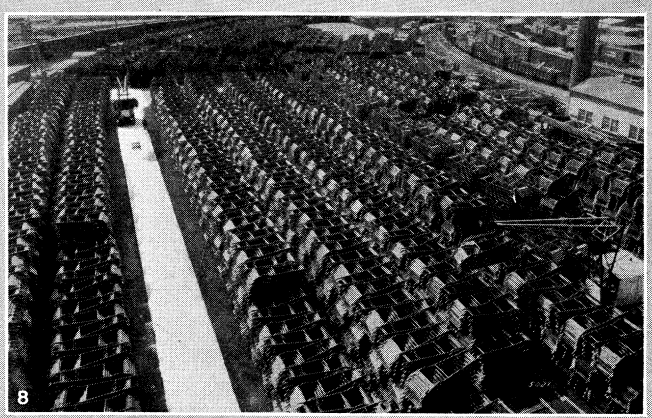










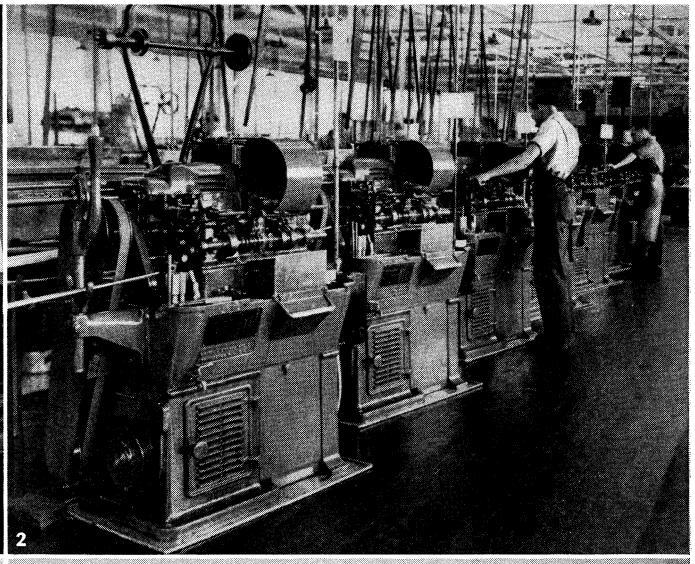


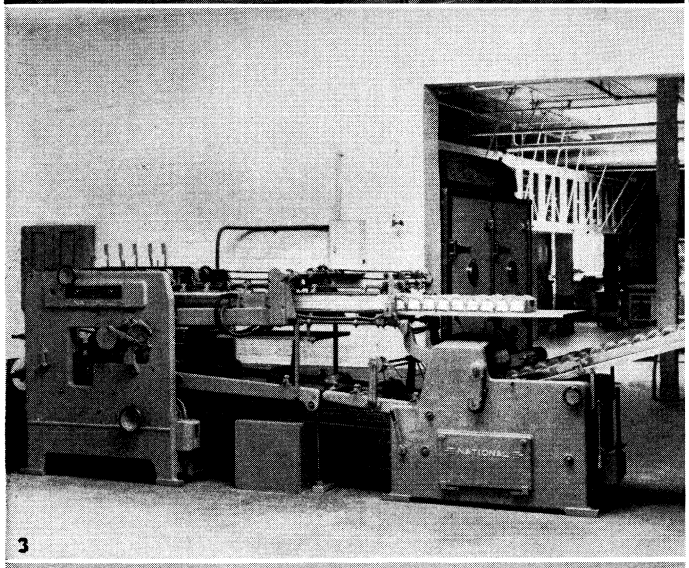
BY COURTESY OF THE A. O. SMITH CORPORATION

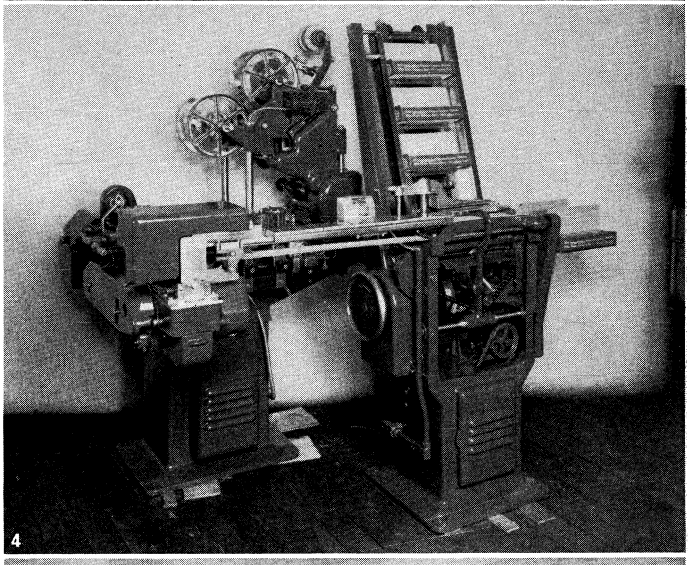
AUTOMATIC MACHINERY USED IN MODERN PLANTS OF TOOL AND PRESSURE MANUFACTURES

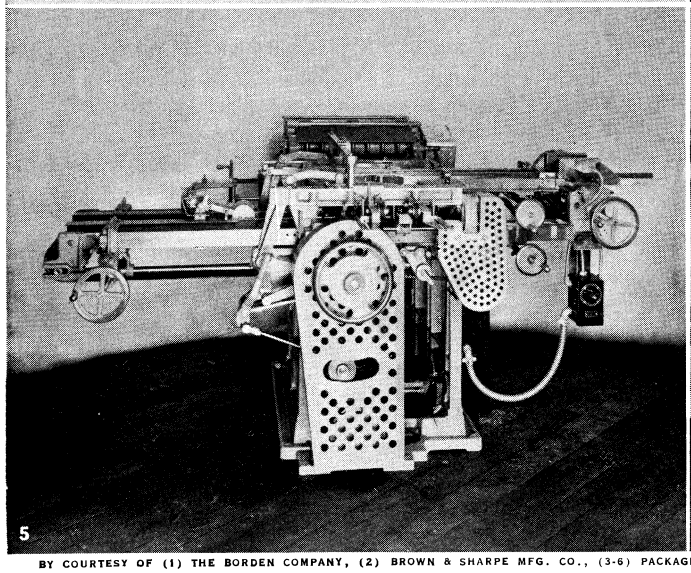
1. Automatic Inspection Machine for strip steel
2. Four of the six presses in the Side Bar Line
3. End Clipping Machine along the Side Bar Parts Assembly Line
4. Side Bar Parts assembly line with the two forming presses in the foreground
5. Portion of the General Assembly in the foreground and cross Bar lines in the distance
6. Complete view of the General Assembly with the Nailing Machine in the background
7. The Automatic Frame Painting Machine
8. The outside Frame Storage with room for 135,000 frames

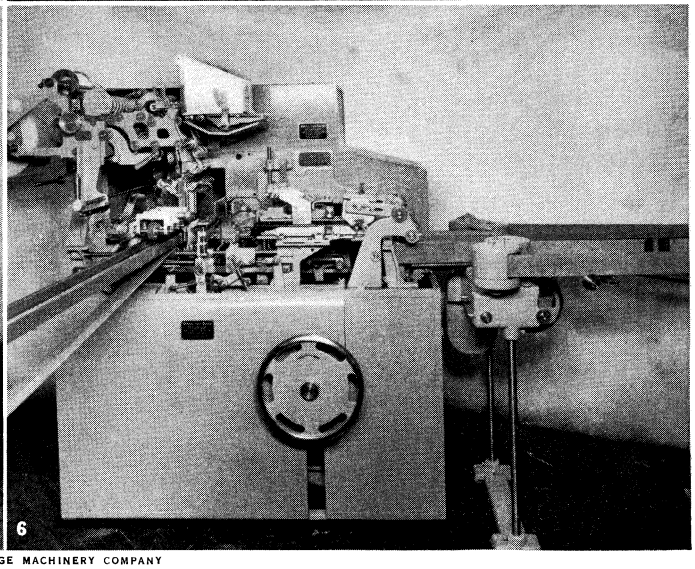
AUTOMATIC MACHINES











BY COURTESY OF (1) THE BORDEN COMPANY, (2) BROWN & SHARPE MFG. CO., (3-6) PACKAGE MACHINERY COMPANY

VARIOUS TYPES OF AUTOMATIC MACHINERY

1. A bottle-filling machine. As the milk bottles emerge from the washing apparatus (left) they pass on a conveyor to the filling machine, where they are filled, capped and sealed automatically
2. Automatic screw machines for making complete screws, studs and other turned parts from bar stock
3. Combination bread slicer and wrapper. One operator standing in the same position can feed the slicer and receive the wrapped loaves from the delivery end of the wrapper
4. Automatic machine which wraps individual packages of cigarettes in cellophane with an easy-opening tape, then assembles the packages into groups of ten and places them in cartons
5. Adjustable automatic machine for packaging many differenr kinds of articles
6. High-speed machine for wrapping soap tablets and other similar articles

preserved to us entire, which contains some simple propositions on the motion of points on the sphere and its circular sections; and *Peri Epitolōn kai Duseōn,* which treats of the apparent rising and setting of the fixed stars. The former is interesting for the light it throws on the development of the geometry of the sphere even before Autolycus and Euclid. *(See* THEODOSIUS.)

AUTOLYSIS: *see* PATHOLOGY.

AUTOMATIC MACHINES, machines which function throughout their cycle of operation without the intervention of human effort. Special types are used in many industries for two main reasons; to reduce the necessity for manual labour and to secure uniformity of product. The rapidity with which automatic machines are developed and used depends largely on the cost and quantity of manual labour available. This is shown by the relatively slow introduction of special types of automatic machines into countries where labour is cheap, and the wide-spread use of such machinery where the wage rate is high, as in the United States. The great advantages of uniformity of parts lie in the saving of labour in assembling parts together and in repair work, and so is also closely related to the general wage level.

Machines can be designed and built to perform any operation normally done by hand. Some movements are difficult and require intricate and costly mechanisms. But given an output sufficiently large and labour costs high enough, the machine will be forthcoming. Unfortunately the designer and builder rarely profit to nearly the same extent as the user of the machine, unless the machines are leased, either on royalty or at a fixed charge per month or per year.

Automatic machines are now in use in nearly all industries, from the making of food products to the forming and machining of fairly heavy metal parts. Notable and interesting examples are to be found in the making of parts of watches and clocks (*q.v.*), cigarettes (*q.v.*) and in the wrapping of such products as chewing gum, soap and safety razor blades. Incidentally, the razor blades themselves are punched, ground, tempered and sharpened in machines that are almost entirely automatic. In some industries such as flour milling, automatic or semi-automatic machinery has almost entirely replaced human labour. Few men are to be seen, even in the flour mills producing hundreds of barrels of flour per day. Recent steel mills also have machinery so nearly automatic that many men are relieved of much of the back-breaking labour that was formerly necessary.

Classification.— The term automatic is rather elastic as applied to machinery and is, or should be, divided into two main classes, semi-automatic and full automatic. Nor is this distinction always definite. Full automatic machines are usually considered to be those to which the material is fed in bulk, as long bars, strips or reels of metal; or semi-finished material in quantities, as screw blanks or similar parts. The latter are generally dumped into some kind of a hopper to be fed to the machine for slotting, threading, turning or grinding in the case of metals; or tobacco and paper are fed into a machine to issue as finished cigarettes packed in boxes ready for shipment. Soap and hundreds of other products are handled in a similar manner. Semi-automatic machines require the material to be fed to or placed in the machine and removed from it, but all the mechanical operations are performed by the machine without further manual assistance.

The full automatic machines are much more intricate and require greater care in designing. This is largely because of the mechanism required to feed the material into the machine, to hold it firmly while the operations are being performed, and then release, or even eject the finished piece so as to make room for the next cycle of operations. When the work is to be performed on plain bars or rods that can be fed through the work spindles; in punch presses where the material can be fed through the machine in strips; in textile machines where the yarn or thread is continuous, the feeding mechanism is comparatively simple. But the problem is far from simple where the machine must pick up pieces of paper, as in an automatic job printing press, place them on the platen, and remove them at the proper time and pile them suitably; or pick up a safety razor blade, place it in the grinding machine correctly, so that the edges will be ground at the proper angle; pass it to another machine which automatically strops it and then finally to the machine that wraps it in waxed paper, without touching the sharpened edge in any way. In this sort of work, suction cups are frequently used to pick up flat pieces.

Another intricate problem is the sorting of screws, pins, etc., so as to insure their going into the machine in the correct position. These are usually dumped into a hopper which must sort them and direct them, singly, into the chute or slide that feeds them into the machine itself.

Special Types.— Automatic machines are usually made especially for different industries and frequently for different firms in the same industry. Some, such as the Jacquard loom, printing presses both of the job and web types, screw machines, etc., are of fairly wide application. But machines, such as those for bending wire into specially designed safety-pins, or for other purposes, are frequently designed and built solely for a single firm. In one such case, back in the old "hook and eye" days, one designer found it necessary to use a jet of air to blow the hooks away from the machine, as they would not fall rapidly enough of their own weight, to clear the machine. In this machine, a sheet of paper and a roll of wire were fed into it, the fasteners formed, fastened to a card, the cards stacked one dozen to a box, which was wrapped, sealed, and the distinctive name printed thereon, no one in the mean time touching the machine or a part of the product.

The same basic principles, however, are frequently applied to widely varying materials and purposes, but often in a strikingly similar manner. An excellent example of this similarity is to be found in the machines for making lead pipe bends or "traps" for plumbers, and those which turn out "elbow" macaroni for large food product manufacturers. Although there is a vast difference in the material used and in the size of the product, both machines are identical in principle. Both extrude a plastic material (lead or dough) in the same manner and control the flow of material in such a way that more is fed to the outside of the bend, forcing the extruded tube to assume the desired shape. When the curve is completed both materials are automatically cut off in the same way.

One of the most important points in designing automatic machinery is in securing the proper sequence of the different motions and the requisite time between the different movements. In "timing" the movements the designer must consider the time consumed in moving the work, the tools or the fingers into position, the actual time of the operation itself, and of moving the tools out of the way and replacing the completed work with a piece that is unfinished. Every movement of this cycle must be carefully laid out, both to avoid the loss of time and prevent the interference of various movements. Designers who have been brought up in this line of work follow the various steps from force of habit, but a novice will spend much time in studying out the next move.

Elements of Design.— Automatic machines are not confined to any size or class of work. And yet all may be said to operate on basically the same principles. *Levers, screws, gears* and *cams* properly arranged and connected in suitable combinations, are the heart of all automatic machinery. With suitable methods of stopping any movement at the proper time, and all parts interconnected so that each will perform its operation in proper sequence, machines are built that seem unbelievably human in their action.

As an example of how some of these various elements are combined in actual machines we show an outline of the movements of a type of riveting press used in the huge automobile frame-assembling plant of the A. O. Smith company in Milwaukee (for photographs of this plant *see* Plate I.), taken from the patent specifications. Starting with the electric motor *A* (fig. 1) we follow the drive through the pinion and gear to the worm B, which drives the disk C by means of the worm-wheel, in the direction of the arrow. The disk carries the crankpin *D* and the cam slot E. Crank D drives the connecting rod F and the crank-arm G, that rocks about the shaft H. To the right of *H* is another small crank I that moves the ram J of the press up and down for heading the rivets in the frame. Simultaneously the lower part, or anvil K, moves up and down so as to head the rivets and return to

the open position at the proper time. The movements of the anvil are effected by the cam slot *E* in which is a roller at L, in the end of lever M. This lever, being pivoted at N, moves the wedge (or cam) *O* under the plunger supporting the anvil *K*, and so raises and lowers it at the proper time under control of the cam slot *E*. By following the revolution of the disk *C*, it will be seen that before the riveting ram J gets far on its down stroke, the wedge *O* has raised the anvil *K* into the position shown. The cam holds the wedge in this position until the ram J has headed the rivet and then withdraws the wedge for a little more than half the revolution of the disk *C*. During this time, the ram J is being raised and the next frame is being set in position for riveting. This is only one of many mechanisms in this huge assembling machine, a description of which may be found below; but it shows one application of all the elements, if we consider the worm B as a screw, which it really is. Similar combinations of these four elements will be found in most of the modern types of automatic machines.

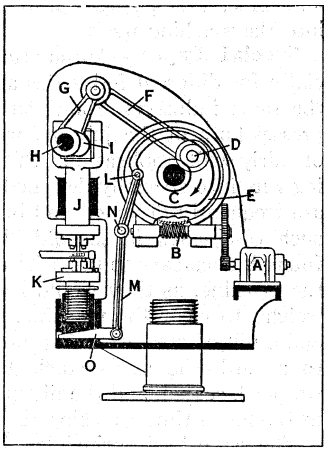


FIG 1.—RIVETING PRESS

Automobile Frame Assembly.—Let us follow the flow of steel through the A. O Smith company's plant on its two-hour journey, during which the heavy piles of strip steel are changed into enameled, precision motor car frames at the rate of one every 10 seconds. The strip steel, made to exacting specifications, is picked up from the cars by monorail cranes and shot through an automatic inspection machine *(see* Plate **I**, fig. 1) at the rate of 900 pieces per hour. Besides being straightened, the length, width, thickness and curvature of the strips is checked up and any piece found defective is automatically thrown out. The entire unit performs without human assistance and the passed blanks, in piles of predetermined size, are delivered to monorail cranes, which move them on to the pickling machine. Here the steel is received in special crates of five tons capacity, which are handled through the different baths by means of a crane operated with remote control. Following pickling, the strip stacks are again picked up by monorail cranes and over ingenious rail systems moved into the manufacturing building and deposited at the feed-ends of the two main assembly lines

Two types of parts going to make up a frame are side-rails and cross members. Due to their different peculiarities and lengths, they each have a separate system of machinery leading to the far end of, the building where one large unit takes care of the final assembly.

Let us first follow the side-rails. The pickled steel entirely handled by conveyors passes through the side bar press line *(see* Plate **I.**, fig. 2) with its four operations. First, the straight strip is *kicked up* in order to as nearly as possible follow the desired contour of the side-rail. Next, the numerous rivet holes, gauge-points and other openings are pierced, separate presses for right and left hand rails being required. Next there operates a single blanking press which trims the blanks, whereupon two more presses take care of the forming operation, *i.e.,* the folding up of flanges to obtain the conventional channel section. The feeding and unloading of each of these presses is done entirely automatically, and all the movements are timed and synchronized in a single unit, which does not require labour at any point. The side-rails are automatically deposited in crates, which move to the next unit by crane.

Before the side-rails can be assembled into a frame, there still remains a great deal of work to be done on them. A number of spring hangers, brackets and other attachments must be riveted on; but first the ends must be clipped *(see* Plate **I.**, fig. 3) off and certain holes drilled and reamed with extreme accuracy. This is done in the single large unit called the "side-bar parts assembly" *(see* Plate **I.**, fig. 4). Right and left hand bars are handled in pairs simultaneously, and loaded on to trucks automatically. The assembly is about 350ft. long, has 38 trucks and 19 stations, at each of which adjustable automatic machines are performing the various operations required. The finished side-bars are automatically removed from the trucks at the end and inspected before being delivered to the adjacent general assembly unit.

Going back to the point where the strip steel enters the manufacturing building, the steel intended for cross members is deposited by the monorail cranes at the loading ends of four crossbar finishing lines *(see* Plate **I**, fig. 5). Each of these is equipped with blanking, piercing and forming presses, very similar to, although smaller than, corresponding machines for the side-bar press line described above. Like them, the crossbar presses are fed automatically and all handling is done with automatic machinery.

Following the press-line is a continuation, which has a purpose similar to the above mentioned side bar parts assembly line. However, much less work has to be done on crossbars, requiring proportionally less space. At the end, the finished crossbars arrive at the general assembly unit in a manner similar to the side-bars.

The general assembly performs two important functions and does both automatically. It collects all the required parts for the frame, assembles them and puts in all the rivets *(see* Plate **I.**, fig. 6), finally *setting* each rivet by forming the rivet heads, as was described above. One conveyor system with trucks called the hand-loader line takes care of the first function. A so called *nailing machine* assembles the frame and puts in the rivets, while another conveying system equipped with other trucks handles the last function of riveting. All three sub-units are synchronized and operated with one single motor.

When the frame is stripped off its truck at the discharging end, it is delivered to the painting machine. On a conveyor, running the full length of the building, it travels back to storage. While on the way, it is carefully inspected and if any part is missing or defective, it is side-tracked, fixed up on a special repair line and then sent on its way again.

Arriving in the storage building *(see* Plate **I.**, fig. 7) it first has to pass through a washing machine where grease, dirt, etc., is thoroughly removed in a special automatic machine, using hot alkali solution. Clean and dry it is delivered to the *painting machine,* where, hung, one close to the other on an endless chain, the frames slowly pass through and special lacquer paint is sprayed on at the rate of 75gal. per minute; they pass through an oven which bakes the paint, then through a cooling chamber, emerging. after one to 1½ hours as a finished product *(see* Plate I., fig. 8).

A few examples of automatic machinery as used in other industries will give a good idea of the extent to which machinery is replacing human labour in nearly all lines of work. The folding of men's collars, for example. is done on a Sweet and Doyle machine that foids collars to the desired shape, after they have been cut from the cloth at the rate of 12 collars per minute in regular production.

Milk, now sold almost exclusively in bottles, is handled by machinery from the time it leaves the cow—some dairies even employing mechanical milking machines. The milk and cream are separated by centrifugal machines, both are cooled by mechanical refrigerators, and they are bottled in a machine known as the Elgin, which handles 12 bottles of milk simultaneously. The bottles are carried on a conveyor, stop long enough to be filled, and are then replaced by the next 12 bottles.

From here they travel on a conveyor to the capping machine, where the name of the dairy and the date of bottling is stamped on the cap.

The bottles are sealed at the rate of 50 per minute.

Cigars are made on a machine at the average rate of 480 per hour, the exact speed depending on several factors, such as the shape, size and quality of the cigar. This machine accomplishes all the manufacturing processes such as measuring and feeding the filler leaf into the machine, applying the binder, forming the "bunch," wrapping with the proper kind of tobacco and trimming to length.

Bread Baking.--Automatic machines have been designed which mix dough, cut it into uniform pieces and feed it into the

oven, through which it is carried in exactly the right time to be properly baked, being then received as a loaf from the oven, all without contact with human hands The loaf is then ready to be wrapped by automatic machinery. One machine of the latter type receives the loaf, slices it, and wraps it in properly-labelled wax paper or cellophane. A single operator, standing in one position, can feed the loaves into this machine and receive them from the delivery end.

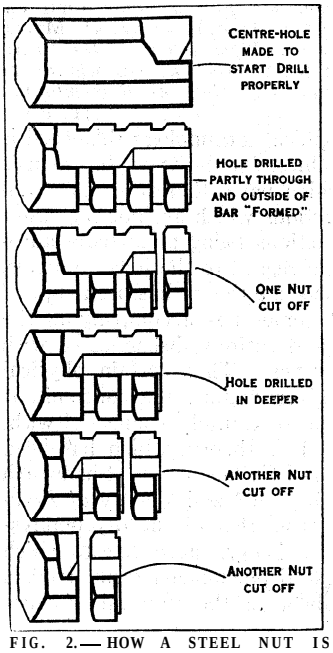
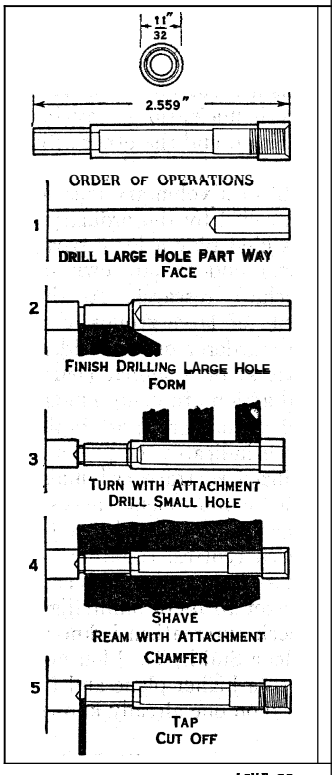


FIG. 2.—HOW A STEEL NUT IS MADE EVERY FIVE SECONDS ON A SIX-SPINDLE AUTOMATIC SCREW MACHINE

Machine Tools.—A good example of automatic mechanism as applied to a standard type of machine tool is seen in the Pratt and Whitney automatic lathe shown in Plate I., fig. 8. This is for what is known as second operation work, where a previous operation has been necessary to prepare jobs for this machine. The pieces to be turned are stacked in the vertical magazine at the back, this being done by hand, although it could be done automatically if the labour-costs warranted. At the proper time, the feed slide below the pile of work moves back so that the lowest piece in the slide can drop into the notches in front. The next forward movement of the slide carries the piece to the centre of the lathe and holds it while the tail canter forces it into position for driving from the live spindle. Next, the tools move into position for cutting and are fed forward the desired distance The piece is then released, and the tail stock centre recedes, the finished piece drops out of the way and the cycle is repeated.

A typical example of a multiple spindle automatic screw machine is a machine known as the National-Acme, five-spindle machine capable of handling $\frac{9}{16}$in. material through the work spindles. In this machine are five of these spindles and five tools at work, with a correspondingly large output. The indexing time is short, owing to a rapidly accelerating indexing movement. This machine is driven by a 5 h.p. motor running at 1,800 revolutions per minute and has a net weight of over **3,000** pounds The spindle speed can be varied from 1,050 to 2,885 revolutions per minute. The production range is from 355 to 2,880 pieces per hour, depending on the character of the work.



BY COURTESY OF THE NATIONAL ACME CO

FIG. 3.—SEQUENCE DRAWING SHOWING DIFFERENT STEPS IN TURNING OUT A TELEPHONE PLUG

An idea of the way in which the work is divided between the five spindles may be had by studying fig. 3. This shows the finished piece at the upper left with its principal dimensions. The other illustrations show the work performed at tach tool station. It should be remembered that all five of these operations are in process at the same time on material which is in each of the five work spindles. The first tool is a drill that goes in about $\frac{1}{3}$ of the length of the piece. The next station completes the large hole and at the same time a tool in the cross slide forms the neck at the end. The outside is next turned, using three tools so that only one-third the tool travel will be required. At the same time a high speed drilling attachment drills the small hole clear through the piece and leaves a centre beyond the cutting-off point. The outside is then finished with form or shaving tools in the cross slide,

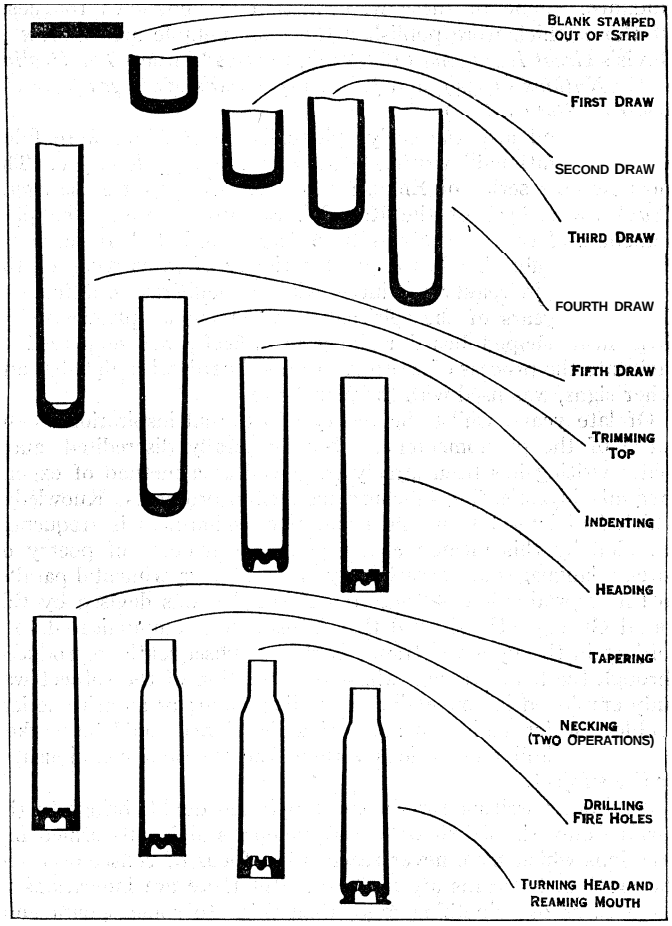


FIG. 4.—VARIOUS OPERATIONS IN MAKING A CARTRIDGE CASE

and the hole reamed to secure the desired size. The large hole is also chamfered. The last spindle taps the hole in the end and as soon as the tap has backed out the cutting-off tool comes in and separates the finished piece from the bar. The small drill has left a centre for starting the large drill on the next cycle of operations performed on the same bar of stock.

There are, of course, many more types of special automatic machines, but these will serve to show some of the developments and to bear out the statement that automatic machines can be designed and built for duplicating any human motion. In the machine-tool field there are comparatively few strictly automatic machines, if we consider this term as meaning those in which the work is fed to the machine without human assistance. Many machines are called automatic which perform their cycle automatically after the work has been put in place and the machine started by the operator. Such machines run their cycle and stop when it is completed. But they do not unload, reload and start again without attention from the operator as a strictly automatic machine should do (*See* MACHIKE-TOOLS.) (F. H. C.)

AUTOMATIC TRAIN (CONTROL: **see** RAILWAYS.

AUTOMATIC WRITING, the name given by students of psychical research to writing performed without the volition of the agent. The writing may also take place without any consciousness of the words written; but some automatists are aware of the word which they are actually writing, and perhaps of two or three words on either side, though there is rarely any clear perception of the meaning of the whole. Automatic writing may take place when the agent is in a state of trance, spontaneous or induced,

in hystero-epilepsy or other morbid states; or in a condition not distinguishable from normal wakefulness. Automatic writing has played an important part in the history of modern spiritualism. The phenomenon first appeared on a large scale in the early days (c. 1850–60) of the movement in America. Numerous writings are reported at that period, many of considerable length, which purported for the most part to have been produced under spirit guidance. Some of these were written in "unknown tongues." Of those which were published the most notable are Andrew J. Davis's Great Harmonia (1851–52), Charles Linton's *The* Healing of the *Nations* (1854), and J. Murray Spear's Messages from tlze *Superior* State (1852).

In England also the early spiritualist newspapers were filled with "inspirational" writing—Pages of *the* Paraclete, etc. The most notable series of English automatic writings are the Spirit Teachings (1894) of the Rev. W. Stainton Moses. The phenomenon, of course, lends itself to deception, but there seems no reason to doubt that in the great majority of cases recorded the writing was in reality produced without deliberate volition. In the earlier years of the spiritualist movement a "planchette," a little heart-shaped board running on wheels, was employed to facilitate the process of writing. A ouija board, with alphabet and other signs, was used with the planchette.

Of late years, whilst the theory of external inspiration as the cause of the phenomenon has been generally discredited, automatic writing has been largely employed as a method of experimentally investigating subconscious mental processes. Knowledge which had lapsed from the primary consciousness is frequently revealed by this means; *e.g.,* forgotten fragments of poetry or foreign languages are occasionally given. An experimental parallel to this reproduction of forgotten knowledge was devised by Edmund Gurney. He showed that information communicated to a subject in the hypnotic trance could be subsequently reproduced through the hand-writing, whilst the attention of the subject was fully employed in conversing or reading aloud; or an arithmetical problem which had been set during the trance could be worked out under similar conditions without the apparent consciousness of the subject.

Automatic writing for the most part, no doubt, brings to the surface only the débris of lapsed memories and half-formed impressions which have never reached the focus of consciousness—the stuff that dreams are made of. But there are indications in some cases of something more than this. In some spontaneous instances the writing produces anagrams, puns, nonsense verses and occasional blasphemies or obscenities; and otherwise exhibits characteristics markedly divergent from those of the normal consciousness. In the well-known case recorded by Th. Flournoy (*Des Indes à* la *planète* Mars) (1900) the automatist produced writing in an unknown character, which purported to be the Martian language. The writing generally resembles the ordinary handwriting of the agent, but there are sometimes marked differences, and the same automatist may employ two or three distinct handwritings. Occasionally imitations are produced of the handwriting of other persons, living or dead. Not infrequently the writing is reversed, so that it can be read only in a looking-glass (*Spiegel*schrift); the ability to produce such writing is often associated with the liability to spontaneous somnambulism. The hand and arm are often insensible in the act of writing. There are some cases on record in which the automatist has seemed to guide his hand not by sight, but by some special extension of the muscular sense (W. P. Carpenter, Mental *Physiology,* 4th ed. 1876, $128; W. James, Proceedings American S.P.R., 1885–89).

Automatic writing frequently exhibits indications of telepathy. The most remarkable series of automatic writings recorded in this connection are those executed by the American medium, Mrs. Piper, in a state of trance (Proceedings S.P.R.). These writings appear to exhibit remarkable telepathic powers, and are thought by some to indicate communication with the spirits of the dead.

The opportunities afforded by automatic writing for communication with subconscious strata of the personality have been made use of by Pierre Janet and others in cases of hystero-epilepsy, and other forms of dissociation of consciousness. A patient in an attack of hysterical convulsions, to whom oral appeals are made in vain, can sometimes be induced to answer in writing questions addressed to the hand, and thus to reveal the secret of the malady or to accept therapeutic suggestions.

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AUTOMATISM. In philosophical terminology this word is used in two main senses: (1) in ethics, for the view that man is not responsible for his actions, which have, therefore, no moral value; (2) in psychology, for all actions which are not the result of conscious endeavour. Certain actions being admittedly automatic, Descartes maintained that, in regard to the lower animals, all action is purely mechanical. The same theory has been applied to man, with this difference that sometimes accompanying the mechanical phenomena of action, and entirely disconnected with it, are the phenomena of consciousness. Thus certain physical changes in the brain result in a given action; the concomitant mental desire or volition is in no sense causally connected with, or prior to, the physical change. This theory, which has been maintained by T. Huxley (Science and Culture, 1881), Shadworth Hodgson (Metaphysic of Experience, 1898 and Theory of Practice, 1870), must be distinguished from that of the psychophysical parallelism or the "double aspect theory," according to which both the mental state and the physical phenomena result from a so-called "mind stuff" or single substance, the material or cause of both.

Automatic acts are of two main kinds. Where the action goes on while the attention is focused on entirely different subjects (*e.g.,* in cycling), it is purely automatic. On the other hand, if the attention is fixed on the end or on any particular part of a given action, and the other component parts of the action are performed unconsciously, the automatism may be called relative.

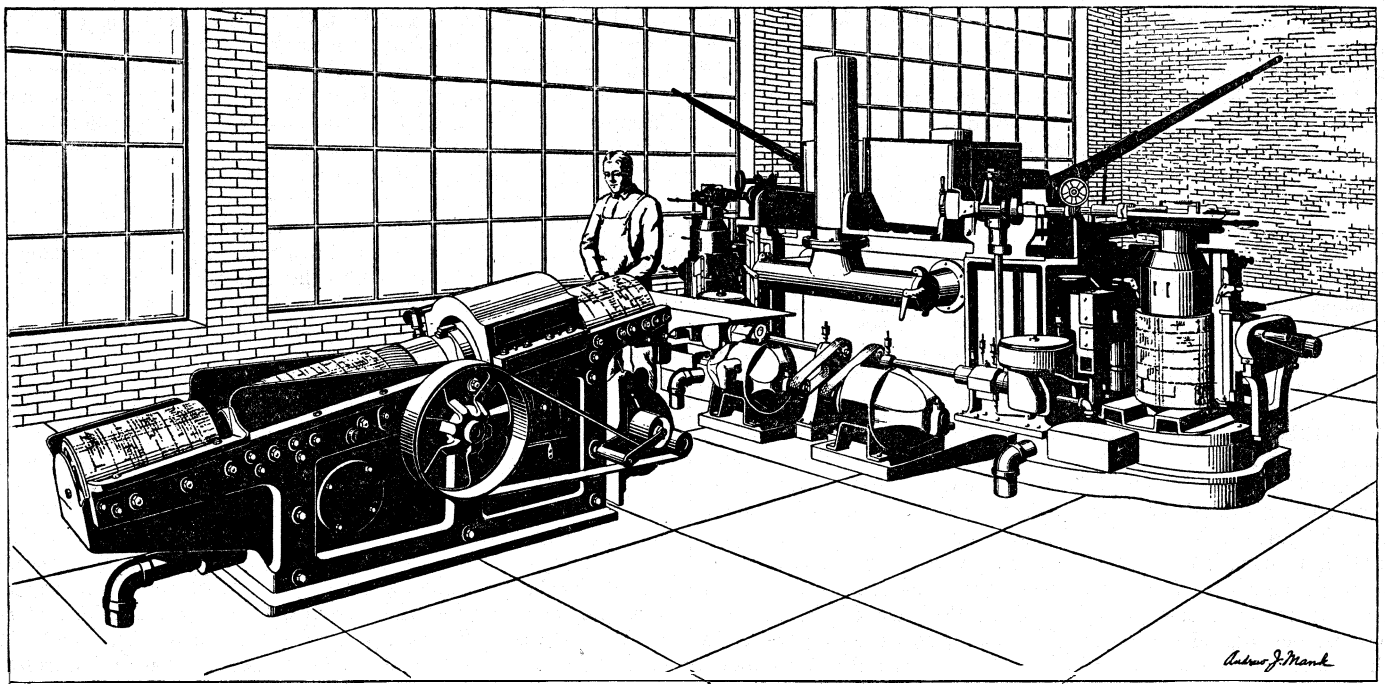
Sensory Automatism is the term given by students of psychical research to a centrally initiated hallucination. Such hallucinations are commonly provoked by crystal-gazing (*q.v.*), but auditory hallucinations may be caused by the use of a shell (shell-hearing), and the other senses are occasionally affected.

Motor *Automatism,* on the other hand, is a non-reflex movement of a voluntary muscle, executed in the waking state but not controlled by the ordinary waking consciousness. Phenomena of this kind play a large part in primitive ceremonies of divination (*q.v.*) and in our own day furnish much of the material of psychical research. At the lowest level we have vague movements of large groups of muscles as in "bier-divination," where the murderer or his residence is inferred from the actions of the bearers; of a similar character but combined with more specialized action are many kinds of witch seeking. These more specialized actions are most typically seen in the Divining Rod (*q.v.*), which indicates the presence of water and is used among the uncivilized to trace criminals. At a higher stage still we have the delicate movements necessary for Automatic Writing (*q.v.*) or Drawing. A parallel case to automatic writing is the action of the speech centres, resulting in the production of all kinds of utterances from trance speeches in the ordinary language of the speaker to mere unintelligible babblings. An interesting form of speech automatism is known as Glossolalia; in the typical case of Helene Smith, Th. Flournoy has shown that these utterances may reach a higher plane and form a real language, which is, however, based on one already known to the speaker.

(N. W. T.)

BIBLIOGRAPHY.—W. James, Principles of Psychology, vol. i. (1890); F. W. Myers, Proc. S.P.R., ix. (1894), xii. (1897), xv. (1901); and Human Personality (1903); Th. Flournoy, Des *Indes à* la *planète* Mars (1900) and Archives de Psychologie, vol. i. (1902); G. F. Stout, Analytical Psychology, vol. i. (1902); Folklore, xiii. (1902); Man (1904). See articles PSYCHOLOGY; SUGGESTION.

AUTOMATON, a self-moving machine, or one in which the principle of motion is contained within the mechanism itself (Gr. αὐτός, self, and μάω, seize). The word is generally applied to contrivances which simulate the motions of animal life. If the



BY COURTESY OF THE WOOD NEWSPAPER MACHINE CORP.

DOUBLE JUNIOR AUTOPLATE AND AUTOSHAVER IN A MODERN NEWSPAPER PLANT

Curved stereotype printing plates, which are required for high-speed rotary newspaper presses, are cast in a curved form with the autoplate machine, shown at the right. The autoshaver, on the left, trims and shaves the curved stereotype to fit the plate cylinder of the Press

human figure and actions be represented, the automaton has sometimes been called an *androides*. In 400 B.C. Archytas of Tarentum is said to have made a wooden pigeon that could fly, and during the middle ages numerous instances of the construction of automata are recorded. Regiomontanus is said to have made of iron a fly, which would flutter round the room and return to his hand, and also an eagle, which flew before the emperor Maximilian when he entered Nuremberg. The Swiss have always been celebrated for their mechanical ingenuity, and they construct most of the curious toys, such as flying and singing birds, which are frequently met with in industrial exhibitions. Kempelen's famous chess-player for many years astonished and puzzled Europe. This figure, however, was no true automaton, although the mechanical contrivances for concealing the real performer were exceedingly ingenious. J. N. Maskelyne (1875–80) exhibited his automata, Psycho (who played cards) and Zoe (who drew pictures), at the Egyptian hall, London. (*See* CONJURING.) In the 20th century a number of automatons have been invented which, operated by remote electrical or mechanical control, perform many of the actions of a human being. One of the most ingenious the "Voder," demonstrated in 1939 at Philadelphia, was a device with "vocal cords" of vacuum tubes that reproduced vowels, consonants, and monosyllables. The operator, who used a keyboard and foot-pedal, produced whole sentences of human speech from the mechanism

AUTOMOBILE: *see* MOTOR CAR.

AUTOMORPHISM, the conception and interpretation of other people's habits and ideas on the analogy of one's own. (*See* APPERCEPTION.)

AUTONOMY, in general, freedom from external restraint, self-government (Gr. *αὐτός*, self, and *νόμος*, law). In philosophy, the term (with its antithesis "heteronomy") was applied by Kant to that aspect of the rational will in which, qua rational, it is a law to itself, independently alike of any external authority, of the results of experience and of the impulses of pleasure and pain. In the sphere of morals, the ultimate and only authority which the mind can recognize is the law which emerges from the pure moral consciousness. This is the only sense in which moral freedom can be understood. (*See* ETHICS; KANT.) Though the term "autonomy" in its fullest sense implies entire freedom from causal necessity, it can also be used even in determinist theories for relative independence of particular conditions, theological or conventional.

AUTOPLASTY, the repair of diseased or injured parts by pieces taken from another part of the same body. The practice is based on the fact that tissues transplanted to other portions of the same body will either continue to grow or will supply a framework to support the reparative tissue. It is especially valuable where there has been extensive destruction of skin. Here usually small pieces of healthy skin are placed on the raw surface. These become islets of growth and gradually enlarge so as to merge and so cover the area. Occasionally in cosmetic work about the face flaps are used which are still left partially attached to their original sites so as to ensure the blood supply. Pieces of bone, particularly from the readily accessible shin-bone, are used to help support the spine when it has been weakened by tuberculosis.

AUTOPLATE, a machine for rapidly and automatically casting curved stereotype printing plates for rotary presses. Before the invention of this machine by Henry A. Wise Wood in 1900, curved stereotype plates were produced by manual processes. The autoplate produces plates mechanically at a great saving of time, casting three or four newspaper-page size plates a minute.

A sheet of flong, a specially-prepared papier maché is laid over the locked-up page form with moulding blankets over it. The form, usually comprising type and photo-engravings, is forced into the flong under heavy pressure, producing a stereotype mat or matrix—a mould of the form.

Newspapers generally use "dry" mats, a development which speeded up the moulding of stereotype mats and thus made for faster production of newspapers.

The moulded mat is placed in a dryer in which it is shaped to the curve of the printing cylinder, and dried. The dried mat is then placed in casting position, and a charge of moulten stereotype metal is forced against the mat in the mould cavity. forming a curved printing plate by a single stroke of the autoplate pump.

After a lapse of a few seconds for solidification, the "tail" or extension formed during casting is cut off and the plate ejected. The cast plate is then transferred by hand to the autoshaver, in which the inside surface of the plate is shaved accurately, the plate cooled and delivered ready to be clamped on the printing cylinder of the press. (*See* PRINTING.)

AUTOPSY (syn. post-mortem, necropsy), the examination of a dead body with the object of determining the cause of death. This examination may be for legal purposes (*see* **CORONER** and

MEDICAL JURISPRUDENCE) or for the extension of knowledge. When autopsy is ordered by a coroner for legal purposes the relatives have no option, but in most instances of patients dying in hospitals, the consent of the relatives is sought and their decision, if negative, is rigorously observed.

There is great difference amongst nationalities with regard to post-mortem examinations. In the United States, in Catholic countries, amongst Jews and Irish there is great aversion towards autopsies, with the result that the advance of medical knowledge is seriously handicapped. In the absence of autopsy a diagnosis of the cause of death is in large measure an opinion as distinguished from a fact. Even a physician of the highest skill often finds in the post-mortem room that his diagnosis of the patient's disease during life needs rectification. The knowledge he obtains thus he applies in future cases to the advantage of those patients.

The performance of an autopsy calls for special knowledge and skill on the part of the pathologist, and, besides inspection of the various organs, microscopical, bacteriological and chemical methods are employed where necessary and a detailed report on the case supplements the clinical notes in the hospital records. The extent to which advance of knowledge depends upon post-mortem examination is hardly realized. Thus the entire range of cancer research depends upon an accurate diagnosis of cancer, which can only be made microscopically and, in the case of the internal organs, depends either on surgical operation or on autopsy. In their absence the diagnosis is at best conjectural. When post-mortem examination has been carried out by a skilled pathologist there is no disfigurement, and the feelings of the relatives are considered to the fullest possible extent.

AUTOTOMY, the term applied to the self-mutilation practised by certain animals as a means of escape from their enemies. Thus many Crustacea (crabs, lobsters, etc.) will break off a limb if grasped thereby. Amongst vertebrates many lizards will shed the posterior part of their tail when this is held. A new part is grown again in a comparatively short time.

AUTRAN, JOSEPH (1813–77), French poet, was born at Marseilles on June 20, 1813, and died in that city on March 6, 1877. His best known work is La *Mer* (1835). remodelled in 1852 as *Les Poèmes de la mer*. Another important work is his *Vie rurale* (1856), a series of pictures of peasant life. Among his writings is a tragedy, La *Fille d'Eschyle*, played with great success at the Odéon in 1848. A definitive edition of his works was brought out between 1875 and 1881.

AUTUN, a town of east-central France, capital of an arrondissement in the department of Saône-et-Loire, 62 mi. S.W. of Dijon on the P.L.RI. railway to Nevers. Pop. (1936) 13,716. It stands on the slope of a hill above the river Arroux. Autun (Augustodunum) succeeded Bibracte as capital of the Aedui when Gaul was reorganized by Augustus. Under the Romans it had twice its present area, and was renowned for its schools of rhetoric. Roman remains include the ramparts and aqueducts, a theatre and amphitheatre, a square tower and a sepulchral pyramid in the neighbouring village of Coubard. The counts of Autun were dukes of Burgundy from 880 till 1276. The chapel of St. Nicolas (12th century) contains many local antiquities. The cathedral of St. Lazare, once the chapel attached to the residence of the dukes of Burgundy, is in the highest part of the town. Mainly 12th century, the Gothic central tower and the chapels were added in the 15th century by Nicolas Rolin, chancellor of Burgundy, born at Autun. The group of the Last Judgment sculptured on the tympanum above the west door, and the painting by Ingres representing the martyrdom of St. Symphorien, which took place at Autun in 179, are noteworthy. In the cathedral square stands the Renaissance fountain of St. Lazare. The hôtel Rolin (15th century) contains the collections of the "Aeduan literary and scientific society." Autun is the seat of a bishopric, of tribunals of first instance and of commerce. Oil is extracted from the local bituminous schist; leather manufacture, metal-founding, the making of umbrellas, marble-working, and furniture-making are carried on. Autun is the commercial centre for a large part of the Morvan, and trades in timber, grain, horses, and cattle.

AUTUNITE or **CALCO-URANITE,** a mineral which is one of the "uranium micas," differing from the more commonly occurring torbernite (*q.v.*) or cupro-uranite in containing calcium in place of copper. It is a hydrous uranium and calcium phosphate, $Ca(UO_2)_2(PO_4)_2+8(\text{or } 12)H_2O$. Though closely resembling the tetragonal torbernite in form, it crystallizes in the orthorhombic system and is optically biaxial. The crystals have the shape of thin plates with very nearly square outline. An important character is the perfect micaceous cleavage parallel to the basal plane, on which plane the lustre is pearly. The colour is sulphur-yellow, and this enables the mineral to be distinguished at a glance from the emerald-green torbernite. Hardness 2–23; specific gravity 3·05–3·19. Autunite is usually found with pitchblende and other uranium minerals.

AUVERGNE, formerly a province of France, corresponding to the departments of Cantal and Puy-de-Dôme, with the arrondissement of Brioude in Haute-Loire. It contains many mountains volcanic in origin (Plomb du Cantal, Puy de Dôme, Mont Dore), fertile valleys such as that of Limagne, vast pasture lands, and numerous medicinal springs. The population still retains strongly marked Celtic characteristics. In the time of Caesar the *Arverni* were a powerful confederation, the Arvernian Vercingetorix being the most famous of the Gallic chieftains who fought against the Romans. Under the empire *Arvernia* formed part of *Prima Aquitania*, and the district shared in the fortunes of Aquitaine during the Merovingian and Carolingian periods. Auvergne was the seat of a separate countship before the end of the 8th century; the first hereditary count was William the Pious (886). By the marriage of Eleanor of Aquitaine with Henry Plantagenet, the countship passed under the suzerainty of the kings of England, but at the same time it was divided, William VII., called the Young (1145–68), having been despoiled of a portion of his domain by his uncle (William VIII., called the Old, who was supported by Henry II. of England), so that he only retained the region bounded by the Allier and the Coux. It is this district that from the end of the 13th century was called the *Dauphiné d'Auvergne*. This family quarrel occasioned the intervention of Philip Augustus, king of France, who succeeded in possessing himself of a large part of the country, which was annexed to the royal domains under the name of *Terre d'Auvergne*. As the price of his concurrence with the king in this matter, the bishop of Clermont, Robert I. (1195–1227) was granted the lordship of the town of Clermont, which subsequently became a countship. Such was the origin of the four great historic lordships of Auvergne. The *Terre d'Auvergne* was first an appanage of Count Alphonse of Poitiers (1241–71), and in 1360 was erected into a duchy in the peerage of France (*duché pairie*) by King John II. in favour of his son John, through whose daughter the new title passed in 1416 to the house of Bourbon.

The last duke, the celebrated constable Charles of Bourbon, united the domains of the *Dauphiné* to those of the duchy, but all were confiscated by the crown in consequence of the sentence which punished the constable's treason in 1527. The countship, however, had passed in 1422 to the house of La Tour, and was not annexed to the domain until 1615. At the time of the revolution it formed a *gouvernement*, with two divisions: Upper Auvergne (Aurillac), and Lower Auvergne (Clermont).

BIBLIOGRAPHY.—*See* B. Gonot, *Catalogue des ouvrages imprimés et manuscrits concernant l'Auvergne* (1894) ; André Imberdis, *Histoire générale de l'Auvergne* (1867) ; J. B. M. Bielawski, *Histoire de la comté d'Auvergne et de sa capitale Vic-le-Comte* (1868).

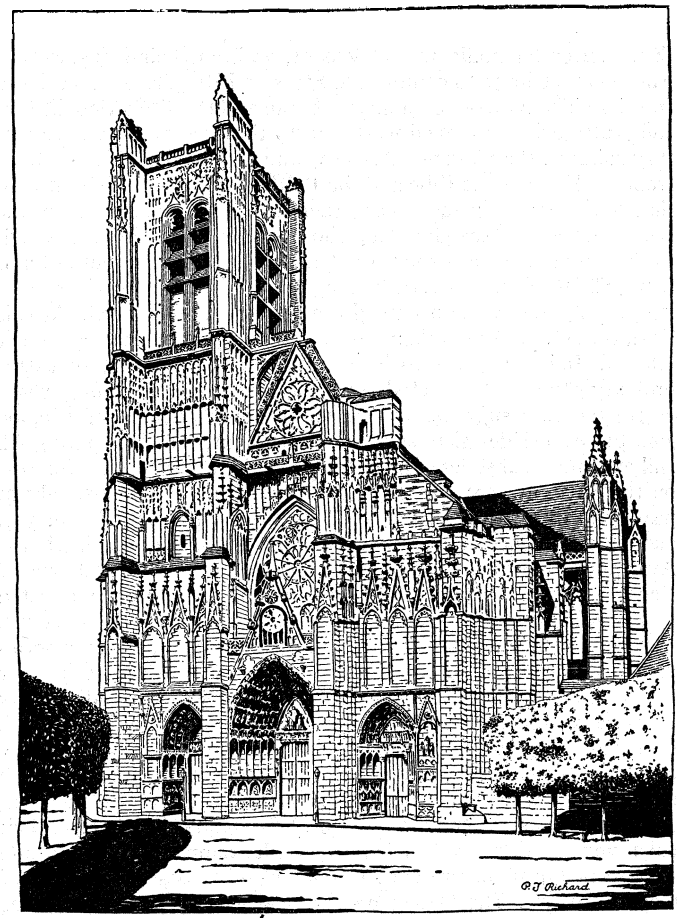
AUXENTIUS (fl. c. 370), of Cappadocia, an Arian theologian (*see* ARIUS).

When Constantine deposed the orthodox bishops who resisted, Auxentius was installed into the seat of Dionysius, bishop of Milan, and came to be regarded as the great opponent of the Nicene doctrine in the West.

When the orthodox emperor Valentinian ascended the throne, Auxentius was left undisturbed in his diocese, but his theological doctrines were publicly attacked by Hilary of Poitiers (*Liber contra Auxentium*, Benedictine edn.).

AUXERRE, central France, capital of the department of Yonne, 38 mi. S.S.E. of Sens on the P. L. M. railway, between Laroche and Nevers. Pop. (1936) 23,197. It stands on the left bank of the Yonne, which is crossed by bridges leading to suburbs.

Auxerre (Autessiodurum) became the seat of a bishop and a "civitas" in the 3rd century. Founded under the Merovingians, the abbey of St. Germain in the 9th century had become a seat of learning. The bishopric was suppressed in 1790. The countship of Auxerre was granted by King Robert I. to his son-in-law Renaud, count of Nevers. It passed by marriage to the house of Courtenay and thence to the families of Donzy, Châtillon, Bourbon and Burgundy. John IV. sold his countship to King Charles V. in 1370.



THE CATHEDRAL OF ST. ÉTIENNE IN AUXERRE, A FINE SPECIMEN OF FRENCH GOTHIC ARCHITECTURE. DATING FROM THE 13TH CENTURY

The town is irregularly built and the streets steep and narrow; its ancient fortifications have been replaced by boulevards. The former cathedral of St. Étienne, a majestic Gothic building (13th to 16th centuries) has three richly sculptured portals and a rose window, and a massive north-west tower; the south-west tower is unfinished. Beneath the choir (fine early Gothic) extends a crypt of the 11th century with 12th century mural decorations. The church has fine stained glass and many pictures. The ancient episcopal palace, now a prefecture, preserves a Romanesque gallery (12th century). The church of St. Eusèbe belongs to the 12th, 13th and 16th centuries. Of the abbey church of St. Germain (13th and 14th centuries) most of the nave has disappeared, so that its imposing Romanesque tower stands apart. Crypts of the 9th century contain the tombs of bishops of Auxerre. The abbey was once fortified and a high wall and cylindrical tower remain. The church of St. Pierre (16th and 17th centuries) has an elaborately ornamented west façade. The old law-court contains the museum and a library. The middle of the town has a gateway and belfry (15th century). Manufactures of ochre, from local quarries, and of iron goods are carried on. The canal of Nivernais reaches Auxerre, which has a busy port and hydroplane base and carries on boat-building. Trade is principally in the choice wine of the surrounding vineyards, and in ochre, metal goods, tanners' bark and coal. The town is the seat of a court of assizes, and has tribunals of first instance and of commerce.

AUXILIARY, that which gives aid or support (from Lat. *auxilium,* help); the term is used in grammar of a verb which completes the tense, mood or voice of another verb; in engineering, ***e.g.***, of the low steam power used to supplement the sail-power in sailing ships; in military use of foreign or allied troops, more properly of any troops not permanently maintained under arms. In the British army the term "Auxiliary Forces" was employed formerly to include the Militia, the Imperial Yeomanry and the Volunteers. So long as infantry was held to be the decisive arm, the term "auxiliary arms" was often used to mean the other arms, especially artillery, which assisted it in this rôle and gave fire-support to its assault.

AUXIMUM (mod. *Osimo*), ancient town, Picenum, on an isolated hill 8m. from the Adriatic, on the road from Ancona to Nuceria, a Roman fortress to protect settlements in Northern Picenum; the walls were built 174 B.C. of large squared blocks; they still exist. It was important in the civil wars and in imperial times, as inscriptions and the monuments of its forum (the present piazza) show. In the 6th century it is called by Procopius the chief town of Picenum, Ancona being spoken of as its harbour.

AUXONNE, town in the Côte-d'Or department, East France, 19 mi. E.S.E. of Dijon on the P.L.M. railway to Belfort. Pop. (1936) 3,727. It lies in the wide plain on the left bank of the Saône, whence its name (ad *Sonam*). The rnediaeval town was the centre of a county which passed to the dukes of Burgundy in the 13th century. The town received a charter in 1229, and had a mint founded by the dukes. In the 17th century Vauban restored the ramparts and stronghold, traces of which still remain, and built the arsenal now used as a market. Auxonne was invested by the allies in 1814 and surrendered to the Austrians in 1815. The church of Notre Dame (14th century) has two front towers (one unfinished) and a lofty spire surmounting a third tower over the crossing. The *Hôtel-de-Ville* (15th century) and some Renaissance houses are of interest. There are a tribunal of commerce and a communal college, but industries are unimportant though there is a large trade in market-garden and vegetable produce. There is also an aerodrome.

AVA, the ancient capital of the Burman empire, is on the Irrawaddy, on the opposite bank to Sagaing. Amarapura, another ancient capital, lies 5m. N.E. of Ava, and Mandalay, the present capital, 6m. N. The classical name of Ava is Yadanapura, "(the city of precious gems." It was founded by Thadomin Payā in A.D. 1364 as successor to Pagān, and the religious buildings of Pagān were, to a certain extent, reproduced here, although not on the same scale. It remained the seat of government for about four centuries with a succession of 30 kings. In 1783 a new capital, Amarapura (*q.v.*), was founded by Bodawpayā, but was deserted again in favour of Ava by King Baggidaw in 1823. On his deposition by King Tharawaddi in 1837, the capital reverted to Amarapura; but finally, in 1860, the last capital, Mandalay was occupied by King Mindōn. Traces of the great council chamber and various portions of the royal palace are still visible. but otherwise the secular buildings are completely destroyed; and most of the religious edifices are also dilapidated.

AVA: see KAVA.

AVADĀNA, the name given to collections of Buddhist tales purporting to be told by the Buddha in order to show the results of *karma.* They exist in a large number of Sanskrit (Nepalese) works of which the chief are the Avadānasataka (Century of Legends), and the Divyāvadāna (The Heavenly Legend). The older collections belong to Hīnayāna, and such compositions were continued in Mahāyāna schools They are not found in the Pāli, as a separate literary form, but the Canon contains a work called Apadāna, consisting of recitals in verse by elders, who tell how their good deeds in previous births have led to happiness. The Mahā-apadāna sutta ("great achievement"). in the Dīghanikāya gives an account of the last seven Buddhas. (See BUDDHA AND BUDDHISM)

AVAHI (ăv′ą-hĭ), a Malagasy lemur (*Avuhis laniger*) allied to the indri (q.v.), characterized by its woolly coat, and measuring about 28 in. in length, of which rather more than half is tail. The avahi is nocturnal, and is met with alone or in pairs. Very slow in its movements, it rarely descends to the ground, but, when it does, walks upright. It is found throughout the forests on the east coast of Madagascar, and also in a limited district on the northwest coast, the specimens from the latter locality being of smaller size and different colour. The eastern phase is generally rusty red above, with the inner sides of the limbs white; while the predominant hue in the western form is usually yellowish brown. See PRIMATES.

AVALANCHE (adopted from a French dialect form, *avalance,* descent), a mass of snow usually mingled with ice, soil, pebbles and boulders, which rushes down a mountain side destroying anything in its path. It often produces a strong wind which uproots trees on each side of its course. Above the snow line where the supply of snow exceeds the loss by evaporation the surplus, partly compacted to ice by pressure descends the mountain sides either slowly in the form of glaciers, or more swiftly in ice-falls or in avalanches. On steep slopes the foundation easily gives way, owing to the loosening effect of spring rains, the blowing of the *föhn* or from other causes and the whole mass slides downward. Thunder or even a loud shout is said to be sufficient to set the overloaded snow in motion when the mass is just poised, and Swiss guides often enjoin absolute silence when crossing dangerous spots.

AVALLON, a town of France, capital of an arrondissement in the department of Yonne, 34 mi. S.S.E. of Auxerre on a branch of the P.L.M. railway. Pop. (1936) 5,544.

Avallon (*Aballo*) was the seat of a viscounty in the mediaeval duchy of Burgundy. The church of St. Lazare (12th century) has two western portals sculptured in ornate Romanesque style; the tower on the left of the façade was rebuilt in the 17th century. The Tour de l'Horloge (15th century), pierced by a gateway through which passes the Grande Rue, contains a museum on its second floor. Remains of ancient fortifications, including seven flanking towers, are still to be seen. There is a statue of Vauban, the military engineer. The public institutions include the subprefecture, a tribunal of first instance, and a communal college. Trade is in wood, wine, leather, live-stock, grain, and wool.

AVALON (also written **AVALLON, AVOLLON, AVILION, AVELION),** in Welsh mythology the kingdom of the dead; in the Arthurian romances, the abode of heroes to which King Arthur was conveyed. In Welsh the name is Ynys yr Afallon, usually interpreted "Isle of Apples," but if the Celtic traditional derivation, a king over the dead named Avalloc (Welsh *Afallach*), is correct, the name comes from the Welsh *afal,* an apple, and is probably intended to symbolize the enjoyments of elysium. Perhaps owing to a confusion between Glasberg, the Teutonic kingdom of the dead, and the Anglo-Saxon Glaestingaburh, Glastonbury, the name "Isle of Avalon" was given to the ridge in Somersetshire culminating in Glastonbury Tor, while Glastonbury itself came to be called Avalon.

See *Studies in the Arthurian Legend,* by J. Rhys (Oxford, 1891); also ARTHUR; ARTHURIAN LEGEND; ATLANTIS.

AVALON, a seaside and sportsman's resort, situated on the southeast coast of Santa Catalina island, Calif., about 56 mi. S. of Los Angeles and 27 mi. by steamer from San Pedro and Long Beach on the mainland. The town is picturesquely built in a narrow valley and on the slopes of an amphitheatre of rugged hills surrounding a small, semicircular bay, which is the chief harbour of the island. The resident population, largely augmented at times by people whose permanent homes are across the channel, is engaged mainly in connection with the tourist trade. Each year the island is visited by thousands of tourists, including fishermen from all parts of the world, who are attracted by the climate, scenery and fishing grounds. Population in 1940, 1.637.

AVALON, formerly West Bellevue. a residential borough of Allegheny county, Pa., U.S.A.. 6 mi. N.W. of Pittsburgh, on the Ohio river and the Pennsylvania railroad. The population in 1940 was 6,155.

AVARS of Europe, sometimes called "pseudo-Avars," were probably a Turkish tribe, named Uigurs, who were subjected by the true Avars—a nation akin to the Huns, perhaps identical with the Yüan-Yüan, when the latter were driven out of Central Asia about A.D. 461. The Avar confederation dominated the Volga steppes till 555, when the Avars were defeated and almost annihilated by the Turks. The Uigurs, flying westward under Avar chiefs, took the name of Avar. In 555 they reached the country of the Alani, north of the Caucasus, whence they sent envoys to Constantinople, offering their services. The Emperor Justinian offered them Lower Pannonia for settlement, and, on their refusing this, paid them a tribute to combat the Slavs and Bulgars on his eastern frontier. The Avars overcame the Antae and the Bulgarian Utiguri and Kutriguri, and moved westward to the present Galicia, where they subdued the Slavonic Dubledy, and extended their suzerainty from the Volga to the Elbe and the Baltic. In 565 Justinian discontinued the tribute; the Avars then allied themselves with the Lombards against the Gepidae, who occupied the present Transylvania, bargaining for a share of the spoil and the conquered territory. The Gepidae were crushed in 567, and, the Lombards migrating to Italy, the Avars occupied the Danube-Theiss basin. At this time, the Avars were perhaps the greatest power in Europe. Their Khagan, Baian, appears to have been a military leader of extraordinary genius. He exacted from the Byzantine emperors, whom he treated with supreme arrogance, an annual tribute of 120,000 gold pieces, besides gifts such as an elephant, a bed of pure gold, and enormous subsidies. Baian took Sirmiurn, the Roman fortress on the Save, in 580; for the next 30 years he was alternately at peace and war with the Empire. He besieged Thessalonica in 597, and only pestilence in his ranks saved the city. After his death, the Avar power declined, although in 617 they ravaged the suburbs of Constantinople, carrying off 270,000 prisoners, and in 626, assisted by Slavs, Bulgars and Gepidae, and co-operating with the Persians, besieged the city itself. In 601, however, Priscus inflicted a series of defeats on them; in 603 the Slavs on their north-west frontier revolted, and later the kingdom of Moravia was formed; in 63j Bulgaria became independent; then the Croats. In the 7th and 8th centuries the Avars no longer troubled Byzantium, although they ravaged both Germany and Italy, sometimes in conjunction with the Lombards. In 791 Charlemagne attacked their western frontier on the Enns. After a bloody war of five years, Pippin took their chief ring and destroyed their power. The remnants of the nation were settled near the present Petronel, near the eastern frontier of modern Austria. Their Khagan swore fealty to the Franks, and was baptized. Two revolts, in 799 and 803, were suppressed, and soon after, the name of Avar vanished from history. The downfall of this once mighty nation was so complete and spectacular that it became proverbial among the Russians. The Avars were probably never more than a small ruling caste, and were absorbed by the Slavs: the theory that they were the ancestors of the mediaeval Vlachs and the modern Rumanians is untenable. On the other hand, the influence of their empire on the ethnographical distribution of modern Europe is immense, most of the western Slavs having either been driven to their present habitats before the advancing Avars, or settled by them to guard their frontiers. They lived in rings, or fenced enclosures, the largest of which was said to be 38 miles round. Here they kept their vast treasures; but they have left not a single monument.

See the account by Sir H. H. Howorth in the *Journal* of the Royal Asiatic Society (1889); also Prof. Bury's annotated edition of Gibbon's *Decline and Fall of the Roman Empire* (1909). (C. A. M.)

AVATAR, an "incarnation," especially the "descent" of a deity to save the world. Thus. the 10 *avatārs* of Vishnu were in the later epics, as (1) a fish, (2) a tortoise, (3) a boar, (4) a monster, half man, half lion, to destroy Hiranyakasipu, the infidel worshipper of Siva, (5) a dwarf, (6) Rāma, (7) Rāma, son of Jamadagni, (8) Krishna, (9) Buddha, and the 10th, yet to appear, will be, the Hindus believe, Kālki, in the form of a white-winged horse destined to destroy the earth.

See E. W. Hopkins, *Epic Mythology,* Strasbourg, 1915.

AVEBURY, JOHN LUBBOCK, 1ST BARON (1834–1913), English banker, politician and naturalist, was born in London

April 30, 1834, and died at Kingsgate Castle, Kent, May 28, 1913, the son of Sir John William Lubbock, 3rd baronet, himself a highly distinguished man of science. John Lubbock was sent to Eton in 1845, but three years later was taken into his father's bank, and at 22 became a partner. In 1865 he succeeded to the baronetcy. His love of science kept pace with his increasing participation in public affairs. He served on commissions upon coinage and other financial questions; and at the same time acted as president of the Entomological Society and of the Anthropological Institute.

Early in his career several banking reforms of great importance were due to his initiative, while such works as *Prehistoric Times* (1865), and The *Origin of Civilization* (1870), were proceeding from his pen. In 1870, and again in 1874, he was elected a member of parliament for Maidstone. He lost the seat at the election of 1880; but was at once elected member for London University, of which he had been vice-chancellor since 1872. He promoted various measures in Parliament, including the Bank Holidays Act 1871, and bills dealing with absconding debtors, shop hours regulations, public libraries, open spaces, and the preservation of ancient monuments, and he proved himself an indefatigable and influential member of the Unionist party. As a writer of popular scientific books Lord Avebury (he was raised to the peerage in 1900) had few rivals in his day. Many of his hooks ran into a great number of editions, and served a great educational purpose in arousing an interest in science among many young people who would have been repelled by the ordinary text book.

Among his works are: *The Origin and Metamorphoses of Insects* (1873), *British Wild Flowers* (1875), *Ants, Bees and Wasps* (1882), *Flowers, Fruits and Leaves* (1886), *The Pleasures of Life* (1887), *The Senses, Instincts and Intelligence of Animals* (1888), *The Beauties of Nature* (1892), *The Use of Life* (1894).

AVEBURY, village of Wiltshire, England, on the upper Kennet, among the Marlborough Downs, six miles W. of Marlborough. Population (1931) 561. The name is famous as that of a stone circle, perhaps the largest in the world, upon which the village, which, as Avreberie or Abury, dates at least from the time of Domesday, has encroached. The circle encloses an area of over 28 ac., and has an average diameter of 400 yards. It is surrounded by a deep ditch and an outside rampart of earth. The ditch, which has a marked "berm," is over 40ft. wide at the top; its depth varies, but measures in places 30ft., with a distance of 55·5ft. from floor of ditch to top of rampart. Within the larger circle were two smaller ones, probably consisting of double concentric rings of stones. The centres are marked in the one case by an "obelisk," in the other by three stones called "the cove." The monument was probably approached by avenues similar to that of Stonehenge. The stones are all native Sarsens, unhewn; and there appear to be no "foreign stones" such as are found at Stonehenge. They vary in size from 5 to 20 ft. in height above ground, and from 3 to 12 ft. in breadth. Scientific excavations, carried out in 1908 and subsequently, have suggested a Late Neolithic date for Avebury; but it cannot be proved not to have been constructed, at least in part, in the days when the use of metal was known in Britain. The fragments of pottery suggest a date contemporary with the Long Barrows. There are many barrows on the neighbouring downs, besides traces of a double oval of monoliths on Hackpen Hill, and the huge mound of Silbury Hill. Windmill Hill, with earth ramparts, nearby is proving of great interest, having probable cultural links with earthworks of the age of transition from stone to metal at Michelsberg and else here in central Europe.

AVEIA, an ancient town of the Vestini, on the Via Claudia Nova, 6m. S.E. of Aquila and N.E. of the modern village of Fossa, Italy. Some remains of ancient buildings still exist. Paintings in the church of Sta. Maria ad cryptas of the 12th to 15th centuries are important in the history of art.

AVEIRO, port and episcopal see, north-western Portgual, on the Lisbon-Oporto railway. Pop. (1930) 12,735. Aveiro is built on the southern shore of a marshy lagoon, containing many small islands, and measuring about 15m. from north to south, with an average breadth of about one mile. The Barra Nova, an artificial canal about 33ft. deep (built 1801–08), gives access to the ocean. The local industries include the preparation of sea-salt and the catching and curing of fish. There is also a brisk trade in mine, oil and fruit; while the Aveiro district contains copper and lead mines, besides much good pasture land.

Aveiro is probably the Roman Talabriga. In the 16th century it was the birthplace of João Affonso, one of the first navigators to visit Newfoundland; it soon became famous for its fleet of more than 60 vessels, which went thither yearly for dried codfish.

AVELLA (anc. ABELLA), city of Campania, Italy, province of Avellino, 23 mi. N.E. of Naples by rail. Population (1936) 4,260 (town); 4,305 (rommune). It is in fertile territory and its nuts and fruit were renowned in Roman days. About 2 mi. N.E. lies Avella Vecchia, the ancient Abella, regarded by the ancients as a Chalcidian colony. An important Oscan inscription relates to a treaty with Nola, regarding a joint temple of Hercules (2nd century B *c.).* It has remains of the walls of the citadel and of an amphitheatre, and lay on the road from Nola, perhaps joined here by a branch from Suessula.

AVELLANEDA, GERTRUDIS GÓMEZ DE (1814–1873), Spanish dramatist and poet, was born at Puerto Príncipe (Cuba) and removed in 1836 to Spain, where she published her first poems (1839) under the pseudonym of "La Peregrina." Her novels, such as *Sab* (1839) and *Guatimozín* (1846) are of no great importance. She obtained, however, a series of successes on the stage with *Alfonso Munio* (1844), a tragedy in the new romantic manner; with *Saúl* (1849), a biblical drama; and with *Baltasar* (1858). La Avellaneda has a grandiose tragical vision of life, a vigorous eloquence rooted in pietistic pessimism, a dramatic gift effective in isolated acts or scenes; but she is deficient in constructive power and in intellectual force, and her lyrics, though instinct with melancholy beauty, or the tenderness of resigned devotion. too often lack human passion and sympathy.

See E. B. Williams, *The Life and Dramatic Works of G. Gómez de Avellaneda* (Philadelphia, 1924).

AVELLANEDA, a city in the Argentine republic. pop. 139,572 in 1914, and estimated to be about 386,000 in 1942; a suburb of Buenos Aires, on the southern side of the Riachuelo which separates it from Buenos Aires proper. It is virtually a part of the capital but is organized as a separate municipality. Avellaneda is one of the new cities of the Argentine, owing its rapid development to the growth of Buenos Aires in recent years. It is chiefly industrial and commercial in character, and contains meat-packing plants, wool-washing establishments, textile mills and extensive markets for agricultural and stock products. Two railways (the Great Southern and the Midland) have been built into Avellaneda from Buenos Aires, and it is also reached by tramways and motor-bus lines. Several bridges span the Riachuelo, connecting Buenos Aires and Avellaneda.

AVELLINO, episcopal see, Campania, Italy, capital of province of Avellino, 1,150 ft. above sea-level, 28 mi. direct and 50 mi. by rail E.N.E. of Naples, at the foot of Mt. Vergine. Pop (19361 20,578 (town); 29,091 (commune). It is the junction for Benevento and Rocchetta S. Antonio. The name derives from the ancient Abellinum, ruins of which lie 2½ mi. N.E., close to Atripalda village, and consist of remains of city walls and an early imperial amphitheatre. Abellinum apparently was the chief place of a tribe, to which belonged also some independent communities among the Hirpinii and Apulians. It lay on the boundary of Campania and the territory of the Hirpinii, at the junction of the roads from Nola (perhaps also from Suessula) and Salernum to Beneventum. In the 9th or 10th century castle (now ruined) the antipope Anacletus II. crowned Count Roger II. king of Sicily and Apulia.

AVEMPACE (Abu Eakr Muhammad ibn Yahya, known as Ibn Bājja or Ibn Sa'igh; *i.e.,* son of the goldsmith, the name being corrupted by the Latins into Avempace, Avenpace or Aben Pace), the earliest and one of the most distinguished of the Arab philosophers of Spain. Little is known of the details of his life. He was born probably at Saragossa towards the close of the 11th century. According to Ibn Khāqān, a contemporary writer, he became a student of the exact sciences, and was also a musician and a poet.

But he was a philosopher as well, and apparently a sceptic. He is said to have rejected the Koran, to have denied the return to God, and to have regarded death as the end of existence.

But even in that orthodox age, he became vizier to the amir of Murcia. Afterwards he went to Valencia, then to Saragossa. After the fall of Saragossa (1119) he went to Seville, then to Xativa, where he is said to have returned to Islam to save his life. Finally he retired to the Almoravid court at Fez, where he was poisoned in 1138. Ibn 'Usaibi'a gives a list of 25 of his works, but few of these remain. He had a distinct influence upon Averroes (*see* ARABIAN PHILOSOPHY).

BIBLIOGRAPHY.—For his life, *see* M'G. de Slane's trans. of Ibn Khallikān's *Biographical Dictionary* (1842), vol. iii, p. 130 *et seq.*, and Ibn 'Usaibi 'a's biography translated in P. de Gayangos' edition of the *Iiistory of the Mohammedan Dynasties in Spain*, by al-Maqqari (1840), vol. ii, appendix, p. xii. List of extant works in C. Brockelmann's *Geschichte der arabischen Litteratur*, vol. i, p. 460. For his philosophy, *cf.* T. J. de Boer's *The History of Philosophy in Islām* (1903), ch. vi.

AVENARIUS, RICHARD HEINRICH LUDWIG (1843–1896), German philosopher, was born in Paris and died at Zürich, where he had been professor of philosophy for nearly 20 years. At Leipzig he was one of the founders of the *Akademisch-philosophische Verein*, and was the first editor of the *Vierteljahrsschrift fur wissenschaftliche Philosophie*. His chief works are *Philosophie als Denken der Welt gemäss dem Princip des kleinsten Kraftmasses* (1876) and the *Kritik der reinen Erfahrung* (1888–90). In these works he made an attempt to co-ordinate thought and action. Like Mach, he started from the principle of economy of thinking, and in the *Kritik* endeavoured to explain pure experience in relation to knowledge and environment. He discovers that statements dependent upon environment constitute pure experience. This philosophy, called Empiriocriticism, is not, however, a realistic, but an idealistic dualism, nor can it be called materialism.

BIBLIOGRAPHY.—*See* Wundt, *Philos. Stud.*, xiii (1897); and J. Petzoldt, *Einführung in d. Philos. d. reinen Erfahrung* (1900).

AVENGER OF BLOOD, the person. usually the nearest kinsman of the murdered man, whose duty it was to avenge his death by killing the murderer. In early societies, crimes of violence were regarded as injuries of a personal character to be punished by the sufferer or his kinsfolk. This right of vengeance in many countries was the subject of strict regulations and limitations. The law of sanctuary (*q.v.*) and the institution of blood-money, and the wergild offered the wrong-doer a mode of escaping from his enemies' revenge.

(*See* Westermarck, *Origin and Development of the Moral Ideas*, 1906, vol. i, ch. xx.)

AVENGERS or **VENDICATORI,** a secret society formed about 1186 in Sicily to avenge popular wrongs. The society was finally suppressed by King William II, who hanged the grand master and branded the members with hot irons.

AVENOL, JOSEPH LOUIS ANNE (1879–), French statesman, was the son of Ernest Avenol and Renée de Hansy. He was educated at the École des Sciences Politiques and the University of Paris. In 1905 he secured his first governmental appointment, as a member of the staff of the general inspector of finances in the French treasury. He advanced to the office of general inspector in 1910 and from 1916 to 1923 was a member of the French government's financial delegation in London. From 1920 to 1923 he mas on the financial committee of the League of Nations at Geneva.

He was deputy secretary general of the league from 1923 to 1932 and in the latter year became secretary general, which office he retained until his resignation in July 1940, shortly after the German conquest of France in World War II.

AVENS: *see* GEUM.

AVENTAIL or **AVANTAILLE** (O.Fr. *esventail*, presumably from a Latin word *exventaculum*, air-hole), the mouthpiece of an old-fashioned helmet, movable to admit the air.

AVENTINUS (1477–1534), whose real name was Johann Turmair, author of the *Annales Boiorum* in seven books, was born at Abensberg (Aventinum) July 4, 1477, and died at Regensburg Jan. 9, 1534. He studied at Ingolstadt, Vienna, Cracow and Paris, and from 1509–17 was tutor to two of the Bavarian princes. William IV, duke of Bavaria, encouraged him to write the *Annales* (first edition 1554), which give the history of Bavaria in conjunction with general history from the earliest times down to 1460. The work, written between 1517 and 1521, was later translated by its author into German as *Bayersche Chronik*. He took immense pains with the work and to some degree anticipated the modern scientific method of writing history. Throughout, the author shows a strong sympathy for the empire in its struggle with the papacy. Many important passages were omitted in the first edition, as they reflected on the Roman Catholics. A more complete edition was published at Basle in 1580 by Nicholas Cisner.

Although Aventinus did not definitely adopt the reformed faith, he sympathized with the reformers and their teachings, and showed a strong dislike for monasticism. On this account he was imprisoned for a short time in 1528, but was released through the intervention of friends. The remainder of his life was somewhat unsettled.

Aventinus, who has been called the "Bavarian Herodotus," wrote other books of minor importance, and a complete edition of his works was published at Munich (1881–86).

See T. Wiedemann, *Johann Turmair gen. Aventinus* (1858); W. Dittmar, *Aventin* (1862); J. von Döllinger, *Aventin und seine Zeit* (1877); S. Riezler, *Zum Schutee der neuesten Edition von Aventins Annalen* (1886); F. X. von Wegele, *Aventin* (1890).

AVENTURINE or **AVANTURINE,** a variety of quartz spangled with scales of mica or haematite. Most aventurine quartz is of yellow or brown colour, but a green variety containing scales of the chrome-mica, fuchsite, is also known. The name aventurine is also applied to certain iridescent felspars. The principal of these is the oligoclase occurring in gneiss at Tvedestrand in southern Norway. The brilliant spangled appearance of such felspars is due to microscopic enclosures, the colours in reflected light being the interference colours of thin films. In most cases the reflecting lamellae are haematite, oriented always after simple crystal forms causing "aventurization" on the planes 001 and 010. Aventurine felspar is also known as sunstone, but aventurization is not confined to oligoclase, occurring also in orthoclase and labradorite (*q.v.*).

AVENUE. Way of access, an approach to a country house, bordered by trees; it is now much used as a name for streets, with or without trees, *e.g.*, Fifth avenue, New York; Shaftesbury avenue, London.

AVENZOAR or **ABUMERON** (Abū Merwān 'Abdal-Malik ibn Zuhr) (d. 1162), Arabian physician, was born at Seville, where he exercised his profession with great reputation. He was a contemporary of Averroes, who, according to Leo Africanus, heard his lectures. and learned physic of him He belonged, in many respects, to the *Dogmatists* or *Rational School*, rather than to the *Empirics*. He was a great admirer of Galen; and in his writings, he protests emphatically against quackery and the superstitious remedies of the astrologers. His *Teisir* (Rectification of Health) mas translated into Hebrew (1280) and thence into Latin by Paravicius (Venice, 1490).

AVERAGE, a legal term (for mathematical meaning, *see* PROBABILITY AND ERROR), may be either *particular* or *general*. Particular average signifies damage or a partial loss sustained by ship, goods or freight through some accidental cause. According to s. 64 (1) of the Marine Insurance Act 1906, particular average is "a partial loss of the subject matter insured, caused by a peril insured against, and which is not a general average loss." It is borne by (or is "particular" to) the parties to whose property the misfortune occurs, unrelieved by any contribution from their co-adventurers. The loss may or may not be recoverable from their insurers (if any) according to the terms of the marine insurance policy (*see* MARINE INSURANCE). The essence of a particular average loss, however, lies in the fact that it is wholly accidental.

General average on the other hand consists of a voluntary sacrifice of part of the property at risk, or the incurring of an

expense, for the common safety of the adventure, and such sacrifice or expense is borne by the property saved. It is defined in s. 66 (2) of the Marine Insurance Act 1906 (the only statutory definition of general average) as follows: "There is a general average act where any extraordinary sacrifice or expenditure is voluntarily and reasonably made or incurred in time of peril for the purpose of preserving the property imperilled in the common adventure."

The equity of the underlying principle of general average has been recognized throughout the centuries, and every State possessing a maritime trade has adopted the rule that a loss caused by a sacrifice in time of peril at sea shall not be borne by one but by all. It will be appreciated, ho ever, that although nothing could be more simple than the fundamental principle of general average, its application to the adjustment of losses arising under modern conditions of maritime commerce is far from simple and has called into existence a profession of experts, known as average adjusters (*q.v.*). The complications of adjustment are added to by the fact that the law of no two countries in the world agrees as to what losses are to be treated as general average, or how such losses shall be borne. In actual practice, the settlement of general average losses and contribution is a matter usually dealt with by underwriters where the interests are insured. Liability to contribute, however, arises quite independently of insurance. Reference is made below to the movement for obtaining some measure of international uniformity in matters of general average.

Dealing with the subject from the point of view of English law, it will be convenient to treat it briefly under the following headings: 1. What losses and expenses are allowable as general average. 2. How much is allowable. 3. What interests contribute to the general average, and on what basis. 4. The question of security to be given for payment of the contributions.

Losses Allowable as General Average. — It will be seen from the definition in the Marine Insurance Act quoted above that a sacrifice to possess the quality of general average must have been made "for the purpose of preserving the property." It is not enough that it was necessary to enable the common adventure to be completed. General average according to English law only arises where the *safety* of the property at risk is at stake. It is not alone sufficient "that an expenditure should have been made to benefit both cargo owner and shipowner" (*per* Bowen, L.J., in *Svendsen* v. *Wallace*, 1883, 13 *Q.B.D.*, p. 84).

(1) Jettison is generally regarded as a typical case of general average and it was so regarded by the Rhodians according to whose law, "if goods are thrown overboard to lighten a ship, all shall make good by contribution that which has been given for all." The jettison of cargo carried on deck, however, is not treated as general average except where such carriage is the custom of the trade and is not contrary to the terms of the contract of affreightment. The reason for the exclusion of jettison of deck cargo from contribution is that a ship's deck is generally considered an improper place upon which to stow cargo. Damage to the ship incidental to a jettison is also allowable as general average, *e.g.*, the breaking of bulwarks or rails during the act of jettison.

(2) Damage done in extinguishing a fire is a very common case of general average and one that entails very complicated calculations in the adjustment of the loss. For many years it was the custom of average adjusters in England not to treat the loss caused by the use of steam, water or other means of quenching a fire as general average. As the result of a series of cases in the courts, however, it was established that any damage done in this way is properly allowable as general average. In practice, however, an exception is made to this rule — that no allowance is made for damage to cargo by water, etc., when the packages so affected were themselves on fire when the water was thrown upon them. This is justified by the argument that the particular packages were already doomed to destruction by fire and the water, therefore, could cause no additional loss to them. The damage done in scuttling or beaching a ship in order to extinguish a fire is also treated as general average.

The case of a fire on board a ship which is extinguished by the use of water or other agency illustrates clearly the distinction between general and particular average. The damage done by the fire itself is particular average, being entirely accidental; on the other hand the damage done by the water used to extinguish the fire is caused by a voluntary act, deliberately performed to avert the destruction of the ship and cargo, and forms, therefore, the subject of contribution by all interests on board saved by that act.

(3) When a ship is aground and in a state of peril, it is often found necessary to lighten her by discharging the cargo into lighters or other craft alongside. Such work can seldom be carried out without causing loss or damage to the cargo discharged, and in so far as the discharge is ordered for the general benefit and not merely to save the cargo itself, *e.g.*, when the ship has already become a total wreck, the cost of discharge and the resulting loss or damage is allowable as general average. Similarly, any loss caused by the discharge of cargo at a port into which the ship has put in distress is treated as general average, where the discharge is effected for the common safety or for the purpose of carrying out repairs to the ship necessary for the prosecution of the voyage.

(4) It may happen that owing to delay on the voyage due to bad weather or other circumstances a steamer's supply of fuel runs out. If the conditions are such as to threaten the common safety, the loss of cargo used as fuel in this emergency is treated as general average, provided that the original supply of ship's fuel was reasonably sufficient for the voyage.

(5) Where the shipowner is only entitled to freight upon the safe delivery of the cargo, the loss of cargo by, say, jettison causes of course a corresponding loss of freight, and in the event of the loss of cargo being allowable in general average the freight so lost is also made good in general average.

(6) A sacrifice of part of the ship, *e* g., the cutting away of a mast when the ship is on her beam-ends, or of her equipment or gear, *e.g.*, the jettison of ship's stores, etc., is treated as a general average loss when necessary for the common safety as much as a sacrifice of cargo. There is this distinction, however, between a sacrifice of cargo and of ship. In the case of the cargo, it should never be voluntarily exposed to peril, and if this be done for the general benefit, the ensuing loss or damage is, broadly speaking, always the subject of general average. The case of the ship, however, is not quite on the same footing. The shipowner is bound to give the services of his ship in exchange for the freight or hire received, and he is bound to give its services even under conditions of stress without claiming compensation for so doing. A ship is not built for fine weather only and even though she may suffer in a gale, and her equipment be severely damaged in bringing her safely through it, no claim can be made by the owners for compensation in general average. Where, however, any part of the ship or her equipment is put to an abnormal use for the purpose of avoiding an imminent peril, the case is different. The cargo is entitled to expect the full *use* of the ship, even under exceptional circumstances, but not that the ship or any part of her should be *abused* in the sense that it is put to a use for which it was never intended. A typical case of the former would be the loss of sails blown away in avoiding a lee shore; of the latter, the cutting up of spars to make a jury rudder. When a ship is aground and in a position of peril, damage caused to her engines in endeavouring to refloat her, as well as the coal used in the operation, is allowable in general average (*The Bona*, 1895, *P.*, p. 125). Damage to or loss of sails in similar circumstances is also the subject of general average.

The deliberate running of a ship ashore to avoid sinking or driving on to rocks or other emergency would seem at first sight to be a clear case of general average sacrifice. Both the main elements of general average appear to be present — the existence of imminent danger and the deliberate decision to incur a certain loss to avert a greater — but no decision has been given in the English courts on the point, although several cases have been decided in America, and the question is by no means free from doubt. The chief argument against the allowance of loss arising from voluntary stranding in general average is that in fact the element of sacrifice does not exist. At the moment of decision to put the vessel ashore she was apparently doomed to destruction by, say, sinking or by striking a reef. This fate is averted by manoeu-

vring her ashore at a place of comparative safety. The damage caused by this act, therefore, cannot be described as having been incurred for the benefit of all, for the mere selection of a better rather than a worse spot to take the ground is in fact a benefit conferred upon and not a sacrifice of the interest thereby damaged. If the grounding saved the ship from sinking in deep water, again no sacrifice is incurred, but merely a diminished loss. This argument, however, is not generally accepted and the better opinion seems to be that where the facts justify the view that there has been a deliberate decision to incur the certain loss which mould follow a voluntary stranding, the loss so incurred is properly allowable as general average. To argue that because a lesser loss has been incurred rather than a greater, no sacrifice has been made, is to deny the benefits of general average contribution to all whose property is sacrificed for the common benefit, for the very essence of the principle of general average is that a lesser loss is deliberately incurred to avoid a greater. Cargo jettisoned, or a mast cut away, to save the adventure from total loss during a hurricane are instances of comparatively minor losses voluntarily incurred to avert a greater, but they are regarded, quite properly, as typical cases of general average. In fact the greater the peril, the better grounds there are for regarding the means used to avert it as general average.

According to a series of American decisions, the principle is definitely recognized that loss through voluntary stranding is general average where it is clear that there was any act of volition at all, and this agrees with the law of most other countries. The practice of English average adjusters, however, is to the contrary, as will be seen from the wording of one of their rules of practice: "The custom of Lloyd's excludes from general average all damage to ship or cargo resulting from a voluntary stranding. This rule does not necessarily exclude such damage as is done by beaching or scuttling a burning vessel to extinguish the fire."

It has been held in England that damage sustained in resisting enemy attack is not general average, nor is the cost of replacing the munitions expended, nor the cost of medical attention to seamen wounded (Taylor v. **Curtis,** 1815, 4 Camp. 33;). It was held that there was no sacrifice, but that the seamen merely did their ordinary duty and nothing beyond it, and that no part of the property had been sacrificed for the general benefit. The same principle is extended to cases of damage to ship by carrying press of sail to escape an enemy, as well as to rockets or storm oil which are used in time of peril. They are carried for the special purpose and cannot be said to be sacrificed when used for that purpose.

Expenses Allowable as General Average. — Not only sacrifices of property, but expenditure incurred for the common benefit, is claimable as general average. The expenditure must, however, be extraordinary in nature to form the subject of general average contributiod. A mere enhancement of the ordinary cost of completing the voyage, though it may be due to extraordinary circumstances, does not entitle the shipowner to claim contribution from the cargo. The following are some of the main instances of general average expenditure:

(1) Salvage may be regarded as in some respects a typical case of a general average expenditure, as jettison of cargo may be regarded as a clear type of general average sacrifice. It consists of the reward payable for services rendered to a ship in distress by outside salvors and it is enforceable by a lien on ship and cargo. But the salvors may be specially engaged to proceed to the ship for the purpose of rendering assistance, or may answer the call of a ship in distress, or may even render unsolicited aid. In the first case the salvage payable is practically indistinguishable from general average expenditure, but in the two last cases, arising independently of contract, it differs from a purely general average expense, theoretically in that the salvors have a separate claim on ship and cargo enforceable at law and the shipowner has not incurred an expenditure for the common safety, and practically in that the basis for arriving at the amounts payable by ship and cargo respectively is not the same as that adopted for dividing a general average expenditure. For one thing the property saved by salvors, according to the rule of the court of admiralty, contributes to the award upon the values at the time when the salvors completed their work, whereas in general average contribution is usually assessed on the values at the end of the voyage, which may be materially different. In this respect the method of dividing salvage in England differs in a marked degree from that adopted in other countries, where it is the universal practice to treat salvage, whether under contract or not, as general average for all purposes, except perhaps where it consists of salving derelict property.

(2) The expenses of refloating a stranded or sunk ship frequently amount to a very considerable sum. The operations may extend over several weeks or even months, and as a rule involve general average sacrifice in the way of jettison or discharge of cargo into craft alongside as well as heavy expenditure for hire of tugs, labour, pumps and other salvage machinery. The expenditure is, ior the most part, clearly extraordinary and as such forms a claim in general average.

(3) When a vessel is forced to put into a port of refuge in consequence of damage received through heavy weather or other casualty, or as a result of a general average sacrifice, such as the cutting away of masts, the port charges and other expenses attendant on her entry into the port are recoverable in general average. So also is the cost of discharging the cargo in order to effect repairs to the ship. The treatment of the subsequent expenses, however, depends on the reason for the putting in to the port. If this act was in consequence of a general average sacrifice, all expenses at the port, including warehouse rent on the cargo discharged, reloading charges and outward port charges are allowable in general average. Should the vessel, however, have put in in consequence of accidental damage, the warehouse rent falls on the cargo itself and the cost of reloading and the outward charges are a charge on the freight (*Svendsen* v. *Wallace,* 11 Q B.D. 616; 10 App. Cas. 404). In this respect again the law of England differs from that of other countries, for it is the general rule elsewhere, with few exceptions, for all port of refuge expenses to be treated as general average whatever the cause of seeking the port. This rule extends also to the allowance of the wages and maintenance of the crew during the delay at the port, therein differing still iurther from the practice in this country, which regards such expense as a mere enhancement of the ordinary expense of the voyage, not extraordinary in nature, and as such not recoverable in general average.

Amounts Allowable. — The amount to be allowed in general average should be the loss which the owner of the property sacrificed has incurred by the sacrifice, or in the case of expenditure, the amount expended. In the case of a ship, the amount of compensation is, generally speaking, the cost of repairs, less certain deductions depending on the age of the ship, representing the improvement through the replacement of old material by new, generally known as "deductions new for old." Loss of cargo through sacrifice is made good on the basis of its value at the port of destination, less any charges saved through its loss, such as duty or landing charges. From all allowances, whether for ship or cargo, deduction has to be made of any loss, damage or charges which would inevitably have been sustained by the property sacrificed subsequent to the general average act. For example, should the whole of the cargo in a ship be damaged by sea-water after a jettison of cargo has taken place, deduction must be made from the allowance in general average for the jettison of the estimated depreciation which that cargo would have suffered had it remained on board. Otherwise an allowance of the sound value of the cargo jettisoned would confer a benefit on such cargo and it would be in a better position than the cargo which was left undisturbed.

It will be seen from the preceding paragraph that regard must be paid to the state of affairs existing at the termination of the adventure. The fact that a loss has been sustained by a general average sacrifice during the voyage is not enough to entitle the owner of the property sacrificed, or the shipowner who has incurred general average expenditure, to compensation. It is the rule in England and all other countries to consider the conditions upon the arrival of the vessel at her destination or, in the case of the voyage being broken up at an intermediate port, at that port. and generally speaking this rule applies both to cases of general average sacrifice and expenditure. Indeed, should the ship and

cargo be totally lost before the end of the voyage, no compensation is payable either for sacrifice or expenditure (*Chellew* v. *Royal Commission on the Sugar Supply,* 1921, 2 K.B. 627).

Interests Contributing to the General Average.—Having considered the main principles of general average and the method of arriving at the amounts to be allowed, it remains to consider what interests contribute to the general average and on what basis. As a general rule it may be laid down that the principle referred to in the preceding paragraph holds good not only for the method of calculating the amount to be allowed, but also for assessing the contributing values, viz., the condition of affairs at the place where the ship and cargo finally part company. Both ship and cargo contribute on their actual values there after deduction of any damage sustained, and this because these values are the actual values saved by the general average act. From the value of the cargo has also to be deducted the freight payable at destination, duty, landing charges, etc., so as to arrive at the net value saved. The freight at the risk of the shipowner also contributes, deducting therefrom the wages of the crew from the date of the general average act and the port and other charges incurred since that date for the purpose of earning the freight. To the values so arrived at has to be added any amount allowed in general average to the particular interest. This is done in order that there may be "equality of contribution as between those whose property has been sacrificed and those whose property has been preserved" (Lowndes, *Law of General Average,* 6th ed., p. 343). The same result could be arrived at by making a deduction from the amount allowed of the same percentage of contribution as falls on the property saved, but in practice, for reasons of convenience, the equalization is effected by the method described. A difficult question arises, upon which the law of England differs from others, when a ship is in ballast and under charter and a general average act is performed. It has been decided in Englsnd that contribution is due from the ship and the amount to be earned under the charter *(Carisbrook* S. *S. Co.* v. *London & Provincial Marine Ins. Co.,* 1901, *2* K.B. 861; 1902, *2* K.B. 651 C.A.), but this is not the rule in other countries, which regard the presence of cargo on board as an essential of general average. Ship, freight and cargo form the main contributing interests, but there are others which are at risk on a sea voyage, notably passengers' effects and luggage and mails. In theory, being saved by a general average act, they should contribute, but although they frequently represent a considerable sum of money, the practical difficulties of obtaining contributions are so great that, speaking generally, they are ignored.

Security for Payment **of** General Average Contribution.—"The shipowner has, at common law, a lien on the cargo while in his possession, or in that of his servants as a carrier, not only for the freight, but also for the cargo's share of general average" (Lowndes, *op. cit.,* p. 392). As, however, the shipowner is not in a position to demand payment of the exact amount due from the cargo at the time of delivery of the cargo, this lien is of practical value only to the extent of enabling the shipowner to enforce the giving of satisfactory security for eventual payment. The security usually required is either the signature of an agreement (known as an "average bond") to pay the proportion of general average as hereafter properly determined, or the payment of a reasonable cash deposit or very frequently both. The owner of goods sacrificed has no corresponding lien on the ship, or the rest of the cargo, for general average contribution, though if the shipowner demands a cash deposit from the cargo owner, the latter is entitled to set off the amount of any claim to which he is rightly entitled as against the ship in respect of any of his goods sacrificed or sold abroad (The *Norway;* in P.C., 1865. Br. & L. 410, 411). It is the duty of the shipowner, moreover, to take the necessary security from each cargo owner for the benefit of the owner of goods sacrificed *(Crooks* v. *Allan,* 1879; 5 *Q* B.D. 38; 49 L.J., Q.B., 201), and if he fails in this duty he is liable in damages to the cargo owner (*Nobels Explosives Co.* v. *Rea,* 1897, 2 Com. Cas. 293).

It mill have been observed from the above summary of the principles of general average that considerable differences exist between the law of England and of other countries. Not only this, but nearly every country differs in its view of what constitutes a general average sacrifice or loss and how it shall be borne, and the confusion which would have ensued had this state of things been allowed to persist would have been, and indeed was, extremely troublesome to the business community. There was always an uncertainty in the minds of underwriters and others as to what losses would or would not be allowed in general average, and on what values the ship, freight and cargo would be called upon to contribute. To remedy this confusion a movement to bring about international uniformity was commenced in 1860 and as a result of many conferences a group of rules was agreed upon for embodiment by reference in bills of lading or charter parties. These eventually took the form known as the "York-Antwerp Rules," from the cities at which the conferences of 1864 (at York) and of 1877 (at Antwerp) were held. The York-Antwerp Rules of 1877 were revised at a conference at Liverpool in 1890 and continued in almost universal use for 34 years, when they were again revised at the Stockholm Conference of the International Law Association held in 1924. The York-Antwerp Rules 1924 are used to such an extent that reference to different and differing codes of law on the subject of general average is almost unnecessary.

See **G.** R. Rudolf, *Yolk-Antwerp* ***Rules*** (1926), and the article MARINE INSURANCE (G. **R.** R)

AVERAGE ADJUSTER. The problems involved in giving effect to the ancient law of general average are very complex, and hardly less difficult are those arising out of the application of the law of marine insurance. The professional average adjuster undertakes the duties of applying these laws, subject to the business usages involved, to individual cases, and to determining the liabilities of the respective parties to a maritime adventure and to contracts of marine insurance. He embodies his findings in adjustments which may vary in bulk from a single sheet of foolscap to a volume of several thousand folios.

In the British Empire the adjuster has no official position. and the adjustments he prepares are subject, in case of dispute, to legal adjudication. Until the middle of the 19th century, adjusting was generally based upon the adjuster's individual interpretation of law and usage. With the increase in overseas trade which followed the termination of the Napoleonic wars, the necessity for uniform interpretation became evident, with the result that in 1872 the Average Adjusters Association was formed in Great Britain. The rules of practice of the association, in which have been embodied the original customs of Llcyds, have no legal sanction, but their value has been recognized by the law courts, and it is rarely that they have been overridden.

AVERESCU, ALEXANDRE (1859–1938), Rumanian general and politician, born March 9 1859, at Ismail (Bessarabia), was a volunteer in the war of independence against Turkey, 1877–78. After the war he remained in the army and studied at the high military school of Turin (Italy). He was minister of war in 1907 when he repelled the peasants' revolt. In 1913 he conducted the military operations in the war against Bulgaria as chief of the general staff. As commander of the 2nd and 3rd Armies, and later of the armies in the Dobruja, during the 1916 campaign, Gen. Averescu became enormously popular with his soldiers, a popularity which later on helped his political career.

In March 1918 he was asked by the king to form a cabinet and conducted the peace negotiations with the Central Powers. He was proclaimed president of the People's League, which later became the People's party, and thanks to the popularity of Gen. Averescu the party came into power in March 1920 with its president as prime minister. After holding office for a year and ten months he resigned, Dec. 17 1921, but remained president of the party. On the retirement of the Bratianu Government on March 27 1926, the king asked Averescu to form a government. He followed the general economic policy of his predecessors at home; and in foreign policy he initiated a rapprochement with Italy. He resigned in June 1927, and was thereafter active only periodically in Rumanian politics. On March 30, 1938, he was appointed a member of King Carol's permanent Crown Council. He died in Bucharest, Oct 2. 1938

AVERNUS, lake of Campania, Italy, about 1½m. N. of Baiae. It is an old volcanic crater, nearly 2m. in circumference, now, as in Roman times, filled with water. Its depth is 213ft., and its height above sea-level 3½ft.; it has no natural outlet. In ancient times it was surrounded by dense forests. It was represented as the entrance by which both Odysseus and Aeneas descended to the infernal regions, and as the abode of the Cimmerii. Its Greek name Ἄορνος, was explained to mean that no bird could fly across it. Hannibal made a pilgrimage to it in 214 B.C. Agrippa in 37 B.C. converted it into a naval harbour, the *Portus Iulius;* and joining it to Lacus Lucrinus by canal connecting with the sea, he reduced the distance to Cumae by boring a tunnel over ½m. in length, now called Grotta Pace, through the hill on the north-west side of Lake Avernus. The canal, however, soon became blocked owing to a gradual rise of the shore. Nero's works for his proposed canal from Baiae to the Tiber (A.D. 64) seem to have begun near Lake Avernus; indeed, according to one theory, the Grotta Pace would be a portion of this canal. On the east side of the lake are remains of baths, including a great octagonal brickwork hall known as the Temple of Apollo (1st century). The so-called Grotto of the Cumaean Sibyl, on the south side, is a rock-cut passage, ventilated by vertical apertures, possibly part of works connected with the naval harbour.

AVERROES (Abul-Walid Mohammed ibn-Ahmad Ibn-Mohammed ibn-Roshd) (1126–1198), the greatest Arabian philosopher in the West and the famous commentator on Aristotle, was born at Cordova. His early life was occupied in mastering theology, jurisprudence, mathematics, medicine and philosophy. Through Ibn-Tofail, he became acquainted with Yûsuf, a prince famous for his patronage of learning. Yûsuf helped to secure for him so many important posts, such as that of judge of Seville (1169) and later of Cordova, that Averroes complained that his frequent voyages into different parts of the empire on public business left him little time for study. Yûsuf's successor, al-Mansûr, at first equally well disposed towards Averroes, was incited, in 1195, by the growing popular distrust in speculative studies to intern the suspected philosopher at Elisâna, near Cordova. Later, Averroes was summoned to Morocco, where he died the year before al-Mansûr with whom (in 1199) the political power of the Mohammedans in the West came to an end, as did the Arabian culture of liberal science with Averroes.

Averroes left no school, and within the history of his own nation has little place. His historic fame came from the Christian Schoolmen, who admired and utilized his commentaries, sometimes judiciously and sometimes to excess. The latter group, in Paris known as the Latin Averroists, even went so far as to adopt his teaching that God eternally produces the intelligences by a process of emanation, that matter is an eternal potency, that the active intellect is one for all men, that there is no freedom or personal immortality, and that there may be contradiction between religion and philosophical truth.

The works of Averroes include treatises on jurisprudence, grammar, astronomy, medicine and philosophy, many of which still exist in manuscript. Some have been published in Arabic or in German translations (*cf.* Uberweg: *Grundriss der Geschichfe der Phil.* pt. 2, 1915, p. 364). By the end of the 12th century, the most important works were translated into Latin, and are found frequently in early printed editions of the works of Aristotle; they include the *Colliget,* a summary of medicine, the *Destructio Destructionis* (against Algazel), the *De Substantia Orbis,* two treatises on the union of the active intellect with man, and the commentaries on Aristotle, for whom Averroes had a profound admiration. The commentaries fall under three heads: the large ones, in which a paragraph from Aristotle is quoted and expounded at length; the medium commentaries, which are *résumés;* and finally the short paraphrases. The large commentaries exist only for the *Posterior Analytics, Physics, De Caelo, De Anima* and *Metaphysics.* On the *History of Animals,* no commentary at all exists, and paraphrases on Plato's *Republic* are substituted for the then inaccessible *Politics.* The best edition of the Latin translations of Averroes's works is that by Juntas (Venice. 1552).

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AVERRUNCATOR, a long shears used in arboriculture for "averruncating" or pruning off the higher branches of trees.

AVERSA, episcopal see, Campania, Italy, province of Naples, 12½m. N. by rail from Naples, from which there is also an electric tramway. Population (1936) 26,538 (town); 36,960 (commune) Aversa was the first settlement granted to the Normans in 1027 for help to Duke Sergius of Naples against Pandulf IV. of Capua. The Benedictine abbey of S. Lorenzo preserves a portal of the 11th century. A large lunatic asylum was founded by Joachim Murat in 1813.

AVERY, SAMUEL (1865–1936), American chemist and educator, was born in Lamoille, Ill., on April 19, 1865. He graduated at Doane college, Crete, Neb., in 1887, and pursued graduate studies at the University of Nebraska. Later he studied at the University of Heidelberg, Germany, from which in 1896 he received the degree of doctor of philosophy. After teaching chemistry in various capacities in the University of Nebraska and in the Nebraskan Agricultural Experiment Station, he was made head professor of chemistry in the university in 1905. In 1908 he became acting chancellor and in 1909 chancellor of the University of Nebraska. He lectured extensively on educational subjects and wrote many bulletins and other papers, chiefly on subjects connected with organic chemistry His chemical researches embraced investigations on glutaric acids, arsenical insecticides, the constitution of Paris green, the extermination of prairie dogs, the action of lime and sulphur in cattle dips and the occurrence of prussic acid in sorghum and kaffir corn.

AVERY, SAMUEL PUTNAM (1822–1904), American art dealer and connoisseur, was born in New York city on March 7, 1822. He began life as an engraver on copper and executed much work for the leading publishers in his native city. Later he became a skilled wood-engraver and illustrated numerous books. In 1865 he established himself as an art dealer. He became identified with many scientific, artistic and educational associations and was a founder and trustee of the Metropolitan Museum of Art. In memory of his son, Henry Ogden Avery, a successful architect who died in 1880, he established the Avery architectural library at Columbia university. In 1893, in memory of a daughter, he established a library in the Teacher's college, Columbia university. He also presented a collection of some 17,000 prints to the New York public library. He died in New York city on Aug. 14, 1904. Eight years later, Avery hall, commemorating both father and son, was built at Columbia university. In this structure is housed the Avery library, a valuable collection of works on architecture and decorative art, containing in 1928 about 29,000 volumes.

AVESNES, capital of an arrondissement in the department of Nord, north France, on the Helpe, 28m. S.E. of Valenciennes by rail. Pop. (1936) 5,389. Avesnes was founded in the 11th century and formed a countship which in the 15th century passed to the house of Burgundy and afterwards to Habsburg. In 1477 it was destroyed by Louis XI. By the treaty of the Pyrénées (1659) it went to France. It was captured by the Prussians in 1815. The church of St. Nicholas is 16th century. The chief industry of the town is wool-spinning, and there is trade in wood. It is the seat of a sub-prefect and has a tribunal of first instance and a chamber of commerce.

AVEYRON, a department of the south part of the Massif Central, in south France, stretching from the Cevennes across the wild Causse noir, the Causse Ste. Affrique and the plateau of Larzac to include portions of the valleys of Tarn, Aveyron and Lot on the west side of the massif. It is bounded on the north by Cantal, east by Lozère, south-east by Gard and Hérault, south-west by Tarn, and west by Tarn-et-Garonne and Lot. Area 3,386 sq. miles. Pop. (1936) 314,682, a heavy decline since 1906.

Aveyron is specially rich in dolmens, evidencing a culture in this locality now increasingly attributed to the early ages of metal. Statue-menhirs are a feature of the culture, as are small metal beads. Vidal de la Blache thinks this culture flourished before the covering of woods, etc., was destroyed, as, since then, the high land of this department has become desert with bare limestone surfaces, sometimes in a chaos of blocks simulating a ruin, as at Montpellier-le-vieux on the Causse noir. The rivers make deep and beautiful gorges and valleys in the highland plateau much of which is well above the 2,000ft. level. The department verges on the volcanic country of Auvergne, and the volcanic mountains of Aubrac on the north-east boundary reach a height of 4,760 feet.

Aveyron has a rigorous climate in the highlands but conditions are mild in the sheltered valleys of the lower lands. The average annual rainfall oscillates about 800mm., but is far higher on the mountains of Aubrac. The mean temperature for winter (reduced to sea level) is about 41° but the actuality varies a great deal. The usual crops are grown on the poor soil, potatoes, some wheat, rye and oats, and so on, but vineyards occur in shelter as at Entraygues, S. Georges, Bouillac and Najac, and chestnuts in the south, between Aveyron and Tarn. Walnuts, plums, apples for cider and mulberries for silkworms are also grown to some extent. The main occupation is, however, that of keeping live stock cattle of the Aubrac breed, and sheep on the Larzac plateau, the latter supplying milk for the famous Roquefort cheeses ripened in caves near the town.

The west of the department is largely formed of archaean rocks, but a long basin of carboniferous and later rocks spreads westward with the carboniferous rocks exposed towards its western end and along the flanks. At the west end coal is worked near Aubin (pop. 1936, 3 961) and Decazeville; at the former surface coal has been in use since the 9th century, the latter is a new industrial town (pop. 1936, 11,154) with iron foundries and is named after the Duc Decazes who founded them in 1830. Coal is also dug near Rodez, and iron is mined in the department, also lead and zinc. Millau is another industrial centre (pop. 1936, 15,393) making gloves as a specialty. Wool weaving and a number of minor industries are maintained and there is a good deal of quarrying.

Rodez, the capital, Millau and Villefranche-de-Rouergue give their names to the three arrondissements into which the department is now divided. The department is a bishopric, with bishop's seat at Rodez, under the archbishop of Albi; it belongs to the 16th military region and to the academic or educational district of Toulouse, its court of appeal is Montpellier. It is served by the Orléans and the Midi railways.

The department corresponds nearly to the ancient Rouergue, the countship of which was united to that of Toulouse in the 11th century. Some "bastides" were founded in the 13th century and Villefranche and Sauveterre are good examples. Of monastic foundations, Conques in the north is one of the most famous in France, with a magnificent Romanesque abbey church containing a rich reliquary. Espalion, Najac and Sylvanès also have interesting mediaeval castles and churches.

AVEZZANO, a town in Italy, province of Aquila, 67m. E. of Rome by rail and 38m. S. of Aquila by road. Population (1936) 15,003 (town); 16,866 (commune). Its fine castle, built in 1490 by Gentile Virginio Orsini, was, with the rest of the town, much damaged by the disastrous earthquake of 1915, of which it was the epicentre. The Lago Fucino lies 1½m. to the east.

AVIANUS, a Latin writer of fables, placed by some critics in the age of the Antonines, by others as late as the 6th century AD. He appears to have lived in Rome and to have been a heathen. The 42 fables which bear his name are dedicated to a certain Theodosius. Nearly all the fables are to be found in Babrius, but Avianus appears to have used a Latin paraphrase as his source, and not the original Greek. His language and metre are correct and the fables became popular as a schoolbook. Imitations were frequent, such as the *Novus* Avianus of Alexander Neckam (12th century).

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AVIARY, called by older writers "volary," a structure in which birds are kept in captivity. While the habit of keeping birds in cages dates from a very remote period, it is probable that structures worthy of being termed aviaries were first used by the ancient Romans, who called them ornithones. These consisted merely of four high walls and a roof, and were lighted with a few small windows, as the birds were considered to pine less if they could not see their free companions outside. Water was introduced by pipes, and conducted in narrow channels, and the birds were fed chiefly upon dried figs, carefully peeled, and chewed into a pulp by persons hired to do this.

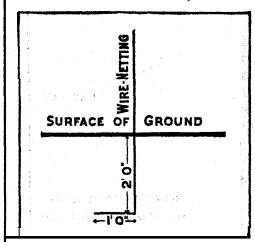


FIG. 1.—METHOD OF FIXING WIRE NETTING TO EXCLUDE VERMIN FROM AVIARY

The habit of keeping birds in aviaries for the sake of the pleasure they afford their owners and for the observation of their habits is, however, comparatively recent. The beginning of geographical research in the 15th century brought with it the desire to keep and study at home some of the beautiful birds the explorers came across, and hence it became the custom to erect aviaries for their reception. In the 16th century, in the early part of which the canary bird was introduced into Europe, aviaries were not uncommon in gardens of the wealthy, and Bacon refers to them in his essay on gardening (1597). Within recent years the method of keeping birds in large aviaries has received considerable attention.

An aviary may be of almost any size, from the large cage known, from its shape, as the "Crystal Palace aviary," to a structure as large as a church; and the term is sometimes applied to the room of a house with the windows covered with wire netting; but as a rule it is used for outdoor structures. composed principally of wire netting supported on a framework of iron or woodwork. For quite hardy birds little more than this is necessary, providing that protection is given in the form of growing trees and shrubs, rock-work or rough wooden shelters. For many delicate species, however, from tropical countries, warmth must be provided during the winter, and thus part at least of an aviary designed for these birds must be a wooden or brick house which can be shut up in cold weather and artificially warmed.

The ideal aviary, probably, is that which is constructed in two parts; viz., a well-built house for shelter in the winter, opening out into a large wire enclosure for use in the summer months. The doors between the two portions may be of wood or glazed. The sheltered portion is best built in brick or stone, as these materials are practically vermin-proof and the temperature in such a building is less variable than in a thin wooden structure. The floor should be of concrete or brick, and the house fitted with an efficient heating apparatus from which the heat is distributed by means of hot-water pipes or some other recognized method. Any arrangement which would permit the escape into the aviary of smoke or noxious fumes is to be strongly condemned. Such a house must be well lighted, preferably by skylights; but it is a mistake to have the whole roof glazed; at least half should be of wood, covered with slates or tiles. Artificial lighting, though not essential in most cases, is desirable during dull weather and short winter days, and electric light may be installed with great advantage; but some method of gradually dimming this is necessary to enable the birds to find their roosting places before the light is completely extinguished. Perches consisting of branches of trees with the bark adhering should be fixed up, and, if small birds are to be kept, bundles of bushy twigs should be securely fixed in corners under the roof.

The outer part, which will principally be used during the summer, though it will benefit most birds to be let out for a few hours on mild winter days also, should be as large as possible, and constructed entirely of wire netting stretched on a framework of wood

or iron. If the latter is selected, stout gas-piping is both stronger and more easily fitted together than solid iron rods. If the framework be of wood, this should be creosoted, preferably under pressure, or painted with three coats of good lead paint, the latter preservative also being used if iron is selected. The wire netting used may be of almost any sized mesh, according to the size of birds to be kept, but as a general rule the smallest mesh, such as half or five-eighths of an inch, should be used, as it is practically vermin-

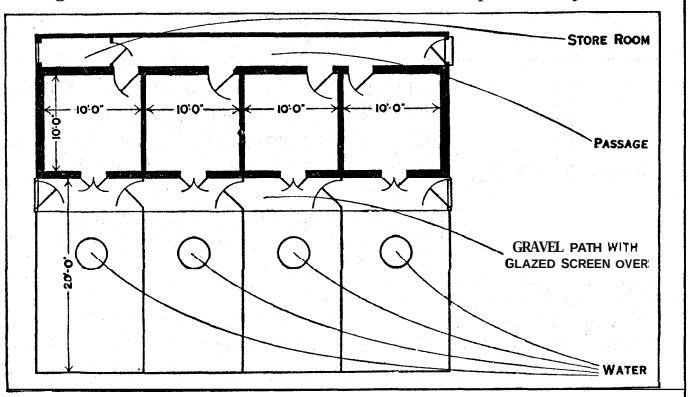


FIG. 2.— GROUND PLAN OF 4-COMPARTMENT AVIARY FOR LARGE BIRDS
Each compartment consists of an inner house 10 ft. square (shown in heavy outline) and an outer flight 20 ft. by 10 feet

proof, and allows of birds of any size being kept. Wire netting for aviaries should be of the best quality, and well galvanized.

Provision must be made for the entire exclusion of such vermin as rats, stoats and weasels, which, if they were to gain access, would commit great havoc amongst the birds. The simplest and a very effectual method of doing this is by sinking the wire netting some 2ft. into the ground all round the aviary, and then turning it outwards for a distance of another foot as shown in fig. 1.

The outer part of the aviary should be turfed and planted with evergreen and deciduous shrubs, and be provided with some means of supplying an abundance of pure water for the birds to drink and bathe in; and a gravel patch should not be forgotten.

Perhaps the most useful type of aviary is that built as above described, but with several compartments, and a passage at the back by which any compartment may be visited without the necessity of passing through and disturbing the birds in other compartments. Fig. 2 represents a ground plan of an aviary of this type divided into four compartments, each with an inner house 10ft. square, and an outer flight of double that area. The outer flights are intended to be turfed, and planted with shrubs, and the gravel path has a glazed roof above it by which it is kept dry in wet weather. Shallow water-basins are shown, which should be supplied by an underground pipe and a cock which can be turned on from outside the aviary; and they must be connected with a properly laid drain by means of a waste plug and an overflow pipe.

An aviary should always be built with a southern or south-eastern aspect, and, where possible, should be sheltered from the north, north-east and north-west by a belt of fir-trees, high wall or bank, to protect the birds from the biting winds from these quarters.

When parrots of any kind are to be kept, it is useless to try to grow any kind of vegetation except grass, and even this will be demolished unless the aviary is of considerable size. The larger parrots will, in fact, bite to pieces not only living trees but also the woodwork of their abode, and the only really suitable materials for the construction of an aviary for these birds are brick or stone and iron; and the wire netting used must be of the stoutest gauge or it will be torn to pieces by their strong bills.

The feeding of birds in aviaries is, obviously, a matter of the utmost importance, and, in order that they may have what is most suitable, the aviculturist should find out as much as possible of the wild life of the species he wishes to keep, or if little or nothing is known about their mode of living, as is often the case with rare forms, of nearly related species whose habits and food are probably much the same, and he should endeavour to provide food as nearly as possible resembling that which would be obtained by the birds when wild. It is often, however, impossible to supply precisely the same food as would be obtained by the birds had they their liberty, but a substitute which suits them well is generally obtainable. The majority of the parrot tribe subsist principally upon various nuts, seed and fruit, while some of the smaller parakeets or pnroquets appear to feed almost exclusively upon the seeds of various grasses. Almost all of these are comparatively easy to treat in captivity, the larger ones being fed on maize, sunflower-seed, hemp, dari, oats, canary-seed, nuts, and various ripe fruits, while the grass-parakeets thrive remarkably well on little besides canary-seed and green food, the most suitable of which is grass in flower, chickweed, groundsel and various seed-bearing weeds. But there is another large group of parrots, the *Loriidae* or brush-tongued parrots, some of the most interesting and brightly coloured of the tribe, which, when wild, subsist principally upon the pollen and nectar of flowers, notably species of *Eucalyptus*, the filamented tongues of these parrots being peculiarly adapted for obtaining this. In captivity these birds have been found to live well upon sweetened milk-sop, which is made by pouring boiling milk upon crumbled bread or biscuit. They frequently learn to eat seed like other parrots, but, if fed exclusively upon this, are apt, especially if deprived of abundance of exercise, to suffer from fits, which are usually fatal. Fruit is also readily eaten by the lories and lorikeets, and should always be supplied.

The foreign doves and pigeons form a numerous and beautiful group which are mostly hardy and easily kept and bred in captivity. They are for the most part grain-feeders and require only small corn and seeds, though the group of fruit-pigeons are fed in captivity upon soft fruits, berries, boiled potato and soaked grain.

The various finches and finch-like birds form an exceedingly large group and comprise perhaps the most popular of foreign aviary birds. The weaver-birds of Africa are mostly hardy and easily kept, their food consisting, for the most part, of canary-seed. The males are, as a rule, gorgeously attired in brilliant colours, some having long flowing tail-feathers during the nuptial season, while in the winter their showy dress is replaced by one of sparrow-like sombreness. The grass-finches of Australasia contain some of the most brilliantly coloured birds, the beautiful grass-finch, *Poëphila mirabilis*, being resplendent in crimson, green, mauve, blue and yellow. Most of these birds build their nests, and many rear their young, successfully in outdoor aviaries, their food consisting of canary and millet seeds, while flowering grasses provide them with an endless source of pleasure and wholesome food. The same treatment suits the African waxbills, many of which are extremely beautiful, the crimson-eared waxbill or "cordon-bleu" being one of the most lovely and most frequently imported. These little birds are somewhat delicate, especially when first imported, and during the winter months require artificial warmth.

There is a very large group of insectivorous and fruit-eating birds very suitable for aviculture, but their mode of living necessarily involves considerable care on the part of the aviculturist in the preparation of their food. Many birds are partially insectivorous, feeding upon insects, when these are plentiful, and upon various seeds at other times. Numbers of species again, which, when adult, feed almost entirely upon grain, feed their young, especially during the early stages of their existence, upon insects; while others are exclusively insect-eaters at all times of their lives. All these points must be considered by those who would succeed in keeping and breeding birds in aviaries.

It would be almost impossible to keep the purely insectivorous species, were it not for the fact that they can be gradually accustomed to feed on what is known as "insectivorous" or "insectile" food, a composition of which the principal ingredients generally consist of dried ants' cocoons, dried flies, dried powdered meat, preserved or fresh yolk of egg, and crumb of bread or biscuit. This is moistened with water or mixed with mashed boiled potato or beef dripping, and forms a diet upon which most of the insectivorous birds thrive. The various ingredients, or the food ready

made, can be obtained at certain bird-fanciers' shops. Although it is a good staple diet for these birds, the addition of mealworms, caterpillars, grubs, spiders and so forth is often a necessity, especially for purely insectivorous species.

The fruit-eating species, such as the tanagers and sugar-birds of the New World, require ripe fruit in abundance in addition to a staple diet such as that above described, while for such birds as feed largely upon earth-worms, shredded raw meat is added with advantage.

Many of the waders make very interesting aviary birds, and require a diet similar to that above recommended, with the addition of chopped raw meat, mealworms and any insects that can be obtained.

Birds of prey naturally require a meat diet, which is best given in the form of small, freshly killed mammals, and birds, the fur or feathers of which should not be removed, as they aid digestion.

The majority of wild birds, from whatever part of the world they may come, will breed successfully in suitable aviaries provided proper nesting sites are available. Large bundles of brushwood, fixed up in sheltered spots, will afford accommodation for many kinds of birds, while some will readily build in evergreen shrubs if these are grown in their enclosure. Small boxes and baskets, securely fastened to the wall or roof of the sheltered part of an aviary, will be appropriated by such species as naturally build in holes and crevices. Most of the parrots, when wild, lay their eggs in hollow trees, and occasionally in holes in rocks, or in ants' hills, making no nest, but merely scraping out a slight hollow in which to deposit the eggs. For these birds hollow logs, with small entrance holes near the top, or boxes, varying in size according to the size of the parrots should be supplied. In providing nesting accommodation for his birds the aviculturist must endeavour to imitate their natural surroundings and supply sites as nearly as possible similar to those which the birds would naturally select.

Aviculture is a delightful pastime, but it is also far more than this; it is of considerable scientific importance, for it admits of the living birds being studied in a way that would be quite impossible otherwise. There are hundreds of species of birds, from all parts of the world, the habits of which are almost unknown, but which may be kept without difficulty in suitable aviaries. Many of these birds cannot be studied satisfactorily in a wild state by reason of their shy nature and retiring habits, not to mention their rarity and the impossibility, so far as most people are concerned. of visiting their native haunts. In suitable large aviaries, however, their nesting habits, courtship, display, incubation, moult and so forth can be accurately observed and recorded. The keeping of birds in aviaries is therefore a practice worthy of every encouragement, so long as the aviaries are of sufficient size and suitable design to allow of the birds exhibiting their natural habits; for in a large aviary they will reveal the secrets of their nature as they never would do in a cage or small aviary. (D. S.-S.)

AVIATION ARTICLES: see AERONAUTICAL ARTICLES.

AVIATION, CIVIL. Civil aviation embraces all forms of flying other than that carried out by fighting forces and may be divided broadly into three branches. Before coming to details it will be useful to describe briefly the scope and nature of each branch. Though comparatively young, civil aviation has made sturdy growth and has developed along distinctive lines.

(1) Air Transport.—This has found a secure footing as an extra-rapid parallel to land and sea methods of transport and as an almost indispensable form of communication where ground services are difficult or non-existent; hence it has an enormous field of usefulness throughcut the world. In most countries air transport is organized by private enterprise, with the aid of Government subsidies.

(2) Other *Commercial* Uses of Aircraft.—These embrace air photographic survey, air photography for trade and advertising, forest fire protection and forest inventories, crop dusting for pest destruction, sky-writing, ambulance and medical duties, prospecting and geological survey, and charter hire.

(3) Flying Training, Private Flying and Air *Racing.*—Elementary training for military as well as civil pilots is in many countries carried on by civil organizations.

Throughout Europe civilian flying schools and the interest of civilians in aviation have been encouraged for many years by the governments of the various nations as measures of military preparedness.

In 1939, the United States for the first time followed this lead in establishing the civilian pilot training program. Even without such governmental assistance, the ownership and use of aeroplanes by individuals is rapidly on the increase and the steady development of light aeroplanes promises an expanding future for this type of aviation.

Air racing has a hold on the public imagination, and the great national and international events everywhere attract thousands oi spectators and world-wide attention.

AIR TRANSPORT

Historical.—Air transport is an entirely modern conception. In 1870, balloons were employed for the carriage of messages from Paris during the siege, a measure for evading the besieging army, which, in other circumstances, could not have claimed to be a practical method of carrying mails. Between 1909 and 1914 various demonstrations were made to prove the suitability of the aeroplane as a rapid conveyance for mail matter, and a considerable number of journeys by air were accomplished by private individuals; but none of these enterprises, though interesting and daring, could fairly be described as the real beginning of air transport.

That air transport would become a practical proposition was, however, recognized, and in 1910 a conference was held in Paris at which an international convention in regard to aerial navigation was drafted. The credit for the first genuine commercial air service lies with Germany; from March 1912 until Nov. 1913 the rigid airships "Victoria Louise," "Hansa" and "Sachsen" plied regularly between Berlin and Friedrichshafen, and in 881 flights. totalling 65,500m., carried 19,105 passengers without injury and in considerable comfort (see AIRSHIP).

The War of 1914–18 obviously interfered with the progress of commercial operations, but while European nations were engaged in the great conflict they, as well as the United States, were studying the feasibility of wider purposes of civil and commercial flying. with the result that shortly after the war a start was made by England, France and Holland on actual operations that have grown, with the progress of other nations, to regular, efficient transport systems that cover all continents and girdle the entire world.

The Cross-Channel **Air** Service.—On Aug. 25, 1919, Aircraft Transport and Travel Ltd. despatched the first aircraft to fly on a regular commercial service to Paris, and on Nov. 10, 1919, an aeroplane belonging to the same company carried the first regularly established air mail to the same destination. The British Handley-Page Transport Ltd. and the French Cie. Messageries Aériennes were quick to follow, and by Jan. 1, 1920, there were three British and two French companies operating on a regular time-table across the Channel. These operations were nearly all carried out by military aircraft, or by military aircraft modified to carry passengers in some degree of comfort. It was clear that air transport could not at once become self-supporting and would need some financial assistance from the State, until experience was gained and aircraft specially designed for commercial purposes were produced with the aid of that experience.

The French Government had already realized the vast possibilities of air transport and a costly and ambitious policy of financial assistance was inaugurated in 1919. This policy was inspired to some extent by its potential influence on the countries flown over, but its ultimate object was to attain rapid communication between Paris and the French colonies in Africa and Asia.

In England, on the other hand, there was not sufficient money allotted for even a very low standard of aerial defence, and air transport was therefore relegated to the background as an enterprise which the nation could not afford, although the British empire had more to gain from its development than any other country in the world. Lacking Government support, the pioneers, and

with them the public who had supported their new enterprises financially, walked towards inevitable ruin. The general financial crisis of the autumn of 1920 brought matters to a head, and Aircraft Transport and Travel Ltd. went into liquidation in December, whilst in Feb. 1921 Handley-Page Transport Ltd. suspended operations, leaving the French in unchallenged occupation of the cross-Channel routes. This disaster brought about a parliamentary and press agitation and, as a result, from March 1921 the cross-Channel services have been subsidized in varying degrees.

From March 1921 until March 31, 1922, two British companies continued limited operations between London and Paris under a system of Government financial support which guaranteed them a 10% profit on the receipts obtained for traffic carried. Whilst this temporary and admittedly extravagant measure was in force, the Londonderry Committee put forward a scheme which was accepted by the Government and operated from April to Sept. 1922. It comprised the provision of half the fleet of each company by the Government on a hire-purchase system, and a subsidy based partly on the load carried and partly on the gross earnings of the companies. Three companies, the Handley-Page Transport Ltd., the Instone Air Line Ltd , and Daimler Airways Ltd., operated to Paris, and one company, the Instone Air Line Ltd., flew to Brussels. It was very soon found that the hire-purchase scheme was impracticable. Moreover, the traffic available between London and Paris was not sufficient for five companies (three British and two French), and it was unsound that all three British companies should be subsidized. On Oct. 1, 1922, this scheme was modified on the basis of avoiding competition between British companies and extending British air transport into Europe as far as possible with the money available.

Meanwhile, owing to the various difficulties which had arisen and the apparent wastefulness of maintaining several separate organizations for a comparatively small volume of traffic, the Hambling Committee was assembled in Jan. 1923. This committee definitely recommended the amalgamation of the existing companies into a single national company with great freedom of action. They indicated that the company must be provided with a substantial capital, and be guaranteed a monopoly of subsidy for a term of years.

"Imperial Airways" Founded.—Thus, in March 1924, a national company, Imperial Airways Ltd., was brought into being with a guarantee of a total subsidy of £1,000,000 spread over a period of ten years on a tspering scale, for regular flying carried out within Europe, the contract with the Government permitting liberty of action as to the services actually operated.

At the commencement the subsidy was paid according to the mileage flown on the regular routes, irrespective of the type of aircraft employed.

As this method of payment held out no inducement to the company to use larger and more economical aircraft it was modified in Dec. 1925 so that "horse-power miles" instead of "machine miles" became the basis of payment.

The fruit of this alteration was that the company renewed its fleet with advanced type of craft, extended its routes, added Bight schedules and generally expanded its facilities Such improvement of service required more financing and Imperial Airways was therefore given a direct subsidy. In 1937 the company consummated an agreement with the government by which it undertook to carry all empire mail between England and those parts of the empire lying in Africa and Asia.

In 1939 plans were laid, at the government's suggestion, to merge Imperial Airways with the firm British Airways, Ltd into a new company to be known as British Overseas Airways corporation.

Empire Routes.—Cross-Channel service between London and Paris marked the beginning of British air transport in 1919, but within ten years in England as well as in other big countries of the world the conviction grew that air transport could only attain its full value over long routes, and accordingly the energies of Imperial Airways were more and more directed to the creation of great imperial routes to Africa and the East rather than toward establishment of comparatively short connections within Europe

British service had long been set up between London and Paris, Basle, Zurich, Brussels, Cologne and Ostend when, in 1926, the Government handed over to Imperial Airways a mail route from Cairo to Baghdad which had been established in 1921 by the Royal Air Force. This Egypt-Iraq stage was the start of a system of routes which in ten years brought every Dominion, excepting Canada, in aerial contact with London. From Cairo, the route was run back via Alexandria and Athens to, Brindisi, where railway connections with Paris were made until the British government could conclude arrangements with France and Italy for a direct air service across all of Europe. Meanwhile, the route was extended East from Baghdad to Basra (1926) and to Karachi (1929) via Koweit, Bahrein, Sharjah and Gwadar.

Karachi had been a major goal when the Eastern service was projected, but the line did not stop there. Instead, in a period of five or six years, it had crossed all of India, bisected the Gulf of Bengal and gone over Burma and thence down through the Malay Straits and into Brisbane—a route distance from London of 12,754 miles, which in 1936 was being negotiated on regular and frequent schedules in approximately ten days, as against the twenty days required by surface transportation. Connection of Singapore with Hongkong, via Penang, Saigon and Tourane, was projected for 1937, closing another of the final links in complete empire service. With probable connection from Hongkong with an American route to Manila, this link would mark the completion of flying routes around the earth.

Meanwhile, Imperial Airways surveyed a British route through Africa from the Mediterranean to the Cape of Good Hope. The survey was followed by demonstration flights, notably over the 1.400 miles between Khartoum and Kisumu, and on March 6, 1931, service was started on the Egyptian-South African route, first extending from Cairo to Kisumu in the Kenya Colony of East Africa, and by January of 1932 from Kisumu to Cape Town. The aerial conquest of Africa—almost 6,000 miles from Cairo to Cape Town—was as spectacular an achievement as the commercial pioneering across the lands of Asia to Australia and China. Distances over Africa and Asia were immense, even by air, and they extended across some of the most isolated stretches of wilderness on the globe. This isolation of far-flung operations, plus complications incidental to arrangements for flight over the countries of peoples indifferent to the white man's sense of progress, prohibited, at least at first, the advantages of complete radio-guided and beacon-lighted routes which played such an important part in the remarkable progress of the United States toward first place in the air transport nations of the world.

A glance at a map, however, will readily indicate the nature of the terrain and the vagaries of the weather encountered in flight over Europe. Asia, Africa and Australia. It is true that a rather complete knowledge of the world weather is now available and consistent flying has acquainted aeroplane crews with the sort of ground over which they fly, but weather changes come too

British Regular Air Transport

(Including United Kingdom, Europe, Asia and Africa)

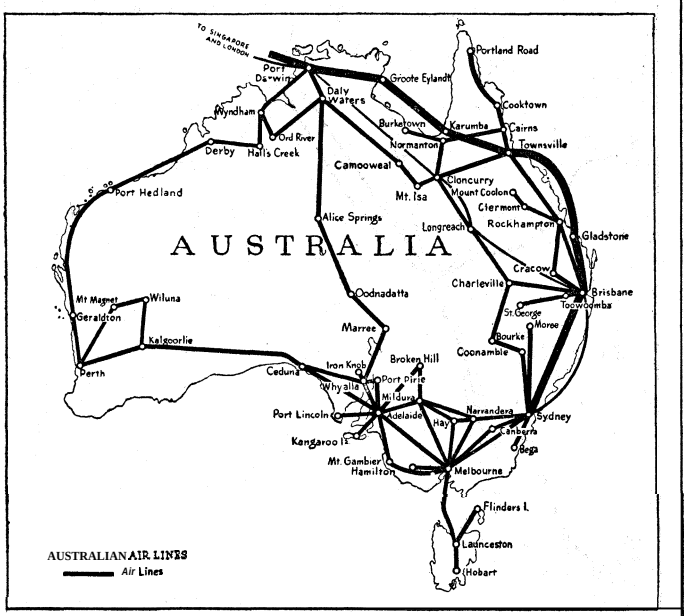
Year	Miles Flown	Passengers Carried	Mail-Freight Cargoes (tons)
1919*	104,000	870†	30
1920	644,000	5,799†	137
1921	225,000	5,256†	19·4
1922	717,000	10,393†	214·6
1923	943,000	15,552†	328·1
1924‡	936,000	13,601†	542·8
1925	806,000	11,000	550
1926	778,000	16,600	679
1927	789,000	19,000	615
1928	916,000	27,300	813
1929	1,189,000	28,300	927
1930	1,222,000	23,400	832
1931	1,354,000	23,500	769
1932	1,793,000	48,200	772
1933	2,638,000	79,100	914
1934	4,557,000	135,100	1,422
1935	8,412,000	200,000	2,612
1936	9,584,000	236,300	3,124
1937	10,773,000	244,400	3,961
1938	14,331,000	222,200	5,980

*Commenced August 25th. †By stages. ‡10½ months only.

suddenly for timely and accurate predictions in far off places and knowledge of terrain is of comparatively little value until navigational and flying skill is brought into play. Hence it is that the extensive pioneering accomplished by British aviators and British equipment formed much of the basis upon which the success of the empire routes was built and has been maintained for many years. An excellent means of visualizing rapidly the many changes that have occurred in the history of British air transport is given in the table on page 802.

Australia. — In Australia air transport is firmly established, the saving in time effected by aircraft being measured by days or in some instances weeks. In 1938, 12 subsidized air routes were in operation totalling almost 22,000 mi., and, besides serving all parts of the continent, maintained links with New Guinea, Tasmania and Singapore.

Apart from conferring the benefits of more rapid communication upon the inhabitants of places lying on the regular routes, the Australian operating companies have done a most useful service



AUSTRALIAN AIR LINES

in undertaking special "taxi" flights to other places. The conveyance of doctors to patients and the carriage of sick people unfit for ordinary travel to hospitals has been especially valuable in assisting the settlement of remote areas. Stock breeders have also been saved large losses in times of drought, when the search for grazing grounds has been successfully carried out by air in a fraction of the time that would otherwise be consumed.

Canada. — For many years Canada's chief contribution to the development of air transportation consisted of extensive pioneering in the field of heavy freight-carrying largely in connection with mining operations in the northern part of the country. In 1939, Canadian air lines and established charter operators carried no less than 23,153,711 lb. of freight and mail. By that time, the Canadian government, working with the Canadian National railways, had established what was, in effect, a government-owned transcontinental air-line system running between Vancouver and Moncton via Winnipeg, Toronto and Montreal. A north-south spur was operated by this same Trans-Canada Air Lines between Lethbridge and Edmonton. Other companies, in 1940, were operating services from Edmonton and Vancouver which connected with American-Alaskan services in the Yukon; from Edmonton and Regina north through the mining districts to Aklavik and Coppermine on the shores of the Arctic ocean. Still another company was operating an extensive network of services to the north and east of Winnipeg.

United States. — Two American brothers, Wilbur and Orville Wright. were the first to fly a heavier-than-air machine and the scene of their accomplishment was naturally the United States. and while their country was the last of the bigger nations of the world to enter broadly into commercial aeronautics, it had outstripped the world in this branch of aviation well within ten years after it began such activity on a wide scale in 1926 and 1927.

The Wrights first flew in 1903, somewhat ahead of successful practical aeronautical experimentation in Europe, notably in France, and from the pioneer teaching in America and Europe a comparatively small group of pilots was evolved — this group, fast dying out, being popularly known in the United States as the "Early Birds," that is, usually, aviators who were trained prior to the World War of 1914–18 The "Early Birds" were itinerant and scattered all over the United States, but the entrance of tht United States into the World War in April of 1917 brought many of them into the army where they served either as commissioned or civilian instructors of the young men, who, after the Armistice, served as the nucleus of the personnel of American aviation when it began its remarkable advance.

The outcome of the World War of 1914–18 was still far from certain when the United States government, on May 15, 1918, inaugurated its first scheduled air-mail service between Washington and New York. At first undertaken as a means of affording cross-country experience to some of the nation's new military fliers, the service won the deep interest of the post office and was taken over by that department of the government on Aug. 12 of the same year. On Sept. 8, 1920, pilots pioneered the first transcontinental mail route between New York and San Francisco. This service mas equipped with old war aircraft powered with Liberty engines, the aircraft being modified only slightly to carry mail sacks in place of an observer. Despite such handicaps, the service set remarkable records for efficiency and regularity and in 1924 the first regular night flying service in the world was carried out between Chicago and Cheyenne. Aside from this contribution, the United States, in contrast to the governments of comparable European nations, gave little or no assistance to commercial aviation enterprise and even neglected to bring any form of air navigation regulations into force.

In February of 1925, however, a congressional bill was passed empowering the postmaster-general to make contracts for the carriage of domestic mail by private enterprise, and in May of 1926 the Air Commerce act came into law whereby air navigation was brought under federal control and a civil aviation branch was set up in the department of commerce to administer the regulations and take charge of route organization and navigational facilities generally. From that point progress has been very rapid. Lindbergh flew to Paris in May of 1927 and by July 1 of the same year 19 air-mail contracts had been awarded and 16 contractors were in active operation. One-half of the trans-continental service had been taken over by a contractor, and within several more months the remainder of the route passed to private operators. At this time the route mileage flown regularly with mails was 7,663 mi. and the distance flown daily (including night flying) was 16.382 mi.

The contrast obtaining with these figures approximately seven years later is impressive. In 1934 there mere 25 operators carrying passengers or mail or express, usually all three, and they had spun a network of lines over North and South America of more than 50,000 mi., a figure far in excess of the route mileage of any other nation in the world. Over this American route mileage, transport craft of various sizes and the fastest speeds were flying more than 133,000 m i daily, more than half of the U.S. continental portion of this distance being negotiated by night, thanks chiefly to an elaborate system of almost 19,000 mi of beacon-lighted radio-equipped airways built for the most part by government money. Other government money, given the air-line operators in the form of mail contracts, permitted the constant purchase of new, fast equipment, some of it includiiig sleeper planes which first went into use on the southern transcontinental route of American Airlines,

The progress of night flying and transport speeds were two of the outstanding features of the advance of American commercial aviation. In 1921, when transcontinental mail service was first

established, 60 hours were required for negotiation of the coast-to-coast distance; in five years this time was cut in half and by 1933 mail, passengers and express were being carried from the Pacific to the Atlantic on regular schedules of 15 hours.

The rather generous policy of government subsidy permitted in great measure the establishment of the transpacific service of Pan American Airways from San Francisco to China via Honolulu, Midway islands, Wake, Guam and Manila. This 8,000-mi. route is by far the longest over-water airways path in the world; it made possible the movement of mail, passengers and express across the Pacific in four days as against the weeks which had been required by some steamships.

A precipitous drop in some of the statistics for American aviation is noticeable in 1934 due to the cancellation by the government of commercial air-mail contracts on grounds of "collusion." But there being little substantiation of the charges, after three and a half months, the contracts were reinstated. Despite this episode, the growth of the business in the United States remained impressive, as shown in the table given herewith:

American Regular Air Transport
(Includes Domestic Air Lines Only)

Year	Miles Flown	Passenger Carried	Express (Pounds)	Mail (Pound-Miles)
1926	4,258,771	5,782	3,555	—
1927	5,779,863	8,661	45,859	—
1928	10,400,239	47,840	210,404	—
1929	22,380,020	159,751	249,634	—
1930	31,992,634	374,935	359,523	—
1931	42,755,417	469,981	788,059	6,280,409,884
1932	45,606,354	474,279	1,033,970	5,402,249,740
1933	48,771,553	493,141	1,510,215	5,135,987,406
1934	40,955,396	461,743	2,133,199	4,922,822,780
1935	55,380,353	746,946	3,822,397	8,265,416,188
1936	63,777,226	1,020,931	6,958,777	11,482,872,622
1937	66,071,507	1,102,707	7,127,369	13,396,460,117
1938	69,668,827	1,343,427	7,335,967	14,845,719,671
1939	82,571,523	1,876,051	9,514,299	17,170,021,595

EUROPEAN AIR TRANSPORT

France. — In this country civil aviation began to be developed immediately after the World War, and since 1919 large sums have been devoted each year to air transport development. In 1927, four air transport companies operating over 8,304 route miles, had connections between London, Paris, Berlin, Brussels, Bucharest and other large cities of Europe and North Africa.

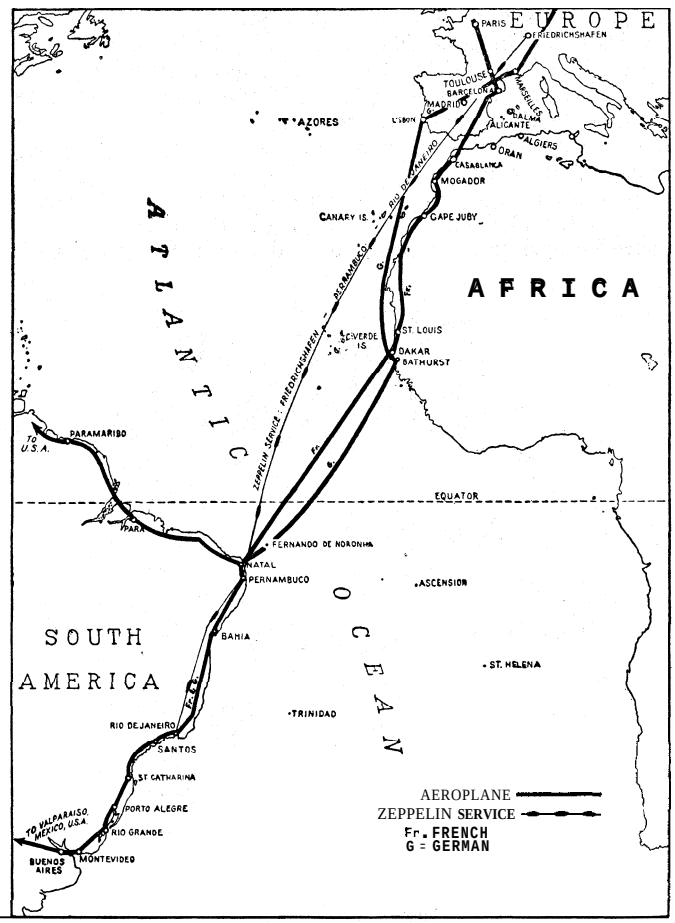
An outstanding success was achieved early by the line from France to Morocco over which mails have been transported since 1919. In 1933, all French air-line activities were merged into a single new company christened Air France of which one-third of the capital was held by the French government. Besides its long route to the orient, the most spectacular French operation is its service, established in 1936 across the south Atlantic. At the outbreak of hostilities in 1939, France stood ready to establish a service across the north Atlantic and, in fact, had actually completed several round-trip crossings with air mail.

Germany. — Germany entered the transport lists as soon as the conditions of peace permitted and, to encourage private enterprise, she offered a simple subsidy on a kilometric basis. During the earlier years the various air transport companies went through a process of grouping and regrouping until in 1924 German air transport was in the hands of two rival concerns, the Aero Lloyd and the Junkers company, both of which by rousing local interest had succeeded in establishing subsidiary companies in various parts of Germany.

The keen rivalry between these two groups developed after a time into harmful competition and duplication, and the government was forced to step in. The obvious solution was the formation of a single company, and on April 1, 1926, the Deutsche Lufthansa was brought into existence, and in a few years had established 14,000 mi. of routes radiating from Berlin to the principal cities of Europe with connections to Turkey, Persia and North Africa.

Side by side with its aeroplane services, Germany led all the world in a bold attempt to utilize the airship in air transport (see AIRSNIP). From 1934 to 1939, Germany maintained a highly successful air-mail service across the south Atlantic using mother ships and catapulted flying boats and had demonstrated itself ready to establish a similar service across the north Atlantic.

Other Countries. — Other European countries, particularly Russia and Holland, have spread their wings and flown far. Starting in 1919 with a service that first went between London, Paris and Copenhagen, Holland paralleled the activities of the British in



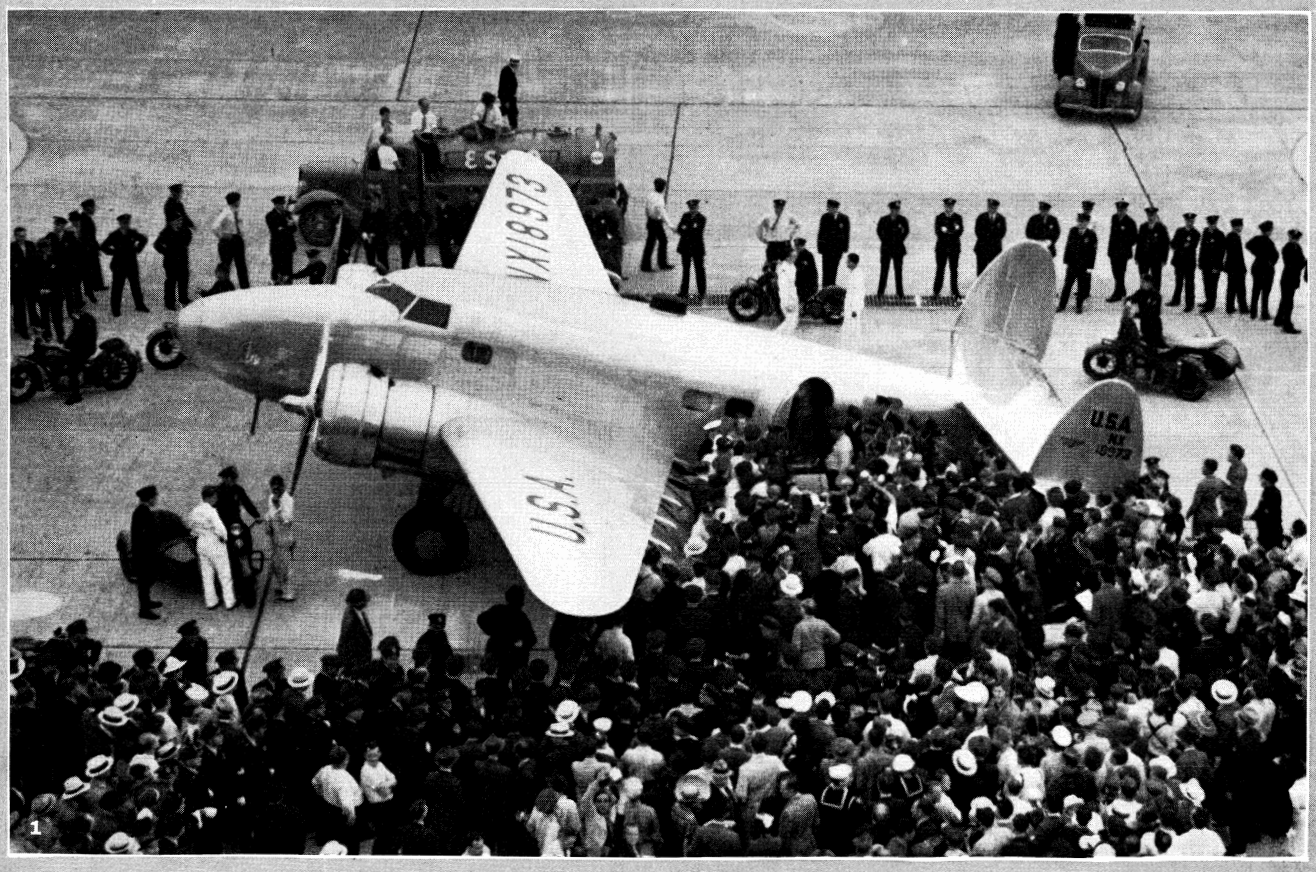
AIR LINES FROM EUROPE TO SOUTH AMERICA

establishing an air line to the east, terminating in Batavia. Russia, flying in all directions out of Moscow, eventually extended its service to Petropavlovsk, almost 6,000 mi. across bleak Eurasia.

The air service of the world in the two decades following the World War of 1914–18 progressed so steadily that by 1939 all continents were covered by extensive air-line networks, practically every major ocean route was paralleled by at least one air-line

Regular Air Services—The World

Year	Route Mileage (Approximate)	Miles Flown (Partly Estimated)
1919	3,200	1,022,000
1920	9,700	2,969,000
1921	12,400	5,831,000
1922	16,000	5,666,000
1923	16,100	6,570,000
1924	20,300	8,764,000
1925	34,000	13,011,000
1926	48,500	16,824,000
1927	54,700	22,242,000
1928	90,700	34,005,000
1929	125,800	53,379,000
1930	150,800	69,505,000
1931	185,100	83,500,000
1932	190,200	93,372,000
1933	200,300	100,580,000
1934	223,100	103,432,000
1935	278,200	149,442,000
1936	305,200	179,243,000
1937	333,500	198,868,000
1938	349,100	233,756,000
1939	499,300	300,030,000



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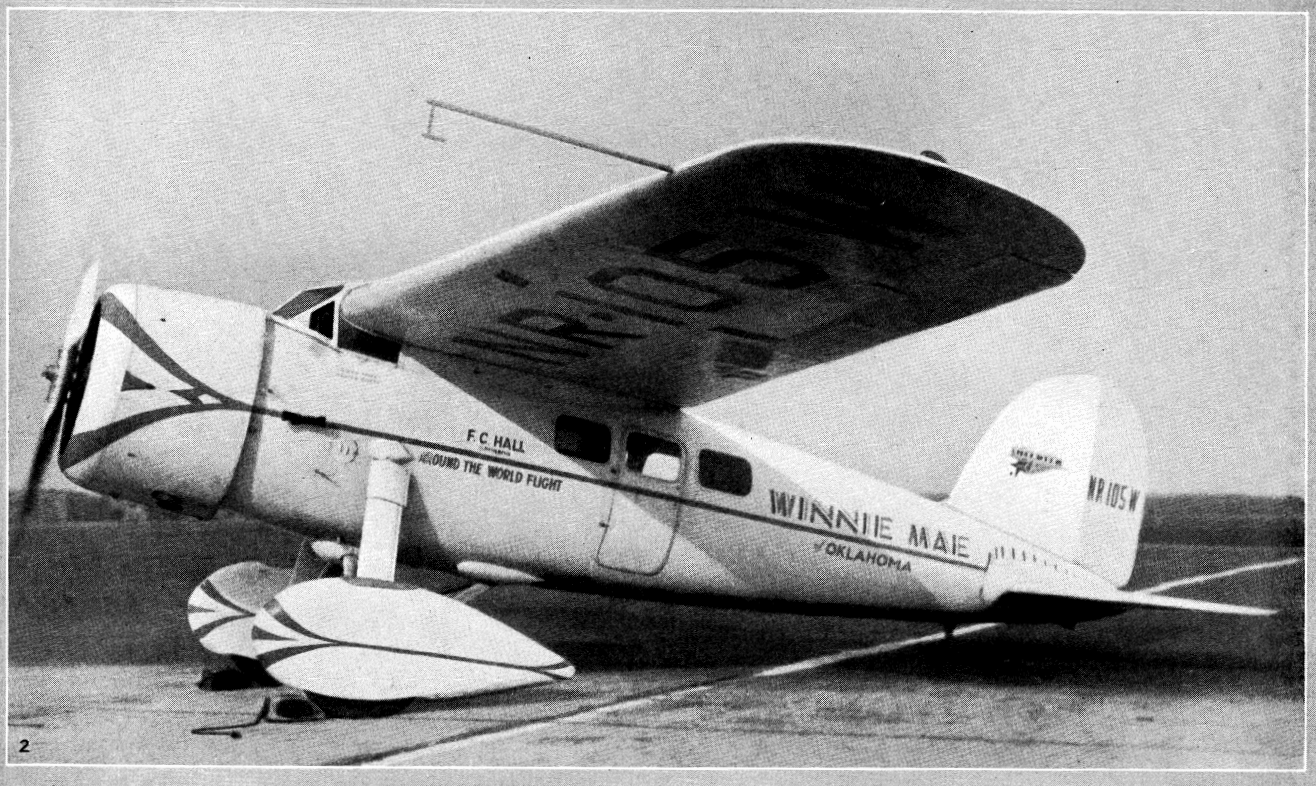


2

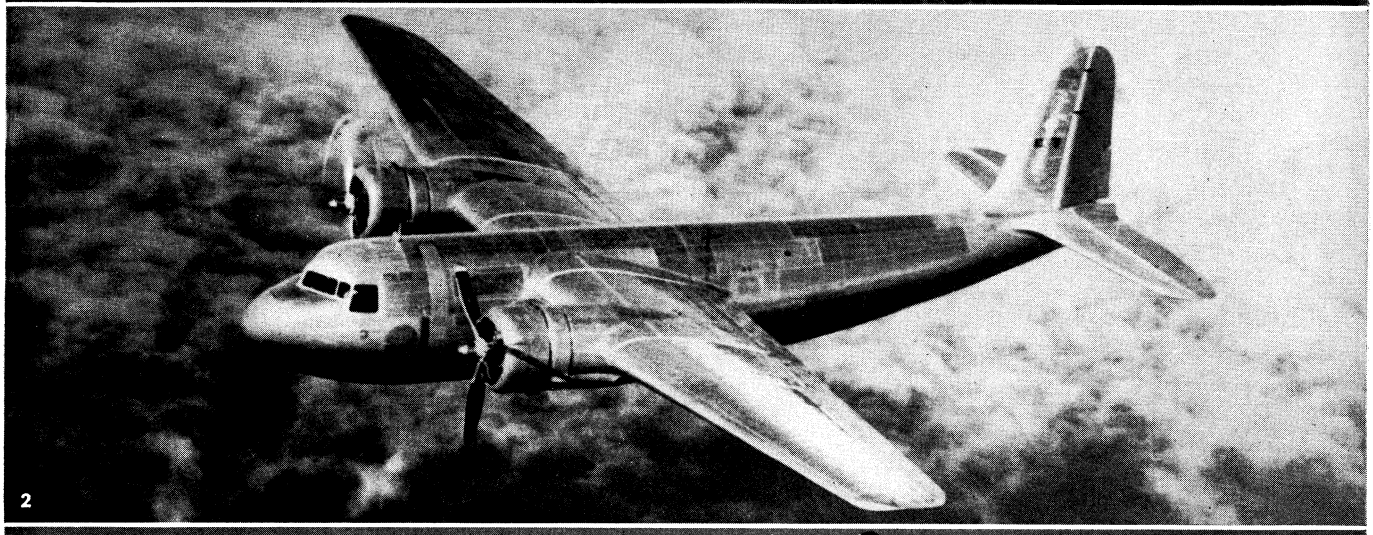
PHOTOGRAPHS (1) ACME. (2) WIDE WORLD

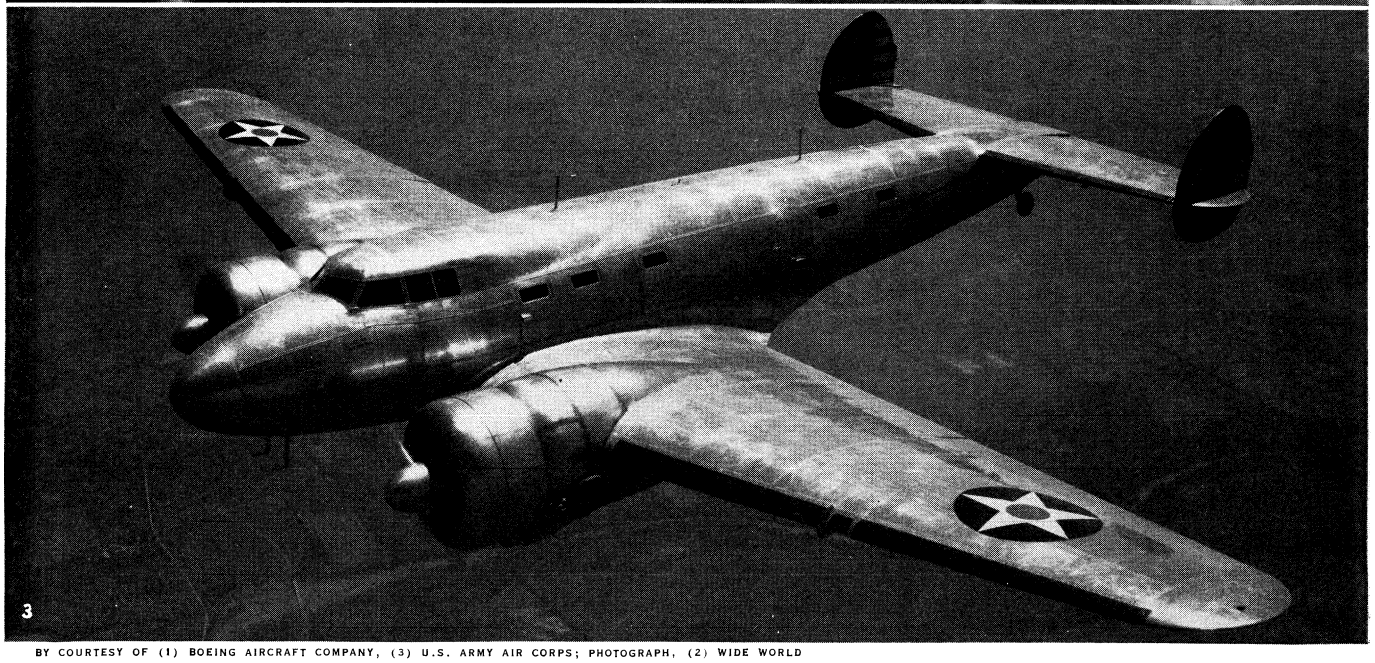
FAMOUS ROUND-THE-WORLD PLANES

1. Twin-motored monoplane which carried Howard Hughes and four companions on his record-breaking flight around the world in July **1938.** View shows the plane as it landed at New York city after encircling the earth in 3 days, **19** hours, **8** minutes, 10 seconds. The Americans made only seven stops

2. First aeroplane to circumnavigate the world. Lockheed Vega craft in which Wiley Post, American pilot, and Harold Gatty, Australian navigator, flew **15,474** miles around the globe in **8** days, **15** hours, **51** minutes in **1931,** and in which Post alone flew the same route in 7 days, 18 hours, 50 minutes in **1933**

AVIATION





BY COURTESY OF (1) BOEING AIRCRAFT COMPANY, (3) U.S. ARMY AIR CORPS; PHOTOGRAPH, (2) WIDE WORLD

PLANES BUILT TO FLY AT HIGH ALTITUDES AND HIGH SPEEDS

1. American Boeing 307 Stratoliner, first commercial aeroplane designed to fly at altitudes up to 20,000 feet

2. Douglas DC-5 airliner flying with one motor cut out. Full-feathering propellers can be brought to a complete stop in flight within several seconds

3. Lockheed XC-35 substratosphere plane of the U.S. Army Air Corps — the first successful pressure-cabin aeroplane

service and even the Arctic regions had yielded to substantial experimentation looking toward the eventual establishment of transpolar air services.

Operations. — A high standard of operating efficiency has been reached all over the world. Almost 100% regularity in flying to a published timetable is claimed for certain European air lines operating during summer weather, and close to 100% is claimed for the main empire routes of Imperial Airways the year around. American international lines likewise approach 100% achievement of schedules. Domestic lines in the United States average over 95% in performance, an extremely creditable showing in view of the day-and-night high-speed nature of their flight assignments.

Bad weather has been responsible for most of the unscheduled landings by commercial transports, a rough percentage for the world being about 65% due to weather and 35% to mechanical failure. Schedule performance, however, is improving steadily everywhere with improved and new navigational communications and weather forecasting equipment and improvement in engines and craft design.

Cost of Operation.—Although some progress has been made toward economical operation, air transport has not yet arrived at a point at which it can be counted on to operate commercially without artificial financial assistance. There are two main reasons for the high cost of air transport as compared with other means of locomotion. First, an aeroplane expends a considerable proportion of its horse-power in climbing into the air and on maintaining itself at a safe height; in all other forms of transport the vehicle can remain at a fixed level on or in its particular element without expenditure of power. Secondly, in order to obtain as great a disposable load as possible for any given horse-power, the structure of both engine and aircraft must be extremely light. Consequently the air transport vehicle is costly to construct, and owing to its comparative fragility involves a high rate of maintenance. The cost of operation per hour depends largely on the horse-power employed; thus every effort is made, not only to increase the total weight per horse-power carried, but also to ensure that the greatest proportion of this total load is devoted to disposable load at the expense of structural weight. The large ground organizations required also add to air-line costs.

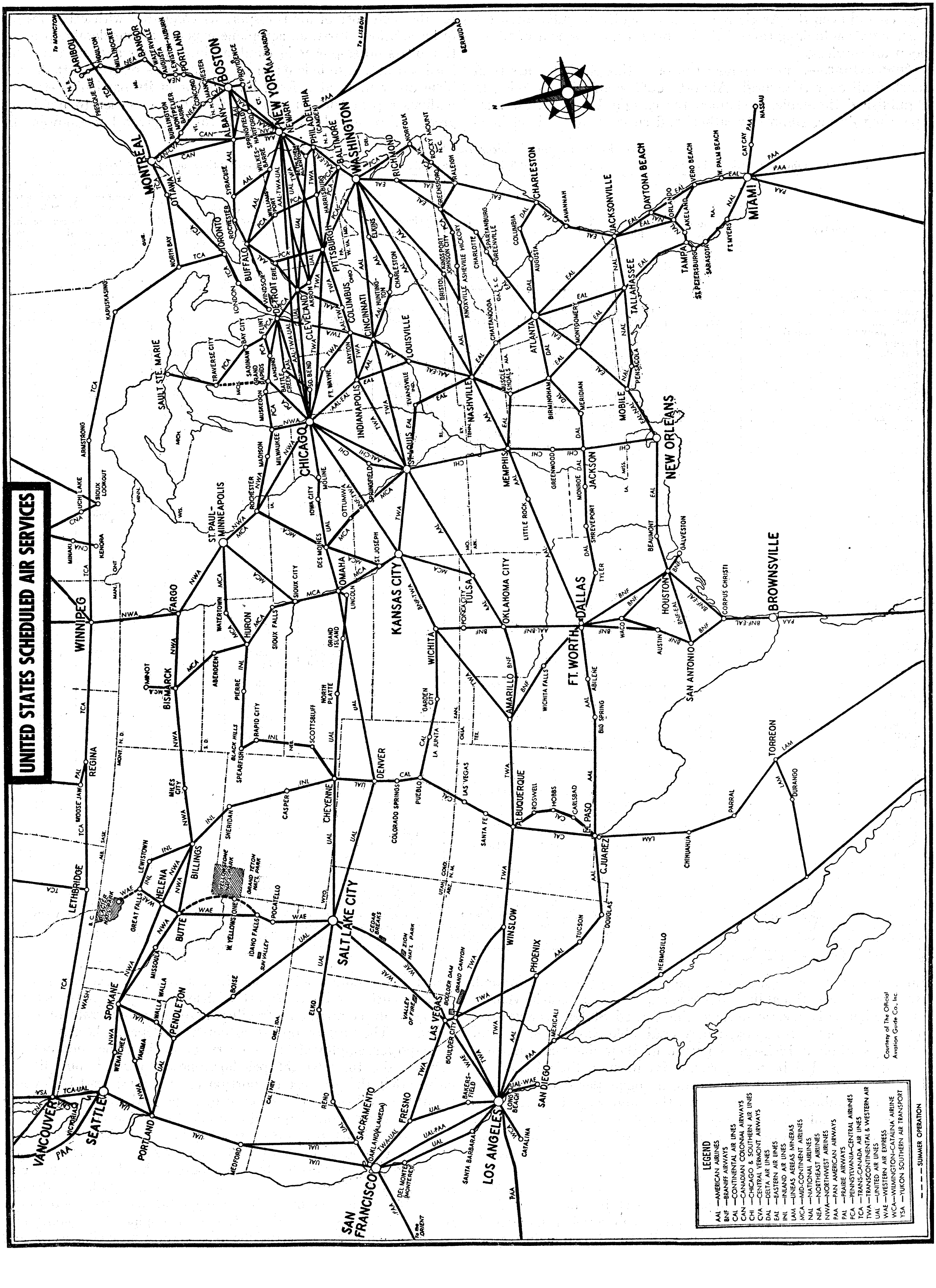
Improvement of Commercial Aircraft. — The problem of reducing the operating cost to cheaper commercial rates represents the most important question before the designers of commercial aircraft. Progress is being made on, broadly, two main lines — the reduction of maintenance costs and the increase of paying load per horse-power. Air-cooled engines have come into wide use; all-metal construction is generally replacing wood and

Regular Air Transport Services and Subsidies of the World in 1938

(The following statistics include, in some cases, unscheduled flights over the regular routes by the companies operating the scheduled services)

Country	Route Mileage		Passengers	Passenger-miles	Mail (including printed matter and parcels)		Goods (including newspapers and excess baggage)		Total Civil Aviation Vote	Direct Air Transport Subsidy
					Tons	Ton-miles	Tons	Ton-miles	£	£
British Empire										
United Kingdom	29,064	14,331,000	222,200	56,368,000	3,453.00	10,060,700	2,527.00	1,025,200	3,129,000[g]	1,131,000[g]
Australia	21,748	9,654,678	106,339	43,053,184	225.62	[a]	600.80	[a]	709,400	249,000
(excluding New Guinea)										
Burma	545	27,727	515	47,430	..	..	..	..	38,212	..
Canada	11,917	10,853,405	98,989	10,198,072	848.35	281,522	8,657.69	947,441	783,101	323,353[h]
Eire	418	385,533	4,987	1,237,797	0.14	13	15.74	4,014	463,633	..
India	4,822	[a]	[a]	[a]	[a]	[a]	[a]	[a]	245,987	..
Kenya	2,932	575,375	3,007	783,052	85.60	23,855	30.10	11,046	24,359	9,000
Malaya	390	227,920	1,820	516,579	0.90	320	12.00	4,620	39,872	16,750
New Guinea	5,412	1,490,289	12,119	[a]	72.70	[a]	11,683.07	[a]	..	..
New Zealand	1,990	1,527,187	51,181	6,478,355	133.901	27,086	63.57	7,270	50,629	..
Palestine	132	47,588	1,478	23,052,410	4.04	34,141	..	..	18,071	..
South Africa	7,893	1,860,278	34,027[e]	9,090,660	1,283.30[e]	359,316	610.46[e]	207,228	37,130	20,000
Southern Rhodesia	1,814	850,322	3,448	[a]	133.09	[a]	7.84	[a]	21,978	16,000
Europe										
Belgium	11,388	2,012,956	33,430	11,145,289	366.43	161,818	807.26	238,491	147,632	91,428
Czechoslovakia	5,654	1,659,913	60,886	[b]	[d]	[a]	1,396.17[d]	[a]	836,708	144,978
Denmark	2,854	597,503	18,336	2,836,364	226.83	61,275	308.16	81,946	36,352	13,774[i]
Finland	1,584	313,017	10,645	2,088,674	73.79	19,735	153.52	16,945	33,261	16,488[i]
France	40,833	9,000,727	96,619	38,847,041	1,150.89	841,747	1,381.42	625,361	2,838,230[j]	1,984,952
Germany	32,720	13,895,356	281,187	[a]	5,484.25	[a]	2,256.19	[a]	[a]	[a]
Greece	547	233,046	7,259	1,521,772	7.66	1,804	232.86	51,590	43,763	43,496
Hungary	1,740	165,612	3,769	664,273	5.41	[e]	54.24	60,620[e]	..	..
Italy	23,583	8,447,448	121,793	[a]	458.90	[a]	859.76	[a]	1,052,933	765,736
Latvia	124	91,466	2,770	253,361	10.99	1,005,019	0.29	26,731	..	..
Netherlands	16,055	6,489,539	163,720	37,223,204	844.68	1,108,868	2,333.99	740,061	116,100	45,235
Norway	2,146	448,446	5,687	1,472,131	155.69	48,900	56.32	10,786	101,978	29,201
Poland	3,744	1,241,831	30,490	5,870,024	142.53	[e]	656.47	624,103[e]	406,685	147,556
Portugal	479	29,384	355	101,010	1.25	355	1.68	477	..	..
Rumania	6,309	736,009	10,304	1,739,394	5.02	2,160	44.60	10,548	21,272	..
Sweden	5,381	1,608,899	46,485[e]	8,782,105	1,180.04[e]	204,223	997.50[e]	269,989	191,857	51,653
Switzerland	2,448	1,066,973	38,902	8,435,248	410.22	83,769	292.070	80,337	29,563	15,860[i]
Yugoslavia	3,483	330,891	6,898	1,318,751	6.86	151,437	133.65	31,849	96,307	61,523
U.S.S.R	65,865	[a]	268,600	[a]	10,433.00	2,935,780	42,715.00	9,418,958	..	..
Near East										
Egypt	2,047	1,011,104	18,559	3,054,550	7 33	3,868	28.49	1,676	138,685	84,000
Turkey	236	[a]	[a]	[a]	[a]	[a]	[a]			
Far East										
Japan	8,694	3,321,450	50,149	10,818,437	248.58	75,004	587.65	148,725	1,408,473	528,569
Netherlands East Indies	7,943	1,244,676	29,972	4,347,057	53.21	30,571	99.90	38,230	71,320	44,591
Philippines	1,086	452,872	16,194	[a]	3.87	[a]	43.15	[a]		
Siam	420	91,300	93		17.00		1.90			
America										
Argentina	1,581	261,340	2,130		14.84		23.55		112,160	52,000
Bolivia	3,571	497,628	20,907	2,105,040	35.60		1,313.30		..	
Brazil	9,182	1,991,924	39,768	11,933,013	87.35	100,199	712.03	261,990	581,683	58,082
Chile	1,159	367,026	4,384	[a]	14.06	9,728	20.83	11,218		
Colombia	4,844	2,425,175	64,160		132.13		5,490.755			
Hawaii	347	550,297	28,718	4,295,458		2,379	53.46			..
Honduras	3,054	1,390,900	22,882	[a]	108.83		6,731.13		..	
Mexico	10,104	3,225,044	64,681	14,006,395	218.87		2,655.88			
Peru	7,080	1,668,537	26,153	[a]	56.51		632.59			
United States of America	71,199	81,058,127	1,369,542	554,239,196	[a]		4,219.51		9,574,273	5,791,673[h]
Uruguay	773	309,703	15,466	[a]	2.82		91.62			
Venezuela	2,302	329,971	8,363		116.50		183.50			

[a]Statistics not available. [b]The figures include the operations of companies associated with Imperial Airways Ltd. on the routes covered by the Empire Air Mail Scheme. [c]By stages. [d]The figure given under "Goods, tons" is the total of goods and mail, [e]The figure given under "Goods, ton-miles" is the total of goods and mail ton-miles. [f]The figures cover the period April 1, 1937–March 31, 1938. [g]These figures do not include the sum of £136,000 which represents contributions from participating governments toward the cost of operation of the empire air services. [h]The sum given under "Direct Air Transport Subsidy" is the amount provided for payment to air-mail contractors. [i]Subsidy provided by the government only. In addition, there are other subsidies provided by towns, municipalities, cantons. etc. [j]Includes only sums directly assignable to civil aviation.
Source: Dept. of Civil Aviation, Air Ministry, London.


UNITED STATES SCHEDULED AIR SERVICES
LEGEND
AAL —AMERICAN AIRLINES
BNF —BRANIFF AIRWAYS
CAL —CONTINENTAL AIR LINES
CAN —CANADIAN COLONIAL AIRWAYS
CHI —CHICAGO & SOUTHERN AIR LINES
CVA —CENTRAL VERMONT AIRWAYS
DAL —DELTA AIR LINES
EAL —EASTERN AIR LINES
INL —INLAND AIR LINES
LAM —LINEAS AEREAS MINERAS
MCA —MID-CONTINENT AIRLINES
NAL —NATIONAL AIRLINES
NEA —NORTHEAST AIRLINES
NWA —NORTHWEST AIRLINES
PAA —PAN AMERICAN AIRWAYS
PAL —PRAIRIE AIRWAYS
PCA —PENNSYLVANIA-CENTRAL AIRLINES
TCA —TRANS-CANADA AIR LINES
TWA —TRANSCONTINENTAL & WESTERN AIR
UAL —UNITED AIR LINES
WAE —WESTERN AIR EXPRESS
WCA —WILMINGTON-CATALINA AIRLINE
YSA —YUKON SOUTHERN AIR TRANSPORT
- - - - SUMMER OPERATION
Courtesy of The Official Aviation Guide Co., Inc.

fabric. Each and all of these innovations appreciably reduce the cost of operation.

Various mechanical developments are being applied to increase the disposable load without adding to the weight and size of the aircraft itself. The greatest load which an aircraft can carry is that with which it can take off and land safely. Once at a safe height in the air, the normal aircraft has plenty of lifting power in hand. Considerable increase in horse-power is being obtained without serious additional weight by means of various systems of supercharging or "boosting" aircraft engines. Variable pitch propellers were perfected about 1934, permitting use of greater horse-power for take-offs with heavy loads and better speed at various flying altitudes.

Cleanliness of design of craft has been one of the most noteworthy advances in aeronautics. The trend, particularly in the United States, has been to ard monoplane construction of cantilever wing design, permitting elimination of outside structural bracing and other elements of "parasitic" resistance. With cleaner designs and improved engine performance speeds increased tremendously, some American transports regularly approaching cruising speeds of zoo miles per hour.

Steps were taken to achieve such speeds without increasing landing speeds. Particularly "wing flaps," usually attached to the lower trailing edge of the wing, were developed and brought the ratio of top speed to landing speed to about $3\frac{1}{2}$ to 1 by 1939.

The adoption of high-speed aircraft on European services lagged behind that in the United States although many European carriers, through the purchase of American equipment, soon established schedules at speeds comparable to the American standards. Just prior to the outbreak of hostilities in 1939, European-built transports were once more comparing favourably to similar American types.

Night Flying. — Due to the facilities provided by the various Governments, night flying has become increasingly popular. Beacons mark practically every important route in the United States and in Europe; beam radio is in wide use in America, and radio telephone has been generally adopted. More than half of the commercial flying in the United States is done at night, and transcontinental journeys of 2,500 and 3,000 miles from sunset to sunrise are common.

INTERNATIONAL AGREEMENTS

At the conclusion of the War when the whole world began to turn its attention to the possibilities of aviation as a commercial activity it was obvious that, if air transport was to accomplish even a small proportion of that which enthusiasts claimed for it, international regulations must be put into force as soon as possible, and the necessary steps were taken at the Peace Conference in Paris during 1919.

International Convention. — The Treaty of Versailles brought into being an International Convention for the Regulation of Aerial Navigation, in which all the Allies participated; under the terms of this Convention a permanent Commission for Air Navigation was to be set up and placed under the direction of the League of Nations. In Great Britain, except for a brief period during Easter Week 1919, post-War civil aviation did not commence officially until May 1, 1919. On Aug. 26, 1919, international civil flying from Great Britain was first started under temporary air navigation regulations.

By June 1922 the International Air Convention had been ratified by a sufficient number of signatory states to make the introduction of its regulations practicable. It was brought into force in Great Britain by the Air Navigation Order dated June 20, 1922. Accordingly, the first meeting of the International Commission for Air Navigation was opened in Paris on July 11, 1922 (see AERIAL LAW). It has been evident that international air navigation regulations were of vital importance, and during 1922, on ratification of the International Air Convention, to which reference has already been made, the International Commission for Air Navigation (known as the I.C.A.N. in England and as the C.I.N.A. on the continent of Europe) came into being. The following states are parties to the Convention and send representatives to this Commission: Belgium, Great Britain and Northern Ireland, Canada, Australia, South Africa, New Zealand, Irish Free State, India, Bulgaria, Chile, France, Greece, Italy, Japan, Argentine Republic, Finland, Iraq, Norway, Netherlands, Spain, Switzerland, Yugoslavia, Poland, Portugal, Rumania, Siam, Czechoslovakia, Uruguay, Sweden, and Denmark.

The general principles laid down by the Convention are as follows:

1. Innocent passage of commercial aircraft of the members over the territories of all.
2. Designation of customs aerodromes at suitable points at which aircraft must land.
3. Issue of licences to all members of the crew and airworthy certificates to all aircraft engaged in international commerce. The forms of these licences and certificates and the qualifications and tests to be demanded have been agreed upon by the Commission.
4. The establishment of a wireless and meteorological organization and a lighting system along air routes authorized by the nation over whose territory they lie.

The full Commission now meets twice every year, the place of meeting being decided on the invitation of one of the governments represented. The Commission has appointed standing subcommissions for the detailed study of operational, technical, medical and legal problems, and these meet at various dates between the meetings of the full Commission. Most European nations who are not members of the International Commission have drawn up regulations of their own, approximating those of the International Commission, and many of them have entered into agreements of various classes and duration with one another and with members of the International Commission in order to facilitate the operation of international air transport.

Since its creation the Commission has taken steps to modify Articles 5 and 34 of the Convention, which were unacceptable to certain ex-neutral and ex-enemy countries. These modifications came into force on Dec. 14, 1926, on the completion of ratification, and the way was opened for several other European nations to join the Convention. America, although a signatory to the Convention originally, has never deposited her ratification, but has established Federal legislation on the general lines of the Convention for the administration of inter-state air transport.

Each country through its national legislature gives effect to the International Air Convention and to the decisions of the International Commission. In Great Britain this is done by the Air Navigation Act, 1920, and by the air navigation orders and air navigation directions issued by the authorities from time to time thereunder.

OTHER COMMERCIAL USES OF AIRCRAFT

There are many kinds of work that can be done by aircraft more rapidly and at least as cheaply as by less up-to-date transport. The first steps were taken in Canada where aircraft have taken a constantly increasing share of the work of survey and forest fire protection. The United States uses the aeroplane as a destroyer of insect pests in the cotton fields, one machine in the air replacing 40 men on the ground. Russia attacks the plague of locusts by similar means. A company in British Guiana finds it worth while to keep a seaplane as an ambulance, whilst aeroplanes are employed for ambulance work in Australia.

Air Survey. — Aerial survey came into existence during the World War. The necessity of photographing trench-lines and hostile positions became more and more vital as operations progressed, and by 1918 military aerial photography had reached a high pitch of efficiency. It was only in a few cases, however, that it was necessary to employ aerial photography as a means of measuring distances on the ground; as a rule, comparatively accurate maps were available, and the photographs were required for filling in details of natural features, buildings, roads, etc., and for disclosing the dispositions of the enemy.

At the end of the war it was clear that aerial photography must provide a very valuable aid to ordinary survey, and from that date onwards aerial survey has been very successfully developed in various parts of the world.

Canada has been the pioneer of air surveying. Her vast and comparatively flat northern regions offered an ideal field for the young enterprise to prove its commercial value. Operations have for the most part been carried out by flying-boats working from the numerous lakes and waterways which intersect large expanses of unsurveyed forest land.

Two systems have been employed: vertical photography aided by certain points previously fixed by triangulation; and oblique photography along a line already traversed by means of ground survey.

Without doubt enough air survey work has been successfully carried out to demonstrate that this type of work has become a decided factor in the development of the British Empire. The most obvious demand for air survey is in regions where ordinary means of transport present serious obstacles to the ground surveyor. Such regions are often of immense value on account of their timber products, as in Canada, or mineral deposits, as in Rhodesia. The air photograph is also of real value to the geologist, the forestry officer, the railway engineer, the irrigation engineer, the draining engineer, the town-planning department, the department of agriculture, the archaeologist and the medical officer.

The point has long been reached where air survey can stand on its own legs, and it is only necessary now to obtain large contracts to maintain it as a really important and prosperous national industry. Practical experience has proved that under a great many conditions air survey saves a vast amount of time and a very appreciable amount of money as compared with ordinary methods.

In France, a law demanding accurate plans of all fair-sized municipalities led to much activity in the survey of towns. In Germany, forest survey has been carried out extensively and successfully, and great progress has been made in solving the scientific problems connected with stereoscopic plotting and the aerial photography of mountain tracts. The United States has followed Canada in aerial survey progress. Her operations have included oil surveys, coast-line and river surveys, the alignment of new roads and railways, municipal surveys and town-planning.

Modern Aerial Photography. — Aerial photography has an established place in various branches of commerce and advertising. In connection with engineering works, building contracts and land development, air photographs provide a valuable and comparatively inexpensive check on progress. For advertising purposes air photographs of factories, estates, hotels and seaside resorts are in constant demand. Municipal authorities have used aerial photography in drawing up plans for town improvements, river authorities have used them for studying currents and the siting of bridges, whilst traffic authorities have proved their value in investigating the baffling problems of road congestion.

Owing to the effects produced in a photograph by variations in the contour, colour and texture of a surface, air photographs often reveal features of interest to archaeologists. The riddle of the avenues at Stonehenge was solved by an air photograph that showed extraordinarily clearly the course of the ancient paths, of which no trace appeared to be visible on the ground. Similarly, under colonial conditions aerial photography is probably the cheapest and certainly the quickest method available for the investigation of schemes of development. Since extreme accuracy as to scale is immaterial, the technical difficulties of air survey do not arise.

Forest Fire Protection. — Experience in Canada has shown that in certain circumstances aircraft patrols are the most efficient method of controlling the fire hazard in forests. The greatest efficiency is reached in areas where population is sparse and ground forces cannot be fully organized.

During the forest fire season, constant air patrols have been maintained over important areas, and fires are reported by wireless to fire-fighting stations; in some cases, the fire-fighting parties and apparatus are actually carried to the site of the fire in aircraft. Enormous tracts of timber have been saved by this means. It has been recorded that 90% of the fires do not spread over more than 100 acres, owing largely to the fact that as soon as the fire is detected men are placed in a position to control it immediately.

The making of inventories and surveys of the forests is combined with fire protection, and in this way the patrols serve a double purpose. Until the introduction of air photography, survey in the forest regions was all but impossible owing to the difficulty and expense of ground operations. The use of aircraft, therefore, assists the conservation of the forest wealth not merely from destruction by fire but also from uneconomic exploitation.

Protection of Cotton and Other Crops. — The idea of utilizing aeroplanes as a means of spraying poison dust on cotton plants, fruit trees and crops generally in order to destroy insect pests was demonstrated in the United States as early as 1921. This method has been developed to a commercial stage and many thousands of acres are treated annually. The poison used is finely powdered calcium arsenate.

On large and favourably situated fields more than 500 acres per hour are treated. Under the most favourable conditions more than 1,000 acres per hour can be treated The method of applying the dust is a comparatively simple one. The "dust" is carried in a hopper on the aeroplane and discharged at an even rate under the control of the pilot. Each run of the aeroplane across the field dusts a strip up to 250 feet wide at a speed of 100 miles per hour. One slow aeroplane can dust 45 acres a minute, which is equal to the work of 40 cart dusting machines.

The principal advantage of aeroplane dusting is the speed at which it works. No sooner is an infestation of insects detected than the whole area, perhaps many thousand acres in extent, can be treated with poison in a few hours. To obtain the same result by the old method would necessitate the maintenance of a large force of men and dusting machines and would be economically unsound. A very substantial increase in yield is secured by effective "dusting" and the air method has been supplanting the old method wherever the territory is favourable for its use. The utility of air dusting is naturally greatest where the fields are large, flat and free from obstructions.

Ambulance and Medical Duties. — In undeveloped countries where methods of transport are elementary, and particularly in countries where tropical diseases are prevalent, great difficulty is experienced in counteracting outbreaks of disease and rendering medical attention to the sick.

Aircraft have already been the means of saving a number of lives by carrying medical assistance to people stricken down with sickness, or by transporting cases of dangerous illness to hospital when the hardships of ordinary travel would prove fatal. For instance, in one case when an epidemic of typhoid fever had been reported, the doctor by using aircraft, was able to reach the scene with supplies of antitoxin in the space of hours instead of the two or three days which would have been occupied by the ordinary means of transport. In British Guiana a seaplane was fitted up as an ambulance for the transport of fever patients from up-country plantations to the hospital at Georgetown; a journey which formerly took from 17 to 21 days can be made in less than two hours.

In Australia more and more use is being made of aircraft to assist doctors and nurses in reaching regions where ordinary methods of transport are primitive, if they exist at all; the result being that a man who would hesitate to take his family out of reach of medical aid knows that in case of need he can obtain help promptly.

Several aircraft constructors have built machines specially fitted out as ambulances and complete with surgical equipment.

Policing by Air. — Aircraft are considerably used for helping the officers of the law. Canada has important salmon fisheries on her west coast where policing by aircraft has been conducted in a very effective manner. The main offences against fishing regulations are fishing with two great length of net or nets of illegal mesh, fishing during the week-end closed season, fishing in restricted areas, and fishing without a licence. Numerous offenders have been detected and it soon became clear that the authorities were determined to have the laws strictly enforced. Denmark is another country to use aircraft in this manner, and the United States equips certain of her coastguard stations with seaplanes for

routine patrol duties.

Several countries have employed aircraft in order to check the movements of smugglers attempting to land prohibited goods, particularly drugs and liquor. In Canada successful and interesting results have been secured. The smuggling of drugs from ships when about to enter Vancouver harbour was well known to the Canadian Government. Members of the crew or passengers had devised a successful method of evading the customs examination by throwing overboard buoyed packages of drugs at selected spots where they were picked up by launches and landed secretly. Owing to the speed of these launches, it proved a difficult matter to catch them. In order to combat this illicit traffic certain incoming liners from the Orient were unexpectedly escorted by aircraft and the risks of detection were so increased that the smuggling stopped.

The aircraft were also used for customs "raids" on vessels suspected of carrying illicit cargo, a thorough examination being made before the goods could be disposed of. A similar use was made of aircraft in enforcing the former prohibition laws of the United States.

Passenger Transport. — There are still people who have not flown, and "joy-riding" concerns which offer "flips" at popular rates continue to operate. They form a large branch of civil aviation, and through their efficient operation and record of safety they have done a most valuable service by creating interest and confidence in flying.

Previous to 1929 the American "gipsy flier" was a figure of romance. Unhampered by any restrictions and with an enormous territory to rove in, some hundreds of these young men carried on the adventurous life of flying nomads, picking up a living from town to town and keeping their machines in the air more by faith than by the resources of engineering. Some of the foremost American pilots, however, emerged to renown from the "barnstorming" field.

Air Taxi Service. — There are many operators of aircraft who specialize in flights at short notice for urgent missions. The newspaper press and cinematograph industry make frequent use of aircraft for hastening the arrival in key cities of photographs and films of important events and place great reliance upon this form of rapid transport. There is an established seasonal traffic in newspapers to the nearer Continental seaside resorts, as only by using the air can English newspapers be delivered to these places on the morning of issue. Flights with belated passengers to Southampton and Cherbourg to catch outgoing liners have been common.

These are examples of the ordinary daily routine of an air taxi service. Frequently a business man will require a machine to take him on a fast tour round the European capitals, or even further afield. Planes have been chartered for business trips from London and Continental Europe to various points in the East, and travelers in America often resort to hired aircraft to carry them about the United States, in which country in 1934 more than thirty million miles of "taxi" flying was completed.

The "drive yourself" idea of renting motor cars was spreading rapidly in the field of fixed base flying operations. Hundreds of American operators found they could rent planes to amateur pilots for occasional flights or cross-country tours, and this business showed much promise of development.

Typical of the sightseeing service rendered by many companies in various parts of the world was that rendered by an American operator in Arizona who flew on a regular schedule over the Grand Canyon; another operstor featured the beautiful sight of New York from the air by night; other lines ran from the mainland to nearby island resorts.

Sportsmen make great use of chartered planes, particularly in trips to major competitive spectacles, such as championship prize fights, international boat racing such as the Harmsworth contest, big collegiate football contests, horse racing and other events of similar nature. The cost for this sort of charter when taken exclusively by a single group runs high, but wherever there are patrons there arr also operators ready to go anywhere on short notice.

Advertising. — Aircraft have proved effective in advertising. The writing of words in the sky is a British invention that has been used extensively. The aircraft used are fast single-seaters which are equipped with a chemical "smoke" generating apparatus of patented design from which a thick stream of white or coloured "smoke" is emitted as the pilot traces out the letters. The work calls for considerable skill on the part of the pilot. He has to keep his letters in line and equal in size over a group perhaps eight miles long, and unless he is quick the first letters will fade before the last are finished.

Aeroplanes and autogyros towing long lettered banners streaming out behind have also been used extensively in advertising, notably over great centres of population and over huge stadia where crowds gather for outdoor sporting events. Planes have also carried powerful amplifying equipment through which an announcer from the sky bawled out praises for commercial products, but this practice met with such public disfavor that it did not remain long in use.

CIVIL FLYING SCHOOLS; LIGHT AEROPLANE CLUBS; AIR RACING

Civil Flying Schools. — In maay countries the training of pilots both for military and commercial purposes has been entrusted to civil schools, partly for reasons of economy and partly to encourage the civil development of aviation.

In the United Kingdom a number of civilian schools or groups organized as flying clubs received governmental subsidies for the training of civilians. As the British program for aerial rearmament accelerated, this program of training was rapidly increased in scope. Until the actual outbreak of hostilities in Europe in 1939, it would be safe to say that the majority of British fliers began their flying careers by enrolment in such civilian training courses.

France went a step further by placing the whole of the ab *initio* training of military pilots in the hands of civil schools and by organizing "centres" at which any ex-Service pilot was entitled to make flights at frequent intervals in order to keep himself in training.

In Germany, prior to that country's denunciation of the Versailles Treaty as to armament limitations, flying training mas subject to certain restrictions owing to the fact that Germany was not permitted to possess a military air service. To summarize these restrictions as briefly as possible: training schools were not to be subsidized out of public funds; a limit was set on the number of officers serving in the Army who were permitted to qualify as pilots, and the Air Police Force, though its members could be given elementary flying training, were not to be equipped with aircraft.

In the absence of Government subsidies the training organizations were actively engaged in raising money by private subscription from public-spirited individuals and companies. The Deutsche Luftfahrt Verband (German Air League) was an energetic supporter of schemes for training, and a subsidiary body known as the "Deutsche Luftfahrt G.m.b.h." was formed to carry out training at three schools. Some pupils were assisted by the Air League to the extent of four-fifths of the cost of instruction.

The ascendancy of Adolph Hitler's Nazi party to governmental power in Germany was followed by denunciation of the Versailles pact and withdrawal from the League of Nations. These actions threw into confusion any statistics on Germany's flying status, although it readily was known that the country was conducting a wide aviation program involving in great part personnel trained from the generation following the World War of 1914–18.

Light Aeroplane Clubs and Private Flying. — The backbone of private flying is the man who keeps his own aircraft and flies it as another man drives his car Eut the movement is a very wide one, ranging from the member of a light aeroplane club, who takes a ten minute "hop," to the pilot who sets out to fly single handed across continents and oceans, and even around the worlrl

Light aeroplane clubs were formed in England in 1924–25, and

at the start of 1935 there were thirty such clubs approved to receive Government financial assistance, and twenty-three clubs receiving no assistance. Of the Government-assisted clubs, the membership during 1934 was 5,814 of whom 1,823 held pilots' "A" licences, the corresponding figures for 1933 being 4,931 and 1,569 respectively.

In the boom years of aviation following the Lindbergh flight to Paris, aviation "country clubs" were started in the United States and while several were operating with some success for a time the depression which set in in 1929 radically halted their activities, and most of the civilian flying instruction in this country was obtained at commercial schools, usually open in conjunction with other commercial operations, such as charter and "taxi" hire and maintenance work.

A grandly spectacular phase of private flying concerns those intrepid men and women pilots who for years braved uncharted air trails over which the commercial transport followed. In this category belong the names of Charles A. Lindbergh, Wiley Post and Harold Gatty, Frank M. Hawks, Roscoe Turner, Dieudonne Costes and Maurice Bellonte, James and Amy Johnson Mollison, Bert Hinkler, Hugo Eckener, Charles Kingsford-Smith, Wolfgang von Gronau, Russell N. Boardman and John Polando, Clyde Pangborn, Amelia Earhart, Paul Codos and Maurice Rossi, C. W. A. Scott and T. Campbell Black.

Lindbergh's New York-Paris flight was the greatest stimulus given aviation up to 1927; the first complete world aeroplane flight by Wiley Post and Harold Gatty and the subsequent solo journey around the globe by Post served as world-wide exploitation for flying; Hawks and Turner consistently and successfully hammered at the cross-country air records of the United States and Europe; the first Paris-New York flight by Costes and Bellonte redounded greatly to French aviation prestige; the Mollisons were consistent fliers to the East and across the North Atlantic. and Hinkler was a pioneer racer to the East and over the South Atlantic; Eckener took the dirigible Graf Zeppelin on voyages of spectacular demonstration at a time when lighter-than-air needed all the publicity it could get anywhere in the world; Kingsford-Smith's flight from San Francisco to Australia via Honolulu and the islands of the South Seas was a brilliant demonstration of navigation; von Gronau was applauded by the conservative elements in the business for his flights in a flying boat across the North Atlantic with stops at island bases; Boardman and Polando extended the world's distance record remarkably, as did Codos and Rossi; Pangborn spanned the Atlantic and was the first to fly from Japan to the United States; Earhart flew the Atlantic twice, once alone, and although lost on one of the final laps of a round-the-world flight, will stand forever as the greatest woman aviator of her time.

Air Racing—Many of these stars of aviation distinguished themselves in exhibition speed and distance flights, although some of them and others also came to the fore in national and international direct competition. The Scott-Black flight from London to Melbourne brought them victory in the Sir MacPherson Robertson international race in 1934, the most important aviation competition in the history of flight up to that time. They covered the 11,300 mile course in 2 days, 22 hours, 54 minutes, winning by a substantial margin over K. D. Parmentier and J. J. Moll, a Dutch team, and Turner and Pangborn, Americans, who finished second and third respectively.

In the United States the Vincent Bendix annual transcontinental contest attracts the ablest of American pilots and the fastest civilian planes. A great share of the credit for the remarkably fast times made across the 2,500 mile stretch from Los Angeles to New York belongs to Frank Hawks, who, in 1929 began a steady assault on the distance. Roscoe Turner followed with consistent performances, the two men and others bringing the record down to about ten hours by 1935.

An event of former international importance was the Schneider trophy races which drew the fastest aircraft that the leading nations of the world could build. This competition, however, ran to great expense and since 1931 no contest for the trophy has been staged, the prize last resting with England by virtue of a speed of 340.048 miles an hour established by Lieut. James N. Boothman. The Schneider competition gave way to separate efforts by some nations to hold the ultimate world speed record. England and Italy were particularly active in this regard, the record in 1934 going to Italy at 440 miles an hour, flown by Francesco Agello.

The British Empire has always been interested in the record between London and Cape Town and London and Australia. Times over these two courses have been broken as frequently as the American transcontinental mark, and although the American cross-country racers fly at a much higher speed, they do not have to negotiate the distances required on the flight to the East or to South Africa. The Scott-Black record from London to Melbourne was expected to stand unbroken for some time, although the record of Amy Johnson Mollison of 4 days, 6 hours, 54 minutes from London to Cape Town, established in 1932, quickly began to attract challengers and it was foregone that this time would be whittled down steadily.

The non-stop flight record has been coveted for many years by various countries. Most of the aeroplanes used on such flights have been specially constructed and usually are not considered in the class of "stock" craft, although record breaking planes and engine performance and reliability mean prestige for the country manufacturing the winner.

Record of important flights across the United States:

1911	C. P. Rodgers	New York-Pasadena	1st flight, 59 days
1912	Robert Fowler	Jacksonville-San Francisco	151 days
1922	James Doolittle	Jacksonville-San Diego	22 hours
1923	Kelly-Macready	New York-San Diego	26 hours
1924	Russell Maughan	New York-San Francisco	21
1928	Arthur Goebel	Los Angeles-New York	18 hours
1929	Frank M. Hawks	Los Angeles-New York	17 hours
1930		Los Angeles-New York	14 hours
1930	Lindberghs	Los Angeles-Nevv York	12 hours
1931	Doolittle	Los Angeles-New York	11 hours, 16 min.
1932	Doolittle	Los Angeles-New York	10 hours, 19 min.
1933	Roscoe Turner	Los Angeles-New York	10 hours, 5 min.
1934	Roscoe Turner	Los Angeles-New York	10 hours, 2 min.
1937	Howard Hughes	Los Angeles-New York	7 hours, 28 min.

List of record non-stop flights:

Date	Place	Aeroplane	Pilot	Distance
1908	France	Wright (U.S.)	W. Wright	77·5 mi.
1909	France	Farman (Fr.)	Farman	145 mi.
1910	France	Farman (Fr.)	Tabuteau	363 mi.
1911	France	Nieuport (Fr.)	Gobe	460 mi.
1912	France	Farman (Fr.)	Fourny	628 mi.
1919	St. Johns, Newf. to beland	Vickers (Br.)	Alcock and Brown	1,936 mi.
1922	San Diego, Cal. to Indianapolis, Ind.	Fokker (U.S.)	Kelly and Macready	2,060 mi.
1923	New York to San Diego, Cal.	Fokker (U.S.)	Kelly and Macready	2,516 mi.
1926	Paris to Djask, Persia	Breguet (Fr.)	Costes and Rignot	3,313 mi.
1927	New York to Paris	Ryan (U.S.)	Lindbergh	3,610 mi.
1927	New York to Germany	Bellanca (U.S.)	Chamberlin	3,911 mi.
1928	Rome to Brazil	Savoia (It.)	Ferrarin and Del Prete	4,466 mi.
1929	Paris to Coulart, China	Breguet (Fr.)	Costes and Bellonte	4,912 mi.
1931	New York to Istanbul, Turkey	Bellanca (U.S.)	Boardman and Polando	5,011 mi.
1933	Cranwell, Eng. to Walvis Bay, South Africa	Fairey (Br.)	Gayford and	5,308 mi.
1933	New York to Rayak, Syria	Bleriot (Fr.)	Codos and Rossi	5,653 mi.
1938	Ismailia, Egypt, to Port Darwin, Australia	Vickers (Br.)	R.A.F.	7,158 mi.

Air racing has been taken up with enthusiasm by the light aeroplane clubs and owners of private aircraft. Regular meetings are being held at which displays are combined with racing and the public are attracted in large numbers. The great crowds drawn to the British Hendon aerodrome to witness the air racing organized there before the War gave evidence of the interest that was subsequently to be aroused by well-organized meets. Under the changed conditions of to-day, with the light aeroplane bring-

ing aviation within the reach of thousands of people, it was ordained that air racing would grow into a big national sport. It has one outstanding advantage over other forms of racing in not requiring a special track. The principal British air race is the annual contest for the King's Cup which has been held each year over a different course since 1922. This race is a test not so much of speed as of piloting and general reliability.

The annual national air races in the United States run over a period of several days and draw hundreds of thousands of spectators. Almost every race brings out new types of design and improved engines which get gruelling tests in the Bendix transcontinental event, staged incidentally to the national air races program, and the Charles Thompson competition over a 100-mi. closed course. Although not held in 1939, the national air races have brought the United States several outstanding flying records.

As of Jan. 1, 1939, some of the most important records, according to *Aircraft* Yearbook, stood at:

OFFICIAL WORLD AIR RECORDS

(World records are defined as maximum performance regardless of the class or type of aircraft used)

MAXIMUM SPEED OVER A 3-KM. COURSE
Francesco Agello, Italy, Oct. 23, 1934
709·209 km.p.h. (440.681 m.p.h.)

DISTANCE, AIR-LINE ..... 11,520·421 km. (7,158·440 mi.)
Kellett, Gething Gaine, Combe, Burnett Gray, Great Britain, Nov. 5–7, 1938

DISTANCE, Closed circuit..... 11,651·011 km. (7,239·588 mi.)
Fujita, Takahashi and Sekine, Japan, May 13–15, 1938

ALTITUDE..... 22,066 m. (72,394·795 ft.)
Capt. Orvil A. Anderson and Capt. Albert W. Stevens, U. S. army air corps, United States, Nov. 11, 1935

OFFICIAL INTERNATIONAL AND NATIONAL RECORDS

(For aeroplanes only)

DISTANCE, CLOSED CIRCUIT

International record..... 11,651·011 km. (7,239.588 mi.)
Comdt. Yuzo Fujita and Fukujiro Takahashi, pilots; Chikakichi Sekine, mechanic; Japan, "Koken" monoplane, Kawasaki special engine of 700 h.p., May 13–15, 1938

National (U.S.) record..... 4,050 km. (2,516·5 j mi.)
Lts. Kelly and Macready, U. S. A., T-2 aeroplane, Liberty 375-h.p. engine, Dayton, Ohio, April 16–17, 1923

AIR-LINE DISTANCE

International record..... 11,520,421 km. (7,158·440 mi.)
Kellett, Gaine, Combe and Gray, Great Britain. Vickers Wellesley, Bristol Pegasus engine, from Ismailia. Egypt, to Darwin, Australia, Nov. 5–7, 1938

National (U.S.) record..... 8,065·736 km. (5,011·800 mi.)
Russell N. Boardman and John Polando, Bellanca monoplane, Wright J-6 300-h.p. engine, from Brooklyn, N.Y., to Istanbul, Turkey, July 28–30, 1931

DISTANCE, BROKEN LINE

International record..... 10,148 km. (6,295.662 mi.)
Col. Mikhail Gronov, Comdt. Andrei Youmuchev and Ing. Sergei Daniline, U.S.S.R., ANI-25 monoplane, AM-34 860-h.p. engine, from Moscow, U.S.S.R., to San Jacinto, Calif., July 13–15, 1937

National (U.S.) record..... None established

ALTITUDE

International record..... 17,083 m. (56,046·473 ft.)
Col. Mario Pezzi, Italy, Caproni 161 aeroplane, Piaggio XI R C engine at Montecelio, Oct. 22, 1938

National (U.S.) record..... 13,157 m. (43,165·880 ft.)
Lt. Apollo Soucek, Wright "Apache," Pratt and Whitney 450-h.p. engine, at Anacostia, D.C., June 4, 1930

MAXIMUM SPEED

International record..... Speed, 610·950 km.p.h. (379.626 m.p.h.)
Dr. Hermann Wurster, Germany, BF 113 R. monoplane, DB 600–950 PC 12-cylinder engine, Augsburg, Nov. 11, 1937

National (U.S.) record..... Speed, 567·115 km.p.h. (352·388 m.p.h.)
Howard R. Hughes, Hughes "Special" monoplane, Pratt and Whitney Wasp Junior 1,000-h.p. engine, Santa Ana, Calif., Sept. 13, 1935

(See also AERIAL NAVIGATION; AERONAUTICS; AEROPLANE; AIRSHIP, etc.)

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IMPORTANT FLIGHTS

Flight	By	Start	Date	Finish	Date	Distance	Duration
New York-Paris	Lindbergh	Roosevelt field, N.Y.	5/20/27	Paris	5/21/27	3,600 mi.	33¼ hr.
Transpacific	U.S. army	Oakland, Calif.	6/28/27	Honolulu	6/29/27	2,407 „	25 „ 50 min.
Pan-American (good will)	U.S. army	San Antonio, Texas	12/20/26	Washington, D.C.	5/ 2/27	*c.*20,000 „	—
Four continents, two oceans	De Pinedo	Cagliari, Italy	2/13/27	Ostia, Italy	6/16/27	*c.*30,000 „	—
South Atlantic	Costes and Le Brix	St. Louis Senegal, Africa	10/14/27	Port Natal, Brazil	10/15/27	2,150 „	19 hr. 5 min.
England-Australia	B. Hinkler	Croydon, England	2/ 7/28	Port Darwin, Australia	12/23/28	—	15½ days
Ireland-Newfoundland (Bremen)	Fitzmaurice et al.	Dublin, Ireland	4/12/28	Greenly Island, N.F.	4/13/28	—	36 „ 30 „
Paris-New York	Costes-Bellonte	Le Bourget	9/ 1/30	Roosevelt field	9/ 2/30	4,030 „	37 „ 18 „
England-Australia	Kingsford-Smith	London	10/ 9/30	Port Darwin	10/19/30	10,000 „	9 d. 23 „ 30 „
Around world	Post-Gatty	New York	6/23/31	New York	7/ 1/31	15,500 „	8 „ 15 „ 51 „
New York-Turkey	Boardman-Polando	Bennett field	7/28/31	Istanbul	7/30/31	5,011 „	49 „ 20 „
U.S.-Japan	Lindberghs	North Haven, Me.	7/29/31	North Haven	8/26/31	10,000 „	27 „
Japan-U.S.	Pangborn-Herndon	Tokyo	10/ 4/31	Wenatchee, Wash.	10/ 5/31	4,860 „	41 „ 30 „
S.A.-Africa	Hinkler	Natal, Brazil	11/26/31	Bathurst, Brit. Gambia	11/27/31	1,400 „	22 „
Newfoundland-Ireland	Earhart	Harbour Grace	5/20/32	Londonderry	5/21/32	1,950 „	15 „ 18 „
England-So. Africa	Mrs. hlollison	London	11/14/32	Cape Town	11/18/32	8,000 „	4 „ 6 „ 54 „
England-So. Africa	Gayford Nicholetts	Cranwell	2/ 6/33	Walvis Bay, S.W. Africa	2/ 8/33	5,309 „	—
Around world	Post	New York	7/15/33	New York	7/22/33	15,600 „	7 „ 18 hr. 50 „
U.S.-Syria	Rossi-Codos	New York	8/ 5/33	Rayak	8/ 7/33	5,657 „	55 „
U.S.-Hawaii	U.S. Navy	San Francisco	1/10/34	Honolulu	1/11/34	2,400 „	24 „ 56 „
Paris-New York	Codos-Rossi	Le Bourget	5/27/34	Bennett field	5/28/34	4,000 „	38 „ 27 „
England-Australia	Scott-Black	London	10/20/34	Melbourne	10/22/34	11,300 „	2 „ 22 „ 54 „
Australia-U.S.	Kingsford-Smith-Taylor	Brisbane	10/20/34	Oakland	11/ 4/34	8,000 „	16 „
Hawaii-U.S.	Earhart	Honolulu	1/11/35	Oakland	1/12/35	2,400 „	18 hr. 16 „
Argentina-U.S.	Hawks	Buenos Aires	5/ 3/35	Los Angeles	5/ 5/35	7,848 „	39 „ 52 „
Around world	Hughes and crew of 4	New York	7/10/38	New York	7/14/38	14,791 „	3 „ 19 „ 8 „

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Aeroplane Races in the United States. — The first aeroplane race in the United States took place in 1910 at Belmont Park, N.Y., when fliers from France, England and other lands went to the U.S. to compete for the Gordon Bennett cup—won in 1909 by Glenn Curtiss at Reims, France. From that time on until after the World War of 1914–18, aeroplane racing in America was rather desultory. There were numerous events, but the manner in which they were conducted made them local rather than national affairs.

The first real aeroplane race in America was held in 1920 for the trophy presented by Ralph Pulitzer. The event was staged at Mitchel field, N.Y., and won by Lieut. C. C. Moseley of the U.S. army air service. The average speed was 178 mi. an hour. In succeeding years greater speeds were attained, until the 1925 race when a speed of 248·975 mi. an hour was attained by Lieut. Cyrus Bettis.

The army and navy took great interest in the early Pulitzer races. In fact, these events played a very important role in developing the speed and efficiency of pursuit aircraft. It is perfectly justifiable to say that efficient performance of modern pursuit planes in army and navy aviation was developed in the gruelling grind to which motors were subjected in the Pulitzer trials. However, when the military air services developed fast tactical ships, they ceased building fast planes for racing purposes.

In April 1939 the record speed for aeroplanes was made by Fritz Wendel, in Germany, who flew for a short distance at the rate of 469 m.p.h. Wes Carroll and Clyde Schlieper, in 1939 in California, stayed in the air 726 hours, picking up fuel in cans.

Since 1920, in addition to the Pulitzer races, the National Aeronautic association has sponsored the national air races with the Pulitzer races as the main feature. At the outset, these races were primarily dependent upon the army, navy and marine corps for entries, with separate events for pursuit, observation, bombardment and light commercial planes. The military services are gradually withdrawing from participation in these races with the result that civilian and commercial entries have gradually taken an increasingly prominent part, a highly desirable development. In 1928, the national air races consisted chiefly of civilian events featuring weight-carrying, speed and light sport aeroplanes. Within the services there are several races exclusively for military planes, such as the Mitchell pursuit trophy, the Curtiss marine trophy, the Patrick attack trophy, the Liberty Engine Builders' trophy and Packard trophy for large aeroplanes. (L. J. M.; X.)

AVIATION, HAZARDS OF. Owing to technological advances in the design and construction of flying and ground equipment, to increasing experience and to steady improvements in flight technique, aviation hazards are decreasing at a rapid rate all over the world. On March 26, 1940, for example, the domestic airlines of the United States completed the first 12 months of their history completely free of accidents either fatal or resulting in serious injury to passengers or crew. During this period, these airlines flew 87,325,145 mi. and carried 2,030,000 passengers a distance of 814,906,250 passenger-miles. Insurance companies in both the United States and Europe now offer travel insurance at the same low rate as that offered to railroad passengers. While the safety of non-scheduled civilian flying was still below that of airline travel, substantial progress has been recorded. In 1939, non-scheduled civil flying in the United States resulted in one fatal accident for every 957,895 mi. flown compared with one fatal accident for every 406,463 mi. flown in 1934. During the first full year of the Civilian Pilot Training Program conducted by the Civil Aeronautics Authority, 10,000 students completed their primary training, flying some 26,600,000 mi. with only one fatal accident. (D. SE.)

AVIATION, MEDICAL ASPECTS OF. Medical studies on the effect of flight were first begun in 1783 when a chicken, a duck and a sheep were sent aloft in a smoke-filled balloon. They returned to earth unharmed, but a few months later a balloonist reported severe pains in his ears during an ascent. This is the first record of an ill effect of flying and as time went on other and more serious effects of flight were reported. Between 1875 and 1878 Paul Bert, a famous French physiologist, made a detailed study of the effect of high altitude and discovered that it was due principally to the decrease of atmospheric pressure with a consequent oxygen lack in the body.

Following the work of Paul Bert there were few further studies on the effect of flight until a few years prior to the outbreak of the World War of 1914–18. The Germans studied the special qualifications required of aeroplane pilots and drew up minimum standards as early as 1910 and by 1915 a special medical service for aviators functioned regularly in Germany. In France the first instructions relative to the examination of military pilots were issued in 1912 and a special service for aviators established in 1917. The first record in the United States of anything pertaining to aviation medicine appeared on Feb. 2, 1912 when the War Department published instructions concerning the physical examination of candidates for aviation duty.

The special medical examinations utilized in Europe in the first year of the World War of 1914–18 did not prove effective, however, as experience was to show. It was found, for example, during the first year of that conflict that of every 100 pilots killed. 2 died as the result of enemy action, 8 from defects in their machines, and go as a result of defects in the pilots themselves. These conditions attracted the attention of the highest medical authorities in each of the countries concerned and at that time there came into being a special branch of military medicine known as aviation medicine. Those who were trained and engaged in the practice of this new specialty became known as flight surgeons.

Between the years 1920–30 civil aviation was established in most of the civilized countries of the world and commercial airlines began carrying a large number of passengers. This introduced new problems in aviation medicine and required the services of specially trained physicians in civil as well as in military aviation. Aviation medicine has been generally recognized as a distinct specialty and may be defined as that branch of medical science which has to do with the selection and maintenance of aeroplane pilots and the prevention and treatment of the harmful effects of flying.

Pilot Selection. — Pilots are selected by means of a special physical examination in accordance with regulations laid down by government agencies. These regulations vary according to the class of licence sought, being fairly lenient for a student pilot's rating, but they become progressively more strict for private, commercial, airline and military ratings. The variation in the requirements for the various classes of licences is based on the fact that the lower ratings permit only the flying of light, simple aeroplanes in a local area and prohibit the carrying of passengers while the highest ratings contemplate the flying of large fast commercial passenger aeroplanes or military aircraft.

For the lower ratings the requirements specify that the candidate have average vision and intelligence and be free from any physical defect or any organic disease which might be considered as a possible cause of an aircraft accident. For the higher ratings the requirements are very detailed and exacting. Two to four years of college work may be required and in addition the candidate is subjected to an exhaustive mental examination to determine his aptitude for flying training. The physical examination is likewise very thorough and no one is accepted who has the slightest defect of any kind. The eye examination is especially strict as is that of the heart and nervous system.

Pilot Maintenance. — Graduate pilots who hold commercial or military ratings are under constant medical supervision. They are carefully re-examined by a flight surgeon at intervals of from 1 to 6 months and should a disqualifying defect be found, the pilot is grounded until the defect is remedied. The health of the pilot is carefully regulated by his medical supervisor who prescribes the necessary hygienic measures, exercise, diet and other modes of living designed to keep him at the peak of efficiency at all times. For the lesser ratings a re-examination every year or two is all that is required.

Accidents in Aviation. — In civil aviation the safety and comfort of the passenger are given primary consideration and as a consequence scheduled air travel is now as safe as any other form of public transportation. In military flying, on the other hand, accomplishment of the military mission is necessarily of first importance. Even in peace time military pilots must be trained to use their equipment under war time conditions and are required to obtain from their aeroplanes the maximum performance which their structural strength will permit. Acrobatics, gunnery and bombing practice must be carried out routinely as well as flying in dangerous weather conditions. Under such conditions military flying is, and probably always will be, a hazardous occupation.

The Harmful Effects of Flying. — In addition to aircraft accidents there are many other conditions peculiar to flight which may produce discomfort, illness and even death. The wind blast due to the speed of the aeraplane is greater than that of the fiercest tornado and is the source of great discomfort in open aircraft. The noise of the motor and propeller may be loud enough to cause deafness after a few years of flying. Vibration in aeroplanes is a prominent source of annoyance and fatigue.

Cold. — As one ascends to high altitude the temperature of the air drops approximately 2° C. for each 1,000 ft. until at 35,000 ft. and above the temperature remains constant at −55°. Thus during a rapid climb the military pilot is not only subjected to a very rapid change in temperature but is often exposed to a degree of cold which cannot be guarded against by even the heaviest winter flying clothing. This exposure not only leads to chilling and frost bite but may be the cause of subsequent respiratory diseases such as pleurisy and pneumonia.

Atmospheric Pressure Change. — Like the temperature, the pressure of the atmospheric air decreases with ascent. Thus at sea level the pressure is 14.7 lb. per sq.in. and is reduced to one-half at 18,000 ft., one-fourth at 34,000 ft. and to one-eighth at 48,000 feet. The most common effect of the change of atmospheric pressure with ascent and descent is pain in the ears and sinuses. The middle ear and the sinuses are air filled cavities in the skull connected to the outside by small openings into the throat and nose. If for any reason these openings are closed during ascent or descent, the air contained in the cavities will be at a higher or lower pressure than the surrounding atmosphere and either a positive or negative pressure will develop in them. When this occurs these structures are damaged and are the sources of great pain. The ear drum is sometimes ruptured during a rapid descent.

A' somewhat similar condition exists with reference to the stomach. This organ normally contains a quantity of gas and during ascent this gas expands in proportion to the decrease of atmospheric pressure. At altitudes of 25,000 to 30,000 ft. the stomach may become so distended that not only do severe abdominal cramps develop but the heart and lungs are crowded upward to the extent that their action is interfered with.

One of the most troublesome effects of decreased atmospheric pressure with ascent is the condition of oxygen lack in the body known as acute altitude sickness. This condition comes about, not because of a decrease of oxygen percentage in the air at high altitude, but because of a decrease of the oxygen pressure which is necessary to carry it into the blood and body tissues. There are few, if any, other conditions known to medicine which produce such profound changes in the body, or which may even produce death, without creating more pronounced subjective manifestations than those experienced in acute altitude sickness. At altitudes of 12,000 ft. or above individuals may react in one of two general ways. Some feel tired, depressed or sleepy and tend to fall asleep. Others will have the opposite reaction and become euphoric with outbursts of hilarity, uncontrolled laughter or pugnaciousness. At an altitude of about 25,000 ft. unconsciousness occurs. This comes on rather suddenly but not unpleasantly and usually without warning.

In contradistinction to the relatively mild or even total absence of subjective symptoms while at high altitude, the after effects of altitude sickness may be quite severe. Flying at 10,000 to 12,000 ft. for a period of 2 to 4 hours is usually followed by a dull headache and a sense of fatigue. Exposure to an altitude of 15,000 to 18,000 ft. for a period of 2 to 6 hours may be followed by a very severe intractable headache, nausea, vomiting, dizziness, mental confusion, muscular weakness, and even complete prostration. At higher altitudes these same effects may appear with shorter exposures until at about 22,000 ft. 15 or 20 minutes may be all that is required to produce them. The more severe the symptoms the longer they persist and as long as 48 to 72 hours may be required for complete recovery. Death from altitude sickness may occur from a prolonged exposure to 18,000 ft. altitude. Above that altitude the exposure period necessary to produce death is progressively shortened until at 25,000 ft. altitude death may occur any time after 25 to 30 minutes.

In addition to its effect on health, altitude sickness reduces both the mental and physical efficiency of the pilot and causes him to become dangerous in the air.

Altitude sickness may be prevented by the breathing of oxygen at high altitude. This method has been in routine use in the military services since the World War of 1914–18 and in 1938 civil airliners began carrying oxygen for passengers.

A marked decrease of atmospheric pressure, such as occurs during a rapid ascent to 20,000 to 30.000 ft. will produce a condition in the body similar to that seen in deep sea diving known as the "bends." In aviation this condition is known as aeroembolism. Aeroembolism is caused by the nitrogen dissolved in the body tissues and fluids coming out of solution and forming bubbles in the blood stream. These bubbles become lodged in the vessels and depending on their location, may produce itching of the skin, pain about the joints, edema of the lungs, or injury to the central nervous system with consequent paralysis or death. The treatment for this condition is descent to lower altitudes where the increased atmospheric pressure forces the bubbles back into solution in the blood. At about 44,000 ft. altitude, even while breathing pure oxygen, the atmospheric pressure is not sufficient to force the oxygen into the blood in the required amount and unconsciousness occurs. Thus the altitude to which one may go while breathing oxygen is definitely limited. Even were this not true, 63,000 ft. would be the absolute limit of human tolerance for at that altitude the atmospheric pressure is so low that the blood and other fluids of the body would boil due to the fact that liquids may be caused to boil either by increasing their temperature or by decreasing their superimposed atmospheric pressure. At body temperature blood will boil at a pressure of 47 mm. Hg which corresponds to that at 63,000 feet.

Airsickness. — Airsickness is caused by the irregular motion of the aeroplane in bumpy air over-stimulating the inner ear and causing dizziness, nausea, vomiting and prostration. It is identical with seasickness and occurs most frequently in passengers since candidates for flying training who are susceptible to attacks of airsickness are eliminated.

Treatment. — The prevention of accidents and the harmful effects of flight, rather than their treatment after they occur, is the principal function of aviation medicine. The careful selection and maintenance of pilots is an important part of this program of preventive medicine. The designer and builder of the aeroplane also contributes greatly to the safety of aviation as does the agency that trains the pilot and governs the operation of aircraft. In civil aviation the rate of ascent and descent is regulated as well as the altitude to which passengers may be carried. The closing. heating and soundproofing of aeroplanes have contributed greatly to the comfort of both pilots and passengers alike. In 1937 the first military aeroplane and in 1940 the first commercial aeroplane equipped with a pressure cabin was placed in service. A pressure cabin aeroplane is one having the cabin sealed air tight within which the atmospheric pressure is maintained at or near that at sea level when the aeroplane is flying at high altitude. This is accomplished by an air compressor which takes atmospheric air, compresses it, and forces it into the sealed cabin. A relief valve in the cabin, set to maintain the required cabin pressure, passes the air back to the outside atmosphere thus assuring adequate ventilation. By keeping the cabin pressure near that at sea level all of the harmful effects of flying due to the decrease of atmospheric pressure at high altitude, or during a change in altitude, are eliminated. The pressure cabin aeroplane is without doubt one of the greatest contributions ever made to the safety and comfort of civil flying. Its practicability in military aircraft is limited due to the fact that a single bullet hole through the cabin would cause it to lose its pressure. For flight above 40,000 ft. however, the pressure cabin aeroplane or a pressure suit is the only possible means of sustaining life.

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AVIATION INSURANCE: *see* AERIAL LAW.

AVICENNA (Abū 'Alī al-Husain ibn 'Abdallah ibn Sīnā) (979–1037), the greatest of Arabian philosophers in the East. and a physician in whom Arabian medicine reached its culmination.

Born in the province of Bukhārā of a family connected with public service, Avicenna at the age of ten was well acquainted with the Koran and Arabic classics. During the next six years he acquired a knowledge of philosophy, mathematics, astronomy. and medicine. His philosophical ability was such that he had memorized the *Metaphysics* of Aristotle, though its meaning remained obscure until he bought, by chance, the commentary of Alfarabi. At 17 his medical knowledge enabled him to cure the Samani ruler, Nūh ibn Mansûr, from a dangerous illness. His chief reward was an access to the royal library.

With the ending of the Samanid dynasty in 1004, Avicenna seems to have spent a short time in the service of the ruler of Khwarazm or Khiva, and then to have wandered about until he began his lecturing on logic and astronomy at Jurjân, near the Caspian. From there, he passed on to Rai and Karzwîn, and ultimately to Hamadbn, where he occupied the office of vizier to Shams Addaula. The soldiery, however, mutinied against their nominal sovereign, and demanded that the new vizier should be put to death. Addaula consented to his banishment, but Avicenna managed to hide himself until an attack of illness induced the amir to restore him to his post. When the ruler of Isfahan captured Hamadbn in 1024, Avicenna passed into his service as physician and general literary and scientific adviser. In this capacity he spent the remaining thirteen years of his life, combining hard work with frequent bouts of excessive pleasure. While marching with the army in a campaign against Hamadân, he was seized with severe colic, and died in June 1037, at the age of 58.

About 100 treatises are ascribed to Avicenna, and of these, the most influential was his *Canon of Medicine.* Although this work, like all other Arabic medical treatises, presents the doctrines of Galen and Hippocrates, modified by those of Aristotle, it was able to eclipse the *Summary* of Rhazes (d. *c.* 923), who, on account of his clinical observations, was one of the most original Mohammedan physicians, because of its greater method and its treatment of medical science as well as practical medicine. The *Canon* includes five books; the first and second treat of physiology, pathology, and hygiene, the third and fourth deal with the methods of treating disease, and the fifth describes the composition and preparation of remedies, and includes Avicenna's personal observations. It was badly translated into Latin by Gerard of Cremona (d. 1187), but the translation remained the standard text-book of medicine even until about 1650, when it was still used in the universities of Louvain and Montpellier. The best editions of this translation are those of Venice 1554, and Basle 1556. The Arabic text which was edited at Rome in 1593 has recently been re-edited in Egypt.

The second most influential work of Avicenna was his *al-Shifa* (the book of recovery), which includes long treatises on *Logic, Physics, Mathematics,* and *Metaphysics.* The *Logic,* part of the *Physics* (viz. *Sufficientia, De Caelo,* and *Lib. sex naturalium* or the *De Anima),* and the *Metaphysics* were translated into Latin by John of Spain and Gundissalinus, and passed through several editions, including that of Venice 1508. The *Metaphysics* has also been rendered into German in 1907 by M. Horten. The *al-Nadjat,* which is a résumé of the *al-Shifa,* has been recently translated into Latin by Mgr. Carame under the title, *Avicennae Metaphysices Compendium* (Roma, 1926). Both of these works show the influence of Alfarabi on his logic, the dynamism of his physics, the empirical tendency of his psychology, and his systematization of Aristotle coloured by a Neoplatonic theory of the production of the world *(see* ARABIAN PHILOSOPHY).

Of Avicenna's numerous other works, the *Kitab el-Jcharat. wa' tanbilzat* (the Book of Theorems) was edited in Arabic by M. Forget, 1892, and some of the mystical treatises by M. Mehren, 1892; the famous poem on the soul was translated into English by E. H. van Dyk (Verona, 1906).

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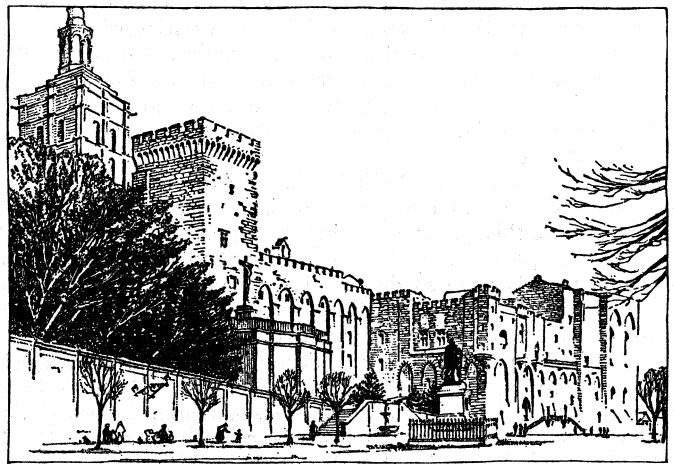
For the list of extant works, *see* C. Brockelmann's *Geschichte der arabischen Litteratur* (Weimar, 1898).

AVIENUS, RUFIUS FESTUS, a Roman aristocrat and poet, of Vulsinii in Etruria, who flourished during the second half of the 4th century A.D. He was probably proconsul of Africa (366) and of Achaia (372). Avienus was a pagan. He translated the Φαινόμενα of Aratus and paraphrased the Περιήγησις of Dionysius under the title of *Descriptio Orbis Terrarum,* both in hexameters, and compiled a description, in iambic trimeters, of the coasts of the Mediterranean, Caspian and Black seas in several books, of which only a fragment of the first is extant. He also epitomized Livy and Virgil's *Aeneid,* but these works are lost. Some minor poems are found under his name in anthologies.

Edition of complete works by N. E. Lemaire *(Poetae Latini Minores,* vol. v., 1819); of *Aratea* by Breysig (1882). French translation of complete works by Despois and Saviot *(Bibliothlque Latine-Française,* 1826).

AVIGLIANA, a town of Piedmont, Italy, 14 mi. W. by rail from Turin. Pop. (1936) 2,940 (town); 5,107 (commune). It has mediaeval buildings and a large dynamite factory.

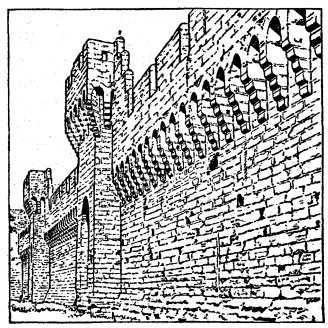
AVIGNON, capital of the department of Vaucluse, south-east France, 143 mi. S. of Lyons on the railway to Marseilles. Pop. (1936) 53,769. It lies on the left (east) bank of the Rhône where rising ground banks the river on both sides and gives defensible sites (Avignon on the east and Villeneuve-lès-Avignon on the west). There is also an island (Ile de la Barthelasse) in the river between them. A few miles below Avignon the Durance reaches the Rhône from the east, and the city is a nodal point for roads from this valley and the east side of the Rhône generally Villeneuve is similarly a focus of roads on the west. The division



PALACE OF THE POPES AT AVIGNON, WHERE THE PAPAL COURT RESIDED DURING ITS SO-CALLED BABYLONIAN EXILE
The palace, which took 30 years to complete, is a combination of castle, convent and fortress. It is now in part a national monument and in part a military barrack. The cathedral tower is to the left

of the river somewhat reduced the difficulty of crossing and helped to give the site its importance. The power of the Rhône is so great that a bridge could not be built in antiquity even by the Romans, but in 1177–85 St. Bénézet built one which was broken down and repaired at various times but was abandoned in 1680. As much of the bridge as was supported by the four arches nearest Avignon still stands and has on it the original Romanesque chapel (with 16th century portions above) dedicated, as usually happens on such sites, to St. Nicholas. Somewhat lower down the river a suspension bridge crosses from Avignon to Villeneuve. Avignon (Avenio) was an important site of the Gallic Cavares, and under the Romans a leading city

of Gallia Narbonensis. Severely harassed by barbarians and Saracens, it later belonged successively to the kings of Burgundy and of Arles and to the counts of Provence, of Toulouse, and of Forcalquier. At the end of the 12th century it became a republic, but in 1226 it was dismantled by Louis VIII. as punishment for its support of the Albigenses, and in 1251 was forced to submit to the counts of Toulouse and Provence. Pope Clement V. made it his residence, and from 1309–77 it was the papal seat. In 1348 the city was sold by Joanna, countess of Provence, to Clement VI. After Gregory XI. had migrated to Rome, two antipopes, Clement VII. and Benedict XIII., resided at Avignon, from which the latter was expelled in 1408. The town remained in the possession of the popes, who governed it by means of legates, till its annexation by the National Assembly in 1791, when conflicts between the adherents of the papacy and the republicans led to much bloodshed. The ramparts built by the popes (14th century) are very fine, with machicolated battlements, towers, and gateways, and they are surrounded by boulevards. The town is traversed by the Cours de la République, with the hôtel-de-ville on the Place Georges Clemenceau and the Place du Palais outside the enceinte in which, on a rocky hill, stand the cathedral and the palace of the popes. The Romanesque (13th century) cathedral (Notre Dame des Doms) contains the mausoleum of Pope John XXII., a masterpiece of 14th century Gothic work; the church has been much altered and is more or less dwarfed by the fortress palace of the popes begun in 1316 by John XXII. in the Gothic style and continued till 1370. It now belongs to the city. Among the minor Gothic churches of the town are St. Pierre, with graceful façade and richly carved doors, St. Didier, and St. Agricol. Avignon suffers severely in winter from the mistral winds. Jean Althen, a Persian, introduced in 1765 the culture of the madder plant which long formed the staple and is still an important branch of local trade. There are flour mills, oil-works, and leather works. Soap and chemicals are manufactured, and wine, teasels, and almonds traded, while the town is well-known for its sarsanet and other fabrics. Avignon was a bishopric in the 3rd century and became an archbishopric in 1475. It has tribunals of first instance and of commerce, a council of trade arbitrators, and a chamber of commerce.



BY COURTESY OF THE PARIS. LYONS, AND MEDITERRANEAN RAILWAY

THE WALLS OF AVIGNON, BUILT BY POPES OF THE 14TH CENTURY

AVILA, JUAN DE (1500–1569), Spanish saint, "Apostle of Andalusia," was born in Almodovar in the diocese of Toledo. He studied law at the University of Salamanca, and philosophy and theology at Alcala. He intended to do missionary work in Mexico, but in 1530, the archbishop of Seville persuaded him to turn his attentions to Andalusia. There his charity and humility and his fame as a good confessor attracted innumerable disciples including St. Theresa, St. John of God, and St. Francis Borgia. John was not beatified until Nov. 12, 1893.

His works were collected at Madrid in 1618, 1757, 1792 and 1805. The well-known *Audi Fili* was translated into English in 1620, and the *Spiritual Letters* in 1904. *See* Luis Muñoz, *Vida y virtudes del venerable varon J. de Avila* (1671); *L.* Oddi, *Life of the Blessed John of Avila (1898).*

ÁVILA, a province of central Spain, astride the Central Sierras from the Plaza de Almanzor (2,592 mi.), the culminating point of the Sierra de Gredos, to the Sierra de Malagón. Pop. (1939) 232,142; area 3,042 sq.mi.; density, 76.3 per sq.mi. South of the Sierra de Gredos, Ávila extends to the river Tiétar; it advances north for some distance across the plateau of Old Castile. On the level ground in the north, the centre of which is Arévalo, agriculture predominates, but the soils are poor, resting on outwash from the central Sierras. For the rest, Ávila is a province of sierras, mainly granitic, rising step-like from the plateau to the Sierra de Gredos, and separated from each other by longitudinal valleys which are, in some cases, dried-up lake-bottoms along lines of structural weakness. Of these the best known are the Barco de Ávila and the Valle de Amblés; the latter lies at the eastern end of an important structural line, giving a natural route from Plasencia to Avila. The head-waters of the rivers Alberche and Tiétar, flowing to the Tagus, and of the Tormes and Adaja, flowing to the Duero, occupy these longitudinal valleys. The raising of stock, especially of the merino sheep (of which the purest breeds surviving in Spain are found in the central Sierras) is the principal industry; the forests, mostly pine, are still in places important. The pastures and forests formed the basis of the life of the mediaeval communities, subdivided into *sexmos,* between which the area of the present province was divided. Nevertheless, 38% of the provincial area is under cultivation, and of this, wheat, grown with and without irrigation, occupies nearly one-fourth and is increasing its acreage, with rye, barley, oats and maize following in order of importance. Modern methods are widely adopted; production of cereals exceeds consumption, and a surplus is exported to other parts of Spain. The vine flourishes only in such areas as the Tiétar and Alberche valleys, which produce wines of some repute; olive cultivation is confined to a few sheltered localities (Arenas de San Pedro, Cebreros) with very high yield. Estates are generally large; there is often a shortage of labour, and harvesters are brought in from Galicia. The sierras formerly abounded in game, but the diminution of the ibex of the Sierra de Gredos led to the creation in 1905 of an ibex sanctuary. Avila, the capital (pop., 1940, 18,644), is the only large town. The province and capital were conquered by Francisco Franco's Nationalists early in the civil war of 1936–39.

BIBLIOGRAPHY.—G. W. Edwards, *Spain* (1926); Span. Lib, of Information, *Spain* (April, 1941).

ÁVILA (Rorn. *Abula, Avela,* etc.), capital of the province of that name; 54 mi. W. by N. of Madrid. Pop. (1940) 18,644. The old walled city, on the broad back of a ridge sloping west to the river Adaja, commands both the approach to the pass across the Central Sierras in the angle between the Sierra de Guadarrama and Sierra de Gredos, and the junction of two important roads, one downstream, coming from the south-west by Plasencia, the other upstream, converging on the cut made by the Adaja between the Sierra de Ávila and the Sierra Malagón.

The dark granite walls, into which the apse of the cathedral is built; the ancient churches (San Vicente, San Pedro, Santo Tomás and San Segundo) and the mediaeval town-houses of the nobility of Castile make *Ávila de los Caballeros* typical of "the spirit of the old knightly Catholic Castile." The convent and church of Santa Teresa (1515–82) occupy the site of the house in which the saint is said to have been born. Ávila came under nationalist control early in the 1936 civil war.

See O. Jürgens, *Die Spanische Städte* (Hamburg, 1926, bibl.); G. W. Edwards, *Spain* (1926).

AVILA Y ZUNIGA, LUIS DE (c. 1490–*c.* 1560), Spanish historian, was born at Placentia. He married a wealthy heiress of the family of Zuniga, whose name he added to his own. He rose rapidly in the favour of the emperor Charles V., served as ambassador to Rome, and was made grand commander of the order of the Knights of Alcantara. He accompanied the emperor to Africa in 1541, and having served during the war of the league of Schmalkalden, wrote a history of this war entitled *Commentarios de la guerra de Alemaña, hecha de Carlos V. en el año de 1546 y 1547.* This was first printed in 1548, and was translated into French, Dutch, German, Italian and Latin.

AVILÉS, a town of Spain, province of Oviedo; on the Bay of Avilés, a winding inlet of the Bay of Biscay, 24m. by rail W. of Gijón. Pop. (1930) 16,077. The bay, crossed by a fine bridge at its narrow landward extremity, is the headquarters of a fishing fleet, and a port of call for many coasting vessels. Coal from the Oviedo mines is exported coastwise.

AVIZANDUM, a Scots law term; the judge "makes avizandum with a cause," *i.e.,* takes time to consider his judgment.

AVLONA: *see* VALONA.

AVOCA or **QVOCA, VALE OF,** a mountain glen in south-east Wicklow, Ireland. The small rivers Avonmore and Avonbeg unite to form the Ovoca river, flowing south and south-east to the

Irish sea at Arklow. The vale's beauty was sung by Thomas Moore in his *Irish Melodies;* it is narrow and densely wooded, but is somewhat marred by the presence of lead and copper mines, and by the Great Southern railway, on which Ovoca station, midway in the vale, is 42¾ mi. south of Dublin. At Avondale, Charles Stewart Parnell was born.

AVOCADO, the fruit of *Persea americana* of the family Lauraceae, a tree native to the mainland of the western hemisphere from Mexico south to the Andine regions of Colombia and perhaps Venezuela. The common name is a sound-substitute for the Aztec *ahuacatl,* originating probably in Jamaica, where also the name *alligator pear* arose as a sound-substitute, plus reference to the pear-like shape and appearance of many varieties.

The avocado first became known to Europeans through a description published in 1519 by Martin Fernández de Enciso in his *Suma de Geografia.* Enciso had seen the fruit near Santa Marta, Colombia, as he coasted along those shores with one of the first Spanish expeditions to the mainland. In 1526 Gonzalo Oviedo described it in greater detail. Garcilaso de la Vega tells how it was carried from Ecuador to the warm valleys near Cusco by the Inca Tupac Yupanqui, shortly before the Spanish conquest. The common name in Peru and southward is *palta.* In most Spanish-speaking countries, *aguacate,* an adaptation of *ahuacatl,* is used; while in Brazil this becomes *abacate.*

The tree may be tall or spreading, with entire leaves commonly elliptic to obovate in form and 4 to 12 in. in length. The flowers, which are borne in dense racemes, are small, greenish, devoid of petals, with six perianth-lobes, nine stamens arranged in three series, and a one-celled ovary. The fruit is exceedingly variable in shape, size, and colour; some of the Mexican varieties are no larger than hens' eggs, while those of other races may attain three or four pounds in weight. The form varies from round to pear-shaped with a long slender neck, the colour from green to dark purple. The single large seed, with two cotyledons, is round to conical. Between it and the outer skin, which is sometimes no thicker than that of an apple, sometimes coarse and woody in texture, is the greenish or yellowish flesh, of buttery consistency and rich nutty flavour, containing in some varieties as much as 25% of oil, and eaten most commonly in salads, whence the name "salad fruit" which has been used to emphasize the peculiar characteristics of the avocado.

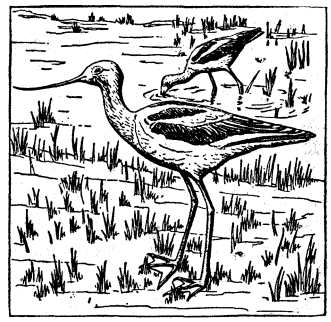
Thaugh it had been widely cultivated in tropical America since pre-Columbian days, it was not until 1900 that the avocado began to attract serious attention in the United States. About that time grafted varieties began to be planted in Florida. A similar development took place in California about 1910. From these beginnings an industry developed which produced more than 17,000 tons of fruit in 1941. An additional 3,000 to 5,000 tons were imported annually by the United States, mainly from Cuba, in the period 1930–40. Outside of tropical and subtropical America, avocados have been grown for many years in Hawaii; to a limited extent in the Malayan archipelago, India, and the south Pacific; and occasionally in the countries around the Mediterranean. Commercial cultivation of varieties from the United States has received attention in Australia, South Africa, and a few other regions.

Horticulturally, avocados are commonly divided into three races, recognized as early as 1653 by Fray Bernabe Cobo. These are the Mexican, the West Indian, and the Guatemalan. The first-named, considered by some botanists to be a distinct species, *Persea drinzyfolia,* is native to Mexico, and is characterized by the anise-like odour of the leaves, and by small (3 to 8 oz.) thin-skinned fruits of rich flavour and excellent quality. This is the hardiest race and therefore of value in regions too cold for the others, though it will not tolerate more frost than the orange. The Guatemalan race is native to the highlands of Central America; is slightly less frost-resistant than the Mexican; and produces fruits of medium to large size (8 to 32 oz.), characterized by thick woody skins and a ripening season different from that of the others. The West Indian race (it would more properly be termed South American) is the most tropical in character, and its cultivation in the United States is limited to southern Florida. Its fruits are frequently of large size and excellent quality. Natural crossing has taken place between these three races, resulting in numerous varieties of mixed character, some of them important commercially.

Avocados can be grown on a wide variety of soils, from the light sandy ones of central Florida to the heavy clays of southern California, but drainage must be perfect. A rich sandy loam or clay loam is perhaps best. Propagation of commercial sorts is by grafting or budding, though seedlings are more commonly grown in the tropics and are to be seen as dooryard trees in California and Florida. In the former state, the Mexican race is used as a root-stock; in Florida, the West Indian is more popular. For commercial orchards, grafted trees are spaced from 20x20 to 30x30 ft. Avocados will not tolerate severe drought, hence irrigation is used in many regions, especially those where there is lack of rainfall during the period when the trees are flowering and setting fruit. The tree is a gross feeder, requiring somewhat more plant food than Citrus; hence fertilizing is standard practice in most commercial orchards. Cultural attention varies in different regions; little pruning is required except that necessary to form a shapely tree and to remove dead or injured branches. Various insect pests and fungous diseases attack the groves in Florida and California, some of them requiring combative measures.

Yields vary with variety and environmental conditions; a fair expectation for most sorts is one to two crates of 40 lbs. each per tree per season, though five to ten times this amount may sometimes be realized. The ripening season of West Indian varieties in Florida is late summer and early autumn, but the Guatemalan varieties and hybrids extend the period to February or March. Since better prices are obtained in northern markets during the winter, the tendency is for commercial plantings to consist mainly of sorts maturing at that time of year. In California, Mexican varieties ripen in late autumn; Guatemalans and hybrids from early spring to late summer. Fruit is therefore available during most of the year. The majority of plantings made in California up to 1940 were of the *Fuerte* variety, which matures during an exceptionally long season, winter to late summer

(W. Po.)



BY COURTESY OF THE NATIONAL ASSOCIATION OF AUDUBON SOCIETIES

THE AVOCET. A MIGRATORY WADING BIRD OF BLACK, WHITE AND CINNAMON PLUMAGE, THAT FREQUENTS MARSHES FOR FOOD

AVOCET (ăv'o-sĕt), a long-legged wading bird, conspicuously marked with black and white, the avocet *(Recurvirostra avosetta)* is remarkable for its long, slender bill, bent upwards at the distal end. The legs are long and the feet webbed. The bird inhabits Europe, Africa and central and south Asia, and formerly bred in England—its last breeding place being at Salthouse, in Norfolk, where the people made puddings of its eggs. These latter resemble those of the lapwing, as does the mode of nesting. The plumage of both sexes is black and white, and no courtship antics are performed. It obtains its food by working its bill from side to side in shallow pools, thus capturing small crustaceans and insect larvae. Two species, R. *americana* and *R. andina,* are found in America, R. *anzericana* reaching Saskatchewan, R. *andina* confined to the mountain lakes of Chile. A fourth species is found in Australia.

AVOGADRB, AMEDEO, CONTE DI QUAREGNA (1776–1856), Italian physicist, was born at Turin on June 9, 1776, and died there on July 9, 1856. He was for many years professor of higher physics in Turin university. He is chiefly remembered for his "Essai d'une manière de determiner les masses relatives des molecules élémentaires des corps, et les proportions selon lesquelles elles entrent dans les combinaisons" (*Journ. de Phys.,* 1811), in which he enunciated the hypothesis known by his name (Avogadro's law) that under the same conditions of temperature and pressure equal volumes of all gases contain the same number of smallest particles or molecules, whether those particles consist of single atoms or are composed of two or more atoms of the same or different kinds.

AVOGADRO'S CONSTANT is the number of molecules *(see* MOLECULE, CHEMICAL) in one gram-molecule, the molecular weight of the substance in grams. It is invariably the same, whatever the substance, its value being approximately 6.16×10^{23}, and it is denoted by the constant N. *Avogadro's Law* states that equal volumes of different gases at the same temperature and pressure contain the same number of molecules, *i.e.,* the volume of a gram-molecule is constant for all gases. This is correct only for perfect gases *(see* article GAS), but is approximately true for real gases *See* KINETIC THEORY OF MATTER; THERMODYNAMICS; and ELECTRON, THC.

AVOIDANCE, from "avoid" (O.Fr. *esvuidier* or *évider,* to empty out), the action of making empty, void or null, hence, in law, invalidation, annulment *(see* CONFESSION AND AVOIDANCE); also the becoming void or vacant, hence in ecclesiastical law a term signifying the vacancy of a benefice. In general use, the word means the action of keeping away from anything, shunning.

AVOIRDUPOIS or **AVERDUPOIS** (from the French *avoir de pois,* goods of weight), the name of a system of weights used in Great Britain and America for all commodities except the precious metals, gems and medicines. The foundation of the system is the grain. A cubic inch of water weighs 252.458 grains. Of this grain 7,000 now *(see* MEASURES AND WEIGHTS) make a pound avoirdupois. This pound is divided into 16 oz., and these ounces into 16 drachms.

Avoirdupois Weight

Drachm, 16=ounce,	16=pound,	14=stone,	2=quarter,	4=hundred,	20=ton.
27 3 grains	437'5	7,000	98,000	196,000 grs.	112 lb.	2,240 lb.

AVON, the name of several rivers in England and elsewhere. The word is Celtic, appearing in Welsh (very frequently) as *afon,*

in Manx as *aon,* and in Gaelic as *abhuinn* (pronounced *avain*), and is radically identical with the Sanskrit *ap,* water, and the Lat. aqua and *amnis.* The root appears more or less disguised in a vast number of river names all over the Celtic area in Europe. Thus, besides such forms as *Evan,* Aune, *Anne, Ive,* Auney, *Inney,* etc., in the British Islands; *Aff, Aven,* Avon, Aune appear in France; *Avenza* and *Avens* in Italy; *Avia* in Portugal, and *Avono* in Spain. The names Punjab, Doab, etc., also show the root. In England the following are the principal rivers of this name:—

(1) **The East or Hampshire Avon** rises in Wiltshire south of Marlborough and flows through the Vale of Pewsey. Traversing the eastern edge of Salisbury plain, it passes Amesbury, and reaches Salisbury after a very sinuous course. Here it receives on the east bank the Bourne and on the west the Wylye. In a wider fertile valley it skirts the New Forest on the west, receives the Stour, and 2½ mi. lower enters the English channel through the broad but narrow-mouthed Christchurch harbour. Length, excluding lesser sinuosities, about 60 mi. The total fall is over 500 ft.; that from Salisbury (35 mi. from the mouth) about 140 ft. The river is of no modern value for navigation, but may have been important in prehistoric times. It abounds in roach and there are valuable salmon fisheries. Drainage area, 1,132 sq.mi.

(2) **The Lower or Bristol Avon** rises on the eastern slope of the Cotswold hills in Gloucestershire, collecting streams south of Tetbury and east of Malmesbury. It flows east and south in a wide curve, through a broad valley past Chippenham and Melksham, turns abruptly west to Bradford-on-Avon, receives the Frome from the south and enters the narrow valley in which lie Bath and Bristol. Below Bristol the valley is known as the Clifton gorge, famous for its wooded cliffs and for the Clifton (*q.v.*) suspension bridge. The cliffs and woods have been disfigured by quarries, but many portions are now in the hands of the National Trust or other bodies. The Avon finally enters the estuary of the Severn at Avonmouth. From Bristol downward the river is one of the most important commercial waterways in England. The Kennet and Avon canal between Reading and the Avon (now disused) follows the river closely from Bradford to Bath, where it enters it by a descent of seven locks. Length of the river, excluding minor sinuosities, about 75 mi. The total fall is between 100 and 600 ft. Drainage area, 891 sq.mi.

(3) **The Upper Avon,** also called the Warwickshire, and sometimes the "Shakespeare" Avon from its associations with Stratford, is an eastern tributary of the Severn. It rises near Naseby in Northamptonshire, and, with a course of about 100 mi., joins the Severn immediately below Tewkesbury in Gloucestershire. After flowing southwest to Rugby, it runs west and southwest to Warwick, receiving the Leam on the east. Continuing southwest it goes past Evesham to Tewkesbury. The valley is broad, and especially after Warwick, through the Vale of Evesham, the scenery is very beautiful, the rich valley being flanked by the bold Cotswold hills on the south and by the wooded Arden district on the north. Famous beauty spots include Warwick castle, Stratford and Evesham. The river is locked, and carries some trade up to Evesham, 28 mi. from Tewkesbury; the locks from Evesham upward to Stratford (17 mi.) are decayed, but there are many reaches suitable for pleasure boats. Total fall of river, about 500 ft.; from Rugby about 230 ft.; and from Warwick 120 ft. Coarse fish abound. Other streams of this name in Great Britain are one from Dartmoor to the English channel; one in South Wales with its mouth at Aberavon in Glamorganshire; and, in Scotland, tributaries of the Clyde, Spey and Forth.

AVRANCHES, capital of an arrondissement in the department of Manche, northwest France, 87 mi. S. of Cherbourg on the Western railway. Pop. (1936) 7,115. It lies on the slopes and summits of a 341 ft. hill looking westward to the bay and rock of St. Michel. At the foot of the hill flows the tidal river Sée. The site was an important Roman military station, and in the middle ages Avranches was the chief place of a county of the duchy of Normandy.

It sustained several sieges, the most noteworthy of which, in 1591, was the result of its opposition to Henry IV. In 1639 it was the focus of the peasant revolt against the salt-tax, known as the revolt of the Nu-pieds. Avranches was from 511 to 1790 a bishop's see, held in the 17th century by Daniel Huet; and its cathedral, destroyed as insecure at the time of the first French revolution, was the finest in Normandy. Its site is now occupied by an open square, one stone remaining to mark the spot where Henry II of England received absolution for the murder of Thomas Becket. Avranches is the seat of a sub-prefect and has a tribunal of first instance. Leather-dressing and lacemaking and bleaching are also carried on, and horticulture flourishes in the environs. Trade is in cider, grain, butter, flowers and fruit, and there are salmon and other fisheries.

AVULSION (Lat. avulsio, a tearing off), the forcible separation of a considerable portion of land from the property of one owner and its deposit on the soil of another, caused by the mechanical action of water due to flood, change in the course of a river or the encroachment of the sea. The property thus separated belongs to the original owner, who is entitled to recover its possession. (See ACCRETION; ALLUVION.)

AVUNCULATE. The rights and duties enjoyed by the maternal uncle (Latin, avunculus) in many primitive societies throw light on the status of relatives in the social order. He may have specific duties at the initiation of his nephew (his sister's son) or take a leading part in his marriage rites or be responsible for his social training.

He may have, and in the case of matrilocal marriages seems to have always, responsibility for choosing the husband or approving the husband of the daughter of his sister. In many instances his position owes its importance to the matrilineal matrilocal system by which a woman's brother is necessarily her guardian (see MATRIARCHY). In matrilineal patrilocal societies he is still his sister's guardian, although on marriage she passes to residence in her husband's community. In many strictly patrilineal patrilocal societies the maternal uncle has a similar position and it is supposed that in most of these cases his privileges are a survival of an earlier, matrilineal order. In some of these societies the institution of cousin-marriage is found by which the maternal uncle's son has by custom a preferential right to his cousin, the daughter of his father's sister, or, more usually, the sister's son has a similar right to his maternal uncle's daughter. Cousin marriage has definite social and economic advantages and creates emphasis on the mutuality which all marriages produce and this fact indicates social conditions which enable the maternal uncle to claim and receive special authority in the social life over his sister's children. See R. H. Lowie, Primitive Society, 1921.

AVVAKUM (1620?–1681), Russian archpriest and author, famous as the leader of the conservative party in the Russian church in the 17th century, son of a village priest, was born at Grigorovo, near Nijni Novgorod. He became protopope or rector of a Moscow church, and a conservative reformer of the discipline of the church. He declined to accept the revision of the ritual of the Russian church according to Greek practice, proposed by Kikon (q v.) and was exiled to Siberia in 1653, where he joined the expedition of Pashkov in 1655, returning to Moscow in 1664 after the fall of Nikon. But the Synod of Moscow (1666–67), though it deposed Nikon, condemned Avvakum's doctrines, and he was compelled to take the tonsure and was sent to Pustozersk, in the extreme north of Russia. His autobiography (written *c.* 1673), was one of the most popular books of the Russian schismatics or old believers. He urged martyrdom on his followers and was himself burned at the stake in April 1681.

Avvakum was the first writer to use colloquial Russian for a literary purpose. Prince Mirsky says of his Life that it is "the only work of really intrinsic significance in the whole space separating the Old Russian Lay of *Igor* in the 12th century from the first expressions of modern poetry in the odes of Lomonosov and Derzhavin in the later 18th."

See Life of the *Archpriest* Avvakum, trans. by Jane Harrison and Hope Mirrlees (1924).

AWADIA, a Ga'aliin (Arab) sub-tribe in the Berber province. *See* H. A. MacMichael, History of the Arabs in the *Sudan* (1922).

AWAJI, an island of south Japan, 218 sq.mi. in extent. It lies (34° 20′ N., 134° 45′ E.), athwart and almost closes the eastern end of the island-studded Inland sea. Awaji ("the way to Awa") is the stepping-stone between Kyoto, the old capital of Japan, and Awa, the eastern end of Shikoku. It is said that the gods stepped from heaven upon Awaji; it is a rocky hilly island, displaying in miniature the features characteristic of all south Japan. (See JAPAN.)

AWAN, the name given to a dynasty of Babylonian rulers from its capital city. The designation mas later changed to Awak (in the district of Kazallu), but its exact location remains unknown. It probably stood east of the Tigris and was certainly not far from Susa.

AWARD, the decision of an arbitrator (See ARBITRATION.)

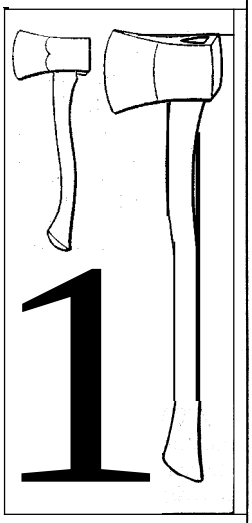
AWE, LOCH, the longest freshwater lake in Scotland, situated in mid-Argyllshire, 116 ft. above the sea, with an area of nearly 16 sq.mi. It is 23 mi. long northeast to southwest from Kilchurn castle to Ford, its breadth varying from one-third of a mile to 3 mi. at its upper end, where it takes the shape of a crescent, one arm of which runs towards Glen Orchy, the other to the point where the river Awe leaves the lake. The upper extremity is majestic, the lower half tame. Inishail Island contains ruins of a church and convent.

AWL (O.Eng. ael; at one time spelt *nawl* by a confusion with the indefinite article before it), a small hand-tool for piercing holes.

AWLAD HAMAYD: see BAKKARA.

AXE, a tool or weapon, taking various shapes, but, when not compounded with some distinguishing word (*e.g.,* in "pick-axe"), generally meaning an edged head fixed upon a handle for striking. A "hatchet" is a small sort of axe. In O.E. the word was aex.

In British politics. the word "axe" came, after World War I. to be applied to efforts to reduce public expenditure.



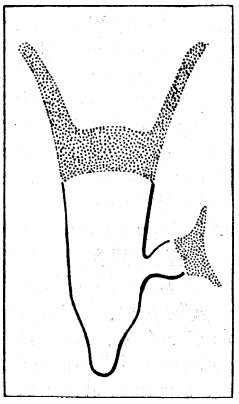
AN AXE AND HATCHETS
The axe, largest of the three, is mainly used for felling trees. Camper's hatchet at top, and carpenter's hatchet below, deal with small trees and undergrowth

AXHOLME, ISLE OF, a flat and formerly marshy tract in northwest Lincolnshire, about 18 mi. by 5 mi., and almost entirely under 100 ft. in elevation. The area is roughly 73.4 sq.mi. The rural district consists of 13 parishes with an area of 79.9 sq.mi. and a pop. (est. 1938) of 12,970.

In 1627 King Charles I, who was lord of the island, entered into a contract with Cornelius Vermuyden, a Dutchman, for reclaiming the meres and marshes and rendering them fit for tillage. This undertaking led to the introduction of a large number of Flemish workmen, who settled in the district, and, in spite of the violent measures adopted by the English peasantry to expel them, retained their ground in sufficient numbers to affect the physical appearance and the accent of the inhabitants to this day.

The principal towns are Epworth and Crowle. Joint light railways, L.M.S.R. and L.N.E.R., run north and south through the isle, connecting Goole with Haxey junction. The land is extremely fertile and produces heavy crops.

AXIAL GRADIENTS, a term applied to the regular decrease in the rate of protoplasmic activities, which is observed in organisms between one point of the body and another. The region where the rate is highest is the head-end of animals, and the growing point of plants; and from these points, the gradual decrease in rate of activities follows the axis of the organism. It is for this reason that the gradients are called "axial." The demonstration of axial gradients in the higher animals is made difficult by the high degree of specialization which they show; but it has been established that they exist in Protozoa, Coelentera, Platyhelmia, Annelida, larvae of Echinodermata, embryos of fish, tadpoles of frogs and embryos of birds. In addition, axial gradients have been demonstrated in a number of eggs. The methods of demonstration make use of the fact that the rate of activities of the protoplasm can be roughly measured by the rate of oxidation. The methods are the following: (1) direct susceptibility to toxic substances; (2) indirect susceptibility to toxic substances through acclimatization; (3) differential reduction of potassium permanganate to manganese dioxide in the tissues; (4) measurement of the output of carbon dioxide; (5) detection of difference of electric potential.



FROM "THE JOURNAL OF EXPERIMENTAL ZOOLOGY." BY PERMISSION OF THE WISTAR INSTITUTE OF ANATOMY AND BIOLOGY, PHILADELPHIA

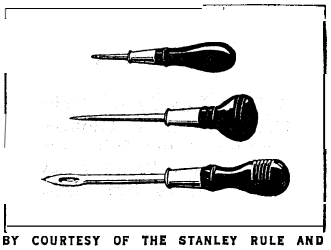
MEASUREMENT OF TISSUE GROWTH
The breaking down and building up processes of the tissues are not the same all over an organism. The Hydra, here shown, has been subjected to harmful conditions which affected the regions of the body where the rate of activities was highest. The damaged regions (dotted) include the mouth and tentacles of the little bud at the side

The importance of axial gradients lies in the fact that they are set up in previously homogeneous protoplasm by the action of external stimuli, and that, once set up, they constitute the prime differentiation of the organism during development, including especially polarity and symmetry. The relative rates of activity at different levels on the gradients determine the quality of the tissue which in development will differentiate at those levels. (See EXPERIMENTAL EMBRYOLOGY.)

BIBLIOGRAPHY.—Nearly all the important literature on axial gradients is contained or referred to in C. M. Child, Physiological Foundations *of* Behavior (1924). (*G.* R. DE B.)

AXILE or **AXIAL** (related to the axis), used technically in botany. An axile placentation is one in which the ovules are attached to the axis.

AXINITE, a mineral consisting of a complex aluminium and calcium boro-silicate; the calcium is partly replaced in varying amounts by ferrous iron and manganese, and the aluminium by ferric iron; the formula is $HCa_3BAl_2(SiO_4)_4$. The mineral was named (from ἀξίνη, an axe) on account of the characteristic thip wedge-like form of its anorthic crystals. The colour is usually clove-brown, but rarely it has a violet tinge. The best specimens are afforded by the beautifully developed transparent crystals, found at Le Bourg d'Oisans in Dauphiné. The specific gravity is 3.28. The hardness of $6\frac{1}{2}$–7, combined with the colour and transparency, renders axinite applicable for use as a gemstone, the Dauphiné crystals being occasionally cut for this purpose.



BY COURTESY OF THE STANLEY RULE AND LEVEL CO.

TYPES OF AWLS IN GENERAL USE
Top, The Brad awl; centre, Scratch awl; bottom, Belt awl

AXIOM, a statement admitted without proof, as that if two equal quantities are added respectively to two equal quantities, the sums will be equal. The Greek philosophers recognized the existence of first principles "the truth of which," as Aristotle said, "it is not possible to prove." These were called axioms, and also "the common [things]" (τά κοινά, ta koina) or "common opinions" (κοιναὶ δοξαι, *koinai* doxai). (See MATHEMATICS, FOUNDATIONS OF.)

AXIS, a word having the same meaning as axle, and also with many extensions of this primary meaning. It denotes the imaginary line about which a body or system of bodies rotates, or a line about which a body or action is symmetrically disposed. In geometry, and in geometrical crystallography, the term denotes a line which serves to aid the orientation of a figure. In anatomy, it is, among other uses, applied to the second cervical vertebra, and in botany it means the stem.

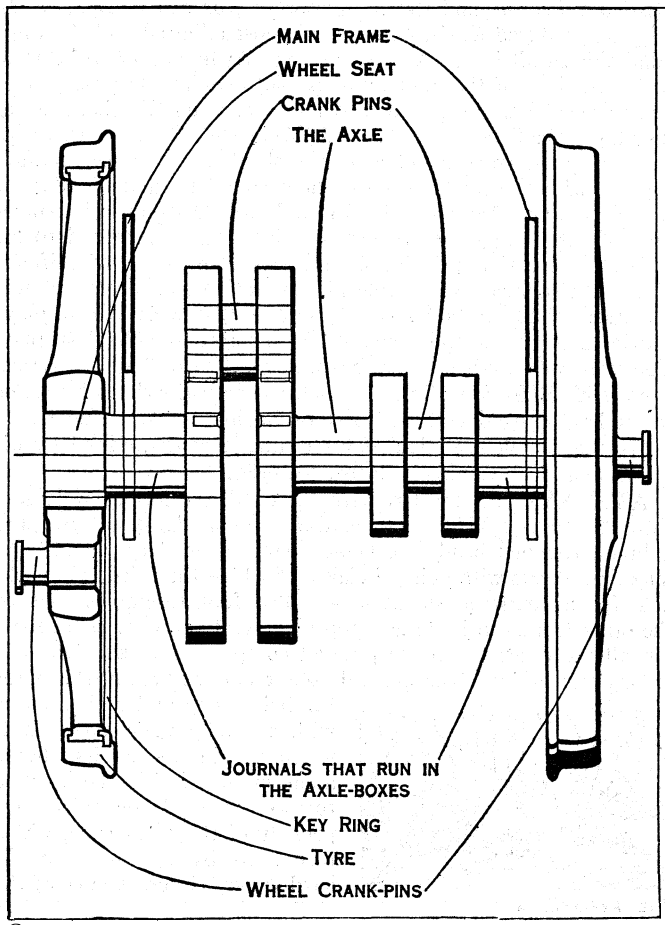
AXIS, MAGNETIC. The axis of a magnet is the line drawn from its south to its north pole. (See MAGNETISM.)

AXIS, OPTIC, the direction in a crystal along which the ordinary and extraordinary rays are propagated with the same velocity. (See LIGHT: *Polarization* and *Electromagnetic* Theory.)

AXLE, a pin or shaft on which a wheel turns, or a shaft revolving in bearings, and having wheels affixed. In carriages and carts the fixed bar is called the axle-tree, and the ends are the axles. In railway carriages, wagons, locomotives, tramcars, travelling cranes, and the like the axle runs in hearings, the length making contact therein being called the journal. Axles for steam and internal-combustion engines which require outside connecting-rods or coupling-rods have the journals between the wheels, but other rolling-stock and tramcars outside. (In M E. axel-tre is derived from O.Norw. oxull-tre, cognate with O.E. aexe or eaxe, and Lat. axis.)

An axle may be driven, as in the case of locomotives, tramcars, or cranes, either directly or through the intervention of gearing. or it may be idle in this respect. Motor-car axles comprise two main classes, the driven one at the back in two parts with differential gear, and mounted within a tube or secondary axle, and the front one consisting of a fixed bar, to which are pivoted the stub axles. Ball or roller bearings take the place of plain bearings in motor and certain other axles, but while roller bearings have been applied to some extent in railway carriages, the plain

axle-box still holds sway. The latter only requires bearing surface over the top half of the axle, hence merely a "keep" is fitted to the bottom half. The bearing surface is usually gunmetal, with white-metal liners cast in, and adequate arrangements for grease or oil lubrication have to be ensured. In view of the serious consequences likely to arise from broken axles on railways, only the best class of steel is employed, made and tested to stringent



CRANK AXLE FOR GREAT WESTERN RAILWAY. "KING" CLASS LOCOMOTIVE
Great care is taken in the making of locomotive crank axles to eliminate risk of fracture. In the one illustrated, the shaft portions are hollow, the webs of heat-treated slabs, and the whole shrunk together and locked with screws

specifications. The large numbers required entail the use of special lathes, turning both journals simultaneously. Finally a hardened steel roller in a holder is pressed with great force against each revolving journal, closing the pores of the metal, and leaving a highly-burnished and hard-wearing surface.

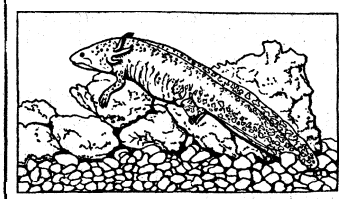
The failure of a locomotive crank-axle is even more serious than that of a carriage or wagon, consequently the manufacture demands the utmost care. In some cases a solid forging is supplanted in favour of the "marine type" built-up axle, made of heat-treated hollow axle, crank-pins, and web shrunk together, and locked with screws. Mr. C. B. Collett follows this method for Great Western engines, of the "King" class (see fig.). Wheels are forced on their axle seatings in hydraulic presses, the pressure required varying from 80 tons in the case of small wheels up to zoo tons or more for large locomotive driving wheels. For the final processes of turning the treads, the axles are put in the lathe with the wheels thus assembled. (F. H.)

AX-LES-THERMES, a watering place of south-west France, in the department of Ariège, at the confluence of the Ariège, with three tributaries, 26m. south south-east of Foix by rail. Pop. (1936) 1,114. Ax (aquae), a spa of ancient (Roman) origin, is well known for its warm sulphur springs, which vary greatly in temperature.

AXMINSTER, urban district, Devonshire, England, on the river Axe, 27m. E. by N. of Exeter by the Southern railway. Pop. (1938) 2,355. Area 2.0 sq mi. The situation of Axminster at the intersection of the two great ancient roads, Iknield Street and the Fosse Way, and also the numerous earthworks and hill-fortresses in the neighbourhood indicate a very early settlement. According to Domesday, Axminster was held by the king. In 1246 Reginald de Mohun, then lord of the manor, founded a Cistercian abbey at Newenham within the parish of Axminster, granting it a Saturday market and a fair on midsummer day, and the next year made over to the monks from Beaulieu the manor and hundred of Axminster. The abbey was dissolved in 1539. The midsummer fair established by Reginald de Mohun is still held. The minster. dedicated to St. Mary the Virgin, illustrates every style of architecture from Norman to Perpendicular.

Axminster was long celebrated for the admirable quality of its carpets, which were woven by hand, like tapestry. Their manufacture, which was established in 1755, was closed in 1835 and the machinery removed to Wilton, near Salisbury. but in 1936 the industry was again started in Axminster. Toothbrushes and nail brushes are also made there.

AXOLOTL, the aquatic larval form, which may become sexually mature, of the salamander Amblystoma tigrinum. This larva was for long held to be a species of perennibranchiate urodele (see AMPHIBIA); but in 1865, some axolotls in the Jardin des Plantes, Paris, metamorphosed into the salamander form. This phenomenon of larval sexual maturity is called neoteny (see METAMORPHOSIS). The axolotl, long known as an article of food in Mexico, inhabits the U.S.A. and the cooler parts of Mexico. In form it resembles the larva of the common newt but reaches a length of about a foot. A semi-albino variety is known. The adult A. tigrinum is dark brown in colour, with yellow spots, and differs little in appearance from European salamanders. In Lakes Chalco and Xochimilco, near Mexico City, the axolotl apparently never metamorphoses; these lakes contain abundant food and good shelter, while the surrounding country is dry and comparatively barren. Thus it is an advantage for the species to become mature in the aquatic



BY COURTESY OF THE N.Y. ZOOL. SOCIETY
AXOLOTL. THE AZTEC NAME FOR THE PERMANENT LARVAL FORM OF THE MEXICAN SALAMANDER

form. Further north, another subspecies occurs which inhabits smaller pools, and metamorphosis is much more readily induced, *e.g.,* by the drying of the pools. The permanently aquatic condition is in this species brought about by a suppression of the activity of the thyroid gland, the secretion of which is responsible for metamorphosis in Amphibia. Administration of thyroid will cause axolotls of any age to transform into the terrestrial form.

AXONE, the nerve fibre process of a neuron, which conducts away from the cell body (see DENDRITE; SYNAPSE). The axone is much longer than the dendrites, and also is frequently provided with a myelin sheath. Myelin is a fat-like material, white in colour; hence the white matter of the central nervous system is composed of axone fibres. The peripheral process of a bipolar or unipolar neuron is sometimes called a "sensory axone," though this is a seeming contradiction to the direction of conduction by which axone is defined. An axone may have collateral branches, and usually has a diffuse branching at the end of the fibre, called its terminal arborization.

AXUM: see AKSUM.

AXUMITE KINGDOM, THE. About the 1st century of the Christian era a new kingdom grew up at Aksum (*q.v.*), of which a king Zoscales is mentioned in the *Periplus Maris Erythraei*. Fragments of the history of this kingdom, of which there is no authentic chronicle, have been made out chiefly by the aid of inscriptions (see Littmann and Dittenberger cited in bibliography). To the Axumite King Aeizanes the emperor Constantius addressed a letter in A.D. 356.

Aeizanes and his successors style themselves kings of the Axumites, Homerites (Himyar), Raidan, the Ethiopians (Habašat), the Sabaeans, Silee, Tiamo, the Bugaites (Beğa) and Kasu.

This style implies considerable conquests in south Arabia, which, however, must have been lost to the Axumites by A.D. 378. They claim to rule the Kasu or Meroitic Ethiopians; an inscription records an expedition along the Atbara and the Nile to punish the Nuba and Kasu, and a fragment of a Greek inscription from Meroë was recognized by Sayce as commemorating a king of Axum. Except for these inscriptions Axumite history is a blank until in the 6th century the Axumite king appears sending an expedition to wreck the Jewish state then existing in south Arabia, and reducing that country to a state of vassalage: the king is styled in Ethiopian chronicles Caleb (Kaleb), in Greek and Arabic documents el-Esbaha. In the 7th century a successor to this king, named Abraha or Abraham, gave refuge to the persecuted followers of Mohammed at the beginning of his career (see ARABIA: History, ad *init.*). A few more names of kings occur on coins, which were struck in Greek characters till about AD. 700, after which time that language seems to have been displaced in favour of Ethiopic or Geez: the condition of the script and the coins renders them all difficult to identify with the names preserved in the native lists. For the period between the rise of Islam and the beginning of the modern history of Abyssinia there are a few notices in Arabic writers; so we have a notice of a war between Ethiopia and Nubia about 687 (C. C. Rossini in Giorn, *Soc.* Asiat. *Ital.* x. 141), and of a letter to George, King of Nubia, from the king of Abyssinia some time between 978 and 1003, when a Jewish queen Judith was oppressing the Christian population (I. Guidi, ibid. iii. 176, 7).

The Abyssinian chronicles attribute the foundation of the kingdom to Menelek (or Ibn el-Hakim), son of Solomon and the queen of Sheba. The Axumite or Menelek dynasty was driven from northern Abyssinia by Judith, but soon after another Christian dynasty, that of the Zagués, obtained power. In 1268 the reigning prince abdicated in favour of Yekūnō Amlāk, king of Shoa, a descendant of the monarch overthrown by Judith (see ABYSSISIA).

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AY, AYE. The word "aye" meaning always (pronounced as in "day") is connected with Gr. ἀεί, always, and Lat. aevum, an age; it is often spelt "ay." "Aye," meaning Yes (pronounced like "eye"), is probably the same word etymologically, though differentiated by usage; the form "ay" for this is also common.

AYACUCHO, a city and department of central Peru, formerly known as Guamanga or Huamanga, renamed from the small plain of Ayacucho (*Quichua,* "corner of death"). This lies near the village of Quinua, in an elevated valley 11,600 ft. above sea-level, where a decisive battle was fought between General Sucre and the Spanish viceroy La Serna in 1824, which resulted in the defeat of the latter and the independence of Peru. The city of Ayacucho, capital of the department of that name and of the province of Guamanga, is situated on an elevated plateau, 9,200 ft. above sea level, between the western and central Cordilleras, on the main road between Lima and Cusco, 394 mi. from the former by way of Jauja. Pop. about 18,200. It has an agreeable, temperate climate, is regularly built, and has considerable commercial importance. It is the seat of a bishopric and of a superior court of justice. It is distinguished for the number of its churches and conventual establishments, although the latter have been closed The city was founded by Pizarro in 1539 and was known as Guamanga down to 1825. It has been the scene of many notable events in the history of Peru.

The department of Ayacucho extends across the great plateau of central Peru, between the departments of Huancavelica and Apurimac. Area, 18,185 sq.mi. Population (1940), 414,208. It is divided into seven provinces and covers a broken, mountainous region, partially barren in its higher elevations but traversed by deep, warm, fertile valleys.

AYAH, a Spanish word (aya) for children's nurse or maid, introduced by the Portuguese into India and adopted by the English to denote their native nurses.

AYALA, LOPEZ DE: see LOPEZ DE AYALA.

AYALA Y HERRERA, ADELARDO LOPEZ DE (1828–1879), Spanish writer and politician, was born at Guadalcanal and at a very early age began writing for the theatre. A four-act play in verse, *Un Hombre* de *Estado,* was accepted by the managers of the Teatro Español, and given on Jan. 25, 1851. Within a twelve-month Ayala became more widely known by his *Castigo* y *Perdon,* and by the humorous Los dos *Guzmanes.* In 1854 he produced Rioja, perhaps the most admired and the most admirable of all his works. About 1855 Ayala, who had been an active partisan of the moderates, passed over to the progressives and this political manoeuvre had its effect upon the character of his plays. On Feb. 20, 1856, his El Conde de *Castralla* was suppressed by the government after the third performance. Ayala's rupture with the moderates was now complete, and in 1857 he was elected as Liberal deputy for Badajoz. His political changes are difficult to follow or to explain. In 1871 he returned to his early Conservative principles, and was a member of Alfonso XII's first cabinet. Meanahile his reputation as a dramatist was increased by El *Tanto por* Ciento and El Tejado de *Vidrio,* plays satiric in intention and romantic in inspiration. His last play, Consuelo, mas given on March 30, 1878. The best of his lyrical work is his *Epístola* to Emilio Arrieta; if he had written lyrics, he might have ranked with the best of Spain's modern singers.

See the complete edition of his dramatic works, edited by his friend and rival Tamayo y Raus, 1881–85.

AYE-AYE, the most remarkable of all the Malagasy lemurs (*see* PRIMATES). The aye-aye, *Chiromys madagascariensis,* has a broad rounded head, short face, large eyes, large hands and long thin fingers with pointed claws, of which the third is remarkable for its extreme slenderness. The foot resembles that of the other lemurs in its large opposable great toe with a flat nail; but all the other toes have pointed compressed claws. The tail is long and bushy. The general colour is dark brown, the outer fur being long and rather loose, with a woolly under-coat. It is nocturnal in its habits, living alone or in pairs, in the bamboo forests. It feeds on juices, especially of the sugar-cane, which it obtains by tearing open the hard woody circumference of the stalk with its strong incisor teeth; but it also devours wood-boring caterpillars, which it obtains by first cutting down with its teeth upon their burrows, and then picking them out of their retreat with the claw of its attenuated middle finger. It constructs large ball-like nests of dried leaves, lodged in a fork of the branches of a large tree, and with the opening on one side.

THE AYE-AYE. A LITTLE ANIMAL ABOUT THE SIZE OF A CAT

AYLESBURY, municipal borough of Buckinghamshire. England, lying on a slight eminence in the fertile Vale of Aylesbury, which extends north of the Chilterns, and includes the upper Thame basin. Pop. (1931) 13.382; (1938) 14,490. Area 5 sq.mi. The town is on the L.N.E., Met. and G.W. Joint Ry. and is in the Aylesbury parliamentary division. There is little doubt that the rich neighbourhood was occupied in prehistoric times. In 1239 Henry III made a grant of an annual fair at the feast of St. Osith (June 3rd), which was confirmed by Henry VI. Queen Mary's charter of 1554 constituted Aylesbury a free borough and instituted a Wednesday market. Various privileges appear to have lapsed in the reign of Elizabeth, and it was only in 1917 that Aylesbury was made a municipal borough.

From the first, Aylesbury tended to become the chief ecclesiastical centre of the county. It is clear from Domesday that it possessed very valuable lands; and it is difficult to explain why it was not made the capital of the shire. (See BUCKINGHAMSHIRE.) The Franciscan Friars were established here in the 14th century. The Church of St. Mary is primarily Early English but has numerous later additions. The old streets of the town are mostly narrow and irregular, but growth is taking place on town-planning lines. Lace making and straw plaiting are carried on in the district, and important industries are printing and

milk products. The rearing of ducks is less extensive than formerly.

AYLESFORD, HENEAGE FINCH, 1ST EARL OF (1649?–1719), son of Heneage Finch, earl of Nottingham, was educated at Westminster school and at Christ Church, Oxford. In 1679, during the chancellorship of his father, he was appointed solicitor-general, being returned to parliament for Oxford university, and in 1685 for Guildford. In 1682 he represented the Crown in the attack upon the corporation of London, and the next year in the prosecution of Lord Russell, when, according to Burnet, "and in several other trials afterwards, he showed more of a vicious eloquence in turning matters with some subtlety against the prisoners than of strict or sincere reasoning."[1] In 1684, in the trial of Algernon Sidney, he argued that the unpublished treatise of the accused was an overt act, and supported the opinion of Jeffreys that *scribere est agere*.[2] The same year he was counsel for James in his successful action against Titus Oates for libel, and in 1685 prosecuted Oates for the Crown for perjury. Finch, however, though a Tory and a Crown lawyer, was a staunch churchman, and on his refusal in 1686 to defend the royal dispensing power he was summarily dismissed by James. He was the leading counsel in June 1688 for the seven bishops. He sat again for Oxford university in the Convention Parliament, which constituency he represented in all the following assemblies, except that of 1698, till his elevation to the peerage.

He was one of the few nho in the House of Commons opposed the famous vote that James had broken the contract between king and people and left the throne vacant. He held no office during William's reign, and is described by Macky as "always a great opposer" of the administration. In 1689 he joined in voting for the reversal of Lord Russell's attainder, and endeavoured to defend his conduct in the trial, but was refused a hearing by the House. In 1703 he was created baron of Guernsey and a privy councillor, and after the accession of George I on Oct. 19, 1714, earl of Aylesford. He died on July 22, 1719.

The 2nd earl died in 1757, and since this date the earldom has been held by his direct descendants, six of whom in succession have borne the Christian name of Meneage.

Many of his legal arguments are printed in *State Trials (see* esp. viii. 694, 1,087, ix. 625, 880, 996, x. 126, 319, 405, 1,199, xii. 183, 353, 365). Wood attributes to him on the faith of common rumour the authorship of *An Antidote against Poison . . . Remarks upon a Paper printed by Lady (Rachel) Russel* (1683), ascribed in *State Trials* (ix. 710) to Sir Bartholomew Shower; but *see* the latter's allusion to it on p. 753.

AYLESFORD, a town of Kent, England, 3½ mi. N.W. of Maidstone on the Southern railway. Pop. (1931) 3,636. Several remains of antiquity exist in the neighbourhood, among them a dolmen called Kit's Coty House, about a mile N.E. from the village, and the Countless Stones. To the west are the remains of a Carmelite friary founded in 1242, said to have been the first house of Carmelites established in England. In the vicinity is Preston Hall, which in 1921 became a hospital for disabled ex-service men and the headquarters of "British Legion Village."

AYLESHAM, the first of eight mining villages in the Kent coalfield, 7 mi. S.W. of Sandwich, England. The first section of the village, which is in Nonington parish and has a station on the S Ry., was planned on original lines and was completed in 1928, when the population was about 2.000. The centre of the town, reserved as a shopping square, lies at the head of a small valley whence wide roads follow the contours of the valley. Pop. of Nonington (1931) 3,808.

AYLLON, LUCAS VASQUEZ DE (*c.* 1475–1526), Spanish adventurer and colonizer in south-eastern North America, was born probably in Toledo, Spain, about 1475. He accompanied Nicolas Ovando to Hispaniola (Santo Domingo) in 1502, engaged with profit in various commercial enterprises, and became interested in a plan for the extension of the Spanish settlements to the North American mainland. In 1521, he sent Francisco Gordillo on an exploring expedition which touched on the coast of the Florida peninsula at about 33° 30' at the mouth of a river which Gordillo named the St. John Baptist, and after coasting northward for some distance along a region known among the Indians as Chicora, returned to Hispaniola with a cargo of Indian slaves. Gordillo's report of the region, and the stories of one of the Indians, were so favourable, that Ayllon in 1523 obtained from Charles V. a charter for lands extending 800 leagues to the north, which named him *adelantado* and governor of the region, and included the right to plant colonies, instructions to seek for the strait to the Spice Islands, and provisions for the spiritual and temporal welfare of the natives. In 1525 he sent out another reconnoitering expedition, under Pedro de Quexos, which explored the coast for about 250 leagues. In July, 1526, he himself set forth with 500 colonists, including women and priests, about 100 African slaves and 89 horses. He landed near Cape Fear, in 33° 40′, on a river which he called the Jordan, where he stopped long enough to replace a wrecked vessel—considered the first instance of ship-building on the North American continent—and to send scouting parties to explore the coast and the immediate interior. Then moving farther along the coast, he began the construction of a town which he called San Miguel de Guadalupe, and which some writers hold was on the exact site of the later Jamestown, Virginia. More probably, as Lowery contends, it was near the mouth of the Peedee river in South Carolina. The importation of African slaves here was undoubtedly the first instance of the sort in what was to be the United States. The colony was ill fated. Fever carried off many of the colonists. On Oct. 18, 1526, Ayllon himself died of it. Dissensions immediately broke out among the colonists. Some of the slaves rebelled and escaped into the forest, and the Indians grew hostile and audacious. In December the town was abandoned, and the remnant of the colonists embarked for Hispaniola. Less than 150 arrived safely. They took Ayllon's body with them, but on the way, it was consigned to "the sepulchre of the ocean-sea, where have been and shall be put other captains and governors."

See J. G. Shea, *History of the Catholic Church in the United States*, vcl. i. (1886); W. Lowery, *The Spanish settlements Within the Present Limits of the United States* (1901); H. E. Bolton and T. M. Marshall, *The Colonization of North America, 1492–1783* (1920); and H. E. Bolton, *The Spanish Borderland* (1921).

AYLMER, JOHN (1521–94), bishop of London, was born in 1521 at Aylmer Hall, Tivetshall St. Mary, Norfolk. About 1541 he was made chaplain to the duke of Suffolk, and tutor to his daughter, Lady Jane Grey. His first preferment was to the archdeaconry of Stow, in the diocese of Lincoln, but his opposition in convocation to the doctrine of transubstantiation led to his deprivation.

From exile in Switzerland he wrote a reply to John Knox's famous *Blast against the Monstrous Regiment of Women*, under the title of *An Harborowe far Faithfull and Trewe Subjects, etc.*, and assisted John Foxe in translating the *Acts of the Martyrs* into Latin. On the accession of Elizabeth he returned to England. He was a member of the famous convocation of 1562, which reformed and settled the doctrine and discipline of the Church of England.

In 1576 he was consecrated bishop of London, and thereafter made himself notorious by his harsh treatment of all who differed from him on ecclesiastical questions, whether Puritan or Papist. He is frequently assailed in the famous *Marprelate Tracts*, and is characterized as "Morrell," the bad shepherd, in Spenser's *Shepheard's Calendar* (July). He died in June, 1594. His life was written by John Strype (1701).

AYMARAN, an important linguistic stock of South American Indians. The term has really no proper application to the tribes of this group, having arisen through an unfortunate blunder. It has, however. become too well fixed to make any change possible. The various tribes of the stock, of which the most important were the Collas, Lupacas and Pacasas, occupied originally the greater part of the high plateaux forming the closed basin of lakes Titicaca and Poopo and the "salars" of Coipasa and Uyuni in Bolivia and southern Peru. From the existence of

[1] *Hist. of His Own Times*, i. 556. Swift has appended a note, "an arrant rascal," but Finch's great offence with the dean was probably his advancement by George I. rather than his conduct of state trials as here described.

[2] *Ibid.*, 572, and Speaker Onslow's note.

Aymara place-names and small groups of Aymara-speaking peoples further north in Peru, it is not improbable that tribes belonging to this stock had once a much greater northern extension, and were forced southward by the advancing Quichua (*q.v.*). Archaeological evidence in some measure confirms this suggestion, since the pre-Inca Andean culture far to the north at Chavin on the upper Marañon shows undoubted relationship to that of Tiahuanaco near lake Titicaca, generally regarded as of Aymaran origin.

The Aymaran tribes had, at the time of the Spanish conquest, long been subjugated by the Inca, whose ruling class may itself have been of Aymaran origin. The considerable remains of the older Aymara culture still await adequate archaeological investigation. Physically the modern Aymara are short and mainly brachycephalic or round-headed. The prehistoric population was, however, apparently dolichocephalic or long-beaded, the change being probably due to long intermixture with the brachycephalic Quichua.

See for general discussion Sir Clements Markham, The Incas *of* Peru (1910), also E. W. Middendorf, Die Aymara Sprache (Leipzig, 1891); *G.* Rouma, "Les Indiens Quitchouas et Aimaras des Hautes Plateaux de la Bolivie," *Bull. Mem. Soc.* Anthropologie de *Bruxelles,* vol. xxxii. pp. 281–391; **A.** Chervin, Anthropologie *Bolivienne* (Paris, 1907).

AYMER or **AETHELMAR, OF VALENCE** (d. 1260), bishop of Winchester, was a half-brother of Henry III., being the son of John's widow by her second marriage with Hugo of Lusignan. In 1250, Henry III., the King, by putting strong pressure upon the electors, succeeded in obtaining the see of Winchester for Aymer. Aymer was illiterate, ignorant of the English language, and wholly secular in his mode of life, and his appointment aroused justifiable indignation. At the Parliament of Oxford (1258) he and his brothers repudiated the new Constitution prepared by the barons. He was pursued to Winchester, besieged in Wolvesey castle, and finally compelled to surrender and leave the kingdom. He had never been consecrated; accordingly in 1259 the chapter of Winchester proceeded to a new election.

Bibliography.—See W. Stubbs, Constitutional History, vol. ii. (1896); *G.* W. Prothero, *Simon* de Montfort (1877); W. H. Blaauw, Barons' War (1871).

AYR, royal, municipal and police burgh and seaport, and county town, Ayrshire, Scotland, at the mouth of the river Ayr, 41½m. S.S.W. of Glasgow by the L M S railway. Pop. (1931) 36,784. Ayr proper lies on the south bank of the river, which is crossed by three bridges, besides the railway viaduct — the Victoria Bridge (1898) and the famous "Twa Brigs" of Burns. The Auld Brig is said to date from the reign of Alexander III. (d. 1286). The new Brig was built in 1788. The prophecy of Burns came true in 1877, when the newer bridge yielded to floods and had to be rebuilt (1879); the older has been restored, and is closed to wheeled traffic. The town buildings, surmounted by a fine spire, contain assembly and reading rooms. Of the schools the most notable is the Academy, for which new buildings were completed in 1911. This in 1764 superseded the grammar school of the burgh, which existed in the 13th century. The Gothic Wallace tower in High street replaces an old building of the same name taken down in 1835, from which were transferred the clock and bells of the Dungeon steeple. A niche in front is filled by a statue of the Scottish hero by James Thom (1802–so), a self-taught sculptor. There are statues of the 13th earl of Eglinton, General Smith Neill and Sir James Ferguson in the fine Wellington square, one of Wallace in Newmarket street, and one of Burns outside the railway station. In the suburbs is a racecourse where the Western meeting is held in September of every year. Fisheries and shipbuilding are carried on, and there are several foundries and engineering establishments. There is a large export and import mineral traffic. The harbour, with wet and slip dock, occupies both sides of the river from the new bridge to the sea, and is protected on the south by a pier, and on the north by a breakwater with a dry dock. There are esplanades south and north of the harbour. The town is under a provost and council, and, with Irvine, Ardrossan, Prestwick, Saltcoats and Troon returns one member to parliament.

In 1873 the municipal boundary was extended north to include Newton-upon-Ayr and Wallace town, formerly separate. Newton is a burgh of barony with charter said to have been granted by Robert Bruce in favour of 48 inhabitants who had distinguished themselves at Bannockburn. The suburb now manufactures chemicals, boots and shoes, carpets and lace and there are large breweries. It has a harbour and dock. About 3m. north of Ayr, Prestwick, a popular watering-place is the headquarters of a flourishing golf club. The pleasant suburb of Alloway is 23m. to the south. The "auld clay biggin" in which Robert Burng was born on the 25th of January, 1759, has been repaired and is the property of the Burns's Monument trustees. In the kitchen is the box bed in which the poet was born, and many of the articles of furniture belonged to his family. Adjoining the cottage is a museum of Burnsiana. The "auld haunted kirk," though roofless, is otherwise in a fair state of preservation. In the churchyard is the grave of William Burness, the poet's father. Not far distant, on a conspicuous position close by the banks of the Doon, stands the Grecian monument to Burns, in the grounds of which is the grotto containing Thom's figures of Tam o'Shanter and Souter Johnnie.

At the close of the 12th century, Ayr was made a royal residence, and soon a royal burgh, by William the Lion. During the wars of Scottish independence the town was the scene of many of Wallace's exploits. In 1315 the Scottish parliament met in the church of St. John to confirm the succession of Edward Bruce to the throne. The liberality of William the Lion bestowed an extensive grant of lands; while in addition to the well-endowed church of St. John, it had two monasteries. When Scotland was overrun by Cromwell, Ayr was the site of one of the forts he built to command the country.

AYRER, JAKOB (?–1605), German dramatist, of whose life little is known. He seems to have come to Nuremberg as a boy and worked his way up to the position of imperial notary. He died at Nuremberg on March 26, 1605. Ayrer left some 60 or 70 plays which were printed at Nuremberg under the title *Opus Theatricum* in 1618. This collection contains 30 tragedies and comedies and 36 Fastnachtsspiele (Shrovetide plays) and *Singspiele.* As a dramatist, Ayrer is virtually the successor of Hans Sachs, but he came under the influence of the so-called *Englische Komödianten,* that is, troops of English actors, who, at the close of the 16th century and during the 17th, repeatedly visited the continent, bringing with them the repertory of the Elizabethan theatre. From those actors Ayrer learned how to enliven his dramas with sensational incidents and spectacular effects, and from them he borrowed the character of the clown. His plays are cast in a more ambitious mould than those of Hans Sachs. He chose in many cases complicated historical subjects which served for a cycle of three, four, or even five pieces. The *Heldenbuch,* for instance, has three dramas on Hugdietrich, Otnit and Wolfdietrich. Ayrer was not in any way a great writer, but his work marks a forward stage in the practice of the drama.

Bibliography.—*Ayrers Dramen,* ed. by A. von Keller, have been published by the Stuttgart Lit. Verein (1864–65). See also L. Tieck, Deutsches Theater (1817); **A.** Cohn, Shakespeare in Germany (1885), which contains a translation of the two plays mentioned above; J. Tittmann, *Schauspiele* des sechzehnten Jahrhunderts (1888); W. Wodick, Jacob Ayrers *Dramen* in ihrer Verhaltnis *zur* einheimischen *Literatur* und *zum* Schauspiel der englischen Komddianten (1912).

AYRSMIRE, south-western county of Scotland, bounded on the north by Renfrewshire, on the east by Lanarkshire and Dumfriesshire, on the south-east by Kirkcudbrightshire, on the south by Wigtownshire, and on the west by the Firth of Clyde. It includes off its coast the conspicuous rock of Ailsa Craig, 10m. W. of Girvan; Lady Island, 3m. S.W. of Troon; and Horse Island, off Ardrossan. Its area is 1,142sq.m., its coast-line being 70m. long. In former times the shire was divided into the districts of Cunninghame (north of the Irvine), Kyle (between the Irvine and the Doon), and Carrick (south of the Doon), and these terms are still occasionally used.

The county boundary runs almost wholly over high ground. The uplands of the south (Black Craig, 2,298ft.) extend over a larger area within Ayrshire than those of the north. They belong to the Silurian system of the southern uplands of Scotland, in

which, as elsewhere, there are numerous intrusions of volcanic and igneous rocks, notably about Loch Doon, where a large granite mass is associated with fine wild scenery. The hills of the north are mainly of Old Red Sandstone, or of igneous rocks of Carboniferous age. The boundary uplands embrace an undulating lowland bordering the coast with younger palaeozoic rocks, affording fertile soils, and including a wide extent of the coal measures which are one of the foundations of the industrial wealth of central Scotland. There are also, especially in the centre of the lowland, red sandstone tracts which have been extensively quarried. The rivers of the county are short and unnavigable, but the tranquil beauty outside the industrial districts of Doon, Afton, Cessnock and Lugar, has been made famous in the poems of Robert Burns. The chief river is the Ayr. It rises at Glenbuck, on the border of Lanarkshire, and after a course of some 38m. falls into the Firth of Clyde at the county town which, with the county, is named from it. The largest of many lochs is Loch Doon, 5½m. long, the source of the river of the same name. From Loch Finlas, about 20m. south-east of Ayr, the town derives its water-supply. The Nith rises just in Ayrshire.

History.— Traces of Roman occupation are found in Ayrshire. At the time of Agricola's campaigns the country was held by the Damnonii, and their town of Vandogara has been identified with a site at Loudoun Hill near Darvel, where a serious encounter with the Scots took place. On the withdrawal of the Romans, Ayrshire formed part of the kingdom of Strathclyde and ultimately passed under the sway of the Northumbrian kings. Save for occasional intertribal troubles, the annals are silent until the battle of Largs in 1263, when the pretensions of Haakon of Norway to the sovereignty of the Isles were crushed by the Scots under Alexander III. A generation later William Wallace surprised the English garrison at Ardrossan, and burned the barns of Ayr in which the forces of Edward I. were lodged. Robert Bruce is alleged to have been born at Turnberry Castle, some 12m. S.W. of Ayr and he held the title of Earl of Carrick (now borne by the prince of Wales).

In 1307 he defeated the English at Loudoun Hill. Cromwell demolished the castle of Ardrossan and is said to have utilized the stones in rearing a fort at Ayr. Between 1660 and 1688 the sympathies of the county were almost wholly with the Covenanters, who suffered one of their heaviest reverses at Airds Moss—a morass btween the Ayr and Lugar—their leader, Richard Cameron, being killed (July 20, 1680). The county was dragooned and the Highland host ravaged. The Hanoverian succession excited no active hostility if it evoked no enthusiasm. The castles of Loch Doon, Turnberry, Dundonald, Portencross, Ardrossan and Dunure are to be noticed, and there are ruins of celebrated abbeys at Kilwinning and Crossraguel, and of Alloway's haunted church, famous for their associations.

Population and **Administration.**—The population was 299,254 in 1921, and 285,182 in 1931, when Gaelic and English were spoken by 1,160 persons, and Gaelic only by four. The pop. of the chief towns in 1931 were: Ardrossan (6,888), Auchinleck (6,624)) Ayr (36,784), Beith (5,977), Dalry (6,827), Galston (4,601), Girvan (5,292), Irvine (12,032), Kilbirnie (8,193), Kilmarnock (38,099), Kilwinning (5,324), Saltcoats (10,173), Troon (8,544). The county, with Bute, returns three members to parliament, for the North Ayrshire and Bute, Kilmarnock and South Ayrshire divisions respectively. Ayr, the county town, and Irvine are royal burghs and belong to the Ayr group of parliamentary burghs. The county forms a sheriffdom, and there are resident sheriffs-substitute at Ayr and Kilmarnock.

Agriculture.—With fertile if rather heavy soil, and the near neighbourhood of large towns, agriculture is specialized. Potatoes are extensively grown, the coast-lands supplying the markets of Scotland and the north of England. Of other roots, turnips and swedes are most widely cultivated, heavy crops being obtained by early sowing and rich manuring. Oats form the bulk of the cereal crop, but wheat and barley are also grown. High farming has developed the land enormously. Dairying has received particular attention.

Cheddar cheese of first-rate quality is made in Ayrshire, the manufacture having been set on foot by an adviser from Somerset in 1855. The Ayrshire cows are famous for the quantity and excellence of their milk. Great numbers of cattle, sheep and pigs are raised for the market, and Ayrshire horses are in high repute, but have decreased in numbers in recent years.

Other **Industries.**—Ayrshire has the second largest Scottish coalfield. There is a large output also of iron ore, pig iron and fire-clay. The chief coal mining centres are Ayr, Dalmellington, Patna, Irvine, Stevenston, Beith, Kilwinning, Dalry, Dreghorn, Kilmarnock, Galston, Hurlford, Muirkirk, and New Cumnock. Ironstone occurs chiefly at Patna, Dalry, Dreghorn and Beith and there are blast furnaces at Cumnock, Stevenston, Dalmellington, and many other places. A valuable whetstone has been worked at Bridge of Stair on the Ayr—the Water-of-Ayr stone. At Catrine are cotton factories and bleachfields, and at Ayr and Kilmarnock extensive engineering works, and carpet, blanket and woollens, boot and shoe factories; cotton, linen thread, shoes, lace, woollens and other fabrics and hosiery are also made at Dalry, Kilbirnie, Kilmaurs, Beith and Stewarton. Irvine has important chemical works. Near Stevenston, works have been erected in the sandhills for the making of dynamite and other explosives. There are large factories for lace and muslin at Galston, Newmilns and Darvel, and at Beith cabinet-making and tanning are considerable industries. Shipbuilding is conducted at Troon, Ayr, Irvine and Fairlie, which is famous for its yachts. The leading ports are Ardrossan, Ayr, Girvan, Irvine and Troon.

Communications.— The L.M.S. railway serves the industrial towns, ports and seaside resorts. Its trunk line via Girvan to Stranraer commands the shortest sea passage to Belfast and the north of Ireland, and its main line via Kilmarnock communicates with Dumfries and Carlisle and so with England. For passenger steamer traffic to the other parts of the Firth of Clyde, Arran, Ireland, etc. Ardrossan is the principal port.

AYRTON, HERTHA (1854–1923), English scientist, was born at Portsea, April 25 1854, the daughter of Levi Marks, a clockmaker and jeweller, and was brought up in London by her aunt, Mrs. Alphonse Hartog. At her aunt's house she met Madame Bodichon, one of the founders of Girton College, who introduced her to George Eliot and many distinguished people. She went up to Girton in 1876, and when she returned studied science in London, and married (May 6 1885) Prof. W. E. Ayrton, whose pupil she had been.

The work on the electric arc, which made her famous, began in 1883. She read various papers on the subject before learned societies, and her book, The Electric *Arc*, appeared in 1902. In 1903 Prof. Ayrton was asked by the Admiralty to elucidate some of the problems connected with the electric searchlight. The four reports sent in (1904–08) were largely, and the last one entirely, the work of Mrs. Ayrton. She continued to work on the problem after her husband's death in 1908, continuing at the same time her researches on ripple-forming vortices in water. Her discoveries in this connexion she utilized practically in the invention of the Ayrton anti-gas fan, for the repulsion of noxious gases in war. The first instalment of these fans was sent out to the front in France in May 1916. She was then asked by the War Office to investigate the ventilation of gun emplacements. Up to the end of her life she was experimenting with the transmission of coal gas to obviate the necessity of separate gas-works in each district. She died Aug. 26 1923.

Mrs. Ayrton was a militant suffragist before the World War. She had a host of friends in London and Paris; James Darmesteter was an intimate friend of hers before her marriage, and she had a lifelong friendship with Mme. Curie.

See Evelyn Sharp, *Hertha Ayrton* (1926).

AYRTON, WILLIAM EDWARD (1847–1908), English physicist, was born in London on Sept. 14 1847. He was educated at University College, London, and in 1868 went out to Bengal in the service of the Indian Government telegraph department. He taught physics at Tokyo and in London and in 1884 became professor of electrical engineering at South Kensington. He published, both alone and jointly with others, a large number of papers on physical, and in particular electrical, subjects, and his name was especially associated, together with that of Professor

John Perry, with the invention of a long series of electrical measuring instruments. He died in London on Nov. 8 1908.

AYSCOUGH, SAMUEL (1745–1804), English librarian and index-maker, was born at Nottingham. In 1782 Ayscough published a two-volume catalogue of the then undescribed manuscripts in the British Museum. About 1785 he was appointed assistant librarian at the museum, and soon afterwards took holy orders.

His first official work was a third share in the British Museum catalogue of 1787, and he subsequently catalogued the ancient rolls and charters, 16,000 in all. In 1789 he produced the first two volumes of the index to the *Gentleman's Magazine*, and in 1790 the first index-concordance to Shakespeare. He died at the British Museum on Oct. 30 1804.

AYSCUE (erroneously ASKEW or AYSCOUGH), **SIR GEORGE** (d. 1671), British admiral, came of an old Lincolnshire family. He took part in the first Dutch War. The indecisive battle off Plymouth (Aug. 16 1652) cost him his command, though an annuity was assigned him. The later years of the Commonwealth he spent in Sweden, Cromwell having despatched him thither as naval adviser. At the Restoration he became one of the commissioners of the navy, but on the outbreak of the second Dutch War in 1664 he once more hoisted his flag as rear-admiral of the Blue and took part in the battle of Lowestoft (June 3 1665). In the great Four Days' Battle (June 11–14 1666) he served with Monk as admiral of the White. His flagship, the "Prince Royal," was taken on the third day, and he himself remained a prisoner in Holland till the peace. Lely's portrait of Sir George Ayscue is in the Painted Hall at Greenwich.

AYSEN, a province of southern Chile, created in 1928 from parts of the provinces of Chiloé and Llanquihué and of the territory of Magallanes. It includes most of the Chonos archipelago, the peninsula of Taitao, the large island of Wellington, with many smaller islands, and a strip of coast some 600m. in length by about 50m. in width. The area is but partially explored. It consists almost entirely of mountains, rising 2,000 to 6,000ft. abruptly from the sea and deeply dissected into valleys and fiords. The islands are the southward continuation of the Chilean coast range, here submerged until only the summits of the higher peaks stand above the sea. There is very little level land. This is a district of heavy, all-year rains and uniformly cool but not cold temperatures. Snow frequently falls in winter and lies perpetually upon the tops of many of the mountains. From these snow fields many rivers are formed and in some places glaciers descend to or nearly to the sea. Among the rivers the larger are the Aysen, from which the territory receives its name, the Rayas, the Cisnes, the Corcovado, the Huemules, the Palena, the Yelcho and the Baker. The presence of English names throughout the region is due to the part played by British navigators in exploring the coasts and islands. The most notable of the British expeditions to this area was that which Fitzroy and King (accompanied by the young naturalist, Charles Darwin) carried out in the "Adventure" and the "Beagle" (1826–36). The best description of this territory still to be found is in the narrative of that expedition. The whole of Aysen is densely forested up to the snow line. Most of the trees at a low level are broad-leaved evergreens, several varieties of beech predominating. Coniferous trees are also found. The timber has not been of great value to Chile until recent years, but there are now a number of saw-mills at work and lumbering is the leading industry. The province is sparsely inhabited. The official census figures for 1940 place the population at 17,014. Most of these are Indians, other settlements consisting of small lumbering or fishing colonies. Aysen, the capital, on the river of the same name, is the largest town, though it has less than three thousand people.

AYTOUN or **AYTON, SIR ROBERT** (1570–1638), Scottish poet, son of Andrew Aytoun of Kinaldie, Fifeshire, was born in 1570. He was educated at the university of St. Xndrews. On the accession of James VI. to the English throne he wrote in Paris a Latin panegyric, which brought him into immediate favour at court. He was knighted in 1612. He held various lucrative offices, and was private secretary to the queens of James I. and Charles I. He died in London, and was buried in Westminster Abbey on Feb. 28 1638. Aytoun was one of the earliest Scots to use the southern standard as a literary medium.

Aytoun's Latin poems are printed in *Delitiae Poetarum Scotorum* (Amsterdam, 1637), i. pp. 40–75. His English poems are preserved in a ms. in the British Museum (*Add. mss.* 10,308), which was prepared by his nephew, Sir John Aytoun. Both were collected by Charles Rogers in *The Poems of Sir Robert Aytoun* (London, privately printed, 1871). This edition is unsatisfactory, though it is better than the first issue by the same editor in 1844. Additional poems are included which cannot be ascribed to Aytoun, and which in some cases have been identified as the work of others. The poem, "I do confess thou'rt smooth and fair," may be suspected, and the old version of "Auld Lang Syne" and "Sweet Empress" are certainly not Aytoun's.

Some of the English poems are printed in Watson's *Collection* (1706–11) and in the *Bannatyne Miscellany*, i. p. 299 (1827). There is a memoir of Aytoun in Rogers's edition, and another by Grosart in the *Dict. of Nat. Biog.* Particulars of his public career will be found in the printed *Calendars* of *State Papers* and *Register of the Privy Council* of the period.

AYTOUN, WILLIAM EDMONSTOUNE (1813–1865), Scottish poet and humorist, only son of Roger Aytoun, a writer to the signet, and of the same stock as Sir Robert Aytoun. He was educated at Edinburgh academy and university, and at Aschaffenburg, Germany. He became a writer to the signet in 1835 and was called to the Scottish bar in 1840. On his own confession, however, although he "followed the law, he could never overtake it." A preliminary volume of poems entitled *Poland, Homer, and other Poems* had appeared in 1832. His first contribution to *Blackwood's Magazine* appeared in 1836, and from 1839 onwards until his death he remained on the staff of the paper. His acquaintance with Mr. (afterwards Sir) Theodore Martin began in 1841. They collaborated in a series of humorous and satirical papers in which appeared from time to time the verses afterwards republished separately as *The Bon Gaultier Ballads* (1855). These are of striking interest as providing a model for later writers of humorous verse, and in particular for W. S. Gilbert (q.v.), in the *Bab Ballads*. Aytoun excels in parody, and *Montgomery, a Poem* deserves to be as well known as Macaulay's celebrated castigation of the fashionable poet. Indeed the lines:—

> Calm as Great Paul at Ephesus was seen
> To rend his robes in agonies serene

might have been among those selected by Macaulay to be pilloried in the *Edinburgh Review*. He is equally successful with parodies of Tennyson and Thomas Moore. Perhaps the best known in the collection is *The Massacre of the Macpherson*, which has continued to figure in many anthologies and song-books. In 1845 Aytoun was appointed professor of rhetoric and *belles lettres* at Edinburgh university. His services to the Tory Party, especially in the cause of protection, were recognized by his appointment in 1852 as sheriff of Orkney and Zetland. Among his other writings are: *Lays of the Scottish Cavaliers* (1848; also Burleigh Library ed. 1896); *Firmilian, a Spasmodic Tragedy* (1852), in which he ridicules the writings of Philip James Bailey, Sydney Dobell and Alexander Smith (qq.v.); *Bothwell, a Poem* (1854); *Collection of the Ballads of Scotland* (1858); and *Norman Sinclair*, a novel (1861).

In conjunction with Sir Theodore Martin he published a translation of the *Poems and Ballads of Goethe* (1858). Aytoun died at Blackhills near Elgin on Aug. 4 1865.

See *Memoir* of *W. E. Aytoun* (1867) by Sir Theodore Martin, with an appendix containing some of his prose essays. The poems of Aytoun were republished by H. Milford in the Oxford edition (1921).

(E. I. J.)

AYUB KHAN (1855–1914), Afghan prince, son of Sher Ali (formerly amir of Afghanistan) and cousin of Abdur Rahman, was born about 1855. During his father's reign little is recorded of him, but after Sher Ali's expulsion from Kabul by the English, and his death in Jan. 1879, Ayub took possession of Herat. In 1880 he invaded Afghanistan with the intention of asserting his

claims to the sovereignty, and in particular of gaining possession of Kandahar, still in the occupation of the British. He encountered the British force commanded by General Burrows at Maiwand (July 27) and was able to gain one of the very few pitched battles that have been won by Asiatic leaders over an army under European direction. His triumph, however, was short-lived; while he hesitated to assault Kandahar he was attacked and defeated (Sept. 20, 1880) by Sir Frederick (afterwards Lord) Roberts, at the close of the latter's memorable march from Kabul, and utterly discomfited. He made his way back to Herat, where he remained for some time unmolested.

In the summer of 1881, he again invaded Afghanistan, and on the anniversary of the battle of Maiwand defeated Abdur Rahman's lieutenants, mainly through the defection of a Durani regiment. Kandahar fell into his hands, but Abdur Rahman now took the field in person, totally defeated Ayub, and expelled him from Herat. He took refuge in Persia, and received an allowance from the Persian Government.

In 1887, internal troubles in Afghanistan tempted him to make another effort to seize the throne. Defeated and driven into exile, he wandered for some time about Persia, and in November gave himself up to the British agent at Meshed. He was sent to India to live as a state prisoner and died at Lahore on April 6, 1914.

AYUNTAMIENTO, the Spanish name for the district over which a town council has administrative authority; it is used also for a town-council or a town-hall. It is derived from the Lat. *adiungere,* and originally meant "meeting." The ayuntamiento consisted of the official members, and of regidores or regulators, who were chosen in varying proportions from the *hidalgos* or nobles and the *pecheros* or commoners. This distinction has now been abolished, and the powers and the constitution of ayuntamientos have been much altered.

AYUTMIA (Siamese KRUNG-KAO), for more than four centuries the capital of Siam, is on the northern main line of the state railways, 42 mi. from Bangkok. It was destroyed by the Burmese in 1555 and again in 1765, after which it ceased to be the capital. Historically it is the most interesting spot in Siam; the island site of the city has ruins of innumerable palaces, pagodas, churches and fortifications, while there is a rich local archaeological museum.

The bulk of the population (about 50,000) lives in floating houses along the edges of a network of river creeks and channels. The only trade consists in the exchange of great quantities of paddy (through Bangkok) for cloth and other goods needed by the peasants.

Ayuthia is the chief town of one of the richest agricultural provincial divisions of Siam (pop. of province in 1937, 326,218), the seat of a high commissioner, and the headquarters of a division of the army. The government offices occupy spacious buildings once a royal retreat; the government is that of an ordinary provincial division (*Monton*). Outside the town is an ancient masonry enclosure, periodically used for the capture of elephants.

AYVALIK, a seaport town on the west coast of Turkey (vilayet of Karasi), opposite the island of Mitylene. Population, 16,744.

It stands near the site of the Aeolian Heraclea, on rising ground at the end of a bay which is separated from the Gulf of Adramyttium, and protected from the prevailing winds by the Moschonisi islands (*Hecatonnesoi*). It was formerly an exclusively Greek town, but the Greek population was "exchanged" for Muslim immigrants in 1924. The town was formerly known as Aivali.

AZAÏS, PIERRE HYACINTHE (1766–1845), French philosopher, was born at Sorèze and died at Paris. The son of the musician P. H. Azaïs (1743–96), he spent his early years as a teacher and a village organist. In 1809 he published his Des Compensations *dans les destinées humaines* (5th ed. 1846), which pleased Napoleon so much that he made its author professor at St. Cyr.

The Restoration government at first suspected him as a Bonapartist, but at length granted him a pension. From that time he occupied himself in lecturing and the publication of philosophical works.

In the *Compensations* he sought to prove that, on the whole, happiness and misery are equally balanced, and therefore, that men should accept the government which is given them rather than risk the horrors of revolution.

His other works are: *Système universel* (1812); Du *Sort* de *l'homme* (1820); *Cours* de philosophie (1824), reproduced as Explication *universelle* (1826–28); Jeunesse, *maturité,* religion, philosophie (1837), De la *phrénologie, du magnétisme, et* ae la *folie* (1843).

AZALEA, a genus of popular hardy or greenhouse shrubs, belonging to the heath family (Ericaceae), related closely to *Rhododendron,* but kept distinct by most gardeners. The beautiful varieties now in cultivation have been bred from a few originals, natives of the hilly regions of Asia and the United States. They are perhaps unequalled as indoor decorative plants. These are usually increased by grafting the half-ripened shoots on the stronger-growing kinds, the shoots of the stock and the grafts being in a similarly half-ripened condition, and the plants being placed in a moist heat of 65°. They require a rich and fibrous peat soil, with a mixture of sand to prevent its getting waterlogged. The best time to pot azaleas is three or four weeks after the blooming is over. To produce handsome plants, they must while young be cut back as required. Specimens that have grown stringy may be cut back just before growth commences. The lowest temperature for them during the winter is about 35°, and during their season of growth from 55° to 65° at night, and 75° by day, the atmosphere being at the same time well charged with moisture.

The following are some well-known North American species: **A.** arborescens, a deciduous shrub 10–20 ft. high; ***A.*** calendulacea, a beautiful deciduous shrub 2–6 ft. high, with yellow, red, orange and copper-coloured flowers, and **A.** *nudiflora,* the pinkster flower, a shrub, 3–4 ft. high, which hybridizes freely with ***A.*** *calendulacea.*

The Ghent azalea (***A.*** *gandavensis*), the Korean azalea (***A.*** yedoensis) and the Kurume azalea (***A.*** obtusa) have been the parents of hundreds of named horticultural forms, which, with the North American species, are among the finest hardy shrubs in cultivation. (N. TR.)

AZAMGARH, a city and district of British India, in the Gorakhpur division of the United Provinces. The town is situated on the river Tons. Pop. (1931), 18.046.

The area of the district is 2,212 sq.mi., and its population in 1931 was 1,571,577. It is bounded on the north by the river Gogra, which is flanked by a low-lying tract, varying considerably in width; south of this, however, the ground takes a slight rise. The slope of the land is from northwest to southeast, but the general drainage is very inadequate. The soil is fertile, and very highly cultivated, bearing magnificent crops of rice and sugarcane. The district was ceded to the East India company in 1801 by the wazirs of Lucknow.

AẒĀN, the call to public worship proclaimed by the Muezzin (crier) from the mosque in all Muhammadan countries (Arabic *adhān* "announcement"). In small mosques the Muezzin stands at the door or at the side of the building; in large ones he takes up his position in a minaret. The call translated runs: "God is most great!" (four times), "I testify there is no god but God!" (twice), "I testify that Muhammad is the apostle of God!" (twice), "Come to prayer!" (twice), "Come to salvation!" (twice), "God is most great!" (twice), "There is no god but God!" To the morning Aẓān are added the words, "Prayer is better than sleep!" (twice). The devout Muslim has to make a set response to each phrase of the Muezzin. At first these are mere repetitions of Aẓān but to the cry "Come to prayer!" the listener must answer, "I have no power nor strength but from God the most High and Great." To that of "Come to salvation!" the formal response is, "What God willeth will be: what He willeth not will not be." The recital of the Aẓān must be listened to with the utmost reverence. The passers in the streets must stand still. all those at work must cease from their labours, and those in bed must sit up.

The Muezzin, who is a paid servant of the mosque, must stand with his face towards Mecca and with the points of his forefingers in his ears while reciting Aẓān. He is specially chosen for

good character, and Aẓān must not be recited by any one unclean, by a drunkard, by the insane or by a woman. The summons to prayers was at first simply "Come to prayer!" Muhammad, anxious to invest the call with the dignity of a ceremony, took counsel of his followers. Some suggested the Jewish trumpet, others the Christian bell, but according to legend the matter was finally settled by a dream:— "While the matter was under discussion, 'Abdallāh, a Khazrajite, dreamed that he met a man clad in green raiment, carrying a bell, 'Abdallāh sought to buy it, saying that it would do well for bringing together the assembly of the faithful. 'I will show thee a better way,' replied the stranger; 'let a crier cry aloud "God is most great, etc."' On awaking, 'Abdallāh went to Muhammad and told him his dream," and the Aẓān was thereupon instituted.

BIBLIOGRAPHY.—*Mishkāt al* Mascibih, trans. A. N. Matthews, I. 141 *sqq.* (1809); E. W. Lane, Manners and Customs of the modern Egyptians, ch. iii.

AZANDE, THE, are the least unknown of the comparatively short-statured (medium breadth of head) group of the Southern Sudan population (see SUDAN: Anglo-Egyptian Sudan), but whether the Azande proper stand in any close relationship to other tribes of the Bahr el-Ghazal attributed to this group is quite uncertain, though a number of the latter have undoubtedly been subjected to their influence. Schweinfurth wrote of the Azande as attaining the lowest grade of brachycephaly; measurements (unpublished) taken by E. E. Evans-Pritchard in the Sudan give an average cephalic index of 79, with a stature of about 6 jin. but Czekanowski's long series (*Forschungen im Nil-Kongo-Zwischengebiet*, vol. 4, Anthropologie, Leipzig, 1922) of Azande measurements from the Congo suggest an average cephalic index of 77 to 78 and a stature varying from group to group up to 69in., the higher figures no doubt being due to admixture. The Azande are expert agriculturists. The lower incisors are not removed, but a central v-shaped notch is filed between the upper central incisors.

The Azande, unlike other tribes of the Sudan (with the possible exception of the Shilluk), may be fairly regarded as a nation, for they are really a federation of tribes, each with its territorial sections, having a supreme head or sultan belonging to a special ruling class. This class, the Avongara, is often, but with doubtful accuracy, stated to be the descendants of one Gura, apparently the ruler of a dominant people who some 200 years ago began a process of conquering and absorbing the neighbouring tribes which has lasted to the present day. The territory of the Azande has been estimated at 48,000sq m. and their numbers at from two to four millions, the small portion falling within Sudan territory being divided into two districts, Yei and Meridi, each administered by a paramount chief. Evans-Pritchard's unpublished notes indicate that the Azande are patrilineal and patrilocal, with descent of property and rank in the male line. There is a clan organization described as totemic, but all chiefs (gbia or *vongara*) belong to one class, constituting the Avongara, to whom both endogamous and exogamous marriage is permitted. The political organization consists of a paramount chief ruling over a group or tribe, whose territory is defined by river boundaries. Under him are his brothers and sons, who administer provinces directly from provincial centres, these provincial governors appointing commoners to act as deputies (abakumba). The Azande live in homesteads widely scattered in bush-clearings, consisting—where the housefather is polygamous—of a number of huts, surrounded by cultivation, each occupied by a wife and her children.

A supreme being named Mboli is recognized, but his relation to the everyday affairs of man is by no means clear, though it is certain that offerings are made to him during periods of drought. The ancestral spirits possess a shrine in every homestead, and to them conduct is explained and offerings made. (C. G. S.)

See C. R. Lagae, Les Azande ou *Niam-Niam* (1926).

AZARA, DON JOSE NICHOLAS DE (1731–1804), Spanish diplomat, was born in 1731 at Barbunales, Aragon, and was appointed in 1765 Spanish agent and procurator-general, and in 1785 ambassador at Rome, During the 13 years of his residence there he distinguished himself as a collector of Italian antiquities and as a patron of art. He was afterwards Spanish ambassador in Paris. In that post it was his misfortune to be forced by his government to conduct the negotiations which led to the treaty of San Ildefonso. Azara died, worn out, in Paris in 1804. His end was undoubtedly embittered by his discovery of the ills which the French alliance must produce for Spain.

His younger brother, DON FELIX DE AZARA (1746–1811), spent 20 years in South America as a commissioner for delimiting the boundary between the Spanish and Portuguese territories. He made many observations on the natural history of the country, which, together with an account of the discovery and history of Paraguay and Rio de la Plata, were incorporated in his principal work, Voyage *dans l'Amérique méridionale depuis* 1781 *jusqu'en 1801,* published at Paris in 1809 in French from his ms. by C. A. Walckenaer.

Several sympathetic notices of Azara will be found in Thiers, *Consulat* et Empire. See also *Reinado* de Carlos IV. by Gen. J. Gomez de Arteche, in the *Historia* General de *España,* published by the R. Acad. de la Historia, Madrid, 1892, etc. There is a Notice *historique* sur le Chevalier *d'Azara* by Bourgoing (1804).

AZARIAH, the name of several persons mentioned in the Old Testament. The most important are: (1) King of Judah, son of Amaziah by his wife Jecholiah (II. Kings xv. 1, 2), also called Uzziah (*q.v.*); (2) One of the companions in captivity of the prophet Daniel, called Abednego by Nebuchadrezzar, by whom with two companions he was cast into a "burning fiery furnace" for refusing to worship the golden image set up by that monarch (Dan. i. 6, iii. 8–30).

AZAY-LE-RIDEAU, a town of France, department of Indre-et-Loire, on the Indre, 16 mi. S.W. of Tours by rail. Population (1936) 1,204. The town has a fine Renaissance chateau. well restored.

AZCARATE, GUMERSINDO (1840–1917), Spanish politician, was born at León, Spain, Jan. 13 1840. Educated at the universities of Oviedo and Madrid, in 1868 he was appointed assistant professor of comparative jurisprudence at the University of Madrid, and four years later became professor. In 1875 he resigned rather than submit to the famous Orovio decree limiting the liberty of the chair. He was, however, reinstated six years later and became one of the group headed by Francisco Giner, to which Spain owes most of its up-to-date educational institutions. From 1868 he represented, almost continuously, León, in the Cortes, as a moderate Republican. He had learned by painful experience that the attempt to set up a republic in a country where there was no genuine Republican party could result only in anarchy and military dictatorship. He, therefore, expressed his approval of the reformist evolution toward monarchism initiated by Melquiados Alvárez, but, upon his defeat as a deputy, he proved the strength of his principles by refusing a seat as senator for life. After the Barcelona outbreak of 1909, he kept apart from the violent section of his party. His position was less that of a leader than of a man whose personal character gave a certain dignity to the anti-dynastic parties. He died at Madrid Dec. 14 1917.

AZEGLIO, MASSIMO TAPARELLI, MARQUIS D' (1798–1866), Italian statesman and author, was born at Turin of a noble Piedmontese family. In Rome, where his father was special envoy to the Vatican, he acquired a love of art and music and became an artist, to the horror of his narrow-minded and aristocratic family. From 1831 to 1843 he lived in Milan, where he married a daughter of Manzoni, and turned to literature. His writings, whether novels or pamphlets, aimed at exposing the evils of foreign domination in Italy and awakening the national consciousness.

D'Azeglio fought in the first war of independence, and was twice expelled from Tuscany. He formed the first cabinet under Victor Emmanuel II., concluded peace, and remained in office for three years. D'Azeglio conducted the affairs of the country with tact and ability, improving its diplomatic relations, and opposing the claims of the Roman Curia. He invited Count Cavour, then a rising young politician, to enter the ministry in 1850. Cavour and Farini, also a member of the cabinet, made certain declarations in the Chamber (May 1852) which led the ministry in the direc-

tion of an alliance with Rattazzi and the Left. Of this d'Azeglio disapproved, and therefore resigned office, but on the king's request he formed a new ministry, excluding both Cavour and Farini. In October, however, he retired into private life, suggesting Cavour to the king as his successor. For the next four years he lived modestly at Turin, devoting himself once more to art, although Cavour always consulted him on matters of moment. In 1855 he was appointed director of the Turin art gallery. In 1859 he was given various political missions, including one to Paris and London to prepare the basis for a general congress of the powers on the Italian question. When war between Piedmont and Austria appeared inevitable, he returned to Italy, and was sent as royal commissioner by Cavour to Romagna, whence the papal troops had been expelled. After the peace of Villafranca, d'Azeglio was recalled with orders to withdraw the Piedmontese garrisons; but he saw the danger of allowing the papal troops to reoccupy the province, and after a severe inner struggle left Bologna without the troops. The king approved of his action, and said that his orders had not been accurately expressed; thus Romagna was saved. Early in 1860 Cavour appointed him governor of Milan, evacuated by the Austrians after the battle of Magenta. But, disapproving of the government's policy with regard to Garibaldi's Sicilian expedition and the occupation by Piedmont of the kingdom of Naples as inopportune, he resigned office.

The death of his two brothers in 1862 and of Cavour in 1861 caused d'Azeglio great grief, and he subsequently led a comparatively retired life. As deputy and as writer, he occupied himself chiefly with the Roman question and the relations of Piedmont (now the kingdom of Italy) with Mazzini and the other revolutionists. In his opinion Italy was to be unified by means of the Franco-Piedmontese army alone, all connection with the conspirators being eschewed, while the pope should enjoy nominal sovereignty over Rome, with full spiritual independence, the capital of Italy being established elsewhere, but the Romans being Italian citizens (see his letters to E. Rendu and his pamphlet Le *questioni* urgenti). He strongly disapproved of the convention of 1864 between the Italian government and the pope. D'Azeglio died at his villa of Cannero on Jan. 15, 1866, leaving his autobiographical memoirs, *I Miei* Ricordi, unfinished. Massimo d'Azeglio was a very attractive personality, as well as an absolutely honest patriot, and a characteristic example of the best type of Piedmontese aristocrat. He was cautious and conservative; in his general ideas on the liberation of Italy he was wrong, and to some extent he was an amateur in politics, but of his sincerity there is no doubt. As an author his political writings are trenchant and clear, but his novels, *Ettore* Fieramosca (1833) and *Niccolò* dei *Lapi* (1841), are somewhat heavy and old-fashioned, and are interesting only if one reads the political allusions between the lines.

See L. Carpi, *Il Risorgimento Italiano,* vol. i. pp. 288 *seq.* and Constance d'Azeglio, *Souvenirs historiques* (1884).

AZERBAIJAN, the north-western province of Persia. It is separated on the north from the Soviet Republics of Azerbaijan and Armenia by the river Aras (Araxes); on the east it abuts on the Talish country and the Caspian sea; on the west it is bounded by Asiatic Turkey, and on, the south are the provinces of Kurdistan, Karus, Khamseh and Gilan. The area is estimated at 32,000sq.m. The population, roughly 1½ millions, comprises various races, *e.g.,* Persians proper, Turks, Kurds, Syrians and Armenians.

Physically, Azerbaijan is a high plateau bordered all around by higher mountain crests. Sahend mountain (12,000ft.), the extinct volcano Savalan (15,792ft.) west of Ardabil, and Ararat (17,000ft.) in the north-west, are the highest elevations in the province. The central depression (about 4,000ft.) is the Urmia lake, the most extensive basin of Persia, into which numerous watercourses drain from the surrounding highlands. In general the country is superior in fertility to most provinces of Persia and consists of a regular succession of undulating eminences, partially cultivated and opening into extensive plains. The orchards and gardens which surround many villages yield fruits of almost every description and great quantities, dried, are exported to Russia, the chief centre of the industry and of general trade being Tabriz. There is a lack of forest and timber trees. Lead, copper, sulphur, orpiment and lignite have been found within the confines of the province, and indications of petroleum have been reported. A kind of variegated and translucent marble, known as Maragha or Tabriz marble, is quarried and much used in Persia in the construction of monumental buildings, tanks, baths, etc. The climate is subject to extremes and the cold of winter is severely felt for want of fuel, the only substitute being dried cow-dung. Water from the innumerable streams is abundant. The natives of Azerbaijan make excellent soldiers and a large part of the Persian army is recruited from them.

The revenue of the province from all sources amounted in 1926–27 to 32,870,059 krans. Communicatcns within the province are comparatively good. A railway, 80m. in length, operated at a profit by the Persian Government, runs from Tabriz to Julfa on the Araxes, where it connects with the Caucasian system; a branch (30m.) from Sofia runs to Sharafkhaneh on Lake Urmia. This railway is worked in conjunction with a line of motor boats and barges on the lake and the freight business carried on is large and increasing. There are some 40m. of railway in the extreme north-west corner of the province, also the property of the Persian Government, but in bad repair. A constructed road suitable for heavy motor traffic runs from Tabriz to Julfa (80m.) parallel to the railway, and another runs from Julfa to Khoi. Roads passable by automobiles and light wheel traffic also run from Tabriz to Astara on the Caspian sea and to Kazvin. Tabriz, the chief town of Azerbaijan, has a local telephone service.

AZIMUTH (from the Arabic), in astronomy, the angular distance from the north or south point of the horizon to the foot of the vertical circle through a heavenly body. The azimuth of a horizontal direction is its deviation from the north or south.

AZO (c. 1150–1230), Italian jurist, was born at Bologna, studied under Joannes Bassianus, and became professor of civil law at Bologna. Azo occupied a very important position among the glossators, and his *Summa* Codicis and Apparatus ad codicim, which were collected by his pupil, Alessandro de Santo Aegidio, and completed by the additions of Hugolinus and Odofredus, formed a methodical exposition of Roman law, and were of such weight before the tribunals that it used to be said, "Chi non ha Azzo, non vada a palazzo." Azo numbered among his pupils Accursius and Jacobus Balduinus. He died about 1230.

Azo, whose name is sometimes written Azzo and Azzolenus, and who is occasionally described as Azo Soldanus, from the surname of his father, and as Azzo Porcius, is to be distinguished from two other famous Italians of the same name; viz., Azo Lambertaccius, a canonist of the 13th century, professor of canon law at the University of Bologna, author of Qzcestiones **in** *jus canonicum,* and Azo de Ramenghis, a canonist of the 14th century, also a professor of canon law at Bologna, and author of *Repetitiones super libro* Decretorum.

AZO-COMPOUNDS, an important group of organic substances which may be prepared by the reduction of nitro-compounds in alkaline solution (using zinc dust and alkali, or a solution of an alkaline stannite as a reducing agent); by oxidation of hydrazo-compounds; or by condensation of a nitroso-compound and an amine, since the substances have the general formula R·N:N·R′, where R is an aryl radical and R' a substituted alkyl or an aryl radical. The essential difference between. these substances and diazo-compounds (*q.v.*) is that in the azo-compounds the group —N:N— is attached by both its valencies to different carbon atoms.

Azomethane $CH_3{\cdot}N{:}N{\cdot}CH_3$, the simplest azo-compound, is produced by oxidizing diinethylhydrazine (hydrazomethane) with chromic acid (J. Thiele, 1909). It is a colourless gas, condensing to a pale yellow liquid (b.p. 1·5° C).

The aromatic azo-compounds are intensely coloured, but are not capable of being used as dye-stuffs unless they contain salt-forming acid or basic groups (see DYES, SYNTHETIC). By oxidizing agents they are converted into azoxy-compounds, and by reducing agents into hydrazo-compounds or amines.

Azobenzene $C_6H_5N:NC_6H_5$, discovered by E. Mitscherlich in 1834, may be prepared by reducing nitrobenzene in alcoholic solution with zinc dust and caustic soda; by the condensation of nitrosobenzene with aniline in hot glacial acetic acid solution or by the oxidation of aniline with sodium hypobromite. It crystallizes from alcohol in orange red plates which melt at 68° C. and boil at 293° C. It does not react with acids or alkalis, but on reduction with zinc dust in acetic acid solution yields aniline.

Amino-azo-compounds of the benzene series are prepared by the molecular rearrangement of the diazoamines (see DIAZO-COMPOUNDS) when these are warmed with the parent base and its hydrochloride. They are usually yellowish brown or red in colour, the presence of more amino-groups leading to browner shades, whilst the introduction of alkylated amino-groups gives redder shades. They usually crystallize well and are readily reduced. When heated with aniline and aniline hydrochloride they yield indulines (q v.). Amino-azobenzene $C_6H_5{\cdot}N_2{\cdot}C_6H_4NH_2$, crystallizes in yellow plates or needles and melts at 126° C. Its constitution is determined by the fact that by reduction with stannous chloride it yields aniline and para-phenylenediamine. Diamino-azobenzene (chrysoidine), $C_6H_5{\cdot}N_2{\cdot}C_6H_3(NH_2)_2$, first prepared by O. Witt (1877), is obtained by coupling phenyldiazonium chloride with meta-phenylenediamine. It crystallizes in red octahedra and dyes silk and wool yellow. Bismarck brown (phenylene brown, vesuvine, Manchester brown), which contains the triamino-azobenzene. $NH_2{\cdot}C_6H_4{\cdot}N_2{\cdot}C_6H_3(NH_2)_2$ and a more complex disazo dye (E. Tauber and F. Walder, 1900) is prepared by the action of nitrous acid on meta-phenylenediamine. It forms brown crystals which are readily soluble in hot water, and it dyes mordanted cotton a dark brown. Alkylated amino-azobenzenes are also known, and are formed by the coupling of diazonium salts with alkylated amines provided they contain a free para position with respect to the amino-group.

Methyl orange (helianthin, gold orange, Mandarin orange), $(CH_3)_2N{\cdot}C_6H_4{\cdot}N_2{\cdot}C_6H_4SO_3Na$, is the sodium salt of para-dimethylaminobenzene-azobenzene sulphonic acid. It is an orange crystalline powder which is soluble in water, forming a yellow solution. The free acid is intensely red in colour. Methyl orange is used largely as an indicator. Its constitution follows from the fact that on reduction by stannous chloride in hydrochloric acid solution it yields sulphanilic acid and para-aminodimethylaniline.

Methyl red $N(CH_3)_2{\cdot}C_6H_4{\cdot}N_2{\cdot}C_6H_4{\cdot}CO_2Na$, the sodium salt of *o*—carboxybenzene-azo-dimethylaniline, is prepared by coupling diazotized anthranilic acid (benzene diazonium carboxylate) (see DIAZO-COMPOUNDS) with dimethylaniline. It is a useful indicator in acidimetry and alkalimetry.

Hydroxyazo-compounds.—The hydroxyazo-compounds are prepared by adding a solution of a diazonium salt to a cold slightly alkaline solution of phenol. The diazo-group takes up the para position with regard to the hydroxyl group, and if this be prevented it then goes into the ortho position. It never goes directly into the meta position.

The constitution of the hyroxyazo-compounds has attracted much attention, some chemists holding that they are true azophenols of the type $R{\cdot}N_2{\cdot}R{\cdot}OH$, while others look upon them as having a quinonoid structure, *i.e.,* as being quinone hydrazones of the type $R{\cdot}NH{\cdot}N:R:O$. The first to study the problem on the purely chemical side was Th. Zincke (1883–87) who found that the products obtained by coupling a diazonium salt with a-naphthol and by condensing phenylhydrazine with a-naphthoquinone, were identical; whilst R. Meldola (1889) who acetylated the azophenols, and split the acetyl products by reduction in acid solution obtained evidence of enolic structure. K. Auwers (1896–1900), examined the question from the physico-chemical standpoint by determining the freezing-point depressions, the result being that the para-hydroxyazo-compounds gave abnormal depressions; and the ortho-hydroxyazo compounds gave normal tlepressions; Auwers then concluded that the para compounds are phenolic and the ortho compounds are quinone hydrazones or act as such. A. Hantzsch (1899) considered that the hydroxyazo-compounds are to be classed as pseudo-acids, possessing in the free condition the configuration of quinone hydrazones, their salts, however, being of the normal phenolic type. J. T. Hewitt, 1900, nitrated para-hydroxyazobenzene with dilute nitric acid and found that it gave a benzene-azo-ortho-nitrophenol, whereas quinones are not attacked by dilute nitric acid. He also found by bromination experiments that the presence of mineral acid gives the azo-compound a pseudo-quinonoid character, which it does not possess if by addition of sodium acetate, the mineral acid be removed from the sphere of the reaction.

Para-hydroxyazobenzene (benzene-azo-phenol)—$C_6H_5N:N(1){\cdot}C_6H_4{\cdot}OH(4)$, is prepared by coupling diazotized aniline with phenol in alkaline solution. It is an orange-red crystalline compound which melts at 154° C. Ortho-hydroxyazobenzene, $C_6H_5N:N(1){\cdot}C_6H_4{\cdot}OH(2)$, was obtained in small quantity by E. Bamberger (1900) simultaneously with the para compound. from which it may be separated by its volatility in steam. It crystallizes in orange-red needles which melt at 82·5–83° C. Meta-hydroxyazobenzene $C_6H_5N:N(1){\cdot}C_6H_4{\cdot}OH(3)$ melting at 112–114° C. was obtained in 1903 by P. Jacobson by condensing ortho-anisidine with benzene diazonium chloride, the resulting compound then being diazotized and reduced by alcohol to benzene-azo-meta-anisole, from which meta-oxyazobenzene was obtained by hydrolysis with aluminium chloride.

Azoxy-compounds, $R{\cdot}\overline{N{\cdot}O{\cdot}N}{\cdot}R'$, are usually yellow or red crystalline solids which result from the reduction of nitro- or nitroso-compounds by heating them with alcoholic potash (preferably using methyl alcohol). They may also be obtained by the oxidation of azo-compounds. When reduced (in acid solution) they yield amines: distillation with reduced iron gives azo-compounds and warming with arnmonium sulphide gives hydrazo-compounds. Concentrated sulphuric acid converts azoxybenzene into hydroxyazobenzene (O. Wallach, 1880). Azoxybenzene $(C_6H_5N)_2O$ crystallizes from alcohol in yellow needles, which melt at 36° C. On distillation it yields aniline and azobenzene. Azoxybenzene is also found among the electro-reduction products of nitrobenzene, when the reduction is carried out in alcoholic-alkaline solution.

Mixed *azo-compounds* are those in which the azo-group ·N:N· is united with an aromatic radical on the one hand, and with a radical of the aliphatic series on the other. The most easily obtained mixed azo-compounds are those formed by the union of a diazonium salt with the potassium or sodium salt of a nitroparaffin (V. Meyer, 1876):

$$C_6H_5N_2{\cdot}NO_3 + CH_3{\cdot}CH(NO_2)K = KNO_3 + C_6H_5N_2{\cdot}CH(NO_2)CH_3.$$

Benzene-azo-nitro-ethane

Those not containing a nitro-group may be prepared by the oxidation of the corresponding mixed hydrazo-compounds with mercuric oxide. E. Bamberger (1898) has shown that the nitroalkyl derivatives behave as though they possess the constitution of hydrazones, for on heating with dilute alkalis they split more or less readily into alkaline nitrite and an acid hydrazide:

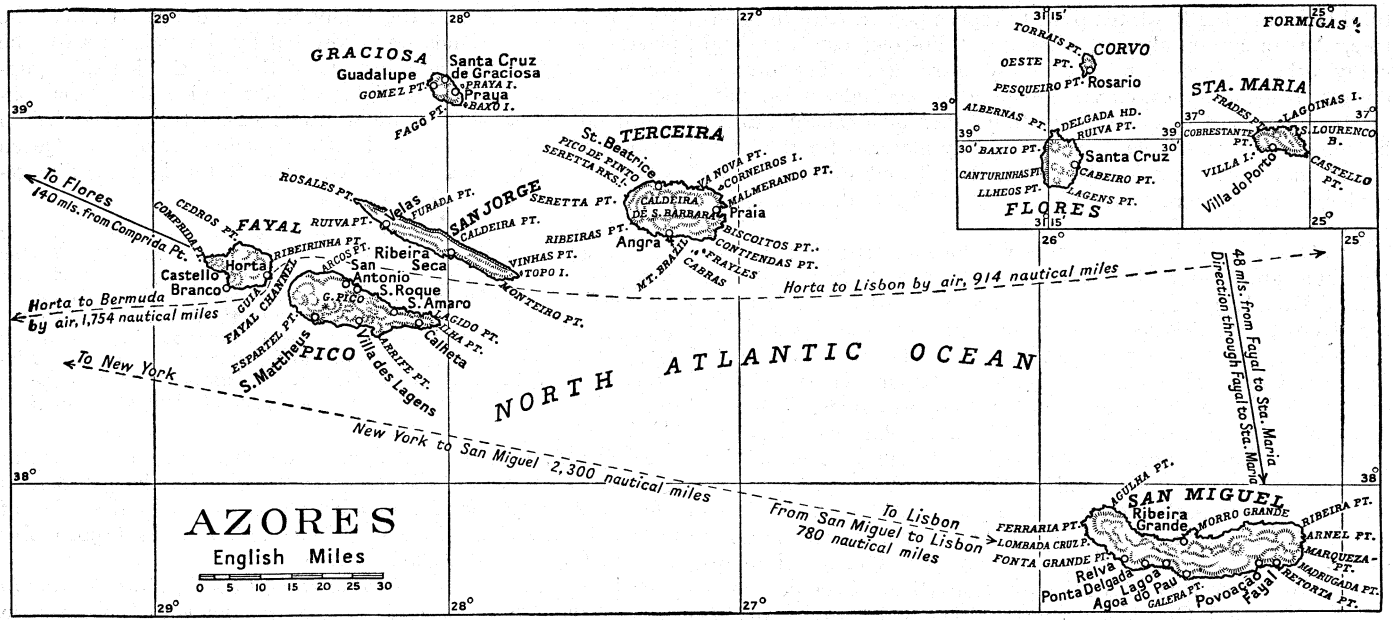
$$C_6H_5NH{\cdot}N:C(NO_2)CH_2 + NaOH = NaNO_2 + C_6H_5NH{\cdot}NH{\cdot}CO{\cdot}CH_3.$$

Benzene-azomethane, $C_6H_5{\cdot}N_2{\cdot}CH_3$, is a yellow oil which boils at 150° C. and is readily volatile in steam. Benzene-azoethane, $C_6H_5{\cdot}N_2{\cdot}C_2H_5$ is a yellow oil which boils at about 180° C with more or less decomposition. On standing with 60% sulphuric acid for some time, it is converted into the isomeric acetaldehyde-phenyihydrazone, $C_6H_5NH{\cdot}N:CH{\cdot}CH_3$.

Phenyl-azocarboxylic acid, $C_6H_5{\cdot}N_2{\cdot}COOH$, is obtained in the form of its potassium salt when phenylsemicarbazide is oxidized with potassium permanganate in alkaline solution (J. Thiele, 1895). It crystallizes in orange-red needles and is decomposed by water. (G. T. M.)

AZOIMIDE or **HYDRAZOIC ACID,** N_3H, a compound of nitrogen and hydrogen, first isolated in 1890 by Th Curtius, corresponding with diazoimino-benzene. $C_6H_5N_3$ (P. Griess, 1866), is prepared by adding amrnonia to diazobenzene perbromide.

Curtius found that either benzoylglycollic acid or ethyl benzoate gave benzoylhydrazine with hydrazine hydrate. Benzoyl-



THE AZORES. SHOWING IN THE MAIN MAP THE POSITION OF THE WESTERN GROUP AND SAN MIGUEL OF THE EASTERN GROUP. AND. IN THE TOP RIGHT INSET. THE CENTRAL GROUP AND SANTA MARIA OF THE EASTERN GROUP

The Azores stretch over a distance of 400 mi. and consist of 9 islands divided into three groups. Punic coins found at Corvo (in the central group) point to the Carthaginians having sailed here in their expeditions westward, but the first permanent foreign colonization was made by the Portuguese in 1421. As an intermediate landing stage between the Old and New Worlds, the economic development of the Azores received fresh impetus from the progress in commercial aviation; regular service was inaugurated in 1939

hydrazine gave a nitroso compound with nitrous acid, which changed spontaneously into benzoylazoimide by loss of water:

$$C_6H_5CO{\cdot}NH{\cdot}NH_2+HONO=H_2O+C_6H_5CO{\cdot}N(NO){\cdot}NH_2.$$

$$C_6H_5CO{\cdot}N(NO){\cdot}NH_2=H_2O+C_6H_5CO{\cdot}N_3$$

The resulting benzoylazoimide was easily hydrolysed by boiling with alcoholic soda, when the addition of ether, precipitating sodium hydrazoate, was in a crystalline condition.

An improved method of preparation is based on the use of hippuric acid, which reacts with hydrazine hydrate to form hippurylhydrazine, $C_6H_5{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO{\cdot}NH{\cdot}NH_2$, and this substance is converted by nitrous acid into diazohippuramide, $C_6H_5{\cdot}CO{\cdot}NH{\cdot}CH_2{\cdot}CO{\cdot}NH{\cdot}N_2{\cdot}OH$, which is hydrolysed by the action of caustic alkalis with the production of salts of hydrazoic acid. To obtain the free acid it is best to hydrolyse the diazohippuramide with dilute soda, the resulting liquid being distilled with dilute sulphuric acid. The pure acid may be obtained by fractional distillation as a colourless liquid with a penetrating odour causing throbbing of the temples; it boils at 30°C., and is extremely explosive.' It is soluble in water, and the solution dissolves many metals (zinc, iron, etc.) with liberation of hydrogen and formation of salts (termed azoimides, azides or hydrazoates). The salts are explosive and readily interact with the alkyl iodides. In its properties hydrazoic acid shows some analogy with the halogen acids, since it forms difficultly soluble lead, silver and mercurous salts. The metallic salts all crystallize in the anhydrous condition and decompose on heating, leaving a residue of the pure metal. The acid is a "weak" acid, being ionized only to a very slight extent in dilute aqueous solution. Lead azide, PbN_6, is a powerful detonator employed in the military services instead of mercury fulminate. (See EXPLOSIVES.)

E. Noelting and E. Grandmougin (1891) obtained azoimide from 2:4—dinitraniline, $C_6H_3(NO_2)_2{\cdot}NH_2$, and from *ortho-* and para-nitro-anilines by converting either of these nitrated bases successively into diazomin salt, diazoperbromide and diazoimine, $NO_2\,C_6H_4{\cdot}N_3$, the last compound was hydrolysed by alcoholic potash and the resulting potassium azide KN_3, distilled with dilute sulphuric acid.

J. Wislicenus (1892) prepared sodium azide by passing nitrous oxide over heated sodamide. The acid can also be obtained by the action of nitrous acid on hydrazine sulphate; by the oxidation of hydrazine by hydrogen peroxide and sulphuric acid (A. W. Browne, 1905).

Ammonium azoimide, $N_3{\cdot}NH_4$, or N_4H_4, and *hydrazine* azoimide, N_5H_5, are soluble, explosive salts.

Chloroazoimide, $Cl{\cdot}N_3$, obtained by F. Raschig (1908), is a highly explosive colourless gas prepared by acidifying a mixture of sodium azide and hypochlorite with acetic or boric acid.

See Thorpe, Dictionary of Applied *Chemistry,* Azoimide, p. 496 (1921).

AZORES or **WESTERN ISLANDS,** an archipelago in the Atlantic Ocean, belonging to Portugal. Area, 888 sq.mi.; pop. (1940) 284,755. The islands extend from north-west to south-east, between 36° 55′ and 39° 55′ N., and between 25° and 31° 16′ W. They are divided into three widely severed groups, rising from a depth of more than 2½m. The south-eastern group consists of St. Michael's (São Miguel) and St. Mary (Santa Maria), with Formigas; the central, of Fayal (Faial), Pico, St. George (São Jorge), Terceira and Graciosa; the north-western, of Flores and Corvo. The nearest continental land is Cape da Roca in Portugal, which lies 800m. east of St. Michael's. Thus the Azores are further from the mainland than any group of Atlantic islands. In general characteristics all the component islands are very similar, rising steeply from scree-lined shores to heights reaching 7,613ft. (in Pico). Their volcanic nature is obvious, and has been shown by the numerous earthquakes and basaltic eruptions since their discovery. In 1522, the town of Villa Franca, at that time capital of St. Michael's, was buried during a violent convulsion.

Climate.— The climate is particularly temperate. The range of the thermometer is from 45" F, the lowest known extreme, or 48°, the ordinary lowest extreme of January, to 8z°, the ordinary. or 86°, the highest known extreme of July, near the level of the sea. Winds from the west and south-west render the navigation of the coasts very dangerous.

Fauna and **Flora.**—The mammalia of the Azores are limited to the rabbit, weasel, ferret, rat (brown and black), mouse and bat, in addition to domestic animals. The game includes the woodcock, red partridge (introduced in the 16th century), quail and snipe. There are valuable fisheries of tunny, mullet and bonito. The porpoise, dolphin and whale are also common. Whale-fishing is a profitable industry, with its headquarters at Fayal, whence the sperm-oil is exported.

The general character of the flora is decidedly European. Vegetation in most of the islands is remarkably rich, especially in grasses, mosses and ferns, heath, juniper and a variety of shrubs. Of tall-growing trees there was, till the 19th century, an almost

total lack; but the Bordeaux pine, European poplar, African palm-tree, Australian eucalyptus, chestnut, tulip-tree, elm, oak and many others, were then successfully introduced. The orange, apricot, banana, lemon, citron, Japanese medlar and pomegranate are the common fruits. A kind of fern *(Dicksonia culcita),* called by the natives *cebellinho,* furnishes a silky material for the stuffing of mattresses and is exported to Brazil and Portugal. The principal seaports are Angra (pop. 1930, 10,642), Ponta Delgada (18,022) and Horta (7,663).

Trade.—The trade of the Azores was long a Portuguese monopoly, but later, prior to World War II, it was shared by the United Kingdom and Germany; textiles imported from Portugal; coal from Great Britain; sugar from Germany, Madeira and the United States; stationery, hardware, chemicals, paints, oils, etc., from the United Kingdom and Germany. Exports consist chiefly of fruit, wine, natural mineral waters and provisions. Trade in pineapples is important. In addition to regular mail services, there are cables to Portugal, Ireland (Waterville), England and the continent, to America and to the Cape Verde Islands. In 1939 regular transatlantic air service via the Azores was inaugurated. The most important island is St. Michael's, with an area of 297 sq.mi.; the pop. in 1930 was 127,162. Graciosa is noteworthy for its scenery. Its chief towns are Santa Cruz de Graciosa (2,237) and Guadalupe (2,647). The chief towns of St. George are Ribeira Seca (4,091) and Velas (2,058). The inhabitants of the islands are mostly of Portuguese origin, with a well-marked strain of Moorish and Flemish blood. Negroes, mulattoes, English, Scottish and Irish immigrants are present in considerable numbers, especially in Fayal and St. Michael's. The predominant religion is the Roman Catholic, and the Azores constitute part of the ecclesiastical province of Lisbon. For purposes of military administration two line regiments of infantry and two battalions of garrison artillery are stationed in the islands.

History.—It does not appear that the Greeks and Romans had knowledge of the Azores, but from the number of their coins discovered in Corvo it has been supposed that the islands must have been visited by the Carthaginians. Arabian geographers, in the 12th and 14th centuries, describe nine islands in the Western ocean, other than the Canaries, which may be the Azores, and mention is made of hawks or buzzards, from which the present name is derived (Port. *Acor,* a hawk). Other authorities believe that references and maps earlier than 1432 describe the mythical St. Brendan Isles, since these records are incorrect as to distances, have the archipelago running north and south instead of east and west, and note no identifying physical features. Likewise, European ships before this time were incapable of so long a voyage. In 1432 Van der Berg—according to the usual account—was driven on the islands, and the news interested the court. The navigator, Gonzalo Velho Cabral—not to be confounded with his greater namesake, Pedro Alvarez Cabral—was sent to prosecute the discovery. Another version relates that Prince Henry the Navigator of Portugal had in his possession a map showing the islands, and that he sent out Cabral through confidence in its accuracy. Cabral reached the island, which he named *Santa Maria,* in 1432, and in 1444 took possession of St. Michael's. The other islands were all discovered by 1457. Colonization had meanwhile been going on prosperously; and in 1466 Fayal was presented by Alphonso V to his aunt, Isabella, the duchess of Burgundy. An influx of Flemish settlers followed, and the islands became known for a time as the Flemish Islands. From 1580 to 1640 they were subject, like the rest of the Portuguese kingdom, to Spain. At that time the Azores were the grand rendezvous for the fleets on their voyage home from the Indies; and hence they became a theatre of that maritime warfare which was carried on by the English under Queen Elizabeth against the Peninsular powers. One such expedition, which took place in 1591, led to the famous sea-fight off Flores, between the English ship "Revenge," commanded by Sir Richard Grenville, and a Spanish fleet of 53 vessels. Under the active administration of the marquis de Pombal (1699–1782), considerable efforts were made for the improvement of the Azores, but the stupid and bigoted government which followed rather tended to destroy these benefits. Towards the beginning of the 19th century, the possession of the islands was contested by the claimants for the crown of Portugal. The adherents of the constitution, who supported against Miguel the rights of Maria (II) da Gloria, obtained possession of Terceira in 1829, where they succeeded in maintaining themselves, and after various struggles, Queen Maria's authority was established over all the islands. She resided at Angra from 1830 to 1833.

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AZORÍN (1874–), Spanish novelist and critic. Born at Monovar (Alicante), José Martinez Ruiz, under the pseudonym which has completely eclipsed his name, has written stories of ancient Castile in El *Alma Castellana (1600–1800)* (1900), *Los Pueblos* (1904), and *Castilla* (1912).

After the three novels La *Voluntad* (1902), *Antonio Azorín* (1903), and *Las Confesiones de un pequeño filósofo* (1904), in which are set down the self-revelations of an ordinary hero, Azorin turned to criticism, and *Al Margen de los Clásicos* (1911), *Rivas y Larra* (1916), *De Granada a Castelar* (1922) reveal him as an independent judge with a fine sense of relative values.

AZOTE: *see* NITROGEN.

AZOTH, the name given by the alchemists to mercury, and by Paracelsus to his universal remedy.

AZOTUS: *see* ASHDOD.

AZOV, a town on the left bank of the river Don, 20 mi, from its mouth, in the north Caucasian area of the R.S.F.S.R. (47° 5′ N., 39° 22′ E.). It was formerly a port, but the harbour is now silted and trade has been diverted to Taganrog and Rostov-on-Don. The chief occupation of the town is fishing. Population 19,266.

The ancient Tanais lay 10 mi. north and the Genoese factory, Tana, was here.

Formerly Azov was of military importance; it was captured by Peter the Great in 1696, restored to the Turks in 1711 and finally became Russian in 1739.

AZOV, SEA OF, an inland sea of southern Europe, communicating with the Black sea by the strait of Yenikale, or Kerch, the ancient *Bosporus Cimmerius.* To the Romans it was known as the *Palus Maeotis.* In prehistoric times a connection with the Caspian sea existed, but present conditions have obtained through the Manych depression since early historical times. It lies between 45° and 47° N. and between 35° and 39" E., its length from southwest to northeast being 370 km., and its greatest breadth 170 kilometres. The area runs to 42,000 square kilometres. It generally freezes from the end of November to the middle of April. The Don is its largest and, indeed, its only very important affluent. Near the mouth of that river the depth of the sea varies from 0.3 to 1.0 mi., and the greatest depth does not exceed 13 metres. Northeast and east winds, in July and August as well as in December, drive the water away from the very shallow gulf of Taganrog and the water level falls 2 metres or more so that ships are liable to ground. On the other hand strong southwesterly winds raise the level in the gulf of Taganrog by 1–1.5 metres. Its Turkish name, Baluk-deniz, means fish-sea. The long sandspit of Arabat on the west separates off the salter lagoons and marshes known as the Sivash or Putrid sea. On the shores of the sea of Azov stand Taganrog, Berdyansk, Mariupol and Genichesk, which export wheat, while Rostov, 45 km. upstream, is the important port for the most fertile part of Russia.

See *Mediterranean Pilot,* Admiralty, London; O. Krümmel, *Oceanographic* (i., 1907) (ii., 1911); N. M. Knipowich, *Wissensch. Fisch-Exped. im Azow. u. Schwarzen Meer* (i. Kerch, 1926, ii. Leningrad, 1927).

AZTEC. This most famous of native American peoples, known also as Mexica, belonged to the Nahua-speaking division of the great Uto-Aztecan family. Their traditions carry them back to an origin from an island cave in Aztlan, the situation of which has been sought in northern Mexico or beyond, but vainly, this portion of the legends being mythical, and Aztlan meaning only "Aztec place." Equally apocryphal are the legendary statements

BY COURTESY OF THE MEXICAN CHAMBER OF COMMERCE

AZTEC CALENDAR STONE. NATIONAL MUSEUM. MEXICO CITY

The surprisingly accurate chronological table of the ancient Aztecs. The stone is three feet thick and the disk part is twelve feet in diameter. It reveals an advanced knowledge of astronomy that is in sharp contrast with the barbarous practices and rituals of the Aztecs

that the Aztec ancestors some centuries before 1492 were nomadic hunters; nearly the whole range of Uto-Aztecan territory is shown by archaeological discoveries to have kno n maize agriculture several thousand years ago. These traditions are unconscious fabrications exalting the later rise of the Aztec by contrast with humble beginnings.

When the Aztec first emerge into semi-history about 1100 A.D., the Toltec power in and about the valley of Mexico was disintegrating, and the Aztec appear as one of a number of Nahua-speaking communities and peoples — the Tlazcalteca, Huexotzinca, Tlahuica, Chalca, Xochimilca, Tepaneca — attempting to obtain a lodgment in the area, or to strengthen themselves in it. The places at which according to their records the Aztec lived in this period and which can be accepted as more or less authentic, are all in the valley of Mexico or within a hundred miles to the northwest. In 1325 they effected a settlement on a marshy island near the western edge of the brackish lake of Tezcoco, named Tenochtitlan, a sister community settling at Tlatelulco a mile north.

This event marks an epoch, in that the Mexica were never again dislodged. They were at this time a small and weak town or village community, probably with limited farmlands and depending considerably on fishing and trade. They were at times subject and tributary to near-by towns, such as Culhuacan and later Tepanec Coyoacan and Atzcapotzalco, which survive as suburbs of Mexico City. After about 50 years they had become strong enough, under the patronage of Culhuacan, to reckon Acamapichtli as their first "king." Fifty years later, however, the third of the line, Chimalpopoca, was captured and killed in Atzcapotzalco.

At this point, however, the tide turned, and the new Aztec ruler, Itzcoatl, joined a revolt in 1427, which soon permanently broke the Atzcapotzalcan and Tepanec power. The lead in this war was probably taken by Tezcoco, a large town across the lake, where Toltec and immigrant "Chichimec" or semi-barbarian elements had fused, At any rate, Tenochtitlan or Mexico ("Mexica place"), Tezcoco and Tlacopan (a Tepanec town, now Tacuba), formed an offensive-defensive alliance, which preserved to each member autonomy and the right to independent conquests, but provided for the division of tribute from joint undertakings in the ratio of 2:2:1. This league, which was organized on a model no doubt long familiar in the region, prospered, but the Aztec, perhaps as the youngest and most vigorous community, became the most aggressive and soon forged ahead. When Cortez arrived the league was still in existence, but the overwhelming majority of conquests, including all at a distance, had been made by the Mexica alone, and their influence was strong in the internal affairs of Tezcoco. The whole duration of the league and of the empire growing out of it was only 90 years.

The Aztec conquests were slow at first, and confined to Mexico valley. Xochimilco, Chalco, and other towns offered a bitter and prolonged resistance. Some communities paid voluntary tribute and were regarded as allies; those that resisted or were beaten after rebelling had the captives taken away for sacrifice. Almost always conquered towns were rebuilt by the survivors, and often flourished, being left in possession of their lands, from which they paid tribute in kind. Confiscation of farmlands to the chiefly lineages of Mexico, resulting in so-called crown domains, was a custom that seems to have grown slowly, not becoming extensive, apparently, until the latter part of the 15th century.

The first conquests outside the valley of Mexico occurred under the second ruler after the throwing off of Atzcapotzalcan overlordship, Montezuma I. (1440–69), the most successful of the Aztec lords. Under him and his successors rapid progress was made in the building up of a foreign vassalage, which was still growing, though slowly and evidently near its apogee under Montezuma II., when Cortez landed near Vera Cruz in 1519. This realm was known and feared in Yucatan and Guatemala, collected tribute as far as the isthmus of Tehuantepec, and included as more or less subject populations the Otomi, Totonac, Zapotec, Mixtec, various Nahua-speaking groups, and others in the central highlands and on both Atlantic and Pacific coasts. It extended, however, only a short distance west of Mexico City, to Toluca, the Tarasca of Michoacan defeating an Aztec invasion decisively and remaining unconquered to the end.

The "empire" also included formally allied cities like Tezcoco, and others like Cholula, which were friendly, acting under Mexican direction when Cortez came, but apparently not paying tribute. It included also, territorially, the Tlaxcalteca and Huexotzinca of Tlaxcala, independent and confirmedly hostile populations, who met the Aztec almost annually in border battles, from which each side retired to sacrifice its prisoners before the temples. The populations about Oaxaca appear to have been held in precarious or intermittent subjection. Characteristic is the fact that as late as 1475, when the period of foreign domination was already well under way, the sister city of Tlatelulco "revolted."

Obviously, the Aztec empire paid no heed to territorial continuity; and quite evidently, too, it was not an empire or state in our sense but a loosely knit aggregation of units related to the dominating community in varying ways. It also embraced only a small fraction of the modern republic of Mexico. Baudelier, therefore, was largely right when he denied (*Peabody* Mus. Rep., vol. ii. 1876–79) that Montezuma II. was an emperor or even king in our sense; although he overshot the mark in trying to construe the Aztec social, economic and political status as essentially equivalent to those of a leaderless, clan-organized tribe of the United States. Aztec society grew out of a relatively primitive condition; but it had been made over.

When Tenochtitlan was founded in 1325, the population may have numbered a thousand or two; in 1519 it was probably a hundred thousand. In the interval, wealth and a species of luxury grew; the temple pyramids rose successively higher; the number of victims mounted; learning and specialization of professions increased; aqueducts, causeways, and public buildings were constructed. The whole basis of culture was, however, already provided in the civilization current in the area and shared in by hundreds of towns, large and small, according to the degree of their prosperity. Most of this civilization was already possessed by the

Toltecs. It altered in detail and appearance, so that objects of Toltec and Aztec period can usually be distinguished without difficulty. As yet, however, not a single important invention or major element of Mexican culture can be designated as having originated in the post-Toltecan period. Of what is called Aztec civilization, the bulk was carried by peoples other than the Mexica: this community came to be the administrator, legatee, dominator and disseminator of the culture. Even the Aztec realm is likely to have had a predecessor among the Toltec of Tula or Teotihuacan; and, like theirs, it would probably have crumbled in a century or two and another have arisen in its stead after a period of disintegration had the Caucasian not appeared on the scene.

Cortez conquered the Aztecs not only because of the awe, wonder and fear which he inspired and through superior organization, discipline, armament, intrepidity and ruthlessness, but because the great majority of peoples in the Aztec sphere either carefully watched the conflict from apart or allowed Cortez to impress them into his service; or, like the Tlaxcalans, aided him actively. The Mexica put up a heroic battle at the last; but it was the stand of a desperate people, outgeneralled, with the fruits of two centuries of national upbuilding already lost, and fighting almost hopelessly for self-preservation. With Tenochtitlan finally conquered, the whole empire and large surrounding districts lay completely pacified under Spanish rule.

The Spaniards carried and established Aztec place names over most of Mexico and Central America. Their speech absorbed an appreciable stock of Nahua words, which remain part of the language of the country, and some of which have become international: coyote, axolotl, ocelot, tomato, metate, chocolate. There are to-day nearly a million Indians in Mexico speaking Aztec-Nahua.

See Torquemada, *Monarquia Indiana* (1723); *E.* J. Payne, *History of the New World* (1892); *P.* Radin, *Univ. Calif. Publ. Am. Arch. Ethn.*, vol. xvii. (1920); Prescott. *Conquest* of *Mexico; T. A.* Joyce, *Mexican Archnsology* (1922); H. J. Spinden, *Ancient Civilizations of Mexico and Central America* (1922). (A. L. K.)

AZTEC RUIN, an American ruin of a prehistoric building of the pueblo type, situated in the valley of the San Juan river near the town of Aztec, New Mexico. It is a large structure covering 4·6ac. and containing about 500 rooms. Of this building the first storey is standing, and in 24 of the rooms the original ceilings have been preserved. Many second-storey rooms remain and also parts of third-storey rooms. Where still intact, the ceilings are upheld by large wooden beams which were cut and dressed with stone tools. The sandstone walls, still reasonably perpendicular, have dressed faces. These ceilings and walls are interesting examples of carpentry and masonry done in the Stone age. The Aztec ruin is the most striking and best preserved of a large group of ruins that serve as an index to the ancient cultures that flourished in the San Juan valley. Excavations have brought to light objects indicating that portions of the Aztec ruin are of the same age as the ruins of Chaco Canyon (*q.v.*). In 1923 the American Museum of Natural History, which has conducted systematic explorations of the building, presented the plot of land containing it to the United States, and immediately thereafter it was established as a national monument. The town of Aztec is reached by rail and is also on the route of the national park-to-park highway. *See* NATIONAL PARKS AND MONUMENTS.

AZUAGA, western Spain, province of Badajoz. Population 16,577. Azuaga is the livestock market of the broad upland pastures watered by the Matachel, a tributary of the Guadiana, and by the Bembézar. a tributary of the Guadalquivir.

AZUAY, a province of Ecuador, 3,872 sq.mi., est. pop. (1942) 254,147, bounded north by the province of Caiiar, east by Oriente, south by Loja, and west by El Oro and Guayas. It was formerly called Cuenca, and formed part of the department of Azuay, which also included the province of Loja. Azuay is an elevated mountainous district with a great variety of climates and proddcts. Among the products are silver, quicksilver, wheat, Indian corn, barley, cattle, wool, cinchona and straw hats. The capital is Cuenca.

AZUNI, DOMENICO ALBERTO (1749–182j), Italian jurist, was born at Sassari, in Sardinia, in 1749, and died at Cagliari, where he was consular judge and director of the university library. He studied law at Sassari and Turin, and in 1782 was made judge of the consulate at Nice. In 1786–88 he published his *Dizionario Universale Ragionato della Giurisprudenza Mercantile.* In 1795 appeared his systematic work on the maritime law of Europe, *Sistema Universale dei Principii del Diritto Maritimo dell' Europa,* which he afterwards recast and translated into French.

AZURARA, GOMES EANNES DE (?–1474), the second notable Portuguese chronicler in order of date. He adopted the career of letters in middle life. He probably entered the royal library as assistant to Fernão Lopes (*q.v.*) during the reign of King Duarte (1433–38), and he had sole charge of it in 1452. His *Chronicle of the Siege and Capture of Ceuta,* a supplement to the *Chronicle of King John I.,* by Lopes, dates from 1450, and three years later he completed the first draft of the *Chronicle of the Discovery and Conquest of Guinea,* our authority for the early Portuguese voyages of discovery down the African coast and in the ocean, more especially for those undertaken under the auspices of Prince Henry the Navigator. It contains some account of the life work of that prince, and has a biographical as well as a geographical interest. On June 6 1454, Azurara became chief keeper of the archives and royal chronicler in succession to Fernão Lopes. In 1456 King Alphonso V. commissioned him to write the history of Ceuta, "the land-gate of the East," under the governorship of D. Pedro de Menezes, from its capture in 1415 until 1437, and he had it ready in 1463. A year afterwards the king charged him with a history of the deeds of D. Duarte de Menezes, captain of Alcacer, and, proceeding to Africa, he spent a twelvemonth in the town collecting materials and studying the scenes of the events he was to describe, and in 1468 he completed the chronicle. Azurara was laborious, accurate and conscientious, though his position did not allow him to tell the whole truth about his hero, Prince Henry.

His works include: (1) *Chronica dsl Rei D. Joam. I. Terceira parte em que se contem a tomada de Ceuta* (1644); (2) *Chronica do Descobrimento e Conquista de Guiné* (1841; Eng. version issued by the Hakluyt Society, 1896–99); (3) *Chronica do Conde D. Pedro (de Menezes),* printed in the *Ineditos de Historia Portugueza,* vol. ii. (1792); (4) *Chronica do Conde Duarte de Menezes,* printed in the *Ineditos,* vol. iii. (1793). The preface to the English version of the *Chronicle of Guinea* contains a full account of the life and writings of Azurara and cites all the authorities.

AZURE, the lapis lazuli, a blue stone (Arab. *al-lazward,* the initial "l" having dropped), hence the colour blue, described in heraldry (q *v.*) as "azure." The word is also applied to the clear blue of a cloudless sky The pigment ultramarine blue was originally produced from powdered lapis lazuli.

AZURITE or **CHESSYLITE,** a basic copper carbonate $2CuCO_3{\cdot}Cu(OH)_2$. Its vivid blue colour contrasts strikingly with the emerald-green malachite, which usually accompanies it. It was known to Pliny as *caeruleum.* The name chessylite is taken from Chessy, near Lyon, where many fine crystals belonging to the monoclinic system have been found. Hardness 3·5-4, sp. gr. 3.8.

Azurite occurs with malachite in the oxidized portions of copper lodes, being due to alteration of copper sulphides by meteoric waters. It is often formed also by reaction between copper-bearing solutions and limestone. It is a common mineral in nearly all copper mines.

AZYMITES, a name given by the Orthodox Eastern to the Western or Latin Church, because of the latter's use of unleavened bread in the eucharist, a practice which arose in the 9th century. (Gr. ἀ-, privative, ζύμη, leaven). The Orthodox Church strenuously maintains its point, arguing that the example of Jesus and the early church alike testify against the use of unleavened bread in this connection.

B THIS letter, corresponding to Semitic *beth* and Greek *beta,* has retained the second place in the alphabet from the earliest times. Its form in the writing of the Moabite Stone, dating from the 9th century B.C., was  . Early Greek forms were  and  . The usual Greek form was or B, and in Latin these two latter forms appear unchanged, giving the modern B. An uncial form occurs in the 6th century A.D. strangely resembling the early Greek forms from the island of Thera, but there can scarcely be a direct connection, the two similar forms having developed independently.

Our minuscule form *b* is a descendant of Latin cursive  . In this form the upper loop is extremely elongated and has almost disappeared. The early Irish form was  , the Carolingian (9th or 10th centuries) . As early as the 2nd century A.D. we find a form , in which the upper loop of the letter has disappeared in the speed of writing.

NAME OF FORM	APPROXIMATE DATE	FORM OF LETTER
PHOENICIAN	B.C. 1.200	
CRETAN	1.100-900	
THERAEAN	700-600	
ARCHAIC LATIN	700-500	
ATTIC	600	
CORINTHIAN	600	
CHALCIDIAN	600	
IONIC	403	
ROMAN COLONIAL	CLASSICAL TIMES	
URBAN ROMAN		
FALISCAN		
OSCAN		
UMBRIAN		
CLASSICAL LATIN AND ONWARDS		

THE DEVELOPMENT OF THE LETTER B FROM ITS EARLIEST TO ITS PRESENT FORM COVERS A PERIOD OF SOME 3.100 YEARS. THE "THERAEAN" FORM IS FROM THE ISLAND OF THERA

The sound represented by the letter is the voiced labial stop. It stood for this sound in the Semitic languages, and in Greek and Latin. From the 2nd century A.D. onwards the sound in Latin tended to become a bilabial spirant, for we find confusion in spelling between b and *u.* The letter however, did not fall into disuse and was used by the Romance languages to represent the voiced labial stop, which was redeveloped by them. In English the sound was always present, an original Indo-European **bh* being represented by it.

In music, B is the second note of the musical alphabet and the 7th degree of the "natural scale" of C. In Germany, however, the alphabetical name for this note is, not B, but H, while B stands for B flat, a fact which it is important to remember in dealing with German music, German writings on music, and so on. Thus in German nomenclature Schubert's "Unfinished" symphony is not in B minor but in H moll (minor), while Brahms's second pianoforte concerto stands as being, not in B flat, but in B.

BAADER, FRANZ XAVER VON (1765–1841), German theologian, born at Munich, on March 27, 1765, studied medicine at Ingolstadt and Vienna, and later became a mining engineer. While in England (1792–96) he was introduced to the mysticism of Boehme and the empiricism of Hume, Hartley and Godwin. On his return to Hamburg he became acquainted with Jacobi and with Schelling. Between Baader and Schelling there was mutual influence until Baader's denunciation of modern philosophy in a letter (c. 1822) to Alexander I. of Russia entirely alienated Schelling.

Meanwhile Baader continued to apply himself to his profession of engineer, gaining a prize of 12,000 gulden (about £1,000) for his new method of employing Glauber's salts instead of potash in the making of glass. From 1817–20 he held the post of superintendent of the Bavarian mines. He retired in 1820, and in 1822 published his *Fermenta Cognitionis,* in which he combats modern philosophy and recommends the study of Boehme. In 1826 he was appointed professor of philosophy and speculative theology at the new university of Munich. Some of the lectures were published under the title, *Spekulative Dogmatik* (1827). In 1838 he ceased to lecture owing to a ministerial order prohibiting laymen from lecturing on philosophy and theology.

The facts that Baader left no systematic works and that he usually expressed himself in obscure aphorisms or mystical symbols make it difficult to summarize his philosophy. He believes that reason must be supplemented by faith and church tradition and that it must clarify the truths given by authority and revelation. But in his attempt to correlate the two realms he approaches the mysticism of Eckhart, Paracelsus and Boehme. Human knowledge is never mere *scientia,* it is invariably *con-scientia*—a knowing with a consciousness of God whose knowledge compenetrates ours. God is not to be conceived as mere abstract Being, but as an everlasting process of activity which is distinguishable under two aspects—the immanent or esoteric, and the emanent or exoteric. As regards ethics, Baader rejects the Kantian or any autonomic system of morals. Not obedience to a moral law, but realization in ourselves of the divine life is the true ethical end. But because man has alienated himself from God no ethical theory which neglects the facts of sin and redemption (and the necessity of prayer and the sacraments) is satisfactory. The history of man and of humanity is the history of the redeeming love of God. Man in his social relations is under two great institutions. One is temporal, natural and limited—the state; the other is eternal, cosmopolitan and universal—the

church. In the state two things are requisite: first, common submission to the ruler, which can be secured or given only when the state is Christian, for God alone is the true ruler of men; and, secondly, inequality of rank, without which there can be no organization. A despotism of mere power and liberalism, which naturally produces socialism, is equaliy objectionable. The ideal state is a civil community ruled by a universal or Catholic church, the principles of which are equally distinct from mere passive pietism, or faith which will know nothing, and from the Protestant doctrine, which is the very radicalism of reason.

Baader ranks among the greatest speculative theologians of modern catholicism, and his influence has extended itself even beyond the precincts of his own church. Among those whom he influenced were R. Rothe, Julius Muller and Hans L. Markensen.

His works were published by a number of his adherents—F. Hoffmann, J. Hamberger, E. v. Schaden, Lutterbeck, von Osten-Sacken and Schluter—Baader's *sammtliche Werke* (16 vols., 1851–60). Valuable introductions by the editors are prefixed to the several volumes. *See* F. Hoffmann, *Vorhalle zur spekulativen Lehre Baader's* (1836); *Grundzüge der Societats-Philosophie Franz Baader's* (1837); *Philosophische Schriften* (3 vols., 1868–72); *Die Weltalter* (1868); *Biographie und Briefwechsel* (Leipzig, 1857); J. Hamberger, *Cardinalpunkte der Baaderschen Philosophie* (1855); *Fundamental-begriffe von F. B.'s Ethik, Politik, u. Religions-Philosophie* (1858); *J. A.* B. Lutterbeck, *Philosophische Standpunkte Baaders* (1854); *Baader's Lehre vom Weltgebaude* (1866); *D.* Baumgardt *F. v. Baader u. die Philosophische Romantik* (1927); Erdmann's *Versuch einer Gesch. d. neuern Phil.;* F. Uberweg, *Grund. der Gesch. der Phil.* (1923). *J.* Claassen, *Franz von Baader's Leben und theosophische Werke* (Stuttgart, 1886–1887), and *Franz von Baader's Gedanken Über Staat und Gesellschaft* (Giitersloh, 1890); Otto Pfleiderer, *Philosophy of Religion* (Eng. trans, 1887); Reichel, *Die Sozietatsphilosophie Franz v. Baaders* (Tiibingen, 1901); Kuno Fischer, *Zur hundertjahrigen Geburtstagfeier Baaders* (Erlangen, 1865).

BAAL, the name of a god, is properly a Semitic word signifying lord or owner. The word is used more generally as a noun of relation, *e.g.* a *ba'al* of hair, "a hairy man" (2 Kings i. 8), b. of wings, "a winged creature," and in the plural, b. of arrows, "archers" (Gen. xlix. 23), b. of oath, "conspirators" (Neh. vi. 18).

In the Old Testament it is regularly written with the article, *i.e.* "*the* Baal"; and the baals of different tribes or sanctuaries were not necessarily conceived as identical, so that we find frequent mention of Baalim, or rather "the Baalim" in the plural. That the Israelites even applied the title of Baal to Yahweh himself is indicated by the occurrence of such names as Jerubbaal (Gideon), Eshbaal (one of Saul's sons) and Beeliada (a son of David, 1 Chron. xiv. 7). The last name appears in 2 Sam. v. 16 as Eliada, showing that El (God) was regarded as equivalent to Baal; cf. also the name Be'aliah, "Yahweh is *baal* or lord," which survives in 1 Chron. xii. 5. However, when the name Baal was exclusively appropriated to idolatrous worship (cf. Hos. ii. 16 seq.), abhorrence for the unholy word was marked by writing *bosheth* (shameful thing) for *baal* in compound proper names and thus we get the forms Ishbosheth, Mephibosheth.

The innumerable baals could be distinguished by the addition of the name of a place or of some special attribute. Accordingly, the baals are not to be regarded necessarily as local variations of one and the same god, like the many Virgins or Madonnas of Catholic lands, but as distinct *numina.* The Baal, as the head of each worshipping group, is the source of all the gifts of nature (cf. Hos. ii. 8 seq., Ezek. xvi. 19); as the god of fertility all the produce of the soil is his, and his adherents bring to him their tribute of first-fruits. He is the presiding genius, patron or cause of all growth and fertility, and baalism, originating, probably, in the observation of the fertilizing effect of rains and streams upon the receptive and reproductive soil, became gross nature-worship. Joined with the baals there are naturally found corresponding female figures known as Ashtāroth, embodiments of Ashtōreth (see ASTARTE; ISHTAR). In accordance with primitive ideas which assume that it is possible to control or aid the powers of nature by the practice of "sympathetic magic" (see MAGIC), the cult of the baals and Ashtāroth was characterized by gross sensuality and licentiousness. The fragmentary allusions to the cult of Baal Peor (Num. xxv., Hos. ix. 10, Ps. cvi. 28 seq.) exemplify the typical species of Dionysiac orgies that prevailed On the summits of hills and mountains flourished the cult of the givers of increase, and "under every green tree" were practised the cults believed to secure abundance of crops. Human sacrifice (Jer. xix. 5), the burning of incense (Jer. vii. 9), violent and ecstatic exercises, ceremonial acts of bowing and kissing, the preparing of sacred mystic cakes, appear among the offences denounced by the Israelite prophets, and show that the cult of Baal (and Astarte) included the characteristic features of heathen worship which recur in various parts of the Semitic world, although attached to other names.

A Baal of the heavens appears to have been known among the Hittites in the time of Rameses II.; and considerably later, at the beginning of the 7th century, it was the title of one of the gods of Phoenicia. In Babylonia, from a very early period, Baal became a definite individual deity (Bel), and was identified with the planet Jupiter. This development is a mark of superior culture and may have been spread through Babylonian influence. Both Baal and Astarte were venerated in Egypt at Thebes and Memphis in the 19th dynasty, and the former, through the influence of the Aramaeans who borrowed the Babylonian spelling Bel, ultimately became known as the Greek Bēlos who was identified with Zeus. Of the worship of the Tyrian Baal, who is also called Melkart (king of the city), and is often identified with the Greek Heracles, but sometimes with the Olympian Zeus, we have many accounts in ancient writers, from Herodotus downwards. He had a magnificent temple to which gifts streamed from all countries, especially at the great feasts. The solar character of this deity appears especially in the annual feast of his awakening after the winter solstice (Joseph, contra *Apionem* i. 18). At Tyre, as among the Hebrews, Baal had his symbolical pillars, one of gold and one of smaragdus, which, transported by phantasy to the farthest west, are still familiar to us as the Pillars of Hercules. His name occurs as an element in Carthaginian proper names (Hannibal, Hasdrubal, etc.), and a tablet found at Marseilles still survives to inform us of the charges made by the priests of the temple of Baal for offering sacrifices.

The history of Baalism among the Israelites is obscured by the difficulty of determining whether the false worship which the prophets stigmatize is the heathen worship of Yahweh under a conception, and often with rites, which treated him as a local nature god; or, whether Baalism was concciously recognized to be distinct from Yahwism from the first. The earliest certain reaction against Baalism is ascribed to the reign of Ahab, whose marriage with Jezebel gave the impulse to the introduction of a particular form of the cult. In honour of his wife's god, the king, following the example of Solomon, erected a temple to the Tyrian Baal. This, however, did not prevent him from remaining a follower of Yahweh, whose prophets he still consulted, and whose protection he still cherished when he named his sons Ahaziah and Jehoram ("Yah [weh] holds," "Y. is high"). The antagonism of Elijah was not against Baalism in general, but against the introduction of a rival deity. But by the time of Hosea (ii. 16 seq.) a further advance was marked, and the use of the term "Baal" was felt to be dangerous to true religion. Thus there gradually grew up a tendency to avoid the term, and in accordance with the idea of Ex. xxiii. 13, it was replaced by the contemptuous *bōsheth,* "shame" (see above). However, the books of Deuteronomy and Jeremiah (cf. also Zeph. i. 4) afford complete testimony for the prevalence of Baalism as late as the exile, but prove that the clearest distinction was then drawn between the pure worship of Yahweh the god of Israel and the inveterate and debased cults of the gods of the land. (See further HEBREW RELIGION; PROPHET.)

BIBLIOGRAPHY.—W. Robertson Smith, *Relig. Semites,* 3rd ed. pp. 93–113 and the additional notes pp. 532–536 with the references. On *Beltane* fires and other apparent points of connection with Baal it may suffice to refer to Aug. Fick, *Vergleich. Worterbuch,* who derives the element *bel* from an old Celtic root meaning shining, etc.

(W. R. S.; S. A. C.)

BAALBEK, a town of the Beka' (Coele Syria), known to the ancients as Heliopolis, altitude 3,850ft., on the watershed separating the Lītānī (Leontes) and the 'Asī (Orontes), hard against one of the lower ridges of the Antilebanon: the population is

about 3,000, consisting of Christians, Mohammedans and Mutawilis in approximately equal numbers. Baalbek is the principal town in the eastern district of the State of the Great Lebanon (French mandated territory until 1941, when Lebanon became an independent republic) and is the see of an Uniate Greek bishop. A river, which rises at Ras el-'Ain, one mile E., provides an abundant supply of good water and drives a number of mills. Since 1902 Baalbek has been connected by railway with Damascus and Beirut via Rayāk, and since 1907 with Aleppo. Portions only of the wall, 2 mi. in circumference, which formerly enclosed the town, are still visible, but the main feature of interest is furnished by the vast and stately temple ruins of the Roman period.

History.—Baalbek in classical times was a centre whence roads radiated to Homs, Tripoli, Juneh, Beirut, Damascus, Sidon and Tiberias. The name has given rise to conjecture. Derivations have been suggested from Baal-Melek (Hoflmann), and Baal-Beka' (Puchstein, Kittel) and identifications with Baal-Gad (Josh. xi. 17.—Thomson), Tunip of the Tell-Amarna letters (Halévy, Winckler). A recent identification is with Kar-(H)adad mentioned in a list of cities taken by Tiglath-Pileser III. in 738 B.C. (Dussaud). No doubt it was early a seat of Baal worship and as the Greeks identified Baal with Hēlios they called the city Heliopolis. Augustus (31 B.C.–A.D. 14) made it into a Roman colony (Julia Augusta Felix) and furnished it with a garrison, and about the close of the second century Septimius Severus bestowed upon it the *ius Italicum,* a boon granted to favoured provincial cities. Antoninus Pius (138–161) initiated the building of a sanctuary to Jupiter Heliopolitanus (Hadad?) whose completion engaged the attention of his successors down to Caracalla (211–217). Before Antoninus' time the gods of Baalbek were already famous and Trajan did not disdain to consult the oracle there. Two other temples were erected later, one to Bacchus (or Atargatis?) and the other to Venus (or Fortuna?). Local representations of Jupiter Heliopolitanus depicted him as beardless, with scaly drapery, a whip in his right hand and lightning and ears of grain in his left, therein exhibiting a marked resemblance to the Babyionian conception of Adad. It has been a generally accepted view that Constantine (324–337) or Theodosius (379–395) converted the Great Court of the larger temple into a church, but on fresh evidence a date as late as the 6th century has been claimed for the erection of the Christian basilica (Thiersch). The Arabs under Abu Ubaida took possession of the town in 635 and converted the temple area into a citadel. Baalbek was the scene of fighting between 'Ali and Mu'āwiya, rivals for the caliphate, in 659. El-Welīd (705–71j) is credited with removing the gilded dome of brass from a church in Baalbek (the Basilica?) to set over the rock in Abd el-Malik's mosque (Dome of the Rock) in Jerusalem. The city wall was demolished by Marwān II. (744–748) to chasten the inhabitants for joining an insurrection. According to the Arab historian Makrīzī (15th century), whose family and name were of Baalbek although he himself was born in Cairo, during the Carmathian occupation (10th century) the town suffered a massacre of its inhabitants at the hands of these fanatics. Damascus swayed largely Baalbek's fortunes in the 12th century. In 1110 it was besieged and taken by Tughtakin, emir of Damascus, who suspected its governor of dealings with the crusaders (1110). The crusaders, indeed, raided within sight of its walls, but never took the city. Zengi, emir of Mosul, after a siege secured the surrender of its citadel on promising to spare the lives of the defenders (1139). He kept his promise by flaying the governor alive. The earthquakes which desolated Syria in the 12th century (1139, 1157, 1170) took heavy toll at Baalbek. In 1175 it surrendered to Saladin. The year 1260 marked the arrival of the Mongol Hulagu to enter in and destroy. Yet it arose from its ashes under the rule of the mameluke sultans and to the reign of the enlightened Kalawun (1277–90) its fine Muslim architecture in mosque and fortress must be mainly attributed. The town was sacked by Timur in 1400. An Arab writer of the end of the 15th century describes Baalbek as a "city possessing a strong fortress with columns erected by Solomon, mosques, schools. fine streets, baths, gardens. rivers. all which it mould take too long to describe." In 1j17 it passed with the rest of Syria into the possession of the Turks, whose hold, however, on the Lebanon district continued ineffective, leaving Baalbek in actuality in the hands of the Mutawilis until in the latter half of the 18th century the "Butcher" pasha of Acre (Jezzār) laid it waste. Ibrāhīm Pasha, the adopted son of Mohammed 'Ali of Egypt, occupied it in 1832. Baalbek returned to Turkish possession in 1840, and following the settlement of the Lebanon after the massacres there in 1860 it attracted tourists. In 1941 it came under British and Fighting French control.

Ruins.— The ruins for which Baalbek is world famous are vast and cover an enormous area. European attention was first directed to them in the 16th century by Baumgarten (1507) and Belon du Mans (1553). The destruction of the mighty temple, one of the grandest architectural achievements of all time, was accomplished apparently by a succession of earthquakes, the havoc wrought at Baalbek by that of 1759 being within European ken. From 1898 to 1905 a German expedition under Prof. O. Puchstein investigated the site. (1) *The Acropolis* is situated to the west of the present town. Within its area are included the ruins of two temples with their extensions in side galleries and annexes *(exedrae).* The temples were erected on an artificial terrace formed by an understructure of vaults varying in height from 24ft. to 42ft. above the surrounding terrain. Part of the wall of enclosure on the north-west is formed of enormous blocks of stone. Three of these, built into the wall 20ft. from the ground and most accurately masoned, are each roughly 62ft.×14ft.×11ft. In each block there is said to be sufficient stone to build a square house with 60ft. frontage, 40ft. height and walls 1ft. thick. A companion stone somewhat larger, shaped but not entirely detached from its bed, can still be seen in the quarry on the outskirts of Baalbek to the south-west. Historians of Byzantine times called them *Trilithon* and the name passed to the acropolis. The original main approach to the temple area was on the east by a stairway joyd. wide, which was destroyed to make way for the moat of the Arab fortress. The German expedition reconstructed a part of it (190j). (2) *Propylaea.* At the head of the stairway was a vestibule, 150ft.×36ft. flanked by square towers, with a frontage of 12 columns. of which the bases alone are left. Three of them bear inscriptions to Antoninus Pius, Julia and Caracalla respectively. (3) *Forecourt.* Three gateways in a richly ornamented screen provided entry to a hexagonal-shaped forecourt about 180ft. in diameter with a peristyle. It was flanked north and south by rectangular *exedrae* with four columns of red granite at each entrance. (4) *Great Court.* Through a majestic doorway of three bays (the northern alone remains) entrance was sought to the Great Court, which was roughly 340ft. square or with *exedrae* 450 feet. In it was the altar. The court was surrounded by a peristyle of 84 columns, furnishing access to richly ornamented *exedrae.* (5) *Basilica.* On the site of the Great Court there was erected by the Christians during the 4th or, as is now suggested, the 6th century a *basilica* comprising three naves, the central one being of double width It was built at first facing west and the apses were built into the first landing of the flight of steps leading to the Jupiter temple. Later, when oriented east, a new apse was erected. In the course of excavation half of the imposing altar of sacrifices was discovered and on the north side of the court a long basin (*piscina*) used for lustration. A corresponding one on the south side was destroyed in later times to make way for liturgical baths. This installation was connected at some time or other by means of a passage with the mosque in the south-west corner of the acropolis. (6) *Temple of Jupiter.* An imposing stairway, later disturbed by the apses of the basilica,, led to the temple dedicated to Jupiter-Hadad, or rather to the "gods of Heliopolis." Its shrine (*cella*), 290ft. by 60ft., was surrounded by a peristyle of 19 columns (Corinthian capitals) on each flank and ten on each front. Of these six only are left standing (south side). The columns are 62ft. high and 7½ft. in diameter, each consisting of three blocks bound together with bronze cramp pins. (7) *The Bacchus or Atargatis Temple* Some 40yd. to the south. on a different substructure and less high. stands a temple much smaller but better preserved and equally of Corinthian style. Commonly attributed to Bacchus it has

recently been attributed to Atargatis (Demeter) by Thiersch. The vestibule contains a row of six fluted colunins. Of the 46 columns, each 52ft. high, forming the peristyle, 19 still stand. A wonderful doorway with jambs and lintels elaborately ornamented with bacchantes, satyrs and genii and with vine leaves and stems, leads to the *cella* (87ft.×75ft.), whose walls still stand at half their original height. The sanctuary (*adytum*) at the west end is approached from the *cella* by a short flight of steps. On the south-east of this temple is an Arab bastion of which two out of three storeys remain. Some 300yd. from the acropolis in the midst of the town is a round temple of the late imperial age attributed to Venus (or Fortuna?). Its transformation into a Greek chapel dedicated to St. Barbara (whose place of martyrdom, however, was the Egyptian Heliopolis) ensured its preservation. To the north of the town is a ruined mosque, formerly the church of St. John, and also fragments of the façade of a Roman theatre.

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BAARN, a town in the Netherlands, 5 mi. by rail east of Hilversum. Pop. (1940) 13,248. It is a favourite summer resort of people from Amsterdam. The Baarnsche Bosch, or wood, stretches southward to Soestdyk, where there is a royal country seat, originally acquired by the State in 1795. In 1816 the estate was presented by the nation to the prince of Orange (afterward Ring William II) in recognition of his services at the battle of Quatre Bras. Until the invasion of the Netherlands in 1940, the estate was the residence of Princess Juliana.

BAB, an Arabic word meaning "gate," used largely in place-names in the Near East, as Báb-el-Mandeb (*q.v.*). The word was brought into greater prominence in the phrase "The Bib" as a designation for Mirza Ali Muhammad ibn Radhik, founder of Bábiism (*q.v.*), on account of his taking the name *Báb-ud-Din* (Gate of the Faith) before spreading his teachings.

BABADAG, a Rumanian town in the department of Tulcea. on the main metalled road from Constanza to Tulcea. In 1930 it had a population of 4,607. It is normally a centre for distribution of agricultural produce of the northern Dobruja. It lies upon a railway line under construction at the time of World War II for connecting Tulcea with Mejidia, thus linking up the main Constanza-Bucharest line with Bessarabia at Ismail and ensuring traffic across the Danube. The town is Turkish in origin, having been founded by Bayezid I in the fourteenth century. It served as Turkish headquarters during nineteenth century campaigns against Russia.

BABBAGE, CHARLES (1792–1871), English mathematician and mechanician, was born at Teignmouth, Devonshire. He was educated at a private school and at St. Peter's college, Cambridge. In the years 1815–17 he contributed three papers on the "Calculus of Functions" to the *Philosophical Transactions,* and in 1816 was made a fellow of the Royal Society. With Sir John Herschel and George Peacock he sought to raise the standard of mathematical instruction in England, and especially endeavoured to supersede the Newtonian by the Leibnitzian notation in the infinitesimal calculus. Babbage's attention seems to have been very early drawn to the number and importance of the errors introduced into astronomical and other calculations through inaccuracies in the computation of tables. He contributed to the Royal Society some notices on the relations between notation and mechanism; and in 1822, in a letter to Sir H. Davy, on the application of machinery to the calculation and printing of mathematical tables, he discussed the principles of a calculating machine, to the construction oi which he devoted many years of his life. Government was induced to grant its aid, and he travelled in Europe, examining different systems of machinery; and some of the results of his investigations were published in the cdmirable little work, *Economy of Machinery and Manufactures* (1832). The great calculating machine was never completed; the constructor apparently desired to adopt a new principle when the first specimen was nearly complete, to make it not a difference but an analytical machine, and the government declined to accept the further risk (see CALCULATING MACHINES). From 1828 to 1839 Babbage was Lucasian professor of mathematics at Cambridge. He contributed largely to several scientific periodicals, and was instrumental in founding the Astronomical (1820) and Statistical (1834) Societies. He only once endeavoured to enter public life when, in 1832, he stood unsuccessfully for the borough of Finsbury. During the later years of his life he resided in London, devoting himself to the construction of machines capable of performing arithmetical and even algebraical calculations.

His *Passages from the Life of a Philosopher* (1864) throws considerable light upon his somewhat peculiar character. He wrote *Tables of Logarithms* (1826); *Comparative View of the Various Institutions for the Assurance of Lives* (1826); *Decline of Science in England* (1830); *Ninth Bridgewater Treatise* (1837); *Tlze Exposition of 1851* (1851).

See *Monthly Notices, Royal Astronomical Society,* vol. 32.

BABBITT, IRVING (1865–1933), American scholar, was born in Dayton, O., on Aug. 2, 1865. After graduating at Harvard in 1889 he continued his studies in Paris and in 1893–94 was instructor in Romance languages at Williams college. In 1894 he went to Harvard in the same capacity and was made professor of French literature in 1912. His attention became centred on an analysis of the theories of the classicists, neo-classicists and romantics, and while this was chiefly applied to problems of literary criticism he extended it also to art and politics. His general conclusion was that the romantics, whom he considered chiefly inspired by Rousseau, exaggeraled the two elements of liberty and sympathy and that in the name of these articles of faith they brought about an undesirable confusion of genres. The romantic exaltation of the ego, according to him, injected into the 19th century a spirit of revolt which denied the worth of what he considered fundamental laws and injured artistic and social thought.

Among his publications are: *The New Laokoön* (1910); *The Masters of Modern French Criticism* (1912); *Rousseau and Romaszticism* (1919) and *Democracy and Leadership* (1924).

BABBITT, ISAAC (1799–1862), American inventor, was born in Taunton, Mass., on July 26, 1799. He was trained to be a goldsmith and thus had some opportunity to experiment with metals, in which work he succeeded in making the first britannia ware produced in the United States (1824). Ten years later he went to Boston and while employed there by the South Boston Iron Co., in 1839, he made one of the types of alloy now known as Babbitt metals. They are hard compositions of tin with antimony and copper, and are used for bearings. For this invention he received a gold medal from the Massachusetts Charitable Mechanics' Association and an award of $20,000 from Congress. He became a manufacturer of this metal and of soap. He died in Somerville, Mass., on May 26, 1862.

BABBITT'S METAL, an alloy, invented by Isaac Babbitt, for the special purposes of machine bearings. A typical anti-friction alloy of this type contains 25 parts of tin, 2 parts of antimony and 0·5 part of copper. According to the British Admiralty specification for an anti-friction alloy in marine engines the metal should contain 2 to 7% of copper and 8 to 9% of antimony, the remainder being tin Babbitt metal contains two inter-metallic compounds SbSn and Cu_3Sn; these comparatively hard constituents are set in a soft plastic matrix containing the excess of tin. Alloys consisting of hard and soft constituents are of special value as anti-friction materials. (*See* ANTI-FRICTION METALS.)

BABBLER, the general name applied to members of a large Old World family of birds (Timeliidae), sometimes united with the thrush family (Turdidae). The best known are the Chinese robin (*Liothrix lutea*), the coach-whip bird (*Psophodes*) and the crow-tits (*Paradoxornithinae*).

BABEL, the native name of Babylon (*q.v.*). The name has become associated with the Tower of Babel. According to the narrative in Genesis, mankind after the flood attempted to build a tower whose top would reach unto heaven. They were, however, prevented through their speech being confounded, and the etymology of the name traditionally is found in the Hebrew verb *bālal* to confound. The original of the tower of Babel has been found in the temple of E-Sagila at Babylon but local and Jewish tradition associated it with the stage-tower of Borsippa. It is possible, however, that many of the stage-towers of Mesopotamia may have become confused in the story, which is widely scattered over the world. Versions have been recorded from near the Zambezi and also from Ashanti; among some of the Tibeto-Burman peoples of Assam the story of a tower and confusion of speech is found. Similar tales are found in Mexico, especially with reference to the great pyramid of Cholula, but these stories may be due to culture contact after the introduction of Christianity, as is the case with other Mexican legends.

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BABEL, TOWER OF, according to Gen. xi. a structure which was erected in the plain (or valley) of Shinar and here the confusion of tongues is said to have taken place. The name "Babel," however, gives a totally different interpretation of the structure for it is derived from *bab,* a gate, and *ilu,* god. The "confusion" of tongues would be correctly indicated by *balal,* a Semitic word meaning "to confuse."

The myth on which the building of the Tower of Babel rests is to the effect that at the time when all men formed a single unit and began their wanderings over the earth they arrived at the plain of Shinar and conceived the idea of a structure which would enable them to reach to Heaven. The gods were alarmed at this suggested intrusion and, descending to the earth, struck terror to the hearts of men by confounding their speech so that no man could understand his neighbour. From this time men wandered steadily abroad and founded independent colonies.

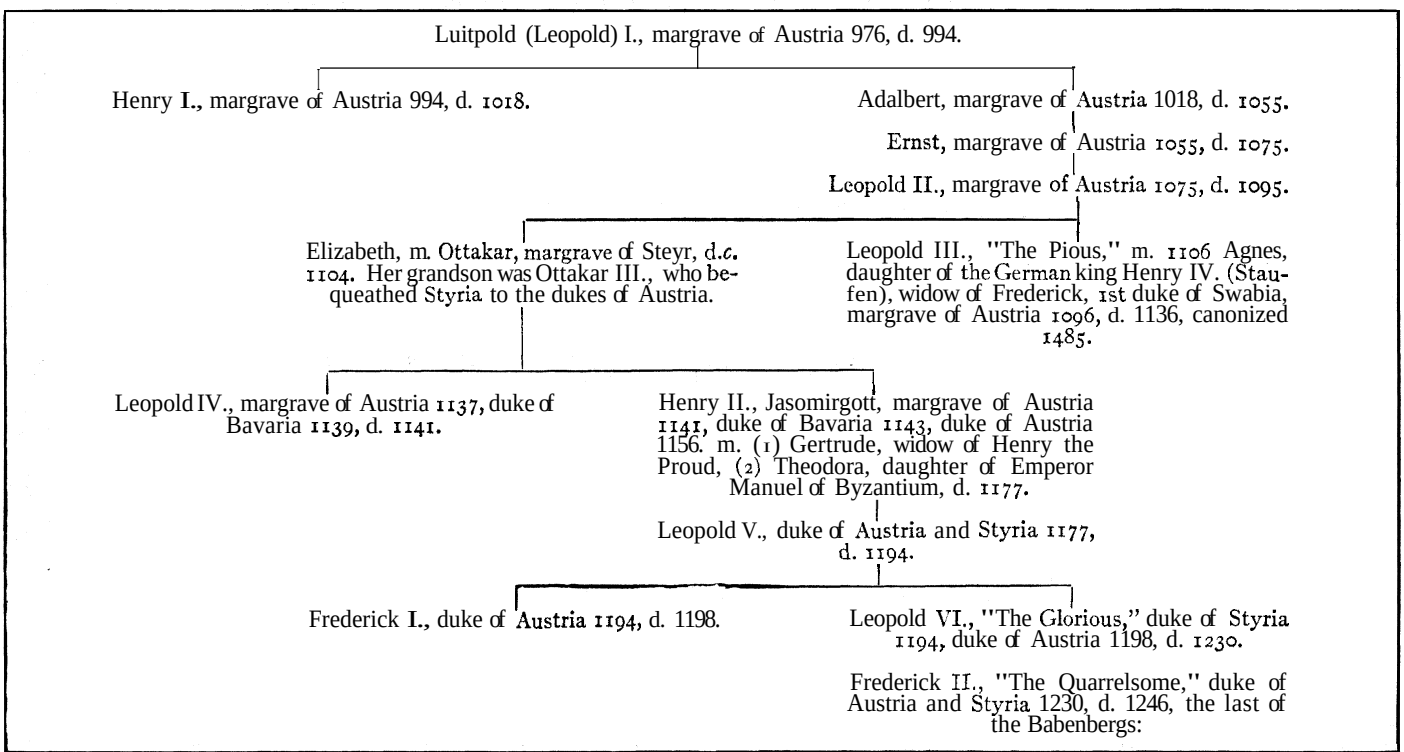
The Tower of Babel is generally identified with *E-temen-an-ki,* the tower north of the Marduk temple *E-sagila,* but it is not known when or by whom it was built. The site of the tower is now but a hole in the ground and is the modern *Es-sahan.*

BAB-EL-MANDEB (Arabic for "The Gate of Tears"—so called from the dangers attending its navigation), a strait between Arabia and Africa connecting the Red sea with the Indian ocean, is 20 mi. across and is divided into two channels by the island of Perim. The western channel is 16 mi. across with 170 fathoms and the eastern 2 mi. with 16 fathoms. Near the African coast is a group of small islands called the "Seven Brothers." The eastern channel has a surface current inwards and the western a strong undercurrent outwards.

BABENBERG, the name of a Franconian family which held the duchy of Austria in the middle ages. Its earliest known ancestor was one Poppo, count in Grapfeld in the 9th century. His son, Henry, margrave and duke in Franconia, fell fighting against the Normans in 886; another son, Poppo, was margrave in Thuringia from 880 to 892, when he was deposed by the German king Arnulf, who favoured the Babenberg's rivals, the Conradines. Henry's three sons, who held the castle of Babenberg on the upper Main, carried on the "Babenberg feud" against the Conradines, till two of them were killed, and the third, Adalbert, on refusing a summons from the regent Hatto I. to appear before the imperial court, was besieged in his castle of Theres, surrendered in 906 and was beheaded.

A Luitpold or Leopold of Babenberg, count in the Donnegau, presumed to be of the above family, was in 976 appointed margrave of the new Ostmark founded that year, which was the nucleus of the later Austria. The history of the family now becomes that of Austria (*q.v.*); the accompanying table shows only the genealogical relationships of the family, which are of some importance for the understanding of German and Austrian history. The Babenbergers were a race of administrators of ability well above the average. The most remarkable of them, personally, was Leopold the Pious.

GENEALOGICAL TABLE OF THE HOUSE OF BABENBERG



BABER, BABAR (1483–1530), a famous conqueror of India and founder of the Mogul dynasty in India. His name was Zahir ud-din Mohammed and he was given the surname of Baber ("tiger"); he was a descendant of Timur and son of Omar Sheik. king of Ferghana. Baber succeeded his father in 1495. In 1497 he successfully fought for Samarkand but, through a rebellion among his nobles, he lost it together with his own kingdom. He continued fighting and regained both territories, but in 1501 he was driven from Samarkand by Shaibani Khan, ruler of the Uzbegs.

In 1504 he crossed the Hindu Kush and after a siege captured Kabul. In the next year he united with Hussain Mirza of Herat against Shaibani; Hussain, however, died and the expedition was abandoned. He returned to Kabul in time to quell a formidable rebellion, but two years later a revolt among some of the leading Moguls drove him from his city. His courage struck the army of his opponents with such dismay that they again returned to their allegiance and Baber regained his kingdom. Once again, in 1510 after the death of Shaibani, he endeavoured to obtain possession of his native country. He received considerable aid from Shah Ismael of Persia, and in 1511 made a triumphal entry into Samarkand. But in 1514 he was utterly defeated by the Uzbegs and with difficulty reached Kabul.

He seems now to have resigned all hopes of recovering Ferghana, and as he at the same time dreaded an invasion of the Uzbegs from the west, his attention was more and more drawn towards India. Several preliminary incursions had been made when in 1521 an opportunity presented itself for a more extended expedition. Ibrahim, emperor of Delhi, was detested even by his Afghan nobles, several of whom called upon Baber for assistance. He at once assembled his forces, 12,000 strong, with some pieces of artillery and marched into India. Ibrahim, with 100,000 soldiers and numerous elephants, advanced against him. The great battle was fought at Panipat on April 21 1526, when Ibrahim was slain and his army routed. Baber took possession of Agra.

A still more formidable enemy awaited him; the Rana Sanga of Mewar collected the enormous force of 210,000 men, with which he moved against the invaders. On all sides there was danger and revolt, even Baber's own soldiers, worn out with the heat of this new climate, longed for Kabul. By vigorous measures and inspiriting speeches he restored their courage, though his own heart was nearly failing him, and in his distress he abjured the use of wine, to which he had been addicted. At Kanwaha, on March 10 1527, he won a great victory and made himself absolute master of northern India. The remaining years of his life he spent in arranging the affairs and revenues of his new empire and in improving his capital, Agra. He died Dec. 26 1530 in his 48th year.

See his *Memoirs*, written by himself, translated into English by Leyden and Erskine (1826); abridged in Caldecott, *Life of Baber* (1844). Also *see* Lane-Poole, *Baber*, "Rulers of India" series (1899).

BABEUF, FRANÇOIS NOEL (1760–1797), known as GRACCHUS BABEUF, French political agitator, was born at St. Quentin on Nov. 23 1760. Until the outbreak of the Revolution he was a domestic servant, and from 1785 occupied the invidious office of *commissaire à terrier*, his function being to assist the nobles and priests in the assertion of their feudal rights as against the unfortunate peasants. The first germ of his future socialism is contained in a letter of March 21 1787, addressed to the secretary of the Academy of Arras. In 1789 he drew up the first article of the *cahier* of the electors of the *bailliage* of Roye, demanding the abolition of feudal rights. During the earlier period of the Revolution he served in various minor posts in Paris and in the provinces. In 1794 he settled in Paris, and on Sept. 3 published the first number of his *Journal de la liberté de la presse*, afterwards *Le Tribun du peuple*. The execution of Robespierre had ended the Terror, and Babeuf—now self-styled "Gracchus" Babeuf—defended the men of Thermidor and attacked the fallen terrorists with his usual violence. But he also attacked, from the point of view of his own socialistic theories, the economic outcome of the Revolution. This was an attitude which had few supporters, even to the Jacobin club, and in October Babeuf was arrested and sent to prison at Arras. Here he came under the influence of certain terrorist prisoners, notably of Lebois, editor of the *Journal de l'égalité*. He emerged from prison a confirmed terrorist and convinced that his Utopia, fully proclaimed to the world in No. 33 of his *Tribun*, could only be realized through the restoration of the constitution of 1793. The universal misery due to the fall in the value of the *assignats* gained him a hearing He gathered round him a small circle of his immediate followers known as the *Société des Égaux*, soon merged with the rump of the Jacobins, who met at the Pantheon. After the club of the Pantheon was closed by Bonaparte, on Feb. 27 1796; his aggressive activity redoubled. In Ventôse and Germinal he published, under the *nom de plume* of "Lalande. soldat de la patrie," a new paper, the *Éclaireur du peuple, ou le défenseur de vingt-cinq millions d'opprimés;* in March of the same year the attempt of the Directory to replace the *assignats* (q.v.) by a new issue of *mandats* created fresh dissatisfaction after the breakdown of the hopes first raised. On April 4 it was reported to the Government that 500,000 people in Paris were in need of relief. From the 11th Paris was placarded with posters headed *Analyse de la doctrine de Baboeuf, tribun du peuple*, of which the opening sentence ran: "Nature has given to every man the right to the enjoyment of an equal share in all property," and which ended with a call to restore the constitution of 1793. Babeuf's song *Mourant de faim, mourant de froid* (Dying of hunger, dying of cold), set to a popular air, began to be sung in the cafés, with immense applause; and reports were current that the disaffected troops in the camp of Grenelle were ready to join an *émeute* against the Government. The Directory thought it time to act; the *bureau central* had accumulated through its agents, notably the ex-captain Georges Grisel, who had been initiated into Babeuf's society, complete evidence of a conspiracy for an armed rising fixed for Floréal 22, year IV. (May 11 1796), in which Jacobins and socialists were combined. On May 10 Babeuf was arrested with many of his associates, among whom were A. Darthé and P. M. Buonarroti, the ex-members of the Convention, Robert Lindet, J. A. B. Amar, M. G. A. Vadier and Jean Baptiste Drouet.

The *coup* was perfectly successful. The last number of the *Tribun* appeared on April 24, but Lebois in the *Ami du peuple* tried to incite the soldiers to revolt, and for a while there were rumours of a military rising. The trial of Babeuf and his accomplices was fixed to take place before the newly constituted high court of justice at Vendôme. On Fructidor 10 and 11 (Aug. 27–28), when the prisoners were removed from Paris, there were tentative efforts at a riot with a view to rescue, but these were easily suppressed. The attempt of five or six hundred Jacobins (Sept. 7) to rouse the soldiers at Grenelle met with no better success. On Prairial 7 (April 26 1797) Babeuf and Darthé were condemned to death; some of the prisoners, including Buonarroti, were exiled; the rest, including Vadier and his fellow conventionals, were acquitted. Drouet had succeeded in making his escape, according to Barras, with the connivance of the Directory. Babeuf and Darthé were executed at Vendôme on Prairial 8 (1797).

Historically, Babeuf's importance lies in the fact that he was the first to propound socialism as a practical policy, and the father of the movements which played so conspicuous a part in the revolutions of 1848 and 1871.

See V. Advielle, *Hist. de Gracchus Babeuf et du Babouvisme* (1884); *P.* M. Buonarroti, *Conspiration pour l'égalité, dite de Babeuf* (1828; English trans. by Bronterre O'Brien, 1836); *A.* Schmidt, *Tableaux de la Révolution française, etc.* (Leipzig, 1867–TO) a collection of reports of the secret police; E. B. Bax, *The Last Episode of the French Revolution* (1911); *R.* W. Postgate, *Revolution from 1789 to 1906 (1920)*; *A.* Prigozhin, *Grakklt Babeuf* (Moscow, 1924).

BÁBÍISM, the religion of the Báb (The Gate), initiated by his proclamation at Shiraz, Persia, on May 23, 1844.

The traditions of Islam had preserved throughout the Mohammedan world a popular conviction that in the "year sixty" would arise the Qa'im, the Messiah, destined to establish the final and complete victory of Islam upon earth. Though the prophecies foretelling this event were interpreted differently by the two branches into which Islam had become divided, the shiah and sunni sects, all Mohammedans agreed that Mohammed was the "Seal of the Prophets"—the final divine revelation—and that the mission of the Qá'im (or Imām Mihdi) must therefore be na other than the purification of the religion of the Qur'ān and its acceptance by mankind.

It was with this expectancy, so closely parallelling that held by the Jews before the coming of Christ, that the Báb became identified in the eyes of the clergy and people during the early days of his mission. Had he confined his aim and effort to the

reform of morals and worship within the framework of traditional Mohammedanism, the Báb might not have aroused the implacable hatred of the ecclesiastics nor awakened the fear of the government itself. It was his action in revealing a new Holy Book, and in abrogating the religious laws of the Qur'ān, which led to the charges that he was the destroyer of religion and the source of rebellion against the state.

The Báb made acceptance of his spiritual station the touchstone of true faith in God, and by his followers he was given the complete devotion due to a Prophet.

The Báb's own words, however, made it clear that while his authority was equal to that of Mohammed, he was likewise the herald of a succeeding and greater Manifestation, "He Whom God Would Manifest," by whose teaching and spiritual power the diverse religions of mankind would be fulfilled in one universal Faith. "I have revealed myself for His Manifestation, and have caused my Book, the Bayán, to descend upon you for no other purpose except to establish the truth of His Cause."

The civilization of Persia at that period was one of ignorance and superstition, a church-state combining materialism and tyranny to suppress the masses of the people. The spirit of pure religion, however, had in leaders like Aḥmad-i-Aḥsá'í and Siyyid Kázim-i-Rashtí, fostered the hope that ancient prophecy would come to realization, and spread to all parts of Islam their teachings that the appearance of the Promised One was imminent. The Báb's first disciples were known as "Letters of the Living," seventeen men and one woman, the famous martyr Tahirih, all of whom were led intuitively to recognize the truth of the Bib's claim. The Báb's charge to these disciples, as he sent them forth to spread the gospel of the new age, restored to religion a consecration and purity the church-state could not evoke nor even recall: "O my beloved friends! You are the bearers of the name of God in this Day. You have been chosen as the repositories of His mystery. It behooves each one of you to manifest the attributes of God, and to exemplify by your deeds and words the signs of His righteousness, His power and glory. The very members of your body must bear witness to the loftiness of your purpose, the integrity of your life, the reality of your faith, and the exalted character of your devotion. . . . Such must be the purity of your character and the degree of your renunciation, that the people of the earth may through you recognize and be drawn closer to the heavenly Father who is the Source of purity and grace. . . . The days when idle worship was deemed sufficient are ended. The time has come when naught but the purest motive, supported by deeds of stainless purity, can ascend to the throne of the Most High and be acceptable unto Him. . . . I am preparing you for the advent of a mighty Day. . . . Scatter throughout the length and breadth of this land, and, with steadfast feet and sanctified hearts, prepare the way for His coming."

None of these disciples survived the storm of opposition which gathered when the full implication of the Bib's religion became understood, and the Báb himself was executed by a regiment of soldiers in the public square of Tabriz on July 9, 1850, under orders given by the Vizier when the Bib's doom had been pronounced by leaders of Islam.

The history of religion records no persecution more savage than that inflicted upon the Babis. The total slain by mobs under severest torture with civil and ecclesiastical sanction is believed to have exceeded twenty thousand men, women and children. The influence of the Bib himself upon those who saw and heard him, even his guards and jailors, was one of overwhelming spiritual radiance and beauty.

After the martyrdom of the Báb a few of his followers sought to maintain a permanent "Bábi" movement, and this sect became known as Ezelis, from their leader, Subhi-Ezel. The majority, however, true to the fundamental character of the Báb's mission, became Bahá'ís.

The cycle of the Bib's religion was the period of nineteen years. from 1844 to 1863, when Bahá'u'lláh was accepted as the Manifestation heralded by the Báb. The Báb's physical remains, secretly buried and hidden in Persia, were in 1909 transported to Haifa, Palestine, and by 'Abdu'l-Bahá laid away in the shrine he had prepared on Mount Carmel. The Bib and Bahá'u'lláh are held by the Bahá'ís to be the co-founders of their faith. *(See* BÁHÁ'Í FAITH.)

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BABINGTON, ANTHONY (1561–1586), English conspirator, son of Henry Babington of Dethick in Derbyshire, and of Mary, daughter of George, Lord Darcy, was born in October 1561, and was brought up secretly a Roman Catholic. As a youth he served at Sheffield as page to Mary queen of Scots, for whom he early felt an ardent devotion. In 1580 he came to London, attended the court of Elizabeth, and joined the secret society formed that year supporting the Jesuit missionaries. In 1582, after the execution of Father Campion, he withdrew to Dethick, and later went abroad. He became associated at Paris with Mary's supporters who were planning her release with the help of Spain, and on his return he was entrusted with letters for her. In April 1586 he became, with the priest John Ballard, leader of a plot to murder Elizabeth and her ministers, and organize a general Roman Catholic rising in England and liberate Mary. The conspiracy included, in its general purpose of destroying the government, a large number of Roman Catholics, and had ramifications all over the country. Philip II. of Spain promised to assist with an expedition directly the assassination of the queen was effected. Babington entered into a long correspondence with Mary, which was intercepted by the spies of Walsingham. On Aug. 4 Ballard was seized and betrayed his comrades, probably under torture. Babington then applied for a passport abroad, for the ostensible purpose of spying upon the refugees, but in reality to organize the foreign expedition and secure his own safety. The passport being delayed, he offered to reveal to Walsingham a dangerous conspiracy, but the latter sent no reply, and meanwhile the ports were closed.

One night while supping with Walsingham's servant, he observed a memorandum of the minister's concerning himself, fled to St. John's Wood, where he was joined by some of his companions, and after disguising himself succeeded in reaching Harrow, where he was sheltered by a recent convert to Romanism Towards the end of August he was discovered and imprisoned in the Tower.

On Sept. 13–14 he was tried with Ballard and five others by a special commission, when he confessed his guilt, but strove to place all the blame upon Ballard. All were condemned to death for high treason On the 19th he wrote to Elizabeth praying for mercy, and the same day offered £1,000 for procuring his pardon; and on the 20th, having disclosed the cipher used in the correspondence between himself and Mary, he was executed in Lincoln's Inn Fields. The detection of the plot led to Mary's own destruction.

There is no positive documentary proof in Mary's own hand that she had knowledge of the intended assassination of Elizabeth, but her circumstances, together with the tenour of her correspondence with Babington, place her complicity beyond all reasonable doubt.

BABINGTON, CHURCHILL (1821–1889), English classical scholar and archaeologist, was born at Roecliffe, in Leicestershire, on March 11, 1821, and studied at St. John's college, Cambridge. He died at Cockfield, Suffolk, of which place he was vicar, on Jan. 12, 1889. From 1865 to 1880 he held the Disney professorship of archaeology at Cambridge. In his lectures, illustrated from his own collections of coins and vases, he dealt chiefly with Greek and Roman pottery and numismatics. He brought out the *editio princeps* of the speeches of Hypereides *Against Demosthenes* (1850), *On Behalf of Lycophron and Euxenippus* (1853), and his *Funeral Oration* (1858). It was by his edition of these speeches from the papyri discovered at Thebes (Egypt) in 1847 and 1856 that Babington's fame as a Greek scholar was made. In addition to contributing to various classical and scientific journals,

he catalogued the classical mss. in the university library and the Greek and English coins in the Fitzwilliam Museum, for which he did great service.

BABIRUSA, the wild swine of Celebes and Buru (*Babirusa alfurus).* The skin is nearly naked, and very rough and rugged. The peculiarity of this genus is the development of the canines, or tusks, of the male. These teeth are ever-growing, long, slender and curved, and without enamel. Those of the upper jaw are directed upwards from their bases, so that they never enter the mouth, but pierce the skin of the face; they curve backwards, downwards, and finally often forwards again, almost or quite touching the forehead. Wallace remarks that "it is difficult to understand what can be the use of these horn-like teeth. It is conceivable that these tusks were once useful, and were then worn down as fast as they grew, but that changed conditions of life have rendered them unnecessary, and they now develop into a monstrous form. . . . In old animals they reach an enormous size, and are generally broken off as if by fighting." *See* SWINE; PECORA.

BABOON, properly the designation of the long-muzzled, medium-tailed Egyptian monkey, *Papio anubis;* in a wider sense applied to all the members of the genus *Papio* now confined to Africa and Arabia, although in past times extending into India. Baboons are large terrestrial monkeys with short or medium-sized tails, and long naked dog-like muzzles, in the truncated extremity of which are pierced the nostrils. They frequent barren rocky districts in large droves, and are exceedingly fierce and dangerous to approach. They have large cheek-pouches, large naked callosities, often brightly coloured, on the buttocks, and short thick limbs, adapted to walking. Their diet includes everything eatable they can capture or kill. The representative of the genus is the yellow baboon (*P. cynocephalus*), distinguished by its small size and grooved muzzle. It ranges from Abyssinia to the Zambezi. The anubis baboons were tamed by the ancient Egyptians. *(See* PRIMATES; CHACMA; DRILL; GELADA and MANDRILL.)

THE ASHY GREY ARABIAN BABOON ATTAINS A HEIGHT OF 4 FT. IT WAS WORSHIPPED BY THE EGYPTIANS AS ANUBIS

BABRIUS, author of a collection of fables written in Greek. He is supposed to have been a Roman, living in the East, probably in Syria, where the fables seem first to have gained popularity. The address to "a son of King Alexander" has caused much speculation. The Alexander referred to may have been Alexander Severus (A.D. 222–235). There is no mention of Babrius in ancient writers before the beginning of the 3rd century A.D., and his language and style seem to show that he belonged to that period. The first critic who made Babrius more than a mere name was Richard Bentley, in his *Dissertation on the Fables of Aesop.* In an examination of these prose fables, which had been handed down from the time of Maximus Planudes, Bentley discovered traces of versification, and was able to extract a number of verses which he assigned to Babrius. Tyrwhitt *(De Babrio,* 1776) and other scholars followed up these researches. In 1842 M. Minas, a Greek, the discoverer of the *Philosophoumena* of Hippolytus, came upon a ms. of Babrius, now in the British Museum, in the convent of St. Laura on Mt. Athos. This ms. contained 123 fables, arranged alphabetically, but breaking off at the letter O. The fables are written in choliambic, *i.e.,* limping iambic verse, having a spondee as the last foot. The style is extremely good. Their genuineness was generally admitted by scholars. In 1857 Minas professed to have discovered at Mt. Athos another ms. containing 94 fables and a preface. but this was soon proved to be a forgery. Six more fables were brought to light by P. Knöll from a Vatican ms. (ed. by A. Eberhard, *Analecta Babriana,* 1879).

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BABU, a native Indian clerk. The word is really a term of respect attached to a proper name, like "Mr." and *Babu-ji* is still used in many parts of India, meaning "sir"; but without the suffix the word is generally used contemptuously as signifying a semi-literate native with a veneer of European education.

BABY BLUE-EYES (*Nemophila insignis),* a small North American plant of the water-leaf family, *Hydrophyllaceae,* one of the most popular wild flowers of California, native to moist places in valleys and mountains. It is a low usually diffuse annual, with stems about 6 in. long, minutely hairy divided leaves and bell-shaped light to deep blue flowers, ½ in. to 1½ in. across, often veined with purple and dotted toward the centre. Cultivated as a border or rock garden plant, it blossoms from early spring to late summer. *(See* NEMOPHILA.)

BABY BOND, in the United States a bond having a face or par value of $100 or less. Such bonds enable small investors to diversify their risks to an extent impossible with bonds of the usual $1,000 denomination. *(See* BOND.)

BABY FARMING, a term meaning generally the taking in of infants to nurse for payment, but usually with an implication of improper treatment. Previous to the year 1871 the abuse of the practice of baby farming in England had grown to an alarming extent. The evil was, no doubt, largely connected with the question of illegitimacy, for there was a widespread existence of baby-farms where children were received without question on payment of a lump sum. Such children were nearly all illegitimate, and in these cases it was to the pecuniary advantage of the baby-farmer to hasten the death of the child. It had become also the practice for factory operatives and mill-hands to place out their children by the day, and since in many cases the children were looked upon as a burden and a drain on their parents' resources, too particular enquiry was not always made as to the mode in which the children were cared for. The form was gone through too of paying a ridiculously insufficient sum for the maintenance of the child.

In 1871 the House of Commons found it necessary to appoint a select committee "to enquire as to the best means of preventing the destruction of the lives of infants put out to nurse for hire by their parents." The practical result of this investigation was the Infant Life Protection Act, 1872, which provided for the compulsory registration of all houses in which more than one child under the age of one year was received for a longer period than twenty-four hours. In 1896 a select committee of the House of Lords sat and reported on the working of chis act. In consequence of this report the act of 1872 was repealed and superseded by the Infant Life Protection Act, 1897, which did away with the system of registration and substituted for it one of notice to a supervising authority. By the act all persons retaining or receiving for hire or reward more than one infant under the age of five, or adopting an infant under two years for a lump sum, paid down, and not exceeding £20, had to give written notice of the fact to the local authority within 48 hours. The local authorities, in this case, the boards of guardians, except in London, where the London County Council is the authority, were empowered to appoint inspectors, and required to arrange for the periodical inspection of infants so taken in, while they could also fix the number of infants who might be retained. The act of 1897 was repealed and amended by the Children Act, 1908, which codified the law relating to children, and added many new provisions. This act is dealt with in the article CHILDREN—PROTECTIVE LAWS.

Decrease of Baby Farming.— The following figures supplied by the British National Society for the Prevention of Cruelty to

Children, show how far less prevalent baby farming is becoming than formerly. In 1918, the society dealt with 29 cases of baby farming, involving 48 children. In 1927 the figures were nine and 13 respectively, with an average of 13 cases and 28 children for a period of ten years.

In Australia all the states have passed legislation with the object of supervising and ameliorating the conditions of infant life. The Government departments control the boarding out to suitable persons of the wards of the state. In South Australia there is a State Children's Council, which, under the State Children Act of 1895, has large powers with respect to the oversight of infants under two years boarded out by their mother. "Foster-mothers," as the women who take in infants as boarders are called, must be licensed, while the number of children authorized to be kept by the foster-mother is fixed by licence; every licensed foster-mother must keep a register containing the name, age and place of birth of every child received by her, the names, addresses and description of the parents or of any person other than the parents from or to whom the child was received or delivered over, the date of receipt or delivery over, particulars of any accident to or illness of the child, and the name of the medical practitioner (if any) by whom attended. In New South Wales the Child Welfare Act, 1923, covers the conditions under which children are boarded out. In Victoria the Infant Life Protection Act, 1915, provides for similar conditions. Provision is also made for the medical care of boarded-out children and it is the duty of the medical officer so appointed to attend these children, when required, at the expense of the State.

In New Zealand the "Children's Protection Act, 1890," the "Adoption of Children Act, 1895," and the "Infant Life Protection Act, 1907" were consolidated and incorporated in the "Infants' Act, 1908." The "Child Welfare Act, 1925," has also helped to give the matter an appropriate and efficient status, more especially by providing for child welfare officers, whose duty it is to assist and guide unmarried mothers, either by placing the child in a suitable foster home or by advising the mother about affiliation proceedings, or helping her to find employment. (J. HA.)

BABYLON, one of the most famous cities of antiquity, is situated on the Hilla branch of the Euphrates just north of the modern town of Hilla. The rise of Babylon to importance seems to have taken place comparatively late in Sumerian history. Up to the present no mention of the town has been discovered in tablets of the pre-Sargonic period, but Sargon is said to have built sanctuaries there. Little is known of the history of Babylonia before the fall of the kingdom of Agade and Babylon itself first appears as the head of an independent kingdom under Sumu-abu at the end of the third millennium B.C. In the struggle which followed between various small cities Babylon was successful and under Hammurabi she became the capital of "Babylonia," ultimately attaining the position of the most important city in western Asia. Her geographical surroundings no doubt contributed considerably to this result. In earlier times the Euphrates flowed past Kish and so long as this city was the centre of a well watered district it possessed a singularly favoured site; but during the third millennium B.C. the Euphrates deserted Kish, and Babylon, only a few miles to the west but beside the new course of the stream, succeeded the old city.

Such minor changes in the river explain the position of the actual city of Babylon but do not account for the very wide influence which she afterwards attained. In this region there is only a narrow strip of land between the Tigris and the Euphrates. Under primitive conditions Mesopotamia was naturally divided into three parts, the upper Tigris fertile belt, which later developed into the kingdom of Assyria, the middle land to which Kish and, later, Babylon held the key and the lower region at the head of the Persian gulf. By the time that Babylon had succeeded to Kish, growth of organization had led the way to empires of wider extent than the comparatively small city-states of earlier times and Babylon, as queen of the central region, succeeded to suzerainty over the whole of Mesopotamia, holding as she did the narrow way between the north and south: for then, as now, the only practical road through Mesopotamia lies along the river valleys.

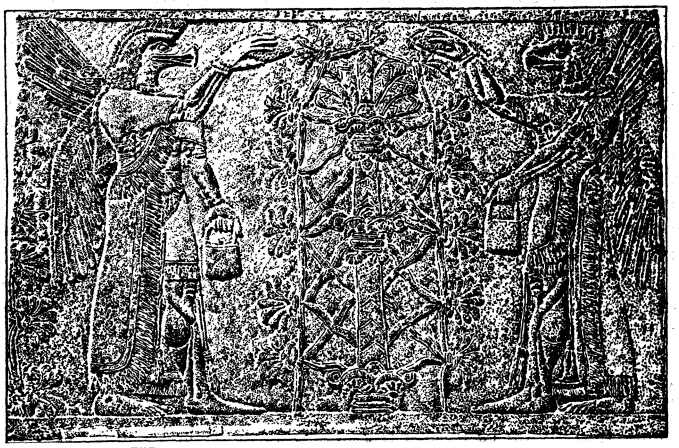
Advantageous as is Babylon's geographical position, other factors helped to make her a dominant city for a long period. Throughout the whole history of Mesopotamia, ancient as well as modern, religion has played an important part in giving prestige and power to a city. In Mesopotamia from the time of Hammurabi onwards the worship of Marduk was specially associated with Babylon. The priesthood acquired considerable power, and even the kings of Assyria found it politic to receive what was practically a coronation rite in Babylon. The priests did not fail to take advantage of the murder of Sennacherib and to proclaim that this misfortune was due to the failure of that prince to submit to Marduk; further it is not without significance that, as Langdon has shown, there was "consistent reference to the great temple of Marduk on the very bricks employed in the reconstruction of older and far more famous sanctuaries throughout Babylonia." Although this is ascribed by Langdon to local Babylonian pride, it is possible that behind this pride there lay the definite policy of a priesthood anxious under all circumstances to glorify the temples under its own control.

We have then in Babylon three factors at work, first geographical, second political and third spiritual. Geographically, owing to the circumstance of a change in the water supply Babylon succeeded to her previously powerful neighbour Kish. Secondly, while the neck of land between the rivers holds the key to power in Mesopotamia, political happenings at a very critical period enabled Babylon to obtain the first place amongst the other cities in the same region. Thirdly even after political power had passed from Babylon the spiritual power which her priesthood had obtained in the time of her political greatness continued to uphold the prestige of the city.

Although the history of Babylon is practically the history of Mesopotamia yet certain details are necessary to understand the topography of the city as described by classical writers and revealed by modern excavators. There are well defined periods. Old Babylon, the capital of Hammurabi and his successors, was almost entirely destroyed by Sennacherib who levelled the city to the ground in 689 B.C. Esarhaddon built a new town on the same site but his elder son, who succeeded to Babylonia, revolted against Assyria. Babylon suffered the horrors of a siege and was eventually captured by Assur-bani-pal. The fall of the Assyrian empire which followed was considered, at least by the pious upholders of Babylon's spiritual supremacy, as an act of divine vengeance on the king who like his predecessor Sennacherib did not offer royal homage to Marduk. In the period which followed Nabopolassar and his son Nebuchadrezzar built the city whose remains have survived until to-day; and it was at this time that Babylon, like Baghdad under the Caliphs and Peking under Kublai Khan, attained its greatest fame. But the end was not far off. The walls were destroyed by sieges, and Xerxes, after his capture of the city, still further continued the reduction of such defensive works as remained; but the murder of Alexander in the palace of Nebuchadrezzar, and even cuneiform texts under the Seleucids, show that much of the old town remained. In 275 B.C. the inhabitants were removed to the new city of Seleucia and with that event the history of Babylon ends. Although the rivalry of Persian religion had done much to destroy the prestige of the old temples, and although the place was depopulated, sacrifices were still performed there in the second century B.C.

In spite of the statements of classical writers and the work of the German excavators the topography of Babylon is still far from clear. The earliest Greek writer on the city is Herodotus, whose account, somewhat confused in places, is probably that of an eye-witness, though Sayce thinks he never visited Babylon. Herodotus describes the town as standing on a broad plain and forming an exact square, each side measuring 120 stades, which, if the length of a stade be estimated at 200 yards, is equal to 14 miles. Other classical writers give lesser estimates, Ctesias for instance suggests that the total periphery of the walls was 360 stades, 42 miles. Various attempts have been made to correlate these statements with the remains which can be observed. Some writers have preferred to ignore the literary evidence and to suppose that they represent an exaggeration of the truth, excavations having

shown that the actual walls of the city have an extent of only about $2\frac{1}{4}$ miles. Other explanations have been offered. First it is suggested that Herodotus included in his wall the neighbouring town of Borsippa, which lay on the east bank of the river. Langdon on the other hand relying both on a cuneiform text and on personal observation of the site concludes that the great line of walls which run from Kish to the Euphrates north of Babylon are part of the defences of the city erected by Nebuchadrezzar and



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

BABYLONIAN STONE RELIEF IN THE BRITISH MUSEUM, SHOWING TWO BIRD-HEADED DEITIES PLUCKING FRUIT FROM THE SACRED TREE

are therefore rightly included by Herodotus in his estimate of the length of the wall. When the plain is viewed from the top of the great mound of Babil, these ancient defences even now form a conspicuous feature in the landscape on a clear day and might easily be confused with the true city walls by one who wrote afterwards largely from memory. While it is possible to trace the actual extent of the walls from their ruins and to compare them with the measurements given by ancient writers the actual height cannot of course be restored and here it is clear that the statements of ancient authorities which give them a height of 300 ft. or over are impossible and that no exact estimate can be made on the basis of existent data.

Herodotus appears to have been guilty of a further confusion or possibly an omission. He states that there was an outer and inner wall. If the outer wall is correctly identified with Nebuchadrezzar's defences, the inner wall may possibly be the equivalent of the mall called by the excavators the outer wall, of which the ruins stand to-day a few hundred yards west of the canal outside the city. Inside these walls are yet other walls, which were either ignored by Herodotus or are his inner walls, in which case he has made an entirely wrong estimate of the outer walls. The actual plan of the city is equally difficult to reconcile with Herodotus' account. There appear to be three different series of mounds. To the north lies the mound of Babil, which has been considered by some writers as being the site of a palace of Nebuchadrezzar and possibly of the hanging gardens. No mention is made of these gardens by Herodotus and the identification rests on the presence of ancient irrigation works only.

About $1\frac{1}{2}$ m. south of Babil lies the mound of Al Qasr Excavations have shown that this mound contained the palace of Nebuchadrezzar, which was built nest to the former palace of Nabopolassar and to the east of the "Gate of Ishtar" from which a raised processional way led southwards. The east side of the mound also contained another small temple. To the south of the Qasr mound lie a series of ruins which include what appears to have been the most densely populated part of the city in ancient times, a great stage tower, and—though the identification has been questioned—the remains of E-sagila, the great temple of Marduk. This is said to have been in the centre of Babylon and to have been destroyed by Xerxes. Unfortunately here our description by Herodotus does not give any assistance as if Xerxes did destroy it Herodotus could not have seen it and he may therefore have confused the temple with some other temple of Marduk, possibly that at Borsippa.

In spite, then, of considerable excavations and of the frequent mention of Babylon both in ciassical writers and in cuneiform texts the actual topography of the city is still not clearly known, and many points still await investigation.

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BABYLONIA AND ASSYRIA. Geographically as well as ethnologically and historically, the whole district enclosed between the two great rivers of western Asia. the Tigris and Euphrates, forms but one country. a fact recognized by the earliest authorities. It naturally falls into two divisions, the northern being more or less mountainous, while the southern is flat and marshy. In the earliest times of which we have any record, the northern portion was included in Mesopotamia (*q.v.*); it was definitely marked off as Assyria only after the rise of the Assyrian monarchy. With the exception of Assur, the original capital, the chief cities of the country, Nineveh, Calah and Arbela, were all on the left bank of the Tigris. The great Mesopotamian plain, the modern El-Jezireh, is about 250 miles in length, interrupted only by a single limestone range, rising abruptly out of the plain, and branching off from the Zagros mountains under the names of *Sarazūr, Hamrin* and *Sinjar*. The numerous remains of old habitations show how thickly this level tract must once have been peopled North of the plateau rises a well-watered and undulating belt of country, into which run low ranges of limestone hills, sometimes arid, sometimes covered with dwarf-oak, and often shutting in, between their northern and north-eastern flank and the main mountain-line from which they detach themselves, rich plains and fertile valleys. Behind them tower the massive ridges of the Niphates and Zagros ranges, where the Tigris and Euphrates take their rise, and which cut off Assyria from Armenia and Kurdistan.

The name Assyria itself was derived from that of the city of Assur (*q.v.*) or Asur, now Qal'at Sherqat (Kaleh Shergat), which stood on the right bank of the Tigris, midway between the Greater and the Lesser Zab.

In contrast with the arid plateau of Mesopotamia stretched the rich alluvial plain of Chaldaea, formed by the deposits of the two great rivers by which it was enclosed. The soil was extremely fertile, and teemed with an industrious population. Eastward rose the mountains of Elam, southward were the sea-marshes and the Kaldā or Chaldaeans and other Aramaic tribes, while on the west the civilization of Babylonia encroached beyond the banks of the Euphrates, upon the territory of the Semitic nomads (or Suti). Here stood Ur (*Mugheir,* more correctly *Muqayyar*) the earliest capital of the country; and Babylon, with its suburb, Borsippa (*Birs Nimrūd*), as well as the two Sipparas (the Sepharvaim of Scripture, now *Abu Habba*), occupied both the Arabian and Chaldaean sides of the river (see BABYLON). The Arakhtu, or "river of Babylon," flowed past the southern side of the city, and to the south-west of it on the Arabian bank lay the great inland freshwater sea of *Nejef,* surrounded by red sandstone cliffs of considerable height, 40 m. in length and 35 in breadth in the widest part.

The primitive seaport of the country, Eridu, the seat of the worship of Ea the culture-god, was a little south of Ur (at *Abu Shahrain* or *Nowāwis* on the west side of the Euphrates) It is now about 130 m. distant from the sea; as about 46 m of land have been formed by the silting up of the shore since the foundation of Spasinus Charax (*Muhamrah*) in the time of Alexander the Great, or some 115 ft. a year, the city would have been in existence at least 6,000 years ago.

The alluvial plain of Babylonia was called Edin, the Eden of Gen. ii., though the name was properly restricted to "the plain" on the western bank of the river where the Bedouins pastured the flocks of their Babylonian masters. A more comprehensive name of southern Babylonia was Kengi, "the land," or Kengi Sumer, "the land of Sumer," for which Sumer alone came afterwards to be used. Sumer has been supposed to be the original of the Biblical Shinar; hut Shinar represented northern rather than southern Babylonia, and was probably the Sankhar of the Tell

el-Amarna tablets. Opposed to Kengi and Sumer were Urra (Uri) and Akkad or northern Babylonia.

The country was thickly studded with towns, the sites of which are still represented by mounds, though the identification of most of them is still doubtful. The latest to be identified are Bismya, between Nippur and Erech, which American excavations have proved to be the site of Udab (also called Adab and Usab) and the neighbouring Fāra, the site of the ancient Kisurra. The dense population was due to the elaborate irrigation of the Babylonian plain which had originally reclaimed it from a pestiferous and uninhabitable swamp and had made it the most fertile country in the world. The science of irrigation and engineering seems to have been first created in Babylonia, which was covered by a network of canals, all skilfully planned and regulated. The three chief of them carried off the waters of the Euphrates to the Tigris above Babylon—the Zabzallat canal (or Nahr Sarsar) running from Faluja to Ctesiphon, the Kutha canal from Sippara to Madain, passing Tell Ibrahim or Kutha on the way, and the King's canal or Ar-Malcha between the other two. Thanks to this system of irrigation the cultivation of the soil was highly advanced in Babylonia. According to Herodotus (i. 193) wheat commonly returned two hundred-fold to the sower, and occasionally three hundred-fold. Pliny (H. N. xviii. 17) states that it was cut twice, and afterwards was good keep for sheep, and Berossus remarked that wheat, sesame, barley, ochrys, palms, apples and many kinds of shelled fruit grew wild, as wheat does in the neighbourhood of Anah. (A. H. S., A. N. J. W.)

ARCHAEOLOGY

In the history of the civilization of Babylonia there are broad archaeological differences between the following periods (1) the prehistoric age, a period without written historical records, before 3500 B.C.; (2) the early Sumerian period, from before 3000 B.C. to about 2500 B.C., of which there is a continuous tradition, occasionally verified and corrected by historical documents; (3) the Agade period, about 2500 B.C. to 2400 B.C.; (4) the dynasty of Gutium and the 3rd dynasty of Ur, about 2400–2150 B.C.; (5) from the dynasties of Isin and Larsa to the end of the 1st dynasty of Babylon, about 2150–1740 B.C.; (6) the Kassite dynasty from about 1740–1150 B.C.; (7) the period of Assyrian domination and the new Babylonian empire, lasting do n to the capture of Babylon of Cyrus in 539 B.C.; (8) the Achaemenian period, down to the victory of Alexander over Darius Codomannus; (9) the Seleucid age, merging into the Parthian.

PREHISTORIC PERIOD

No flint weapons or other remains of a palaeolithic or true neolithic culture have been found in Babylonia or Assyria, and it is doubtful whether the river valleys were ever inhabited by men unacquainted with the use of metal. The earliest settlements are marked by the use of painted pottery with elaborate geometric designs and of flint weapons of the kind called "chalcolithic," showing the difference of metal types. Painted hand-made pottery has been found in a connection that proves it to be earlier than the historic 1st dynasty of Ur by a not inconsiderable interval at Tall al 'Ubaid, near the city of Ur. At Susa there have been found two distinct classes of this pottery, the one of fine clay, porous and therefore unsuitable for domestic use, in a restricted number of shapes, and always confined to graves, with a decoration that marks the end of a long development; the other is thick, in ordinary use, and markedly different in decoration. Three views are held as to the Susa pottery, (1) that the second style developed out of the first, (2) that there was a gap between them, and that the second marks the advent of a different race, (3) that the two styles were at least in part contemporary, and that their difference depends upon the object in view. On other sites, at Bender Bushire, Jamdat Nasr (near Kish), Samarra, Nineveh, Qal'at Shirqāt, painted pottery has been found belonging to an early period, but it cannot be proved that it is in all cases contemporary. The differences to be noted may, however, be due to local differences. In general it may be said that everywhere in these two countries a painted pottery age preceded the advent of a Sumerian civilization of the second period.

Painted pottery did not go out of use suddenly in Babylonia; the last stages are marked by a decrease in the amount of decoration, and it is then found together with a pottery occasionally plain, sometimes decorated with incised patterns. In this last period writing was already known, since tablets have been found with such pottery; the system of numeration used on these tablets is not the sexagesimal, which was characteristic of the Sumerians, though the writing seems closely related with Sumerian.

Besides pottery and flints there are some very roughly made figurines of human beings and animals from the painted pottery period; some jars with handles given the resemblance of human faces, found at Susa and Jamdat Nasr, seem to belong to the end of the period, when plain pottery was more generally used.

The analogy of this painted pottery of Babylonia and Assyria to the early painted wares of Persia, Beluchistan, the Indus valley and even of China has been discussed but no conclusions are as yet agreed upon. The common use of obsidian points to close connections with Armenia. Sumerian traditions of a time before the Flood may perhaps refer to this civilization. Variant lists of ten kings were given and assigned to the towns of Eridu, Bad-tibira, Larak, Sippar and Shuruppak, while Larsa is included in one list; the tradition was already well known by 2200 B.C., and is repeated with some differences partly due to textual corruptions, by Berosus, about 300 B.C. Berosus also related stories about certain creatures which had the bodies and heads of fishes, with human forms below; these seem to correspond to "the seven wise ones" who, according to Babylonian mythology, instructed man in the use of herbs and in prophylactic measures against disease.

EARLY SUMERIAN PERIOD

Bas-reliefs.—According to the dynastic lists of Sumerian kings, the 1st dynasty after the Flood ruled at Kish, and from excavations there some early works of art have been recovered. Fragments of frieze, consisting of white limestone bas-reliefs on a background of date, show a king slaughtering his enemies. and men engaged in tending cattle and dairy work. These reliefs appear to be earlier than the series found at Tall al'Ubaid, 4m. W. of Ur, which are certainly dated to the time of the 1st dynasty of Ur, the 3rd dynasty after the Flood; but the series from there, consisting of shell (*tridacna* squamosa) and limestone bas-reliefs on a background of a bituminous mixture, are in exactly the same technique and serve to show the earliest form of this kind of work. There are differences in the human forms represented; *e.g.*, at Kish the men wear beards, and apparently wigs; at al'Ubaid they are clean shaven. Other peculiarities, such as the milking of the cows from the rear, have been variously explained as due to the clumsiness of the representation or to tribal customs. Almost contemporary with these inlaid reliefs are the stone bas-reliefs on a cylindrical object and on a square plaque from Ur; the latter is notable because it shows a chariot, apparently made of wicker and of wood, covered with an animal skin, drawn either by lions or by composite monsters. The men's dress is also interesting in that it shows the earliest form of the flounced skirt, a single flounce only appearing, and in the centre is a cod-piece resembling a Highlander's sporran. These reliefs immediately precede in point of time the series of plaques with bas-reliefs from Lagash representing Ur-Nina, an early governor of that city, carrying the brick-basket that marks the founder of a temple, facing his family. The last stage in the development of the bas-relief in this period is represented by the "Stele of the Vultures" from Lagash, showing the king, Eannatum, leading his phalanx of warriors, armed with lances, shields and helmets, out to battle, attacking the foe, overwhelming his enemies with a net, and burying the dead, in various registers of a stele with a round top. Minor but sometimes excellent bas-reliefs are to be found on large stone mace-heads and stone vases; on the former, animal and human subjects are both common; on the latter, animal subjects are generally preferred. In some cases the relief becomes actually carving in the round; thus, in a vase supported by a hero struggling with bulls surmounted by birds, parts of the male figure stand free from the background.

Drawings. — Closely associated with the bas-reliefs are shell plaques with incised engravings. The shell is sometimes mother-of-pearl, the incised lines were always originally filled with a red paint. This art is also represented on a stone plaque from Lagash with an inscription of Ur-Enlil. The scenes represented seem to be invariably religious in intention; animals in vegetation, men pouring libations before deities wearing floral crowns, all have some reference to myth or ritual. Some of the shell plaques have been found at Ur in a position which suggests that they formed part of a gaming-board: the perfect example of such a board actually found has only geometrical patterns, or eyes, on the individual plaques. A fine example of engraving is to be found on the silver vase of Entemena representing the bird Im-dugud seizing lions.

Metal-work. — Bas-reliefs were also at this period made of beaten copper; one example is from al 'Ubaid, and the decoration consists of a row of recumbent bulls. The heads are turned outwards, in the round, and affixed separately. They were most probably cast, but some authorities think they were beaten work also. A large example shows a bird holding stags, which had antlers socketed into the head.

Sculpture in the Round. — Metal figures in the round were also made by the same process on bitumen mixtures. Bulls, lions and other animals were built on to wooden frames; in some cases the figures were simply protomae, in others the animal stood quite free. The heads were sometimes inlaid with jasper tongues, teeth, and shell and lapis lazuli eyes; a golden horn seems to show that various metals were sometimes employed. The carving of stone in the round was far less developed. In the majority of instances the human figure is represented. The earliest type is a cross-legged, naked, seated figure; the body is little more than a hulk, the head is disproportionate to the size of the face. Immediately after this must be ranked clumsy seated figures, of women fully robed so that only the head and feet are separately carved, or of men, sometimes cross-legged, with the upper body naked. The last stage, which belongs to the period 2600–2500 B.C., was that of the standing figure; the males wear a full flounced skirt, sometimes decorated with an animal tail apparently used as a dagger-sheath, the women are clothed in various styles, sometimes hooded but never veiled. Various explanations of the manner in which these flounced dresses were put on, and as to the material, have been advanced. It may be that the basis of the cloth was some woven stuff and raw wool twisted into separate hanks was sewn in rows on the cloth. Another view is that a dressed sheepskin was combed, and the wool twisted into the required shape. The statuettes never exceed four feet in height, and seem always to have been placed in temples, to secure the favour of the god. The earliest are cut out of tufa or other volcanic and slightly porous stones, the latest are in hard limestone and diorite, a development probably due to improvement in tools. The eyes and eyebrows were often inlaid. The proportions of the figure are always squat, and the modelling of the naked body is not attempted. The animal heads in stone very closely resemble the metal heads, and were doubtless imitated from them.

Architecture. — The development of architecture within this period covered many centuries. The earliest building appears to have been simply with wet clay. The use of reeds, which allows of large constructions with rounded tops, was at an early date combined with the use of wooden beams; this wattle building was then used in combination with brick construction. The origin of the form of brick common amongst the Sumerians from 3000 B.C. onwards, a plano-convex shape, is not known; the walls so built, well mortared with mud, do not present the unusual appearance that might be expected. Plain brick constructions, in which burnt brick was used for facing walls and foundations, and sun-dried bricks for the interior and upper walls, are found as early as the 1st dynasty of Ur. The most marked feature of the walls is the panelling, and it has been plausibly supposed that this derived from wood constructions. Foundations were, as was always necessary in this country, built upwards. First a terrace of hard mud was laid out and built to a not inconsiderable height; this was faced with burnt brick, and in certain cases the bottom courses were of stone, if available. On this platform the building was marked out and foundation walls of sun-dried brick wider than required built up about two or three feet, and surrounded with stamped mud; on this foundation the building was constructed according to plan. The complete plan of an early building has not yet been recovered, but the external decoration of a small temple at al 'Ubaid has been found. Stone staircases led up to the terrace. The entrance was guarded by copper protomae of bulls. Before the doorway stood round wooden columns, covered either with beaten copper or with white, red and black tesserae wired on to a bitumen covering of the pillars. The wall was decorated in some way with primitive rosettes in white, red and black; the excavator considers that these objects represented flowers and stood free from the wall. There were three rows of friezes fastened by staples, and animal figures in the round may have stood before the wall. A large relief of special significance may have surmounted the entrance.

Sumerian influence may be found in the early temple of Ishtar at the city of Ashur, which has been excavated sufficiently to show a forecourt and a cult-room. The type of these early, and rather small buildings probably anticipated the universal scheme in the later periods. Whether inferences as to the general arrangement of the cult room, which in this case had the statue at the narrow end, the entrance on the wide side, are permissible, is not certain.

Pottery and Stone Vessels. — In this period the only decoration on the plain buff terra-cotta vessels is incised geometrical patterns, or twisted bands, *appliqué*. Occasionally small painted circles occur. The distinguishing feature of certain pots is the spout; when used in temples, these were for libations. The large store-pot for water, of porous clay, was already known. All the pots were turned on a primitive wheel, and are generally carelessly made; from this time forward in Babylonia there are but few variations in the shapes, which were dictated by particular uses and adhere to simple forms. The stone pots were often carved, frequently pointed like inverted cones, and generally dedicated as temple furniture.

Burial Customs. — The most various methods of interment were practised, but it has proved impossible to distinguish the various forms by any broad principles. The characteristic feature is the selection of burial grounds outside the city walls. Inhumation was universal; various attempts have been made to prove cremation, but in all the instances the burning may have been accidentally caused by some rite of purification, and there is no sufficient evidence to establish a general custom. Sometimes the body was interred in a pit, sometimes it was surrounded with matting; occasionally a clay coffin or larnax of a circular or oval shape was used. The body was generally laid on the side, most often in a contracted position to save space, but in various attitudes. Very rarely brick graves were built, in which case the body was laid at full length; the distinction probably marks a difference in social position. The poorest were buried with a few pots and their personal adornments, beads, paint; the wealthy, or those connected with the royal family, took with them to their graves their most prized possessions, gaming-boards of shell inlay, gold daggers of filigree work, and other weapons. There is no proof of a cult of the dead.

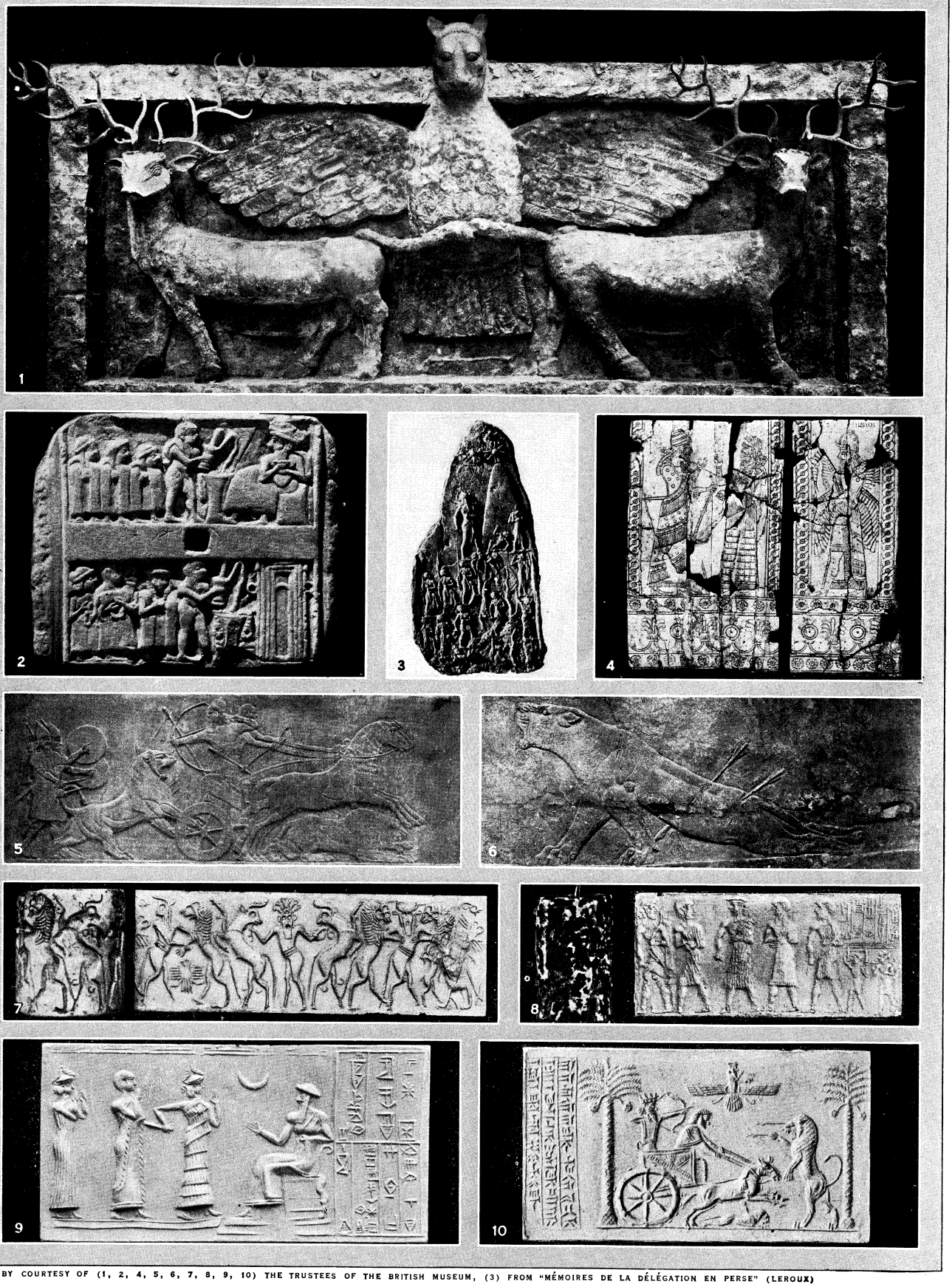
A single instance of a royal burial has shown that more elaborate burials were known. A king who must belong to the 1st dynasty of Ur, or to a period not far removed from it, was buried in a coffin in a tomb with two chambers, an outer and an inner. Immediate dependents, or members of the royal family, were placed in the outer tomb, with fairly rich furniture. The inner tomb was found rifled; it consisted of a limestone structure, with a corbelled vault resting on timbers. Some idea of the richness of the burial may be obtained from a burial near; a man of the same period, wearing a golden headdress on which hair, ears and a "chignon" are represented, lay surrounded by his weapons, and by a multiplicity of vessels, mostly in gold, silver and electrum. The purpose of the headdress is obscure, for it is not clear whether it was worn in life or not; if worn in life, the manner in which it was worn is not certain. The burial is a

BY COURTESY OF (3-8) THE TRUSTEES OF THE BRITISH MUSEUM; PHOTOGRAPHS, (1, 2) FROM DE SARZEC, "DÉCOUVERTES EN CHALDÉE" (LEROUX)

ASSYRIAN AND BABYLONIAN SCULPTURE

1. A governor or priest, limestone, early Sumerian period, from Lagash
2. Fragment of a statue, period of Gudea, about 2400 B.C., from Lagash
3. Statuette of Assur-nasir-pal, king of Assyria, 883–859 B.C., from Nimrud
4. Limestone head of woman, inlaid with shell and lapis lazuli, from Ur
5. Ivory bull's head, period 9th to 7th century B.C., from Nippur
6. Stele with figure of Assur-nasir-pal in high relief, from Nimrud
7. Lion from doorway of the palace of Assur-nasir-pal, from Nimrud
8. Ivory head of a woman, 9th to 8th century, from Nimrud

BABYLONIA AND ASSYRIA



BY COURTESY OF (1, 2, 4, 5, 6, 7, 8, 9, 10) THE TRUSTEES OF THE BRITISH MUSEUM, (3) FROM "MÉMOIRES DE LA DÉLÉGATION EN PERSE" (LEROUX)

RELIEFS AND CYLINDER SEALS

1. Copper relief of Im-gig, from Tell el Ubaid, early Sumerian period
2. Stone relief in two registers, from Ur, early Sumerian period
3. Stele of Naram Sin and his army, from Susa
4. Ivory sides of an Assyrian toilet box, 9th century, from Nimrud
5. Assur-nasir-pal's lion hunt, 9th century, from Nimrud
6. Dying lioness, Assur-bani-pal's lion hunt, 9th century, Nineveh
7. Struggle of mythical heroes, early Surnerian period
8. Warriors of Agade dynasty
9. Goddesses, third Ur dynasty
10. Darius' lion hunt. The inscription reads "Darius the King"

further proof of the wealth of the early period. An important feature is the appearance of the monkey among other amulets in the shape of rams and frogs. The monkey was not native to the country, and must have been known by importation from elsewhere, either Egypt or India.

Seals.—At the time of the 1st dynasty of Ur two forms of seal were equally common—the square or rectangular stamp seal, and the cylinder seal. There is one example of a scaraboid shape, of gold. The stamp seals are engraved with a simple device, such as a scorpion. A peculiar form of the stamp seal is probably not to be considered a seal at all; small models of animals, such as bulls or rams, have sometimes a device on the flat bottom, but these are prophylactic amulets. It has been suggested that the stamp seals are North Syrian in origin, and their use in Sumer is due to northern influence; but the devices used are all connected with astral symbolism and the like, and are connected with Sumerian religious conceptions. The cylinder seal also is purely Sumerian; it took its form as a bead, and the engraver first chose subjects which gave the bead special magical qualities. The variety of the stones used, the general excellence of the workmanship, and the range of subjects and decorative motives are surprising. The commonest theme is the struggle of a mythical hero with animals; the purpose of the theme was to drive away the demons of sickness, though the connection is obscure. The earliest appear to be the large shell, limestone or marble seals; these must belong to some period before 3000 B.C. After that date a long thin shape, frequently carved in two registers, always with scenes that have a direct reference to myths known from later poems, became popular. There is no proof that such seals were at this time used by legal compulsion on commercial documents; they seem to have been used for jar sealings. The name of the owner, and sometimes the god he served, may be found inscribed on some of them.

Weapons and Tools.—War was a constant occupation, and a great variety of weapons was used. Flint arrow-heads prove the use of the bow, though Eannatum's phalanx is only armed with the lance; throw-sticks and maces occur at the same time as axes, daggers with double and single blades, and scimitars. The gold weapons found in graves were perhaps only ceremonial. Of agricultural implements the only extant specimens are clay sickles, to which possibly saw-edged flints were attached by means of bitumen, and hooks, possibly used to lift scrub for cutting fuel. The important feature of the weapons consists in the advanced metal working. Thus the typical early Sumerian battle axe, which might have a perpendicular or horizontal (adze) blade, was socketed on to the handle, not grafted in, though the simpler type in various patterns (similar to the Egyptian axes of the time) was used at all periods.

Amulets and Jewellery.—The lavish wealth of the time is amply illustrated by the profusion of gold and semi-precious stones used for personal adornment, especially at Ur. Gold figures of rams, frogs and apes were worn for prophylactic purposes; a small golden bull is decorated with a beard to represent the divine power. Lapis lazuli, perhaps from the far east (Hindu Kush), and carnelian were common. A larger form of amulet, common in graves, was the model boat, made of stone, wood or even bitumen; to these the devils were consigned, that they might be carried away.

Trade and Foreign Relations.—Seals bearing Indian hieroglyphs of a kind found on early seals at Harappa and Mohenjo Daro in the Indus valley have turned up at Susa, Kish and elsewhere; the designs on these seals are closely connected with Sumerian stamp seals of about 3000 B.C. The trade route which brought, together with these seals, Indian merchandise from the Indus valley may have been by sea; it may also have been by land, as Sumerian objects have been found at Astrabad, and the painted pottery of Sistan resembles prehistoric Sumerian pottery. Egypt was in close trade relationship with Babylonia during the later portion of the pre-dynastic civilization. The great wealth of Ur, and probably of Kish, points to even more extensive trade relations, and it is to be assumed that metals were obtained not only from the Zagros range but also from Cilicia.

Business Documents.—The large number of documents from Lagash at this period deal with the temple offerings and prove that the administration of the town centred about the temple; the priests not only controlled the temple funds and lands, but seem to have been engaged in all business undertakings.

THE AGADE PERIOD

The men who spoke a Semitic language now called Akkadian had long been present in Babylonia, as menials and foreign settlers, before a general rising in the northern cities in the district afterwards called Akkad gave them power. The dynasty founded at Xgade by Sargon did not come into the country as foreigners; there was no clear breach with Sumerian civilization, but certain differences are doubtless due to adaptations by a people of foreign speech. The archaeological evidence proves this very clearly.

Bas-reliefs.—Some badly broken bas-reliefs from Susa, from monuments erected at this time, prove that the "Stele of Vultures" was copied faithfully. But there was a notable development in the treatment of the human figure. One fragment, from Lagash, shows battle scenes in different registers; in them, the men are much slimmer, the muscles and fleshy contours are carefully shown, and the drapery does not obscure the form beneath. To this extent the famous Stele of Victory set up by Naram-Sin is typical of the finest Babylonian work of the period. Foreign influences were clearly at work. Egyptian has been plausibly suggested. The remarkable feature of the stele is the composition; as the king and his warriors ascend the lower spurs of a hill in the Zagros, throwing their enemies down, a lofty peak rises sheer above them. The prototype of this stele was a rock-carving recently found at Darband-i-Gawr, "The Pagan's Pass," in the Qara Dagh, near Sulaimaniah, the territory of Lullubu in Agade times. Another feature of the bas-relief was the rendering of the human face; on the stele of Naram-Sin from the Diarbakr district the heavily bearded face of the king is shown in profile, and the type was faithfully reproduced in the renderings of gods and kings for centuries afterwards. Rock-carving was not uncommon at this time; Anubanini, a king of the Lullubu had a bas-relief carved on a sheer rockface south of Hulwan. Yet another convention became fixed from this time on; gods and divine beings were given horns, the number varying according to rank. Naram-Sin is given horns on the Stele of Victory because between the cutting of the rock-sculpture and of the stele he assumed divinity, a custom peculiar to this dynasty and subsequently copied by the dynasties of Larsa, Ur and Isin. Bas-reliefs on stone vessels depict heroes or gods fighting monsters, and this period may mark the development of the common types of composite creatures.

Sculpture in the Round.—Free figures display a development from the roughly cut and inadequately observed head of Manishtusu to the correctly proportioned and finely cut head of a man from Adab; the technique of inlaid eyes and eyebrows was derived from the preceding era. Similarly in the body there is a range between the continuance of the old lumpish treatment of the flounced skirt, and the fragment of another statue of Manishtusu in which the folds of the garment falling from the shoulder do not obscure the form of the waist, hips and thighs.

No buildings of any extent certainly belonging to this period have yet been discovered. There was a change in the form of the brick which became rectangular, rather large. From this time onwards the timber needed for roofing was obtained, generally by military expeditions, from the Lebanon, cedar being the most favoured. Foreign architecture was also studied; a description, with dimensions, of a typical hissar of Asia Minor is given in a text of Naram-Sin. Brick stamps were commonly used, whereas the written inscription was previously customary.

Seals.—The same features that characterize the best bas-reliefs may be found in the seals, very elaborate treatment of human and animal bodies, balanced spacing and symmetrical opposition. Extremely hard stones, including crystal quartz, were chosen, and the sides of the cylinders are generally concave, a feature hard to understand if the seals were intended to give a flat impression. The crystal quartz cylinders were filled in the centre with a variegated paint which shone through the translucent stone.

Trade and Foreign Relations.—Sea-trade was very active; the quays at Ur and Agade were frequented by the ships of Magan, a country of uncertain location reached by sailing down the Persian Gulf. This trade included the important traffic in copper and in the hard stone requisite for building. Tradition recorded campaigns of Sargon and Naram-Sin to Asia Minor, and there is no reason to doubt the historic fact; other campaigns down the Persian Gulf and across some part of the Mediterranean are not equally credible, but the king of Magan was certainly met in battle by Naram-Sin. To the east, continual strife with the Zagros tribesmen led to the establishment of Akkadian rule over an extensive area, and these efforts were probably directed towards keeping open the trade routes. In the north, Assyria and the Subaraeans alternately rebelled and succumbed.

DYNASTIES OF GUTIUM AND UR

The dynasty of Agade was suppressed by the hill men of Gutium, but no archaeological evidence of the foreign domination can be adduced. Gudea, the *iššakku,* "tenant farmer," or governor of Lagash, and his immediate successor lived under this foreign domination, and an independent dynasty controlled Erech; the Sumerian cities in the south recovered the prosperity and liberty previously lost. The culminating point was reached under the 3rd dynasty of Ur when the kings of the south country established an empire which included Elam and the Zagros range in the east, Assyria and Mesopotamia in the north, and Syria up to the Cilician gates in the west. This was a Sumerian reaction, not so much against the men of Semitic speech in Babylonia, as against a foreign domination from the east; Akkadians permeated the south during this period, the last rulers of the 3rd dynasty of Ur bore Akkadian names, the civilization is derived from that of the Agade period. But the result of the transfer of the seat of power to Sumer was that, owing to the empire established in this, the most flourishing period of Babylonian history, a more definite Sumerian impress was given to the outlying provinces than could otherwise have been the case.

Architecture.—The Sumerian city of this period always included within its walls a "temple" which was actually a complex of buildings, containing the temple of the city god, another of his consort, another perhaps used as the joint habitation of the two; within each temple might be found the "shrines" of different gods, and a "shrine" might contain small "chapels," screened off for lesser deities. Within such temple-complexes dwelt the priests, among whom were the governor, the city judges, the scribes and chief administrative officials. No such temenos can be planned as yet for this period, but it is probable that the plan drawn on the slab held by the statue of Gudea from Lagash was intended for the wall of such a part of his city. The walls of a temenos were in effect the inner fortifications of a city; gateways receded for defensive purposes, the walls had towers and battlements. The city without these walls stood on a lower level; it is as yet impossible to give details as to the general plan of cities, and the remains of dwelling houses of this period at Eridu are simple brick-constructions, interesting because they show windows and a painted black and white decoration. Within the temple complexes narrow streets led past the houses of the gods and of the priests. The larger buildings consist always of a main court with rooms opening off it, sometimes supplemented by a smaller court similarly arranged. The whole precinct was dominated by a temple tower or ziggurat, which might consist of seven, four, or only three stages. Steps up one side gave access to the top stage, which was a small cella, wherein the god was supposed to lie at night with the priestess he had chosen, according to Herodotus' account. The oldest and best extant tower of this kind is that at Ur; it was originally built by Ur-Nammu, the founder of the 3rd Ur dynasty. In later times the four stages were coloured, the lowest stage black, with bitumen, the second white, with gypsum, the third red, the colour of the brick, the fourth sky-blue, the result of glazing. Kings continually boast that they "raised" such structures "like heaven," and it may be that the temple tower corresponded to the conception of heaven's stages, varied between three, four and seven. *(See* RELIGION.)

An important development of the period was the brick-built column. A group of these, curiously close together at Lagash, is definitely dated to the time of Gudea by the French excavators; the row of similar columns at Kish attributed to an early period by the excavators may also belong to about this date. These brick-built columns do not recur in Babylonian architecture, so far as is yet known, until Seleucid and Parthian times, when instances have been found at Babylon and at Kish.

Door constructions depended upon the use of a hard stone—or. in the case of private houses, a burnt brick,—securely wedged in a brick box some distance below the threshold. In a hollow there turned the metal shoe of the wooden post, and the door itself consisted of two wings securely fastened on to this. The question of building in storeys is still doubtful; the evidence alleged from Ur in proof of an upper storey and a gallery, resembling the modern dwelling house of Iraq, is of doubtful value. Roofs seem to have been invariably of timber and mud.

Drainage was extensive and well conceived, at least inside the temple areas. Piping of pieces with bell-mouths, pierced cylindrical drums, and even brick pits of great depth were in use. Within the temples some of these drains unquestionably served ritual purposes.

Bas-relief.—The most favoured method was a return to carving in straight registers, and no attempt to copy Naram-Sin's stele has yet been found. The style of carving is rigid, but careful in detail and effective in grouping. A daring experiment, found on a bas-relief of Gudea, and repeated on the great stele of Ur-Nammu, was the representation of flying figures, bearing the blessing of the holy-water flowing from pots. The dairy scenes of earlier times are repeated; but the themes of the king setting out to build, of builders at work, of priests sacrificing or beating drums to drive off evil influences, are first treated on the Ur-Nammu stele. A remarkable anticipation of a later device may be found on the Gudea vase, in which two serpents twined round a post are watched on either side by bird-headed winged monsters who hold magical staves. The constant appearance of astrological and astronomical symbols in bas-reliefs on pots is noteworthy as marking the increased importance of star-worship.

Sculpture in the Round.—The complete seated figure of Gudea from Lagash retains the squat proportions of the early Sumerian style; the new kind of cloak, much like a cblamys, is less clumsy than the flounced skirt, but there is no attempt at modelling. But the head preserves the correct proportion of the Agade period. A standing figure of the same city governor betrays the same characteristics from the front, but the back view shows very careful modelling in broad masses, to render the natural contours of the human figure. A headless statuette of his son, Ur-Ningirsu, shows a slimmer figure. There are a number of broken figures, all repeating these characteristics, and the male heads of this period often repeat the rather plump conventionalized features of Gudea; but the modelling of the nostrils and mouth is finely done, and in some cases it is difficult to distinguish male stone and clay heads of this period from work done under Greek influence. The best heads are those of women, one from Lagash, one from the city of Ashur, two from Ur; these are portraits of individuals, modified perhaps by the current conception of beauty. In one case the inset eyes are still extant. It has been well said of one of these heads that it is a "spiritual sister" of certain early Athenian female heads of the 6th century. Babylonian sculpture never reached this level again. Casting in metal was also exceedingly good; a copper figure of a city governor, standing rigidly like Gudea, shows an ability to render drapery and follow the line of the human form beneath, together with a sense of proportion, which renders it the best male statuette yet found in Sumer. This art had an influence in the north. A statue dedicated by Puzur-Ishtar, son of Tura-Dagan, governor of Mari, a city west of the Euphrates below the Khabur, is carved in this style; the only variant feature consists in the elaborately curled beard, a custom of the Assyrians.

Seals.—The length of the cylinders in this period was considerably shortened, the execution rather less detailed, and, in conformity with current taste, the postures more rigid than in the

Agade times. The most favoured theme was the introduction of a human suppliant, conventionally rendered, to a god or goddess. The inscriptions are very formal; of the type "God . . ., X son of Y, thy servant," but in certain cases are longer and include the reigning king's name and titles. A great variety of coloured stones was employed.

Foundation Deposits.—The custom of placing small copper figures, the bottom of which is shaped as a peg, in foundations, had commenced in the time of Ur-Nina of Lagash in the early Sumerian period; these were accompanied by small stone tablets in the form of a plano-convex brick, and were placed in a burnt-brick box in the four corners of temple walls. At an earlier date the stone tablets were so placed without the copper figure. In some cases at a later date these copper figures bore a clay brick on their heads. In the Gudea—3rd Ur dynasty period the top of the copper nail is shaped into the head and bust of a man carrying a pointed oval object, perhaps representing a brick. The bottom of these nails is generally inscribed. A peculiar feature at Lagash was that the nail was left separate, held by a half-kneeling, half-running figure of a god, marked by the horned headdress. The phallic interpretation of these figures is quite erroneous. This custom of placing figures in the foundation lasted into the next period and then apparently ceased; it was a Sumerian practice not adopted by the Amorite 1st dynasty of Babylon. In one case the foundation deposit consisted of round-topped stelae bearing inscriptions of Pur-Sin. A rather different kind of deposit consisted in the insertion of small clay cones into the inner core of walls, with the object of perpetuating the name of the builder.

Law and Commercial Custom.—A marked feature of the period was the development of a law code, drawn up probably by Shulgi, the second king of the 3rd Ur dynasty, which was the basis of the Hammurabi code. This code entailed a regularization of business and scribal custom; tablets, to receive legal recognition, had to be sealed, were then inscribed and wrapped in envelopes, also sealed and inscribed with the same text. The observance of this practice in Cappadocia is a proof that the kings imposed their laws upon distant provinces. Commercial documents relating to sales, adoptions and other private business appear beside the records of temple administration. This was a great formative period in the development of social life and in the progress of civilisation.

Trade and Foreign Relations.—Gudea secured his materials by very extensive trade relations; timber came from the Lebanon, gold dust (*i.e.*, alluvial gold) from the Taurus, diorite and other stones from the Zagros, copper from the Median plateau and from Magan. The kings of the 3rd Ur dynasty were, however, engaged in constant warfare along these trade routes without apparently increasing their available sources of supply by contact with a wider area. The inference, justified by historical considerations, seems to be that the incursion of various new peoples into districts along the trade routes tended to shut the inlets into Babylonia, so that these were only partially kept open by an extension of direct authority. The widespread trade of the early Sumerian period was no more.

Provincial Administration.—The kings of Ur were satisfied to appoint the city governors in various districts; they did not attempt to alter the administration of the area they governed by national institutions. Some of the governors were pluralists, and towards the end of the dynasty one alone held nearly all the districts east of the Tigris. Submission was secured by the annual appearance of these governors bringing tribute. The effect of the system seems to have been beneficial; the governors indulged in building schemes within their own cities, and such a provincial capital as the city of Ashur flourished and received an abiding impress from this period. A curious feature of later nomenclature may be traced to this epoch, which illustrates its importance; temples devoted to the worship of the same god in different cities had the same Sumerian name, a custom doubtless due to direct derivation only probable under Shulgi, and walls, gateways, statues were also given Sumerian names, doubtless because the custom was derived from the era of Sumerian governors.

DYNASTIES OF ISIN, LARSA, AND BABYLON

From about 2300 B.C. men called "Amorites" that is "Westerners," were occupied in menial work in Babylonia. They bear names of various types, and may not all have been of western origin; but a new Semitic dialect appears in certain names, and this is a western tongue, more closely connected with Hebrew than with Akkadian. Then an invasion of Akkad from the district of Mari, west of the Euphrates and north of Babylonia, made an Amorite king of Isin; an alliance of Isin with Elam brought about the fall of Ur. Thereafter came a long period of confusion during which various Amorite dynasties struggled with one another; the principal cities involved were Isin, Larsa, Kazallu, Kish and Babylon. Finally the struggle was reduced to a clear issue between a family of Elamite origin, which ruled at Larsa, and the dynasty of Babylon, and in this Hammurabi was finally successful over his enemies, but the supremacy of Babylon did not last more than 50 years. The provinces continually rebelled, and the dynasty was ended by a Hittite raid.

The political history of the time is sufficient explanation of the poverty of archaeological evidence. The great cities were captured and recaptured, and little now remains of the small antiquities. The building operations were confined to restoration of old buildings. The earliest known true arch in Babylonia dates to this period, in a dwelling house at Ur; the fact is probably accidental. The style of fortifications is to be seen from an extant sally port, with the wide broad stairway known to the Assyrians as *mušlalu*. Larger truncated clay cones with more elaborate descriptions of the occasion of the building and the glory of the king, with the inscription repeated on a large circular base, were inserted in the walls. An example of the hollow barrel cylinder used as a foundation deposit, with a long inscription, dates from the Larsa dynasty. The sculpture in the round, while retaining the characteristics of the style of the previous age, shows a decline in artistic ability; a typical instance, the statuette of the goddess Bau, who rides the celestial waters seated on two ducks (?) which symbolize certain stars, is clumsily cut and ill-proportioned. The best bas-relief is that on Hammurabi's stele of laws, showing the king receiving commands from the sun-god, who holds the measuring rod and perhaps the measuring line that symbolize justice; the style is immediately derived from the Gudea reliefs, the faces of king and god exactly resemble Naram-Sin. An interesting stone vase, in the shape of a dog with a small vessel on his back, bearing an inscription of Sumu-ilu, may be paralleled by a coloured terra-cotta vase of later date from Asia Minor. There was a notable change in the burial customs, perhaps due to the Amorites; the dead were frequently buried beneath the floors of houses, either in clay coffins, or in brick corbel-vaulted tombs frequently re-used.

Seals.—A marked change may be found in the designs, and the source of this change is fortunately known. On tablet-envelopes from a site near Caesarea (Mazaca), which date from about 2150 B.C. onwards, two styles of seal impressions are to be found, those which closely resemble the Ur seals, and those in which the field is crowded with symbols; the cutting is more linear and not so elegant, and a series of amuletic figures previously not placed on seals, such as apes, dwarfs, naked goddesses, are commorily introduced. This second type, commonly called "Syro-Hittite" by modern scholars, was introduced into Babylonia by the Amorite dynasties. A large proportion of these seals are of haematite, the cylinder remains the same length as the Ur seals but the diameter is much reduced. The god Amurru, a form of Adad the weather-god, is on many; he stands with one arm a-kimbo, holding a club, and is worshipped-by his consort, who stands with both arms bent upwards. The inscriptions are of the same type as previously.

Literature.—The large output of literary work was a feature of the period. There is a presumption that some of the Iong poems, of which the earliest known copies are dated, were written then, and the evidence of language is in favour of the hypothesis. The Atrahasis version of the Flood story, the Gilgamesh epic, the Creation poem are the finest specimens of verse writing; they were intended for recitation, sometimes as part of a ritual at

festivals, sometimes doubtless simply for pleasure. A consummate mastery of prose is exhibited by the wording of Hammurabi's code of laws, which was itself in debt to Libit-Ishtar's previous code, derived from the Sumerian laws. Scientific study of geometry and mathematics resulted in elaborate calculations of areas and cubic contents beyond the needs of practical affairs. Large collections of omens, derived in part from earlier writings in the temples, were arranged, recording observations from the mixing of oil and water, from the inspection of sheep's entrails, and from the casual behaviour of birds and animals. It is difficult to estimate the total production of the time, but the creative literary effort involved was clearly very considerable and the work was by no means devoid of literary merit.

THE KASSITE DYNASTY

The Hittite raid upon Babylonia left the country leaderless, and gave the Rassite tribesmen who had served Babylonian kings as soldiers in considerable numbers the opportunity to place one of their number on the vacant throne. Thereafter a new political position resulted which has a considerable bearing on the archaeological evidence. The land of Assyria had, until the decline of Babylon, been no more than a province of Babylonia, both politically and culturally. Shamshi-Adad I., about 1840 B.C., created a considerable kingdom of Assyria, but there is no proof of an independent development of civilization in the north until after the advent of Kassite kings at Babylon; from that event, about 1740 B.C., Assyria went its own way, an independent kingdom of Mitanni, centring round the Khabur valley, threw off the Babylonian overlordship, and the Babylonians ceased to exercise any great influence directly upon these lands. The relations of the Kassite kings with the peoples of the east was, on the other hand, very close, and the Elamite and Babylonian civilizations were once again as closely connected as they had been in the earliest times.

The remains of the Kassite period are very rare, and the discovery of a site which will throw light on the civilization of the time is an urgent need. A royal inscription makes it clear that there were some interesting developments in the internal decoration of the temples; Agum-kakrime put figures representing the brood of Tiamat, the dragon of Chaos, on a wall of the temple of Marduk in Babylon, probably in low relief, thus anticipating the work of later times. The building of Kassite kings as yet found are inconsiderable restorations; the most noteworthy is the only extant standing round arch, at Ur.

Bas-reliefs are to be found on the stone "boundary-stones," so called by the Babylonians because they were inscribed with charters granting land to royal retainers and others for services rendered; these stones are ornamented with divine symbols intended to protect the stone from damage by ill-disposed persons. The symbols may in certain cases be astrological, but are for the most part cult objects associated with certain deities. There are occasional instances of representations of the gods, the king, or the persons concerned in the charter, sometimes of merit. Some suppose that these stones, the tops of which are roughly rounded, were intended to represent phalli; there is no proof of this assumption. The original document was on clay, and the purpose of these stone copies is not certainly known. Some have been found apparently in open fields, others were as clearly dedicated in temples. The custom of setting up these "boundary-stones" was continued in later times, and the best examples are from the period that followed the fall of the Kassites. In later times the stone occasionally took the form of a large tablet. Glazed pottery was first made during this period, and opaque glass beads were fairly common.

Seals.—Haematite ceased to be popular, and coloured stones, often variegated, were employed; the cylinders are longer and generally larger in diameter than those of the preceding age. The inscriptions often take the form of prayers to a god. The themes are generally very simple; a seated deity, a goddess or two goddesses beside the inscription, with arms raised in adoration, rows of prophylactic creatures; *e.g.*, frogs. A symbol constantly employed is the Rassite cross, either of the kind called Maltese,  or in a simpler form  . The glyptic art of Babylonia throughout this period was very clearly distinguished from that of the rest of western Asia.

ASSYRIA IN THE EARLY PERIOD

The land of Assyria may originally have been inhabited by the Subaraeans, a race which at a later time occupied parts of Mesopotamia, the hill country north of Assyria, and the valleys of the Zagros range as far south as Kirkuk. The Assyrians, themselves a mixed race with close affinities to the people of North Syria, speaking a language very closely related to Akkadian but with marked peculiarities, probably entered the Tigris valley before the time of Sargon of Agade. They brought with them a calendar of their own, and a yearly eponymous office, the *limu* or *limmu*. Their conquest brought about a breach in the continuity of civilization at the city of Ashur; after the Sumerian domination in the early Sumerian period, there is a new city which shows no sign of influence from the south. The Agade kings and their successors reimposed their rule on the Assyrians, and Babylonian domination continued until the time of the Amorite dynasty. Very few remains of the second millennium are extant, but they are sufficient to prove that Assyrian art and civilization developed in a distinctive national manner. The formative age was that of Ashur-uballit. This king ascended to the throne when Assyria was subject to the kings of Mitanni; when he died, his territory included Mitanni, the Tur 'Abdin, and a large tract south-east of Ashur. This was due to his organization of the state on a military basis. Certain features of Assyrian civilization were due to this military organization; the prominence of certain war-gods, Shulmanu, Enurta, or of the warlike aspects of Ishtar, may be so explained.

Bas-reliefs.—Two bas-reliefs, one in terra-cotta, the other in stone, dating from the middle of the second millennium, show the distinct Assyrian style. The stone object is a basis for a cult object, and the relief represents a king or priest between two figures surmounted with rayed disks, holding staves surmounted by similar disks. The subject is derived from Babylonian themes, the execution is peculiar to Assyria. On a narrow relief below the main scene, men and horses are shown climbing over mountains; the battle scenes of later times faithfully follow this model, and the relief is of great importance because it proves that the frieze style was already formed by the 13th century B.C. The terra-cotta relief apparently depicts Ashur as a tree-god, accompanied by two smaller, unidentified figures. The Assyrian national god was always closely associated with tree-worship, a feature which connects his worship with Syrian and Mediterranean cults; on the other hand, the same myth of Creation was related about Ashur of the Assyrians as about Marduk of Babylon.

Painting.—Painting in various techniques was practised in the time of Tukulti-Enurta I., about 1250 B.C.; tiles were decorated in blue, red and white with geometrical patterns, palmettes, and conventional religious subjects, such as two goats arranged heraldically beside a sacred tree. It is probable that this art arose from Egyptian and Mediterranean influences, due to the lively international trade and political intercourse of the 15th century *B.C.*, the "Amarna age." Glazed terra-cotta pots were common, and some specimens seem to have been imported from Cyprus and Crete.

Seals.—Assyrian seals share the characteristics of the "Syro-Hittite" style rather than the Babylonian. Tablets from the Assyrian provincial town of Arrapkha (Kirkuk) show impressions from short thin cylinders, the themes generally introducing monsters or sacred trees and certain amuletic devices. But in another particularly attractive style, on a longer larger type of cylinder, the ground was more spaciously treated, and hunting scenes, animals bounding across rocks, arid so forth, were cut in shallow intaglio.

Social Life.—Though the Hammurabi code was studied at an early date in Assyria, the Assyrian kings drew up a set of laws of their own, which reflect a social life rather different from Babylonia. Women, unless public or sacred prostitutes, were closely veiled; married women in some cases stayed in their

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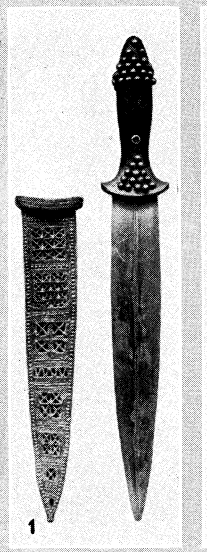
COPPER AND BRONZE FIGURES AND RELIEFS

1. Copper statuette of a bull, beaten on a mixture of sand and bitumen. From Tell el Ubaid, early Sumerian period
2. Copper statuette of a king or governor, third Ur dynasty, source unknown
3. Bronze lion from gate of the palace of Shalmaneser V, inscribed in Aramaic, "Five minas of the land," and in cuneiform, "Palace of Shalmaneser, King of Assyria, 5 minas of the king."
4. Shield belonging to a king of Urartu of the 8th century B.C. The field is quartered
5. Mouthpiece of a pipe or vessel in the shape of a bull's head, 7th century, Assyrian
6. Handle of a ceremonial vessel in shape of a bull's head, 7th century, from Van

BABYLONIA AND ASSYRIA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BY COURTESY OF (1, 6 7, 8, 9, 10) THE TRUSTEES OF THE BRITISH MUSEUM; FROM (2, 3, 4) MORGAN, "MEMOIRES DE LA DÉLÉGATION EN PERSE" (LEROUX AND COMPANY), (5) DE SARZEC, "DECOUVERTES EN CHALDEE" (LEROUX AND COMPANY), (7) ANDREAS, "CERAMICS" (KEGAN PAUL, TRENCH, TRUBNER AND COMPANY)

PAINTED AND ENGRAVED WORKMANSHIP OF BABYLONIA AND ASSYRIA

1. Gold dagger with handle of lapis lazuli, sheath of gold and drawn wire. Early Sumerian period
2. Painted cup from Necropolis at Susa, of "first" style
3. Painted bowl from Susa, of "first" style; 4. Painted vase from Susa, of "second" style
5. Silver vase of Entemena, engraved with symbolic representation of lion-headed eagle seizing lions, and a row of bulls. Early Sumerian period
6. Limestone mace-head showing members of royal family of Lagash in procession. Inscription records the didicatisn of a temple to the city-god
7. Painted and glazed jar from the city of Ashur, of the 9th century B.C.
8. Painted and glazed orthostat from Ashur, 9th century
9. Babylonian stone amulet from Carchemlsh, 7th century. A female demon, Lamashtu, who suckles wild animals, is carried away by a horse
13. Stone head of the demon of sickness, Panzuzu, who was associated with the West Wind. The amulet is pierced for suspension and was worn on the principle that evil averts evil. Sixth or seventh century

father's house and did not enter the husband's family. The king's court consisted of an officialdom partly borrowed from Babylonian models, partly peculiar to Assyria. The dichotomy to be observed in the institutions can be seen in names within the same family; Semitic and non-Semitic names were used inditierently in *a* manner which suggests intermarriage of the Assyrian-speaking people with Subaraeans.

The Assyrian kingdom was powerful throughout the 11th and 12th centuries; occasionally Babylonian kings were able to reverse the position, the most striking instance being Nebuchadrezzar I. about 1150 B.C. An Assyrian revival culminated in the successful campaigns of Tiglathpileser I. about 1090–1060 B.C.; this king was, however, actively engaged in repelling Aramaean tribes, and from about 1050–950 B.C. the invasion of Syria and northern Babylonia by this people exhausted Babylonia and Assyria.

LATER ASSYRIAN EMPIRE

After the Assyrian kingdom had recovered from the strain imposed by the Aramaean invasion of the southern and eastern lands, Assur-nasir-pal II and Shalmaneser III founded the future Assyrian empire by conquests east, north and west in the 9th century. Art and literature were cultivated, and political developments created the prototype of all oriental monarchies. The use of iron, which had been casually known at the beginning of the second millennium or earlier, had become regular from the end of the 12th century; bronze had almost entirely replaced copper for decorative use. It is rarely possible to mistake an Assyrian object throughout the remainder of their history.

Architecture. — The planning of new cities, the complete reconstruction of old sites, was commonly undertaken. Sometimes this entailed considerable engineering feats, such as the sinking of piles in the Tigris, in order to secure more ground. Sites were made into rectangular shapes, or a series of rectangular shapes, as is illustrated by Khorsabad, Sargon's city. A notable feature was the laying out of parks and plantations for the use of citizens. City walls were of great breadth, and strongly fortified; towers were placed at intervals of about 100ft., and at Ashur, Shalmaneser III. built an inner wall (from his time a permanent feature of defensive fortifications) 65ft. away from the outer wall, 23ft. thick, in such a manner that it completely commanded the outer wall. Walls were sometimes built on stone foundations, consisting of large rectangular limestone blocks. The battlements were an inverted T shape, and were frequently decorated with attached rosettes. Columns with capitals of the most varied kinds were used, and some were fluted; occasionally they stood upon a base resting on the back of a colossal lion or bull. Gateways were generally formed by colossal monsters or lions, which would support very heavy lintels and superstructures. Various words for architectural ornament are used in the description of the buildings, but these cannot yet be certainly interpreted; apart from the frieze of sculptured stone blocks, *askuppu,* there was a "belt" of decoration, *nibikhu,* and some rectangular form called *pasqi,* "bridles." It is possible that there was external as well as internal ornament. Assyrian architecture was considerably influenced in the construction of porticos by the Hittite constructions, called *bit hilani* by the Amorites, that were common in North Syria.

Bas-relief. — Assyrian kings decorated the interior walls of their palaces with bas-reliefs cut from a soft alabaster obtained in great quantities near Mosul. There are two series from Assur-nasir-pal's palace at Calah, the modern Nimrud, the one devoted to representations of a sacred ritual in which the king took part, perhaps at the New Year. The second depicts scenes from his campaigns. The first series is larger and more coarsely cut than the second; and the importance of such religious subjects diminished greatly, so that later kings invariably preferred battle scenes. The bas-reliefs of Shalmaneser III. also vary in quality; those on the "black obelisk" are small panels, and the mason was engaged on an unusually small surface which has restricted his style; but the *repoussé* reliefs on the bronze bands from the gates found at Balawat, giving a panorama of the expeditions in Armenia and Syria, are masterly. Round-topped stelae with representations of the king adoring the symbols of the great gods. the sun, the moon, and the evening star, before which an altar was generally placed, were fashionable in the 9th and 8th centuries. The bas-reliefs of Tiglathpileser III. are generally poorly executed, but display the details of military costume; the theme of animals grazing was also introduced in his time. In the reign of Sennacherib, an attempt to link up the walls of a room into a single scene led to compositions such as the siege of Lachish, or the conveyance of colossal bulls, otherwise unexampled. The perfection of the art was reached in the reign of Assur-bani-pal; close study of animal forms, variety in the treatment of the human figure to avoid the doll-like appearance common previously, and a broader spacing make most of the reliefs from his palace, *e.g.,* the lion hunt, the Arabian war, the royal feast, superior to any other Assyrian work. An interesting example of a sculptor's terra-cotta model for a bas-relief, very finely finished, throws some light on the technique.

Sculpture in the Round. — Few sculptures in the round are extant. The finest is a statuette representing Assur-nasir-pal II. bareheaded, holding a nail-studded crook (?) and a mace, with the arms tight to the side and the feet together; there is no attempt to represent the folds of the drapery or the modelling of the figure beneath. The stark simplicity is more probably due to the intention of the artist than to inability. A colossal statue, perhaps intended for Shalmaneser III., for many years *in situ* at Nimrud, reproduces the conventional modelling of the face. Seated statues of Shalmaneser III. and of the god Nabu recall in their lumpish treatment the Gudea statues and mark no advance in technique. Animal heads, on the other hand, were treated realistically; *a* white limestone head of a lion and an ivory head of a bull, both perhaps protomae, are examples of the finest work in this kind ever produced.

Metal Work. — The best extant metal work of the late Assyrian period has been found at Wan, the ancient capital of the kingdom of Urartu, on the shore of Lake Wan. Realistic bronze bulls' heads, a figure of a god in the Assyrian style, couching sphinxes with inlaid human heads (now lost), a snake monster with inlaid black and white roundels, and a model of a wall with a gateway, apertures for archers, towers and battlements, may be cited as typical; the finest individual object is a round shield, quartered, with *repousse'* figures of animals. Some authorities would see in Armenia the centre from which such work was inspired elsewhere, and the commencement of a style continued in Achaemenian Persia. The subject is, from the archaeological point of view, very complicated; a part of the same, or a similar, model of a wall was found at Nimrud, and the Assyrian style of the objects is not to be doubted. The treasure of bronze bowls from Nimrud can be more readily assigned to a source free from pure Assyrian influence; the subjects are treated in a mixed Egyptian and Western Asiatic style only possible in Phoenicia. Metal casting underwent an improvement of some kind in the time of Sennacherib, and colossal figures were made for his palace at Nineveh.

Ivories. — The hoard from Nimrud, which dates probably from the late 8th century, includes a number of ivory plaques from the sides of toilet boxes, and feet from small pieces of furniture; there are also a number of beads in a peculiar style. Some of these pieces are purely Assyrian in theme and treatment; others are as clearly Phoenician. A certain number remain that cannot easily be assigned. The trade in these ivory boxes was very extensive; good examples have been found at Ur.

Stone Vessels. — The ornamentation of the handles of stone vases and the decoration of the sides of votive cups was common. Handles generally take the form of animal heads; battle-scenes or religious subjects of the conventional kind were cut in bas-relief on the cups. Some flat libation vessels are decorated with ducks' or swans' heads, and other vessels are copies of the Egyptian types of the period.

Glass. — There is one glass vessel extant bearing the inscription of Sargon II ; it must therefore have been made in the second half of the 8th century The glass is of a distinctive, very heavy kind, and a few other specimens probably belong to the Assyrian era. There was a work called "the Gate of the Furnace" in Ass-

ur-bani-pal's library giving instructions for the making of glaze and glass. Opaque glass beads were not uncommon.

Painting and Glazing.—In the 10th century, before kings were rich enough to provide sufficient stone for the great friezes, painted bricks or orthostats decorated their palaces. The scenes are treated in the same manner as the reliefs, the colours applied are conventional and were not closely connected with the natural object. Various techniques were employed. It should be remembered that some of the stone friezes when excavated retained traces of the original colour, and in some instances the paint employed would seem to have been similar to that used on the bricks.

Painted and Glazed Pottery.—The native glazed ware is roughly made, and the manner of glazing resembles that of the late Kassite age in Babylonia. A number of ornate pots with palmette and geometrical decoration are more carefully made for royal use; the ornament is in part derived from Egypt. Occasionally animal figures, especially goats, and sacred trees, are introduced. This ware is the finest yet known in Babylonia and Assyria, and may be partly derived from Hittite work, but the designs are not closely related.

Prophylactic Figures and Plaques.—From the earliest times a great profusion of terra-cotta figurines and plaques are found in Babylonian and Assyrian temples. Their purpose is obscure and their artistic value generally small. Some of them, such as masks of the demon of sickness, Pazuzu, must have been used as amulets on houses, for they are pierced for suspension. In the late Assyrian age ritual texts inform us of the use to which a whole series typical of this period were put under the floors of certain rooms in temples to drive away pestilence and sickness of various kinds. Such figures and plaques were made of terra-cotta or of copper, and were buried in brick boxes beneath the threshold, or at stated positions in relation to the sick man's bed. Human figures carrying holy-water pots, or metal staves, and wearing metal belts and miniature daggers, others with a fish-skin over head and back; monsters with human forms, animal or bird heads and bovine hind-quarters, snakes, doves, dogs, dragons. apes, boats, priests and lion-headed men carrying daggers aloft are the common types. Such types reappear on friezes more especially in 9th century Assyria and in earlier examples from Mesopotamia and Syria, and all are derived from Babylonian mythology; but as these figures are characteristic of the Assyrian age, it is probable that the ritual development involved dates from this period. An extant text also describes the postures in which certain gods and semi-divine figures should stand, and as numerous terra-cottas; *e.g.*, of the goddess suckling a child, or of the monsters called Lakhmu and Lakhamu, correspond to this description, it may be that these also were considered apotropaic.

Amulets.—Assyrian amulets frequently take the form of an oblong tablet of stone, with a projection pierced for threading on to a necklace. These are inscribed with incantations generally addressed to the gods, or demons of sickness. Those most common are addressed to Lamashtu, a female monster who wanders the streets at night rendering maidens sterile and men impotent; these are generally carved with a relief showing the monster, suckling dogs or hyenas, being carried away by a boat across the river, the potency of the representation being due to a course of reasoning common in "sympathetic magic." A much favoured amulet at all times was the head of Pazuzu, a demon of sickness associated with the south-west wind; this bearded, lined face was made in bronze, in stone, in semi-precious stones such as lapis lazuli and carnelian, and in clay, and was worn round the neck, on the principle that sickness would avoid the place where he already was. Every kind of bead had an amuletic significance, though not all of their potent functions are yet known. One ritual lays down the rules for threading various kinds of stone on particular threads to avoid Lamashtu, to secure child-birth, or the like. The pomegranate shape was thought to promote sexual strength, and special significance must have attached to the pot-shape, and to the "eyes" of banded agate.

Seals.—The cylinder continued to be the only seal in use until the 7th century, when another type was introduced, the cone shape, with rounded top, pierced, perhaps for fastening on to rings. The free style and linear treatment of the earlier cutting was abandoned, and a formal style, of great precision and a minute delicacy recalling the Agade seals. Religious subjects, such as the worship of gods or the sacred tree, and amuletic themes, predominate, but hunting scenes with no religious reference were favoured, and in them there is the same excellence in the treatment of the human form as marks the friezes. Only one seal extant shows a battle scene, and that appears to have been cut in commemoration of the campaign against the Aribi under Ashur-banipal. The use of the drill, towards the end of the 9th century, did not have any disastrous effects until the close of the Assyrian era, but the commencement of the decline of the art, owing to the schematization of forms into circles with narrow channels connecting them must be dated to the 7th century.

Tools, Weapons, Armour.—Owing to the perishable character of iron the remains are very scanty, and bronze objects preponderate. The tools are generally of simple types; chisels, saws. knives and sickles. Chains, and meshed chain work were discovered at Nimrud, and the excavators thought the latter was part of some chain-armour, which is hardly probable. The weapons show a considerable diversity in shapes, and it is not certain that this diversity is due to a difference in period; arrow-heads sometimes have tangs, sometimes not, the straight dagger and the scimitar were both used, the hafting of lanceheads was particularly varied. Of metal articles used for dress, pins and fibulae of a simple kind were common. Harness from Sennacherib's stables shows the common forms of bits and cheek-pieces. For furniture, a bronze facing on iron was popular. The arms and legs of chairs mere ornamented, and the lion's or bull's head or claw or hoof was commonly used on them. On buildings, metal heads were used as gargoyles or as a roof decoration.

Burial Customs.—The habit introduced by the Amorites into Babylonia of burying the dead beneath the floors of houses was practised throughout Assyrian history and may account for the constant spread of city sites. The tombs of Assur-nasir-pal II and of Shamshi-Adad V, in oblong stone coffins, in well built cellars, yielded no objects of importance; this may be due to tomb robbery, but probably no considerable tomb furniture was customary in Assyria. Assur-bani-pal speaks of the sacred rites performed for ancestors, and says that he restored customs long neglected; the rites intended were perhaps no more than a symbolical breaking of bread and libation of water.

Foundation Deposits.—The inscriptions buried in foundations were made upon (1) cones of the Babylonian type, sometimes with large painted knobs intended to protrude from the wall; (2) upon rectangular stone slabs, buried in the corners of the buildings; (3) on small rectangular tablets of metal, gold, silver, copper and lead; (4) on hollow terra-cotta barrel cylinders, inscribed across the length; (5) on prisms, with five to ten sides, inscribed across the narrow faces, in columns. At the foundation of all buildings some fat, oil and other vegetable products were dedicated.

Libraries—Tablets in Babylonia were commonly kept in stone jars, and the first library arranged on a systematic principle seems to have been formed in the reign of Assur-bani-pal, though the collection of tablets began in the reign of Sargon. The tablets were arranged on shelves; where a work required several tablets, index lists enumerating the first lines formed, with the help of the catch-lines given on each numbered section, a reference index, and tabs hanging down on straws gave the general title of each work. There were two libraries, one in the temple of Nabu and the other in the palace. The system probably grew up slowly, and some of the tablets found in the city of Ashur seem to have belonged to such a library system.

Army—The organization of the army depended on a division into "bands," "fifties" and "tens," and was raised apparently by a census taken in provincial districts from time to time according to estates; an example of such a census for the district of Harran is extant. Originally the army was simply a militia, called out when required either for military purposes or the labours of the *corvée* on royal buildings; but from the time of Tiglathpileser III. onwards the formation of a standing army ("the royal troops,"

"the turtan's troops" and so forth) can be traced. Conquered provinces were immediately required to provide contingents; mercenaries were not employed, as in Egypt. The priests had a part to play; a Babylonian army of the time had a soothsayer to march before it. The liability to serve was not confined to one class, and all who were liable might provide substitutes. For men of the poorest class, there were regulations providing for the support of their dependents for a reasonable period after their capture. In the second millennium, armies consisted simply of chariotry and infantry; in the 9th century cavalry was added as an independent arm, and from the 8th century a body of specially trained men acted as pioneers, for road building, mining under besieged fortresses, and so forth. Siege engines were first introduced in the 11th century; heavy battering rams on wheeled carriages, scaling ladders, and ramps were regularly used, and the Assyrians were unusually successful in this kind of warfare. River-crossing was effected by building bridges of boats. Permanent ring-camps were constructed and used as bases for different columns. The armour of the period was simple; the helmet was a pointed conical shape, to which in the age of Assur-bani-pal a crest, borrowed from the peoples of Asia Minor, was added, round shields were carried in action, and strong reed constructions used for cover in siege operations.

Administration. — An elaborate court ceremonial surrounded the Assyrian king, whereas the administration of the old Babylonian kings had been simple and direct; it became difficult for the suppliant to reach the king, the privilege of every subject, because the monarch was surrounded by powerful officials in whose hands all executive power lay. The principal official in the second millennium had been the *ummanu,* the royal clerk or scribe who communicated the king's orders in writing. From the 9th century onwards the chief officer appears to have been the turtan, the commander of the army, whose functions in the 8th century had to be duplicated, for there was a *turtan* of the right and a turtan of the left. The king's chamberlain, *sukkallu,* perhaps fulfilled the old duties of the *ummanu,* and corresponded to a Persian vizier. Another military and civil officer, the *rab šariš* or *rab šutriš,* "the chief of those at the king's head" (as he reclined on a couch at his audiences), appears in the biblical account of Sennacherib's siege of Hezekiah, and was perhaps in charge of the king's personal attendants. A treasurer, *rab danibe,* sealed the gold and silver received and could veto the issue of it in certain cases. The provincial governors, *šaknu* or urasu, were under the empire assisted by subordinate district officers, the *bel pakhati;* the raising of military levies, the finding of men for the *corvée* and the exaction of taxes was the work of the *zabil kuduri.* The Assyrians made notable developments in methods of government, the full extent of which have not yet been appreciated.

Education. — The only account of the attainments of an Assyrian youth is the panegyric of his own accomplishments by Assur-bani-pal, but that forms a compendium of the ideal attributes of the most cultured man of his time. "I, Assur-bani-pal, understood the wisdom of Nabu; all the art of tablet writing of every kind of clerk, I acquired their understanding. I learnt to shoot the bow, ride horses, and chariots, and to hold the reins." And again, "Marduk, the wise one of the gods, presented me with information and understanding as a gift. Nabu the scribe, granted me all the understanding of his wisdom as a present. Enurta and Nergal made me virile and strong, of incomparable force. I understood the craft of the wise Adapa, the hidden secrets of all the scribal art; in heavenly and earthly buildings I read and pondered, in the meetings of clerks I was present, I watched the omens (taken from the liver of sacrificial victims), I explained the heaven with the learned priests, recited the complicated multiplications and divisions which are not immediately apparent. The beautiful writings in Sumerian that are obscure, in Akkadian that are difficult to bear in mind, it was my joy to repeat. . . . I mounted colts, rode them with prudence so that they were not violent; I drew the bow; sped the arrow, the sign of the warrior. I flung the quivering javelins like short lances. I held the reins like a charioteer, so that I made all the wheels revolve (a reference to the mechanical difficulties caused by friction). I directed the 'weaving' of reed shields and breastworks like a pioneer. I had the learning that all clerks of every kind possess when iheir time of maturity comes. At the same time I learnt what is proper for lordship, I went my royal ways." On the methods of training little light has yet been thrown.

Antiquarian Interest — A marked feature of the time was an interest in the history and literature of the past. Texts concerning the exploits of Sargon of Agade were collected, and explanations of the geography of his time, not always trustworthy, drawn up; a map to illustrate them was drawn in Babylon in the 8th or 7th century. At Ur the Assyrian governor in his restoration of the town came across some early Sumerian texts, which were translated into the language of the time and exhibited in the temple.

Social Life. — The policy of transporting large bodies of population from their native district to other provinces, and the extensive settlement of new cities in Assyria itself, always followed by Assyrian kings, led to a cosmopolitan social life, not only in Nineveh but in the other great cities of the empire. Egyptian prisoners brought with them the manners and objects of their own country. Aramaeans were numerous, and official letters or commercial notes were sometimes written in the Aramaic alphabet. Marriages of Assyrian princesses with Scythian chiefs were arranged. The general result was that a uniform level of civilization was spread over western Asia at this time. The increase of the proportion of slaves to free must have been very marked; though the status of the slave was no different from that of chattels, in relative well-being the slave was in a better position often than the poor Assyrian, and freemen not uncommonly sold themselves or their children into slavery. The position of the women was peculiar; though closely secluded, they might in individual cases be prominent in public affairs. For a number of years Assyria was ruled by a queen-regent, Sammuramat, from whose name the Semiramis of Greek stories may derive. Ladies of the noble class were occasionally empowered to act as provincial governors, *šakintu;* and court intrigues of the usual oriental kind centred about the harem. An important feature of civil life was due to the guild organizations of various classes of craftsmen, for these lived in special quarters of the cities.

NEW BABYLONIAN EMPIRE

When the Assyrian capital fell after a long war conducted by the Medes, Babylonians and Scythians in 612 B.C., and the last Assyrian resistance at Harran failed in 606 B.C., the Chaldaean dynasty founded at Babylon in 625 by Kabopolassar was firmly established. The Chaldaean race first appeared in Babylonia during the troubles caused by the Aramaean invasion; in religion, personal names, and social custom they cannot be distinguished from the older Babylonians, save that they were divided into great tribal stems, with many subdivisions, like the Aramaeans. The new dynasty involved no breach of continuity, but the rise of the Median empire involved new world conditions which can be vaguely traced in archaeological discoveries.

Architecture. — Babylon. which had been partially rebuilt, after the sack by Sennacherib, under Assyrian rule was set out on new lines by Nabopolassar and Nebuchadrezzar II. The massive buildings of this last period are all that have yet been recovered of the central area of the city. The principal feature was the sacred processional way leading through this area and out by the "Ishtar Gate"; along this way, at the New Year festival, every year the image of Marduk was conveyed, ritual acts in a mime taking place at each of the sacred buildings, until the god could be placed on a boat that conveyed him to the festival house, which lay west of the Euphrates, north of the city. The main part of this way was laid with limestone and breccia slabs. The great ziggurat of Babylon dominated the whole site, and it may be that the "hanging gardens" told of by the Greek writers were connected with its stages; the excavators however believe that a vaulted building with an installation for raising water in another part of the temenos was the substructure of the "hanging gardens." This is the first proven example of the vault, apart from the early corbelled vaults of tombs, though some believe that it may be

traced in the remains of much earlier periods. Drainage was conducted by very large brick conduits, to which there were manholes sufficient to allow clearance. Though the kings of this period, especially Nabonidus, always claimed that they restored buildings according to the original plan, there is proof at Ur that they altered the nature of buildings in a way which shows a change in religious worship.

Fortifications were built upon a larger plan than ever before: Nebuchadrezzar constructed a defensive wall and moats eastwards from the Euphrates which extended to Opis on the Tigris, and parts of the internal system show the character of these walls. At Ur the temenos wall was extended by a platform sufficiently large to allow two chariots to pass. The whole temenos was actually referred to as a "fortress building." The extensive use of glaze, semi-precious stones and metal for external decoration is attested by the inscriptions, and good examples of glazing may be found on every new Babylonian site. The town-site at Babylon, Merkes, gives the impression that the period was poor compared with the richer houses of the early period at Ur. Some curious burials of the period have been found; an anthropoid sarcophagus at Babylon, and a copper coffin from Ur, riveted in modern fashion, are rare exceptions from the ordinary terra-cotta and plain stone sepulchres.

Bas-relief.—The art of the large stone bas-relief is not represented by any extant examples, and it is even doubtful whether palace rooms were so decorated. There were, however, independent developments. The figures of bulls and certain monsters on the Ishtar gate are in low relief, made of bricks each cast in a separate mould and designed for a special place. This elaborate technique seems to have been invented at this period, and was subsequently imitated by the Persians. Another kind of relief is mentioned in the inscriptions but not exampled by any extant instance; on black-and-white figure-drawings, done with gypsum and bitumen, gold or other metal overlays were applied within the outlines; these overlays must have been beaten. A few small metal plaques with figures in low and very delicate relief belong to this period.

Sculpture in the Round is represented by a few small stone heads of women, perhaps intended for temple votaries. The poverty in bas-relief and sculpture may not be altogether accidental; the increased use of glazing, and the use of coloured designs, few of which are now preserved, may have affected public taste and caused the stone relief and sculpture to go out of fashion. It is hardly conceivable that the lack of stone was due to any difficulty in obtaining it, for Nebuchadrezzar, Neriglissar and Nabonidus all had free access to Syria. That there was a general decline in taste and artistic ability is rendered probable by the seals.

Seals.—The seals in common use were small in diameter and length, generally of poor stones, and are cut with the drill in a sketchy and generally unfinished manner. The cone seal was reduced to a narrow irregular octagon, also badly cut as a rule. The commonest theme was a priest worshipping before a low altar on which stand the emblems of Marduk, a lance-head, and of Nabu, a wedge-shaped object; to these other symbols are occasionally added. The priest is generally separated from the altar by a low fence or rail. Not all cylinders were intended for common use; some were preserved in temples, and two such belonging to a temple store carved in lapis lazuli depict the gods Marduk and Adad. These are the best examples of New Babylonian seal-carving, and the figures are closely connected with the art of the "boundary-stones," they do not approach the Agade, Third Ur or Assyrian seals in merit.

Religious **Struggles.**—Nebuchadrezzar and his successors were engaged in a desperate rivalry with the Medes, and later with the Persians; in addition to continual political strife, new religious ideas were causing a ferment in the whole world of the time, and some effects of this unrest can be found in Babylonia. Some no longer tolerated the images erected to obscene cults; thus the men of Erech at the beginning of the 8th century had pulled down a shrine of Ishtar in which there was a figure of the goddess with a team of seven lions, a goddess whose cult is known to have been licentious. Nabonidus engaged in a reconstruction of temples and committed certain acts at the New Year festival which the priests did not hesitate to denounce later as impious. The evidence is not sufficient to allow of any clear ideas being formed upon the exact nature of these religious troubles.

Social Life.—As Assyria had been made a cosmopolitan centre, so Babylonia became the home of many separate and isolated communities. The Jews brought from Palestine by Nebuchadrezzar rose to important positions, and were concerned in large commercial undertakings. Isolated Greeks came to Babylon in search of military adventure. Aramaeans used their own alphabetic script increasingly. A marked feature of the period was the growth of large business houses, confined often to a single family, or rather clan, which must have controlled the fortunes of individual cities; the Egibi family at Sippar, the Murashu family at Nippur, both laid the foundations of their fortune at this period. The administration of temple lands was in the hands of increasingly powerful officials.

PERSIAN DOMINATION

When Cyrus entered Babylon in 539 B.C. he posed as the deliverer of the land and the chosen of its gods; his son Cambyses fulfilled the duties of every Babylonian king at the New Year festival of 538 B.C. Rebuilding of the temples at Erech and Ur was undertaken as a sign of the king's piety. As time passed the country was left increasingly to the administration of the governor of the satrapy called Ebir-nari, "Beyond the river," and on the death of Cambyses, Babylonia, like many other provinces, rebelled against the Persians and had to be reconquered by Darius. The province thereafter gave repeated trouble, but remained fairly prosperous, and was made to pay a very large sum into the royal treasury yearly. Towards the end of the Persian domination an outbreak of Zoroastrian fanaticism seems to have led to the destruction of many of the great temples. The zikkurat at Babylon was a mass of debris when Alexander first saw it, though it had been in a good state when Herodotus wrote; the zikkurat at Borsippa must have been burnt about this time; the temple at Ur everywhere shows marks of incendiary destruction, after which the site was deserted, save for stray fugitives. There is every sign that Persian rule in Babylonia was unpopular from the time of Darius I., and that by the time of Darius III. the land had suffered from a religious persecution. There are some signs of a change of burial customs, long rectangular brick tombs in which the body was laid at full length, and the face sometimes covered with a gold mask, or the mouth, eyes and nose covered by thin gold strips may belong to this or a later period. The most typical, and only numerous, objects are the seals and tablets.

Seals.—In shape and cutting the seals closely resemble those of the late Assyrian period; the treatment of the themes alone is typical. The theme of the hero struggling with animals is adopted and becomes the king killing lions; the hunt of Sagittarius becomes the royal lion-hunt. Or sometimes the hero is converted into the ludicrous Bes, possibly with the intention of ridiculing the pagan religion. Contemporary scenes might also be treated, a custom already observed in Assyria; a seal shows a Persian soldier killing a Greek, a memorial perhaps of Darius' war. The treatment of the human body on some of these seals is unsurpassed in any gem-cutting; without the extreme detail favoured by the Assyrians, the forms are indicated with truth and delicacy. The cone seals have themes peculiar to them; the bird-man is a constant subject, as is also the king holding two animals, in the old heroic style. These seals are also very finely cut.

SELEUCID ERA

Alexander the Great ordered the clearance of the temple site at Babylon, and this was effected in part in the reign of his posthumous son. Seleucus I. and Antiochus I. paid particular attention to Babylonia, and seem to have aimed at a general restoration of the old religion. Cities were founded for the Macedonian and Greek colonists, and the ruin caused at Babylon by an incursion of Antigonus Monophthalmus led to the removal of most of the civilian population to Seleucia by order of Antiochus;

this need not have been due to any deliberate wish of the Macedonians to be rid of the ancient capital, as often represented. Rebuilding of the shrine of Nabu at Borsippa was undertaken at Antiochus' command; and the priests of Erech were given facilities for collecting the secret ritual texts, which had been scattered in Persian times, from Susa and elsewhere. A historical school, gathered round a central personality known in Greek as Berossos, was active in compiling chronicles of the long centuries of Babylonian history, that these might be translated into Greek for the instruction of their new rulers. The schools of priests who were engaged in astronomical studies were particularly active at this time, and scientific observation and prognostication was the most important advance in this direction. In the south, business documents continued to be written in cuneiform; the latest known cuneiform text contains astronomical observations for the year 9–8 B.C. Even cylinder seals have been found in use so late as the 3rd century, clearly marked with the Seleucid anchor, and the form survived as an exceptional usage into Parthian times; but it had ceased to be commonly used, and the tablets are sealed with oval ring-bezels bearing typically Greek devices. As the survival of Babylonian religion was one marked feature of the period, the complete disappearance of all native art was another. Stone and bronze statuettes, terra-cotta figurines and plaques, and the pottery and glass ware of the time, betray no survival of native handiwork. All is provincial, classical output, generally tasteless. And as the centuries passed, and Rome occupied the position the Hellenistic kingdoms once had done, until the Parthians drove the mistress of the world out of the Tigris valley, the output became worse, the last remnant of the old Babylonian civilization, the cuneiform tablets, cease to be found, and darkness settled upon the land for several centuries.

GENERAL FEATURES

The civilization which has been described in its historical aspect from the archaeological remains, was based upon an agricultural settlement of the lower valleys of the Tigris and Euphrates, only possible for a people acquainted with the method of irrigation necessary for that land. The problem presented is different from that in the Nile valley, where the annual inundation is welcome. The Tigris, swollen by the molten snows of the northern and eastern hills, floods at the end of March or beginning of April, and an overflow of its banks can do great damage to the surrounding country in the Baghdad region and southwards. The Euphrates floods about the time the Tigris is subsiding as a rule; the damage in this case is not due so much to the violence of the stream as to the deposit of salt left on the surface by any temporary flood. To be successful, irrigation must be preceded by a drainage system. The problem was at any rate in part solved by the avoidance of floods; canal systems sufficient to take the largest possible overflow were devised, and carried out sometimes, apparently by diverting the course of the Euphrates just north of Babylon. These canals were invariably built by forced labour, the royal corvée; and from the earliest to the latest times "Irrigator" was a proud title for any king. The derivative, smaller canals, were fed by simple machines; the *shadûf* still employed was in common use; there is some evidence for the existence of the water-wheel in the new Babylonian era. Some part of the history of the canal system is known; Lagash and Umma were once connected by water with the Tigris, the "Royal Canal" and the "Pallacottas" which lasted throughout the ages until mediaeval centuries were in existence before the time of Nebuchadrezzar II. The rise and fall of the towns was closely connected with the opening and silting up of canals. This silting up, which raises the bed and banks of the river by too considerable a height above the plain, is only avoided by annual cleaning, and that was secured by making the townships and landowners along the banks responsible. Such a dynasty as that which included Hammurabi, by an energetic personal administration, secured good order in this respect; the invasion of the Aramaean tribesmen in the 10th century caused a considerable lapse, with the result that the marsh land was increased. The Chaldaeans, the inhabitants of the marshes, occupied a far more extensive territory in the 7th century than their congeners, the Sea-Land dynasty of Hammurabi's time.

The canals carried commerce in the mean boats required for river traffic. In the earliest days craft had sailed up the Persian Gulf to Ur and even so far north as Agade, somewhere near Babylon, to unload at the brick-built, bitumen-faced quays beside these cities. But the constant recession of the gulf rendered this impossible after the time of the 3rd dynasty of Ur, and thereafter no more is heard of such traffic. The ordinary river boat is a canoe type, propelled by poles, with a high prow fore and aft. On the Tigris, a circular basket, constructed of wood and skin, of some depth, is coated with bitumen, and will serve to carry large animals, when adequately guided, down stream; this is the type now called a *quffah*. On the Euphrates, the raft is used above 'Anah, the modern kelek. The Assyrians on their military campaigns generally carried skins, which were inflated and used by the individual soldier; but Sennacherib, who undertook a great campaign in the marshes and the gulf, brought Phoenician ships with a bank of oars across to the Euphrates. Constant campaigning on the Mediterranean coast brought acquaintance with Mediterranean ships, and there is a representation on a 7th century frieze of a Phoenician ship with a ram.

The other principal feature of this civilization was that it depended upon trade to an exceptional degree. The wealth manifested by the early Sumerian remains can only have been so obtained; and the existence of the great city communities always afterwards proves that the trade was very considerable. It is not, therefore, surprising to find that the Babylonian system of minas, shekels and grains was very widely employed, and has had an influence upon distant lands. Only the actual form taken by the weights can be dealt with here. In Babylonia the commonest type of weight took the form of a duck, with its head turned back, modelled in low relief on the back; these were made in all sizes, in all kinds of stone. Another common form was a barrel cylinder, with flattened ends, a type also used in Egypt; these were generally made of haematite, but other hard stones were also employed. A more unusual form was a stele-shape, with rounded top, rather thick; an instance, dating from at least the second millennium, was found at Ur; Nebuchadrezzar's copy of Shulgi's weight and Darius' weight have also this shape. The Assyrians commonly used the duck-weight; but the royal weights of Sargon, found in the gateway of the palace of Khorsabad, take the form of bronze lions, or lionesses, and stone examples of this kind are known; this lion type was also used in Egypt. The use of the duck-weight and the cylindrical shape is interesting; they were suspended by wire to the end of a beam, as instances are known in which the wires are still intact. By no means all weights were inscribed: sometimes the weight is written in full, sometimes only a number of lines are marked, the unit not being given. In the case of Sargon's weights, there are both Assyrian and Aramaic inscriptions.

Exchange Methods.—The question of the mode of exchange is often complicated. In some cases barter of the simplest kind can be proved, even in the later periods; while even in the earliest, some instances of barter are regulated by a reference to weights of metal, which may not actually have been used in the transaction. On the other hand, there can now be no doubt that the numerous instances of purchase with gold, silver and copper should not be considered as "contracts for" these metals, but as exampling the use of these metals as a means of exchange, and this use can be traced from at least the third millennium to the first. In Babylonia only the three metals were so employed; in Assyria from the end of the third millennium to the end of the second, lead was also so employed, and State fines of delinquents were estimated in terms of lead. The form in which metal was used is doubtful. In early Sumerian times quantities of thin gold ribbon have been shown to have existed, and it is possible that the small amounts of this metal noted, fractions of a shekel being common, were passed over in this form. In Assyria, stamped lumps of lead dating from the 13th century have been found in the temple of Ishtar; such lumps would correspond to Chinese "cash," and would fulfil the description of lead minas and shekels in the documents as "sealed."

On various sites small "twists" of metal, of irregular shape but folded in such a manner as to allow of stringing, have been found in positions which seem to prohibit the view that they are merely waste pieces; such pieces also may have been used for exchange.

Money. — In the time of Sennacherib, however, Assyrian money was, and had for some time been, cast in small pieces. The half-shekel, or *zuzu,* was the denomination specially chosen. The form of these cast pieces is not stated in the inscription which mentions them; but such a piece must have been thin, and thin round pieces of metal, cast in moulds that had "runners," have been found in buildings and burials dating from a very early period. Such roundels may originally have been used as ornament; but it is difficult to think of the late Assyrian cast half-shekels in any other form. It is interesting to note that the word *zuzu* survived into the Christian era as the name of a very small coin.

The distinctive feature of the Babylonian weights was their dependence upon the sexagesimal system. The origin of that system has been much disputed; its use is obvious. The chief point about its origin is whether it depended upon a combination of two other systems, a decimal and a duodecimal, or (more probably) of a system dependent upon five with one based on six, or whether it was independent of the five (or ten) unit. Probability points to the former alternative, for the ner unit, 600, can hardly be explained on the second alternative. The obvious advantage of the system, the ready expression of most fractions, gave rise to a system of notation which closely approximates in use to the decimal point. Thus the number 4.275 could be expressed as  ; *i.e.,* 1 sar 1 ner 1 soss 10+5, or 3,600+600+60+15; the value of the number thus depending on the unit implied.

Staples Cultivated. — The staples of Babylonian commerce in the late period were wheat, emmer, barley, dates, sesame and woven stuffs. It has frequently been asserted that wheat was indigenous in the country, and an example of a species of wheat has been found in remains of the early Sumerian period at Kish; but the distinctive word for wheat does not begin to appear frequently until the end of the third millennium, and before 2000 B.C. barley and emmer were the only cereals in common use. The rich yield of wheat in Herodotus' time made Babylonia the wealthiest satropy in the Persian empire. The cultivation of the date depended on a knowledge of fructification, by grafting the spathe of the male tree into the female spathe. This operation entails climbing the tree with a rope, and the method of fructification was hence called "riding," *rukbu.* Weaving depended. from 2500 B.C., on the import of fax, which must have been obtained from the north, probably from the Khabur district. Cotton, the cultivation of which was introduced into Assyria by Sennacherib from some unknown district, is first mentioned by name, *quṭanu,* in the Persian epoch. Apiculture, of some importance owing to the use of honey and wax, was introduced into Sukhi, a land west of the Euphrates, just north of Babylonia, in the 8th century.

BABYLONIAN CULTURAL INFLUENCE

The evidence of Babylonian influence on other nations is more apparent in religion and in literature than in archaeological remains. Some of the themes of pre-dynastic and early dynastic art in Egypt were clearly borrowed from Sumer, and there is evidence of early Sumerian civilization in Syria in objects found there. At a later date, perhaps not earlier than the middle of the second millennium, the themes of Hittite and north Syrian art were derived from Babylonian mythology, but a direct derivation of the artistic style cannot be proved except in the case of seals. In the first millennium all the Assyrian provinces, especially southern Syria, were affected by the dominant race; a curious hybrid art arose in Phoenicia from a mixture of Egyptian and Assyrian elements. The art of Persia was at first quite dependent on Assyria, and the Lydians were also affected, to judge by the monument of Cyrus at Ephesus. This is all, or nearly all, that can be stated with certainty on this subject. But further discovery may prove a wider range of influence through trade. Isolated cylinder seals of Syrian or Babylonian origin have been found in Crete, and some believe that the use of clay tablets in that island must have originated by borrowing from Babylonia or Asia Minor. Another difficult question is that of glass manufacture. When Thothmes III. collected tribute from Assyria and some Assyrian provinces, he took "genuine lapis" and "Babylonian lapis lazuli"; if this latter was, as seems probable, a manufactured product, it is difficult to see what it can be other than an opaque glass. In that case Babylonia had an important influence on the early glass trade. In short, though the cultural influence of Babylonia was far more restricted than was at one time thought, it played an important part in the development of early civilization and should never be neglected.

ANCIENT SITES

At the end of the 18th century the abbé Beauchamps encouraged some native diggers at Babylon, who frequented the site to obtain mortar, to keep certain antiquities, and obtained some himself. Some of these passed into the possession of C. J. Rich, the British resident at Baghdad, whose report on the antiquities of the country was the direct inspiration of Botta and Layard, the first European excavators. The principal aim of these pioneers at first was to discover the site of Nineveh; they did not sufficiently rely upon Rich's well-grounded judgment that the Assyrian capital must lie under the twin mounds of Quyunjiq and Nabi Yunis. Botta, with the aid of funds from the French government, turned from Quyunjiq, owing to Turkish restraints, to Khorsabad, the ancient Dur-Sharrukin, which Sargon II. of Assyria built, and claimed that this was Nineveh; Layard, digging for Stratford Canning, thought that Nimrud, the ancient Calah, the Assyrian capital in the 9th century, was the same city, though he retained a firman for Quyunjiq.

Since these earliest expeditions in 1841–45 revealed the richness of the land in every kind of antiquity, many sites have been excavated, more have been located, and some are well known from native diggings. At various intervals Quyunjiq has been worked upon, and the excavations still in progress have only touched a small part of the site of Nineveh. That city existed in prehistoric times, but the most important finds, the palace sculptures and the library tablets, belong to the 7th century B.C. Khorsabad is a small site, excavated by Botta and Place; the remains belong exclusively to the 8th century, and are important because they reveal the most complete evidence for the architecture of the Assyrian period known. Nimrud was very thoroughly plundered of large objects, but at the time of its excavation little was understood of the subject, and much may yet be unearthed there; the city was rebuilt and much enhanced in importance in the 9th century, but it existed at the end of the second millennium. Other sites identified are Sharif Ḵhan, the ancient Tarbisi; Irbil, once Arbela, the only old Assyrian town still of importance when Alexander conquered Darius III.; Shemamokh, once called Alshe; and Sadawa, formerly Kakzi.

The earliest capital of the kingdom, the city of Ashur, near the village called Qal'at Shirqāt has been thoroughly excavated by a German expedition, and from it remains of every period have been recovered, down to the early centuries of the Christian era, when the poverty-stricken villagers still kept old Assyrian names. Archaeological finds there can be compared with the history of the time revealed in inscriptions, and the two sources of evidence combine to form a true picture. The thorough investigation of any Assyrian site is always rewarded with a wealth of exact historical information.

Some light on lands east of Tigris has been obtained from the district of Kirkuk, where two small sites have been attacked, one representing the important city of Arrapkha. This was the centre of a Subaraean population in the 14th century, and the personal names show that only a few Assyrians lived in the city. The place was generally an Assyrian province, but managed occasionally to secure independence; Assyrian legal customs and the Assyrian language had been adopted. The work was commenced by native diggers, and is being continued on scientific lines by American excavators.

Antiquities of the Assyrian period have also been found at Wan and Toprak Kaleh in Armenia and at various sites in Syria and Palestine

In Babylonia, Rassam obtained an important series of collections of tablets from Sippar of Shamash, now Abu Habbah, and from Babylon itself. Many years later a German expedition spent many years uncovering the deeply buried remains of Nebuchadrezzar's city at the last named site; except in the town quarter no remains much earlier than the 8th–7th century have appeared, and it would seem that the earlier levels are now sunk beneath the water level. A certain number of tablets and other antiquities have been obtained from time to time at Borsippa, now called Birs Nimrud, and considerable attention has been paid to the ruined ziggurat there. The remains from Sippar, where Rassam's work has been continued by a French expedition, are of very various dates, from the time of the 1st dynasty of Bdbylon to the Seleucid era; there was an important astronomical school there in the later centuries. Slightly north-east of Babylon Tall al 'Ckhaimir marks the position of Kish, where a French expedition commenced work in the first decade of the 20th century which has been carried on by a combined British and American expedition; adjoining Kish lies the city called Khursag-kalamma. Both places were inhabited at the earliest period, and have yielded information concerning the centuries previous to the 1st dynasty of Babylon. The other important site in northern Babylonia, the ancient Akkad, scientifically examined is Nippur, the modern Nuffar, where an American expedition recovered a great store of very early documents, and a series of ,dedications and building inscriptions of kings from the earliest to late Assyrian times prove the long continuance of the temple there as a central shrine for all Sumer and Akkad.

The southern country, Sumer, was first made known by the excavations of Captain Taylor and W. K. Loftus in 1854–55; they discovered the sites of Ur (Tall al Muqayyar), Eridu (Abu Shahrain) and Erech (Warka). The two first named cities have been partly revealed by subsequent British excavations, and a combined British and American expedition now at work at Ur has revealed historical monuments earlier than any previously known. But the nature of the early Sumerian civilization was first discovered owing to the French expedition to Tall Loh, the ancient Lagash at the end of the 19th century; subsequent discoveries have to be grouped around the important group of early city governors there, whose genealogies can be traced through many centuries.

The nature of other sites has been determined by hasty trial trenches: Dur-Kurigalzu lay at 'Aqarquf, immediately west of Baghdad; Kuthah at Tall Ibrahim. Shuruppak, the city of the Babylonian Noah, is known to be Farah, where there are extensive early cemeteries, Kisurra is Tall Surghul, Kutalla is Tall Sifr, perhaps one of the towns called Sippar u-as situated at Dair. Native diggings have resulted in great collections of tablets and antiquities of all ages from Erech reaching European and American museums. Erech was, according to Sumerian tradition, a royal city before the Flood: it was a flourishing centre of industry in the Seleucid era. and no city promises more interesting results in Babylonia than this. Larsa, the modern Sankarah, has also been extensively plundered by native workers: the school of scribes active there between 2200 and 2000 B C. is now well known to have produced an extensive and important series of editions of older texts.

At sites outside Babylonia but closely connected with it, in Susa, one of the Achaemenian capitals, perhaps the earliest known painted pottery has been discovered; apart from the important objects throwing light upon the history of Elam, some of the most important Babylonian monuments such as Naram-Sin's stele of victory and Hammurabi's Code of Laws have been found there by the great French expedition in Persia. It is, perhaps, the site with the most complete historical sequence of "strata" yet known in this region. North-west of Babylonia a promising commencement has been made at the site called Tall 'Asharah, which conceals Tirqa, or Sirqu, the ancient capital of the small kingdom of Khana; this place lies a little south of Dair-az-Zur, and owing to its strategic position played an important part in the political history both of Babylonia and Assyria.

Of the cities which arose in Seleucid and Parthian times there are imposing remains to be seen at Seleucia, Ctesiphon and Hatrah. No scientific work has yet been done upon sites of the "classical" period except Hatrah, and much good would result from more attention to the possibilities of these sites. An early parchment inscribed with a Greek text recordrng a business transaction has been found at a village in the Zagros range. Scientific excavations at the ancient Doura, the modern Tall-as-Salihiyyah, on the Euphrates, 20 odd miles south of Dair-az-Zur, have revealed important paintings of the Roman period. which anticipate the Byzantine style, and some early parchments, one dated to 159 B C., in Greek. Occasionally broken inscriptions coming from Babylonia are published, but statements as to their provenance are generally suspect.

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HISTORY

In the earliest period of which we have any knowledge Babylonia was divided into several independent states, the limits of which were defined by canals and boundary stones. Its culture may be traced back to two main centres, Eridu. which had once been a seaport, in the south and Nippur in the north.

We may call the early civilization of Babylonia Sumerian. The race who first developed it spoke an agglutinative language, and to them was due the invention of the pictorial hieroglyphs which became the running-hand or cuneiform characters of later days, as well as the foundation of the chief cities of the country and the elements of its civilization

Arrival of the Semites.—When the Semites first entered the Edin or plain of Babylonia is uncertain, but it must have been at a remote period. The cuneiform system of writing was still in process of growth when it was borrowed and adapted by the new comers. It is in the north that mention of the Semites first occurs on the monuments.

The earliest monuments that can be approximately dated come from Lagash (Tello). We hear of a "king of Rengi," as well as of a certain Me-silim, king of Kis, who had dealings with Lugal-suggur, high-priest of Lagash, and the high-priest of a neighbouring town A dynasty was later founded at Lagash by the high-priests and the dynasty of Ur-Ninā was set up.

The campaigns of E-anna-du, grandson of Cr-Nina, extended beyond the confines of Babylonia. He overran a part of Elam and took the city of **Az** on the Persian Gulf. Temples and palaces were repaired or erected at Lagash and elsewhere, the town of Ninā—which probably gave its name to the later Ninā or Nineveh—was rebuilt, and canals and reservoirs were excavated. He was succeeded by his brother En-anna-tum I His son and successor Entemena restored the prestige of Lagash.

The eighth successor of Ur-Ninā was Uru-duggina, who was overthrown and his city captured by Lugal-zaggisi, the high-priest of Gis-ukh. Lugal-zaggisi was the founder of the first empire in Asia of which we know. He made Erech his capital and called himself king of Kengi.

Sargon's Semitic Empire.—The next empire founded in western Asia was the Semitic Empire of Sargon of Akkad whose date is believed to be about 2550 B.C. He was the son of Itti-Bel, and a legend related how he had been born in concealment and set adrift in an ark of bulrushes on the waters of the Euphrates Here he had been rescued and brought up by "Akki the husbandman"; but the day arrived at length when his true origin became known, the crown of Babylonia was set upon his head and he entered upon a career of foreign conquest. Four times he invaded Syria and Palestine, and spent three years in thoroughly subduing the countries of "the west," and in uniting them with Babylonia "into a single empire." Elam and the northern part of Mesopotamia (q *v*) were also subjugated, and rebellions were put down both in Kazalla and in Babylonia itself.

Sargon's son and successor, Naram-Sin, followed up the successes of his father by marching into Magan, whose king he took captive. He assumed the imperial title of "king of the four zones," and, like his father, was addressed as a god. He is even called "the god of Agadē" (Akkad).

Bingani-sar-ali was the son of Naram-Sin, but we do not yet know whether he followed his father on the throne. Another son was high-priest of the city of Tutu. The fall of Sargon's Empire seems to have been as sudden as its rise and the seat of supreme power in Babylonia was shifted southward to Ur:

This dynasty of Ur was Semitic, not Sumerian, notwithstanding the name of Dungi. Dungi was followed by Bur-Sin, Gimil-Sin, and Ibi-Sin, and their power extended to the Mediterranean.

After the fall of the dynasty, Babylonia passed under foreign influence. Sumuabi ("Shem is my father"), from southern Arabia (or perhaps Canaan), made himself master of northern Babylonia, while Elamite invaders occupied the south. After a reign of 14 years Sumuabi was succeeded by his son Sumu-la-ilu, in the fifth year of whose reign the fortress of Babylon was built, and the city became for the first time a capital. The Elamite supremacy was at last shaken oti by Hammurabi who was the Amraphel of Gen. xiv. 1, and who, in the thirtieth year of his reign (in 2037? B.C.), overthrew the Elamite forces in a decisive battle and drove them out of Babylonia. The next two years were occupied in adding Larsa and Yamutbal to his dominion, and in forming Babylonia into a single monarchy, the head of which was Babylon. A great literary revival followed the recovery of Babylonian independence, and the rule of Babylon was obeyed as far as the shores of the Mediterranean. Constant intercourse was kept up between Babylonia and the west, Babylonian officials and troops passing to Syria and Canaan, while "Amorite" colonists were established in Babylonia for the purposes of trade.

One of the most important works of this "First Dynasty of Babylon," as it was called by the native historians, was the compilation of a code of laws (*see* BABYLONIAN LAW). This dynasty was followed by another of 11 Sumerian kings, who are sdid to have reigned for 368 years, a number which must be much exaggerated. As yet the name of only one of them has been found in a contemporaneous document. They were overthrown and Babylonia was conquered by Kassites or Kossaeans from the mountains of Elam, with whom Samsu-iluna had already come into conflict in his 9th year. The Kassite dynasty was founded by Kandis, Gandis or Gaddas (about 1743 B.C.), and lasted for 576¾ years. Under this foreign dominion, which offers a striking analogy to the contemporary rule of the Hyksos in Egypt, Babylonia lost its empire over western Asia, Syria and Palestine became independent, and the high-priests of Assur made themselves kings of Assyria.

Rise of **Assyria.**—Under Hammurabi a Samsi-Hadad (or Samsi-Raman) seems to have been vassal-prince at Assur. The foundation of the monarchy was ascribed to Zulilu, who is described as living after Bel-kapkapi or Belkabi (1900 B.C.), the ancestor of Shalmaneser I. Assyria grew in power at the expense of Babylonia, and a time came when the Kassite king of Babylonia was glad to marry the daughter of Assur-yuballidh of Assyria, whose letters to Amenophis (Amen-hotep) IV. of Egypt have been found at Tell el-Amarna. The marriage, however, led to disastrous results, as the Kassite faction at court murdered the king and placed a pretender on the throne. Assur-yuballidh promptly marched into Babylonia and avenged his son-in-law, making Burna-buryas of the royal line king in his stead. Burna-buryas, who reigned 22 years, carried on a correspondence with Amenophis IV. of Egypt. After his death, the Assyrians, who were still nominally the vassals of Babylonia, threw oti all disguise, and Shalmaneser I. (1300 B.C.), the great-great-grandson of Assur-yuballidh, openly claimed the supremacy in western Asia. Shalmaneser was the founder of Calah, and his annals, which have recently been discovered at Assur, show how widely extended the Assyrian empire already was. Campaign after campaign was carried on against the Hittites and the wild tribes of the north-west, and Assyrian colonists mere settled in Cappadocia. His son Tukulti-In-aristi conquered Eabylon, putting its king Bitilyasu to death, and thereby made Assyria the mistress of the oriental world. Assyria had taken the place of Babylonia.

For 7 years Tukulti-In-aristi ruled at Babylon with the old imperial title of "king of Sumer and Akkad." Then the Babylonians revolted. The Assyrian king was murdered by his son, Assur-nasir-pal I., and Hadad-nadin-akhi made king of Babylonia. But it was not until several years later, in the reign of the Assyrian king Tukulti-Assur, that a reconciliation was effected between the two rival kingdoms. The next Assyrian monarch, Bel-kudur-uzur, was the last of the old royal line. He seems to have been slain fighting against the Babylonians, who were still under the rule of Hadad-nadin-akhi, and a new dynasty was established at Assur by In-aristi-pileser, who claimed to be a descendant of the ancient prince Erba-Raman. His fourth successor was Tiglath-pileser I., one of the great conquerors of Assyria, who carried his arms towards Armenia on the north and Cappadocia on the west; he hunted wild bulls in the Lebanon and was presented with a crocodile by the Egyptian king. In 1107 B.C., however, he sustained a temporary defeat at the hands of Merodach-nadin-akhi (Marduk-nadin-akhē) of Babylonia, where the Kassite dynasty had succumbed to Elamite attacks and a new dynasty reigned.

Of the immediate successors of Tiglath-pileser I. we know little, and it is with Assur-nasir-pal II (884–859 B.C.) that our knowledge of Assyrian history begins once more to be fairly full. His son Shalmaneser III. had a long reign of 35 years, during which the Assyrian capital was converted into a sort of armed camp. The last few years of his life were disturbed by the rebellion of his eldest son, which \%ell-nighproved fatal. Assur, Arbela and other places joined the pretender, and the revolt was with difficulty put down by Samsi-Raman (or Samsi-Hadad), Shalmaneser's second son, who soon afterwards succeeded him (824 B.C.). In 804 B.C. Damascus was captured by his successor Hadad-nirari IV., to whom tribute was paid by Samaria.

With Nabu-nazir, the Nabonassar of classical writers, the so-called Canon of Ptolemy begins. When he ascended the throne of Babylon in 747 B.C. Assyria was in the throes of a revolution. Civil war and pestilence were devastating the country, and its northern provinces had been wrested from it by Ararat. In 746 B.C. Calah joined the rebels, and on the 13th of Iyyar in the following year, Pulu or Pul, who took the name of Tiglath-pileser III., seized the crown and inaugurated a new and vigorous policy.

Second Assyrian Empire.—Under Tiglath-pileser III. arose the second Assyrian empire, which differed from the first in its greater consolidation. After terrorizing Armenia and the Medes and breaking the power of the Hittites, Tiglath-pileser III. seized the Phoenician seaport and the highroads of commerce to the Mediterranean and then made himself master of Babylonia. In 729 B.C. the summit of his ambition was attained, and he was invested with the sovereignty of Asia in the holy city of Babylon. Two years later, in Tebet 727 B.C., he died, but his successor Ululā. who took the name of Shalmaneser V., continued the policy he had begun. Shalmaneser died suddenly in Tebet 722 B.C., while pressing the siege of Samaria, and the seizure of the throne by another general, Sargon, on the 12th of the month, gave the Babylonians an opportunity to revolt. In Nisan the Kaldā prince, Merodach (Marduk)-baladan, entered Babylon and was there crowned legitimate king. For twelve years he successfully resisted the Assyrians; but the failure of his allies in the west to act in concert with him, and the overthrow of the Elamites, eventually compelled him to fly to southern Babylonia. Sargon was now accepted as king by the Babylonian priests and his claim to be the successor of Sargon of Akkad acknowledged up to the time of his murder in 705 B.C. His son Sennacherib, who succeeded him on the 12th of Ab, did not possess the military or administrative abilities of his father, and the success of his reign was not commensurate with his vanity. He was never crowned at Babylon, which was in a perpetual state of revolt until, in 691 B.C., he shocked the religious and political conscience of Asia by razing the holy city of Babylon to the ground. His campaign against Hezekiah of Judah was as much a failure as his policy in Babylonia, and in his murder by his sons on the 20th of Tebet 681 B.C. both Babylonians and Jews saw the judgment of heaven.

Esar-haddon, who succeeded him, was commanding the army in a campaign against Ararat at the time of the murder; forty-two days later the murderers fled from Nineveh and took refuge at the court of Ararat. But the Armenian army was utterly defeated near Malatia on the 12th of Iyyar, and at the end of the day Esar-haddon was saluted by his soldiers as king. He thereupon returned to Nineveh and on the 8th of Sivan formally ascended the throne. Under him Babylon became the second capital of the Empire.

Esar-haddon's policy was successful and Babylonia remained contentedly quiet throughout his reign. In February (674 B.C.) the Assyrians entered upon their invasion of Egypt (see also EGYPT: History), and in Nisan (or March) 670 B.C. an expedition on an unusually large scale set out from Nineveh. The Egyptian frontier was crossed on the 3rd of Tammuz (June), and Tirhaka, at the head of the Egyptian forces, was driven to Memphis after fifteen days of continuous fighting. On the 22nd of the month Memphis was entered by the victorious army and Tirhaka fled to the south. Two years later (668 B.C.) Egypt revolted, and while on the march to reduce it, Esar-haddon fell ill and died (on the 10th of Marchesvan or October). Assur-bani-pal succeeded him as king of Assyria and its empire, while his brother, Samas-sum-yukin, was made viceroy of Babylonia. The arrangement was evidently intended to flatter the Babylonians by giving them once more the semblance of independence. But it failed to work. Samas-sum-yukin became more Babylonian than his subjects; the viceroy claimed to be the successor of the monarchs whose empire had once stretched to the Mediterranean; even the Sumerian language was revived as the official tongue, and a revolt broke out which shook the Assyrian empire to its foundations. After several years of struggle, during which Egypt recovered its independence, Babylon was starved into surrender, and the rebel viceroy and his supporters were put to death. Next followed the contest with Elam, in spite of the efforts of Assur-bani-pal to ward it off. Assyria, however, was aided by civil war in Elam itself; the country was wasted with fire and sword, and its capital Susa or Shushan levelled with the ground. But the long struggle left Assyria maimed and exhausted, and she was ill prepared to face the hordes of Scythians — or Manda, as they were called by the Babylonians — who now began to harass the frontiers. A Scythian power had grown up in the old kingdom of Ellip, to the east of Assyria, where Ecbatana was built by a "Manda" prince; Asia Minor was infested by the Scythian tribe of Cimmerians, and the death of the Scythian leader Dugdammē (the Lygdamis of Strabo i. 3, 16) was regarded by Assur-bani-pal as a special mark of divine favour.

Scythian Influence.—When Assur-bani-pal died, his empire was fast breaking up. Under his successor, Assur-etil-ilani, the Scythians penetrated into Assyria and made their way as far as the borders of Egypt. Calah was burned, though the strong walls of Nineveh protected the relics of the Assyrian army which had taken refuge behind them; and when the raiders had passed on to other fields of booty, a new palace was erected among the ruins of the neighbouring city. The last king of Assyria was probably the brother of Assur-etil-ilani, Sin-sar-iskun (Sin-sarra-uzur), who seems to have been the Sarakos (Saracus) of Berossus. He was still reigning in Babylonia in his seventieth year. Nabopolassar, now viceroy of Babylonia, fought against Sin-sar-iskun and the Scythian king of Ecbatana, the Cyaxares of the Greeks, came to the help of the Babylonians. Nineveh was captured and destroyed by the Scythian army, along with those cities of northern Babylonia which had sided with Babylonia, and the Assyrian empire was at an end.

The seat of empire was now transferred to Babylonia. Nabopolassar was followed by his son Nebuchadrezzar II., whose reign of 43 years made Babylon once more the mistress of the civilized world. Only a small fragment of his annals has been discovered relating to his invasion of Egypt in 567 B.C., and referring to "Phut of the Ionians." Of the reign of the last Babylonian king, Nabonidos, however, and the conquest of Babylonia by Cyrus, we now have a fair amount of information. This is chiefly derived from a chronological tablet containing the annals of Nabonidos, which is supplemented by an inscription of Nabonidos, in which he recounts his restoration of the temple of the Moon-god at Harran, as well as by a proclamation of Cyrus issued shortly after his formal recognition as king of Babylonia. It was in the sixth year of Nabonidos (549 B.C.)—or perhaps in 553 — that Cyrus, "king of Anshan" in Elam, revolted against his suzerain Astyages, king of "the Manda" or Scythians, at Ecbatana. The army of Astyages betrayed him to his enemy, and Cyrus (*q.v.*) established himself at Ecbatana, thus putting an end to the empire of the Scythians, which the Greek writers called that of the Medes, through a confusion of Madā or "Medes" with Manda. Three years later we find that Cyrus has become king of Persia and is engaged in a campaign in the north of Mesopotamia. Meanwhile Nabonidos has established a camp at Sippara, near the northern frontier of his kingdom, his son — probably the Belshazzar of other inscriptions — being in command of the army. In 538 B.C. Cyrus invaded Babylonia. A battle was fought at Opis in the month of June, in which the Babylonians were defeated, and immediately afterwards Sippara surrendered to the invader. Nabonidos fled to Babylon, whither he was pursued by Gobryas, the governor of Kurdistan, and on the 16th of Tammuz, two days after the capture of Sippara, "the soldiers of Cyrus entered Babylon without fighting." Nabonidos was dragged out of his hiding-place, and Kurdish guards were placed at the gates of the great temple of Bel, where the services continued without intermission. Cyrus did not arrive till the 3rd of Marchesvan (October), Gobryas having acted for him in his absence. Gobryas was now made governor of the province of Babylon, and soon afterwards the son of Nabonidos, according to the most probable reading, died. (See MESOPOTAMIA; 'IRAQ; CYRUS; DARIUS and PERSIA: History.) (A. H. S ; A. N. J. W.)

BABYLONIAN AND ASSYRIAN RELIGION. Babylonia and Assyria are general geographical and racial terms which designate the eastern branch and habitat of the Semitic peoples, but their religion was essentially Sumerian, and consequently the religion of this earlier non-Semitic people, who founded the mighty civilization of ancient Mesopotamia, must be outlined first. The period of their entry into the valleys of the Tigris and Euphrates is still beyond the scope of exact historical research, but great cities and cults were already in existence before 3500 B.C., and there is quite clear evidence that they moved into the area from the eastern side of the Euphrates. Their legends regard the lost city D&rin Ashnunak 23 miles E.N.E. of Baghdad, modern *Asmar,* as the place from which the cult of Anu the heaven god, Innini the heaven goddess and her brother the dying god Tammuz, were transplanted to the great city Erech on the southern reach of the Euphrates. When we reach firm historical footing by means of inscriptions about 3300 B.C., the Sumerian religion has already an elaborate pantheon and an intricate theological system. The earlier stages of their religious evolution are obscure; although a number of inscriptions from the pictographic period exist, they mention no deities, and refer to no religious ideas. In this immense theological structure, which dominated the religions of Western Asia until the last century B.C., and profoundly influenced both the Old and New Testament, no trace remains of an earlier stage of animism and magic ceremonies.

Sumerian Pantheon. — From the earliest period onward four principal deities were at the head of the Sumerian pantheon, Anu (Semiticized form of *An),* the heaven god, father of all the successive series of deities, who is closely associated with the virgin heaven goddess Innini, the Semitic Ishtar, at Erech (see ANU). Enlil the earth god, and his consort Ninlil had their temple and cult at Nippur (see BEL). The water god (Ea, Enki) and his consort Damkina were worshipped at Eridu at the mouth of the Euphrates on the shore of the Persian gulf. Corresponding to this trinity, who divided the universe among themselves, is the unmarried mother goddess Nintud, goddess of engendering, often called Makh, "the supreme goddess," and known to the Babylonians and Assyrians as the *Bêlit ilāni,* "Queen of the gods." The theological lists assign to her as many as 41 names, which describe various aspects of her divine activity. Of these the following should be specially noted: *Ninkhursag,* "queen of the mountain," by which the Sumerians meant "queen of the earth"; in Babylonian theology this means land of the departed; *Aruru,* goddess of

childbirth; *Mama,* the goddess who created man from clay. There is a tendency to associate her with Enlil, the earth god, as her husband, but her virginal character is consistently maintained. The principal seat of her cult was Kêsh, an unidentified city near Erech, and the famous northern capital Kish was also one of the principal centres of her worship. Special temples were erected to her in every important city, or at least a chapel was consecrated to her in the great temple of the local deity. Innini, the virgin heaven goddess, is only a specialized aspect of the earth mother, particularly as the sister of the dying god Tammuz (*q.v.*). To understand the deeper aspects of this religion a complete study of the character of the mother goddess under her various titles is necessary. She consistently represents divine mercy and compassion as opposed to the severe and wrathful characters of the male deities. When men sin the gods punish with terrible vengeance, but the mother goddess ever intercedes for them. The religious scenes on seals in all periods represent her standing in prayer beside humans, and interceding with a god on their behalf. To the very end of Babylonian religion, Nintud, Aruru, Innini, Ishtar may be correctly described as the *mater dolorosa*, the "Weeping Mother."

Equally primitive, so far as the sources enable Sumerologists to trace the origins, are the two planetary deities Zu-en or Sin, the moon god, and Babhar or Utu, the sun god. Of these two the moon god, whose name means "lord of wisdom," was the more important, possibly through the fame and importance of the city of his principal cult, Ur on the lower Euphrates (see SIN). Larsa, between Ur and Erech, was the centre of the older temple of the sun god, but an equally important centre in the north (Accad) was Sippar on the Euphrates. Larsa is the Ellasar of Genesis xiv. and both of these figure among the five or six antediluvian cities, with Eridu, Badtibirra (Pantibiblus), Larak and Shuruppak. (See SHAMASH.) It must be assumed, therefore, that both Larsa and Sippar are of Sumerian origin, but it is difficult to account for the existence of two principal centres for the worship of the sun god Babbar=Shamash (Accadian). There is a very definite geographical principle in the distribution of the principal Sumerian cults; each is confined to one great city, and the important temple of that city was built to the deity of that place. In these great temples the chapel for the god's consort always joined the central chapel of the deity himself, and smaller temples for other deities often stood in various parts of the city. For example at Nippur there were temples for the mother goddess Ninkhursag, for Sin the moon god, Ninurta the war god, Enki the water god and many others, beside the spacious temple Ekur of Enlil the earth god and his consort Ninlil.

These six great deities form as it were the framework of the immense Sumerian pantheon of nearly 4,000 deities. But this scheme has another essential element, namely the sons of the earth god and the water god. The heaven god Anu appears to have been an abstract principle in their theology, and little attention was paid to his worship outside his city Erech, and even here his cult was less important than that of his daughter Innini-Ishtar. There were only two important schools of theological thought, those of Eridu and Nippur; from Eridu and the water cult come most of the incantation rituals of the magicians, and this school taught the theory that man had been created by the water god, whereas the Nippurians tell how the mother goddess made him from clay.

Attached to the pantheon of the earth god Enlil are the two important deities Ninurta, the war god, formerly read Ninib, and Nusku the fire god; the two sons of the water god are best known under their later names, Marduk of Babylon and Nabû of Barsippa, both of whom are originally connected with the water cult; but for the later developments of their cults the articles under their names must be consulted. There was also a fire god, Gibil, attached to the Enki (water god) pantheon. Of special importance in the pantheon is the consort of the war-god, the goddess Bau, which is more especially her name as consort of Ninurta (under the title Zamama), war god of Western Kish, and Gula, one of the many forms of the great earth goddess Makh-Ninkhursag. (For her connection with the cult of the dying god *see* TAMMUZ.)

All of these deities have many names describing the deification of certain aspects of nature under their control. Of special importance and most primitive is the grain goddess Ashnan, also called Nidaba or Nisaba, worshipped as a type of the earth goddess and specially connected with the rituals of purification. There is a special goddess of wine, Ninkasi, and of the expiatory rituals, Ninkhabursildu. The place of the thunder and rain god in the old Sumerian pantheon is not clear. He was called Immer there, but is of little importance until the later Semitic period at Assur (see ADAD).

The theologians divided the pantheon into two great groups, the Igigi or 600 gods of the upper world and sky, and the Anunnaki or 300 gods of the lower world, or gods of the land of the dead. Nergal (*q.v.*) and Ereshkigal are the two supreme deities of the land of the dead, and most prominent of the Anunnaki group. The centre of the cult of the god Nergal was Cutha, the most northern of all the great city cult centres; but the cult of Ereshkigal does not appear to have been specially confined to any city. That is true of all the cults of the unmarried goddesses, for whose worship the provision was made everywhere, and every man had access to the divine protection of the great mother goddess.

Acceptance of the Sumerian Pantheon by the Semites.— The Semitic race entered into Mesopotamia at a period so remote that it is impossible either to fix definitely the stage of evolution which the Sumerian religion had reached at that time, or to say what deities the Semites brought with them. In any case the South Arabian *Athtar,* god of the planet Venus, was identified with the Sumerian virgin goddess of Venus Ninsianna or Innini, and consequently became a female deity in Babylonia and Assyria, under the name Ishtar. It may be assumed that they also worshipped the sun god Shamash, who was at once identified with the corresponding Sumerian sun-god, Utu or Babbar. Although about 2750 B.C., the Semites of northern Sumer finally became masters of Sumer and founded a great empire at Accad near Sippar, there is almost no trace of genuinely Semitic character in their religion. Only two of the important gods are ever designated by their Semitic names, Shamash and Nabû, god of wisdom, and they usually write these by their Sumerian ideographs. This is also true of the entire subsequent history of Semitic Babylonia and only slightly less true of the later Assyria. The religion and the religious language, the temple liturgies, the theology, the official names of the various orders of the priesthood are Sumerian, and the advent of the Semitic empire of Accad marks no change whatsoever in the history of their religion. The only serious disturbance in the theological structure of the pantheon was caused by the sudden rise to power of the Ainoritic dynasty of Babylon under Sumu-âbu, founder of the great line of kings which numbers among them the famous Hammurabi and Ammizaduga But the Semitic language of Mesopotamia was always designated as Accadian, even the Assyrian scholars described their language as Accadian, and the designation of it as Babylonian or Assyrian is not exactly correct From the period of the First Babylonian dynasty (2169–1870 B.C.), a new element enters into the conception of the pantheon. Henceforth the hitherto unimportant local god of Babylon, Marduk, son of Enki the water-god, assumes a very predominant rôle in the theological works of that city; and since it became the capital of Sumer and Accad and remained so until the end of their civilization, the views of the great priesthood of Babylon naturally prevailed to more or less extent throughout the land, and especially in Assyria. To Marduk they attributed many powers, originally attributed to older and more important Sumerian deities; Ninurta, the son of Enlil and original protagonist of the conflict between the gods of order and the dragons of chaos, suffered severe reduction of power in favour of Marduk, who became not only the champion of the gods and conqueror of the dragon Tiamat (see CREATION, EPIC OF), but the creator of the universe as well. He becomes, henceforth, the principal deity of the rituals of expiation, acting as agent for his father Enki, and also in the late period he even assumed the sacred rôle of Tammuz the dying god, and became the subject of a myth and ritual of death and resurrection. There is a distinct

tendency toward henotheisin and even monotheism in regard to Marduk. But this elevation of the god of the capital was never recognized in the ancient Sumerian cities, such as Erech, Nippur, Larsa, Ur and Kish, which also continued to be great cities and theological centres as long as Babylon itself *(see* MARDUK).

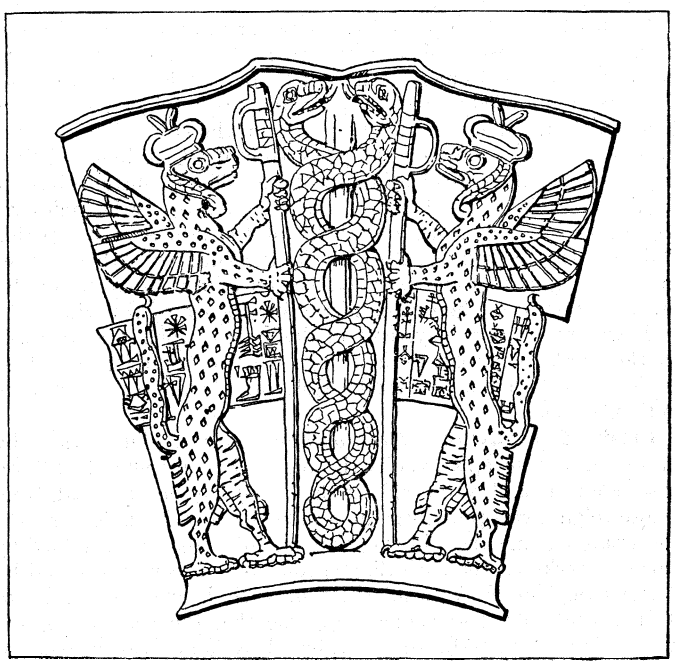
The Temple Liturgies.— The principal feature of the temple services consisted in singing long liturgies, invariably in the Sumerian language even throughout the entire Semitic period, although they are latterly provided with interlinear translations in Accadian for the use of Babylonian and Assyrian laymen. In the early Sumerian period the temple song service consisted of single songs called *ershemma,* or song to the flute, or *kishub,* song of prostration; but the schoolmen of classical times of the great Sumerian revival under the last dynasty of Ur and the kings of Larsa and Isin, finally evolved long and intricate liturgies for all the great deities, those to Enlil and the mother goddess prevailing in number. These consist of a large number of old *ershemmas* and *kishubs,* arranged so as to exhibit the theological ideas concerning the deity and always of most penitential and mournful character. Each liturgy contains a hymn to the "Word of Wrath" of the god to whom the liturgy is sung, except in the case of liturgies to the mother goddess. There is also a long section called the *Titular Litany,* which mentions the Sumerian names of all the principal deities of the pantheon, each followed by a mournful refrain. The last section is a penitential psalm imploring the deity for mercy and peace. These long musical compositions were sung by the priesthood of psalmists, usually to the accompaniment of the instrument *balag,* probably a harp or lyre, although some render the word by tambour or drum.

The liturgical calendars for each great city prescribe the names of the liturgies to be sung on certain days of each of the twelve or thirteen months, as *regular* religious duties of the priesthood known as the *gala,* Accadian *kalû,* priests or psalmists. Then liturgies concerned the universal sorrows of mankind and the dire vengeance of the gods with special reference to some calamity which befell the city in the past. Sometimes more than one full service is prescribed for certain days. The liturgies were also employed in services to avoid the consequences of evil omens; in such ceremonies the rubrics indicate the places in the magic ceremonies when the liturgies must be sung, and the same is true of ceremonies for the consecration of buildings and even for consecration of sacred objects, such as the leather head of a drum. There is nothing apotropaic in the sense of magic in these musical services. They are arid hymns of praise to gods intermingled with pessimistic descriptions of human sufferings portraying the abject misery of life.

The Private Penitential Psalms.— The psalmists were also engaged in another activity of Sumero-Accadian religious life, which more directly affected the lives of individuals. A comparatively small group of liturgical Sumerian prayers has been preserved, which consists of psalms of private penance. They existed in the older Sumerian period, but only one of them has been found. Information concerning this aspect of the religion is obtainable from the literature of the Babylonian and Assyrian clay tablets, and here they are provided with an interlinear translation in Accadian. These are psalms of praise, confession and intercession, said in Sumerian by an official psalmist for a penitent, and they are entirely free from magic ceremonies of any kind. Occasionally these private penitential psalms consist in "part song" between priest and penitent, in which case it must be supposed that the layman belonged to the educated class and understood the liturgical non-Semitic language. The persistent use of Sumerian in all forms of strictly formal worship among the Semitic peoples of Babylonia and Assyria is a remarkable precedent to the use of Latin in the Western Catholic Church.

The Rituals of Expiation.— The Sumerians and the Semites, who accepted so literally the religion of the older race, attributed most of their misfortunes to the malevolence of the demons. Demonology is a very important aspect of their religion, and although the tribe of devils is usually counted as seven, yet the texts name many more. The seven devils are portrayed as semi-human monsters with animal heads (lion, panther, dog, sheep, ram, bird and serpent), and then there is the horrible winged monster of the devastating south-wind, and *Lamashtu,* the terrible female demoness who plagued women in childbirth. To them were attributed the diseases, plagues and general afflictions of man. But they were the creations of the gods themselves. *Lamashtu* is described as the daughter of Anu, and the chief of devils *utukku limnu* is the offspring of Anu. *Namtaru,* the demon of fate, is the beloved son of Enlil. They are also said to have been created in hell, and cause desolation on high and misery on earth. "Bitter poison of the gods are they."

They were in possession of the "curse," personified as *Mamit,* by which they obtained power over every man that sinned either by touching things *tabu,* by committing any ethical sin, or by any religious disobedience. The devils troubled sinners only, and if a man fell into the power of a demon, it proved clearly enough that he had sinned. His salvation depended upon the intervention of the powerful priesthood, known as the *ashipu* or magicians. Every man received at the age of puberty an official name, and by it was placed under the protection of a god, who was henceforth described as "the god of the man so and so." This protecting god dwelled in the man's body in some mysterious way, but any ceremonial or ethical sin caused the inner protecting spirit to leave the man, who at once became the prey of a devil. He was then said to be possessed by a devil, which usually manifested itself by some disease. Power over this demon had been given to the holy priests of the water cult of Eridu, who proceeded to curse the devil and enumerate a long list of demons and sins in hope of finding the "name" of the demon who had occupied the man's body and of the transgression which the man had committed. The incantations against the devils consist of endless descriptions of machinations of the demons, magic rituals and curses in the



FROM HEUZEY "CATALOGUE DES ANTIQUITES CHALDEENNES DU MUSEE NATIONAL DU LOUVRE"
GREEN STONE LIBATION VASE OF ANCIENT BABYLONIA AND ASSYRIA
Libation, or the pouring of wine on a sacrificial victim in honour of a deity, was an important feature in the religious ceremonies of Babylonia and Assyria

names of the gods. The rituals in which troubles are caused by ethical sins are particularly set forth in two great series called "Fire Rituals," the *Shurpû* series in nine tablets and the *Maqlû* series in eight tablets. They differ from the old Sumerian *Utukku* series, or incantations against the seven devils, in being almost exclusively Accadian, and referring principally to ethical and ceremonial sins or to sins committed by a man's father or one of his ancestors, while the devils are hardly mentioned. On the other hand the *Utukku* series do not examine into the causes of the trouble, but devote themselves to mythological matters. often containing hymns of great literary merit.

This priesthood of magicians obtained power over the demons by the curse in the name of the gods, also called Mamit, and by endless symbolic magic, such as tying coloured bands to the man's bed and breaking them in sign that the bonds of the devils were also broken. The most characteristic ceremony consisted in applying water, dough, herbs or salt to the body. By means of magic formulae the demon spirit was supposed to pass into these elements which were then wiped away. The Accadian verb employed for this act of covering and wiping away is *kuppuru*, the cognate of the Hebrew word for "atone," and thus constitutes a very vital element in the history of the Hebrew idea.

Closely allied to the purely magical rituals is the elaborate system of medicine, always intimately connected with incantation. But the doctors *asû* are not consecrated priests, at least they were not of the same standing as the two great orders of psalmists and magicians and the prophets or diviners discussed below. There was, at any rate in the late period, a very serious attempt to study scientific methods in medicine, and it has been recently proved by extensive publication of Babylonian and Assyrian medical texts that they possessed a very profound knowledge of the medicinal values of herbal preparations and mineral products. Their textbooks on the antidotes for poisons, especially serpent and scorpion bites, are traceable to the twenty-first century, and those on the same subject in the eighth and succeeding centuries show no advance on the earlier texts. It is probable that the science was already considerably advanced among the Sumerians in the age of Dungi of Ur. There are textbooks for the treatment of the eyes, teeth, head, intestines, poisons, muscles and ulcers, but incantations are inserted to aid the treatment, and sometimes mythical hymns on the origins of the disease.

Most famous is the legend of the worm which was supposed to be the cause of toothache.

Divination. — The third great order of priests are the *barû* or diviners, whose profession is said to have been founded by the antediluvian king Enmenduranna of Sippar. A legend states that all human knowledge had been written upon tablets before the Flood and buried at Sippar; the prophets who could divine future events were par excellence the possessors of all wisdom and their secrets must not be read by the profane. There is little reference to direct oracles from the gods corresponding to the Delphic oracles of Greece. A group of oracles of the late Assyrian period delivered to Asarhaddon, the king, by the Ishtar of Arbela by the mouths of prophets and prophetesses on political matters exists; but the historic method of obtaining knowledge of the will of the gods was by elaborate systems of divination, which are traceable to the early Sumerian period. The cuneiform tablets on these subjects are seemingly inexhaustible and form a great science in themselves.

Liver Divination (*Hepatoscopy*) (*q.v.*).—Divination by means of the sheep's liver is the oldest known method of forecasting events and is traceable to the age of Sargon of Accad, from whose reign a group of liver divinations has survived. The reason for assuming that the will and plans of the gods were revealed by various marks on the shriveling surface of a sheep's liver and by various physiological peculiarities of each liver, is not easy to define. Sumerian and Semite supposed that the function of the mind was performed by the liver, but there is no evident explanation for the choice of a sheep. In case of the other leading method of divination, by astrology (*q.v.*), it is clear that the planets and constellations, having been identified with various deities, would reveal the will of the gods by their positions and astronomical phenomena. Planets were, however, often called "sheep which are far away," and there is clearly some cause to be sought here for the assumption that the divine mind was revealed in the livers of sheep consecrated to sacrifice, a theory which dominated the schools of diviners throughout all antiquity. Nothing of any importance could be undertaken without obtaining the consent of the gods of divination, Shamash and Adad, by this means. The technical anatomical knowledge of the liver and abdominal organs was, therefore, accurate and detailed, as we know from several clay models of the liver designed for teaching hepatoscopy. The rules were derived in the simple and practical manner of keeping a record from generation to generation of events which actually occurred after certain signs were seen on the liver. Consequently a good many historical references occur in the textbooks on this subject of the utmost value for the historian.

Astrology (*q.v.*).—Equally important and vast are the works of the *barû* priests on divination by the planets and constellations and atmospheric conditions. This method of divination which is probably even more primitive than the rival system of hepatoscopy, is undoubtedly of Sumerian origin, and led to an astonishingly accurate knowledge of astronomy. Mars having been identified with the terrible god of the lower world, Nergal, was eminently a star of evil omen, but not always. The war god Ninurta was identified with Saturn, Ishtar with Venus, Nabû with Mercury, Marduk with Jupiter; and the entire firmanent of fixed stars was divided into a central band along the ecliptic assigned to Anu, and a parallel southern and northern band assigned to Enki and Enlil respectively. Each zodiacal constellation was identified with a deity, and all the other northern and southern constellations were carefully assigned to some god or goddess. Special attention was paid to the motions of the planets and their periods accurately fixed, and the tables for the phases and eclipses of the moon worked out with such care that eclipses could be prophesied. The standard work of the astrologers was known as the series, "When Anu, Enlil and Enki, the great gods, in their wisdom created the great decrees of heaven and earth," which numbers as many as 65 or more large tablets; and there are several series of purely astronomical works. The principles of forecasting are again derived from records of coincidences recorded from generation to generation and traceable to the remote age of Sargon of Accad.

Other Methods of Divination. — Oneiromancy or divination from dreams is well represented in the works of the *barû* priests, and there are several examples of necromancy. There are two famous examples of the latter; the soul of Nebuchadnezzar appeared to his second successor Nabunidus in a dream to interpret a previous astrological observation; and in the most important work on Babylonian pessimism the ancient Sumerian ruler of Lagash appeared in a dream to Tabi-utul-Enlil the Righteous Sufferer to interpret two previous dreams. It was not uncommon for astrological omens to be seen in dreams, and one of great importance to Nabunidus and his son Belshazzar was seen by a courtier. In dreams, great attention was paid to the direction of moving objects; the right was always lucky and the left unlucky; the principle of analogy is also widely employed to interpret the accidents of dreams. For example, if a man dreamed that he was discoursing with others and kept looking at the earth, it was interpreted that men would speak lies about him. This is based upon the fact that mendacity is associated with lack of frank behaviour. Lecanomancy is represented by two large texts which gives omens from the behaviour of drops of oil in a basin of water.

Every trivial phenomenon of nature was seized upon as an indication of future events. The actions of dogs, horses, serpents, birds and fish, and above all the appearances of misbirths both human and animal, are studied with incredible detail. In the history of man, there is no such stupendous system of beliefs in manifestation of the divine will in trivial accidents as in Sumer, Babylonia and Assyria. There is an emphasis upon the animistic spirit in nature by which the *barû* priesthood completely dominated the actions of those peoples for 4,000 years, but it is in accord with their theory of knowledge and absolute abandonment to "Fate." The great series of tablets, numbering more than 106, concerning the ominous character of ordinary affairs of life, was known under the title, "If a city is set upon a hill they that dwell therein will not be happy."

Sumero-Babylonian Philosophy. — The theories of knowledge and the origin of the universe are not separable from religion, and it is not possible to speak of their metaphysics and ethics in the Greek sense. Water is the first principle of all things, and the gods themselves descended from the primeval water. Consequently all their philosophic thought centres about the water god of Eridu and his sons Nabû and Marduk. The creative principle residing in water is called *mummu*, "word, creative form," and

the deities of the water cult are identified with this creative word or logos. This idea of "creative form" is often described as "*band*," and the water deities are described as the "*band* of all things." The original meaning of *mummu* is undoubtedly "spoken word" of the water god, and the creation of all things depends upon the activity of this "word." The reality of anything is its "form," Sumerian *khur*, Accadian *utsurtu*, "design," and rests upon the idea that it is the divine concept of an object, which must be first conceived in the divine mind of the water god and then given tangible form by the creative *mummu*. The form of things is designated by the "name," as "basin, lion, tree, child," and nothing can be known except by revelation, the peculiar prerogative of the *barû* priesthood. This doctrine of revelation and mystic monopoly of wisdom led straight to a priest-ridden orthodoxy. In practice a philosophy of this kind naturally led to a thorough fatalism, and the god of fate, Namtaru, is usually regarded as one of the seven devils. Occasionally the mother goddess Ishtar is designated by the Accadian word for fate, *shinztu*.

This theory of fatalism was not challenged by the philosophers, but a number of satires on the priesthood of divination prove that many did not believe in efficacy of omens, and it may be assumed that they also challenged the orthodox belief in the manifestation of divine plans by the most trivial accidents of nature. No important human plan could be executed until the diviners determined the will of god about it. But an important school of critics arose in Babylonia to deny this and claim the scope of man's will in the philosophical system. They did not go so far as to deny the theory of fatalism as a general principle. More serious, however, was their attack on the ethical side. The problem of suffering was investigated in several works, particularly in the so-called "Babylonian Job," and the "Dialogue of Pessimism." They argued that if the gods control all things and are just, why should the righteous suffer? and a few thinkers carried their conclusions to absolute pessimism, denying that providence is just and that piety results in any rewards at all. The effect of this movement is seen in the rise of a belief in rewards after death and the invention of two legends which declared that man had been originally created sinless and given every opportunity to remain in a state of bliss. This he lost by his own ignorance or by the deception practised on him by a god, who wished to retain mankind in a servile state to serve the gods. It is clear from the religious texts of the very latest period, that the school of pessimists never had much effect on the beliefs and religious rituals of the masses. But there is no record of persecutions for heterodoxy in Babylonia. The priesthood never retorted by violence, but only with apologetic works.

Participation of Laymen in the Religion.—The distinction between priest and layman is characteristic of this religion. The extremely few prayers of a strictly private nature are really royal hymns of praise to the gods. This distinction is particularly noticeable in the conservation of Sumerian in all public temple worship. The layman participated principally in the expiatory rituals known as the "House of Washing," "House of Baptism," and especially the *Enuru* series, which consisted in ceremonies for expelling demons and averting evil omens by magic rituals of the *ashipu* priests, interspersed by prayers said by the layman in his own Accadian language. These are called "Prayers of the Lifting of the Hand," and contain the highest expression of religious fervour in the religion. No examples of this kind of literature have been found in Sumerian; and it must be supposed that the prayers of these series which approximate most nearly to the Hebrew Psalms belong exclusively to the later (Semitic) evolution of the religion.

The Festivals.—The only important yearly festival in all periods was the New Year celebration, which occurred among the Sumerians apparently at the autumn equinox, and was so placed in the calendar (*q.v.*) by the Babylonians of the old southern city Erech to the very end of their history. It was known by the Sumerian word *zag-muk* "beginning of the year," and its occurrence at the autumn equinox is supposed to indicate an original system of beginning the new year at that time, although there is no sure indication of this in the oldest Sumerian records. From about 2400 onward the Sumerian month calendar clearly begins in Nisan shortly after the spring equinox, and this is the time fixed for the festival at Babylon, and in Assyria. The festival lasted eleven days, from the day of the first new moon after the spring equinox, and at Babylon consisted in a pantomime representing the creation of the world by Marduk and the episodes of the conflict between the gods and the dragons of Chaos. On this ritual the Epic of Creation (*q.v.*) was based. At this festival, whether as performed at Babylon, Erech or Assur, the old capital of Assyria, an essential feature is a procession to a building outside the city, known as the "house of the *akîtu*." The king must be present, at any rate, at the function in the capital, and being divested of all insignia of royal power by the high priest, he is momentarily reduced to the rank of a layman and openly humiliated. He then receives anew the royal authority at the hands of Marduk's priest. Thus the divine right to rule was yearly renewed; and so firmly fixed in the minds of the later dynasties of Assyria was this belief in Marduk as the source of all kingly power, that even the kings of that land, who then ruled all Western Asia, yearly renewed their royal warrant at the festival of Babylon. In the southern cities such as Ur and Erech, the Nisan festival was also in use, and consequently two new year festivals were held there. In these cities the ceremonies make no reference to Marduk and the local Babylonian Epic of Creation. There is evidence for this same kind of festival, characterized by a procession to the "house of the *akîtu*" in honour of the local deity of every city, at other times of the year, and the old Sumerian calendar contains references to festivals of various deities in nearly every month. (For the two great religious epics of Babylonian Religion *see* GILGAMESH, EPIC OF, and CREATION, EPIC OF. Special details in ADAD; ANU; BÊL; BĔLIT; EA; ISRTAR; ERESHKIGAL; GULA; MARDUK; NEBO; NERGAL; NUSKU; OANNES; SHAMASH; SIN; TAMMUZ.)

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(S. L.)

BABYLONIAN CAPTIVITY, the name generally given to the deportation of the Jews to Babylon by Nebuchadrezzar. Three separate occasions are mentioned (Jer. lii. 28–30). The first was in the time of Jehoiachin in 597 B.C. After 11 years a fresh rising of the Judaeans occurred; the city was razed to the ground, and a further deportation ensued. Finally, five years later, Jeremiah records a third captivity. The various captivities form the material of several of the psalms.

BABYLONIAN LAW. That the Sumerians, the earliest inhabitants of Babylonia, had long lived under the rule of State-law is to be inferred not only from the great antiquity of their settled dwelling in cities, but from the survival of certain very early documents concerned with sales of land and slaves. The inscriptions of Urukagina, king of Lagash (about 2600 B.C.), relate his efforts to impose respect for earlier customs and to curb the rapacity of priests and officials in oppressing the poor with illegal extortions. There is a direct reference to legal proceedings in Gudea's account (about 2400 B.C.) of a solemn occasion at Lagash, when the business of the courts was suspended, and distraint was not permitted. That no actual laws have survived from these early periods is doubtless due simply to the omission. probably deliberate, to cast them into writing. Like other sciences in Babylonia, law was jealously guarded in the oral tradition of the learned, but there is no need to suppose that it did not already exist in a developed form. As it is, the first actual records of proceedings in court belong to the Third Dynasty of Ur (about 2200 B.C.). They all begin with the phrase "judgment rendered," and are concerned generally with disputes arising out of sales, inheritances, gifts, or divorce. The courts were presided over by two or more *mashkim* ("watchers"), among whom were sometimes to be found the city governor or a royal delegate. When the claim had been made "in the king's name" and rebutted, the case was settled by an oath taken either by one of the parties or by a witness. Shortly after this specimens of actual Sumerian laws begin to appear, doubtless older than the earliest copies which belong to about 2000 B.C. To the same period must also be ascribed the collection of legal phrases and extracts from ancient codes called *ana ittishu*, which has preserved the seven "Sumerian Family Laws"; these concern the relations of adoptive parents and sons, divorce, and the hire of a slave whose services are afterwards lost. Upon three tablets (about 2000 B.C.) are inscribed some 25 laws in the Sumerian language, taken from a larger collection. No less than six of these laws concern family relations; three of them correspond closely with provisions in Hammurabi's Code, the rest do not appear there., Four more deal with slavery; it is decreed that the master of a runaway may claim another slave or 25 shekels of silver from anyone harbouring him. There are also provisions concerning adoption, injuries caused to pregnant women, liability of ox-herds for damage to their charges, the care of gardens, the obligations of neighbours, and false accusation. In general, these laws have much in common with the Code, and well illustrate the selective rather than creative character of Hammurabi's work.

THE CODE OF HAMMURABI

It is the great Code of Hammurabi, discovered at Susa in 1902, which is to us, as it was to the Babylonians, the completest and most perfect monument of their law. Fragments of copies found in Ashur-bani-pal's library at Nineveh, and others of new-Babylonian date, prove that it was known to later ages from its opening words as "When the exalted Anu," and was studied for 1,500 years after its first composition. Of its relations with, and influence upon, the law of Israel much has been written which cannot be considered here. As to its own sources, something has already been said. Compiled from a mass of existing Sumerian law under which highly civilized cities had certainly lived for many centuries, it was probably issued in two versions, Sumerian and Semitic, though only the latter survives. What degree of actual novelty it possessed cannot now be estimated; perhaps it contained hardly anything that could not be found elsewhere, but its great distinction was that the articles were chosen with a view to universal application, not to the customs of any single city, but so as to "establish justice in Sumer and Akkad" In spite of a few primitive remains relating to family solidarity, district responsibility, trial by ordeal, and the *lex talionis*, the Code has advanced far beyond tribal custom, and recognizes no blood-feud, private retribution, or marriage by capture. The king is already the source of justice; the judges are strictly supervised, and appeal to the king is allowed. The whole land is covered with feudal holdings, masters of the levy, and police. There is a regular postal-system. The position of women is free and dignified.

Classes.—The Code contemplates the whole population an falling into three classes, called *awelu, muskinu,* and *ardu.* The first was the designation of the highest class, probably confined to officers of the court or the temple, though their qualifications are nowhere stated. They had aristocratic privileges and liabilities, and the right to exact retaliation for corporal injuries, but they also bore the burden of heavier punishment for crimes and inisdemeanours, with higher fees and fines to pay. The term became in time a mere courtesy-title, and indeed the class receives no illustration from the contracts. Even in the Code itself, when status is not concerned, the term simply means "a man, anyone." Below these persons of quality stood the *muskinu,* whose precise character is even more difficult to define, but it is not probable that they formed the bulk of the ordinary population. The word came in time to mean "a beggar," and with that meaning has passed through Aramaic and Hebrew into many modern languages, but this is certainly not what is meant in the Code; he was free, but had to accept monetary compensation for corporal injuries, paid smaller fees and fines, and owed less valuable offerings to the gods. The *ardu* was a slave, his master's chattel, and belonged to a numerous class. He could acquire property, and even hold other slaves. His master fed and clothed him, paid his doctor's fees. but took all compensation for injury done to him. His master usually gave him a slave-girl as wife (the children were then born slaves), often set him up in a house or business, and simply took a yearly rent. Otherwise he might marry a freewoman (the children were then free), who might bring him a dower which his master could not touch; at his death one half of his property passed to his master. Runaway slaves, if caught, had to be returned, for which a reward of two shekels, about one-tenth of the average value, was prescribed. To obtain, harbour, or smuggle away a slave was a capital offence. Slaves were indicated outwardly by a special identification mark on the head.

Property.—Complete private ownership of land is recognized by the Code, but all land was sold subject to its fixed charges. At least in later practice it was possible for the king to free land from these charges by charter, and the provinces or estates of faithful servants often enjoyed the royal bounty. Among these charges was that of providing men for the army and for the corvée, or statute labour, and a definite area had to find a certain number of men. Perhaps the greater part of the normal levy was supplied from the king's own estates, which were of vast extent. Upon part of these was settled a large population of officials and craftsmen, but particularly soldiers, mostly in occupation of a small holding granted for their maintenance in return for service. These fiefs were usually hereditary, and, in the case of soldiers, inalienable. When ordered out these soldiers could nominate a son, if of age, to hold the benefice and carry on the duty. If there was no son capable, the king put in a *locum tenens,* but granted one-third to the wife to maintain herself and children. Recruitment for the corvée was less regularly effected; it was customary to call for workmen and leave their selection to the local authorities. It seems that rent-paying tenants were exempt, and so were shepherds in charge of flocks. If a soldier was captured by the enemy, and had not sufficient property of his own to pay a ransom, this might be found by a merchant, who could claim reimbursement from the temple of the prisoner's city, or even from the palace itself; the man's holding could not be sold for this purpose.

The temples, besides special gifts, often of great value, and regular income derived from estates and other property, received vast amounts of *naturalia* from sacrifices. Many families had rights to exercise the priesthood on certain days of the year, and the perquisites attached to these offices made the right a negotiable commodity, which could be pledged, rented, or shared within the family, but not alienated. The contracts reveal that the temples were resorted to for loans, particularly of seed-corn, or of ready money to pay harvesters. It is clear that the temples,

in particular those dedicated to Ishtar. contained a large female population, mostly devoted to religious prostitution, the profits of which accrued to the temple. Despite this, such women enjoyed many privileges, but it was incompatible with their dignity to keep or to enter a tavern where the lower forms of vice were practised.

The Code recognizes many ways of disposing of property—sale, lease, barter, gift, dedication, deposit, loan, pledge, all of which were matters of contract. No claim is admitted unless substantiated by documents or the oath of witnesses. A buyer had to convince himself of the seller's title. If he bought, or received on deposit, from a minor or slave without power of attorney he would be executed as a thief; if the goods were stolen, he was liable to death for receiving them, unless he could prove obtaining them by bona-fide purchase, in which case he must restore the goods, but had his remedy against the seller, from whose estate, if dead, he might claim five-fold. When a slave was bought abroad the buyer had to satisfy himself that he had not been stolen or captured from Babylonia, for then he would have to restore his purchase without compensation. A defect of title or undisclosed liability would invalidate the sale.

Land might be farmed by the owner himself, by an employee, or by a tenant. The husbandman was bound to carry out the proper cultivation, raise an average crop, and leave the field in good tilth, In case the crop failed the Code fixed a statutory return. If land was let at a fixed rent, accidental loss fell on the tenant. If let on share-profit, landlord and tenant shared the loss in proportion to their agreed shares of the profit. Waste-land might be taken over for reclamation rent-free for the first three years. If the work was neglected the Code directed the tenant to hand over in good tilth and fixed a statutory rent. The metayer system was in vogue especially on temple lands. The landlord found land, labour, animals, implements, seed, rations, and fodder; the rent was as contracted. Theft or mal-versation of the material supplied was visited with fines or muti-lation. The conduct of irrigation is regulated with a view to pre-venting damage from a flood due to negligence. Houses were let usually for the year, rent being paid in advance half-yearly. The tenant was bound to keep the house in repair, but might use his own wooden fittings. Land was let on lease for house-building for eight or ten years, the tenant being rent-free, after which the building reverted to the landlord.

Despite the multitude of slaves, hired labour was often needed, especially at harvest. Boys were sometimes sent out to work by their parents. The period of hiring might be for a year or for a few days only, and the rates of wages were fixed. Cattle were hired for ploughing, working irrigation-machines, carting, and threshing, at a fixed tariff. Oxen and sheep were committed to a herdsman, who gave a receipt for them and took them out to pasture. He was responsible for all care, must replace losses due to neglect, and attend to the breeding. Damages caused by beasts under his control had to be restored four or even 12-fold.

Payment in kind was as common as payment in cash. It was enacted that a debtor must be allowed to pay in produce according to a statutory scale. Debt was secured on the debtor's person. Distraint on a debtor's corn was forbidden, and the seizure of a working ox was fined. A debtor being seized for debt could nominate his wife, child, or slave to work off the debt; the wife or child could not be detained for more than three years. Death occurring through the creditor's neglect, he became liable to full compensation. In the matter of pledges, the Code enacted that the debtor should take the crop of a field himself and pay the creditor from it. If the crop failed, liability was held over for that year. The debtor's whole property might be pledged as security for payment, and personal guarantees were often given that the guarantor would be liable in case of default.

Exact rules controlled the caravan traffic. The travelling agent had to give a detailed receipt for all goods; nothing could be claimed that was not in the inventory. If no profit was made he was bound to return double the value he had received; if only a small profit, he had to make up the deficiency, but was not responsible for loss by robbery or extortion. On his return he obtained a receipt, and profits were divided, usually equally. These caravans undertook carriage, with five-fold responsibility for loss, freights being generally paid in advance. Warehousing charges were one-sixtieth of the value, the accepter taking all risks and repaying double any deficiencies. Ships were hired at a fixed tariff according to their cargo capacity, inclusive of the crew's wages. Prices for shipbuilding were fixed, and were subject to one year's guarantee of seaworthiness. Boats under way were held responsible for collision with those at moorings, and the skippers of sunken craft refloated had to pay half their value as damages. Sale of intoxicants was subject to fixed prices, and the ale-wife must not suffer her premises to be used for disorderly or illegal purposes.

The contracts show that payment through a banker, or by written draft against deposit, was familiar. Bonds to pay were treated as negotiable. Interest was rarely charged on advances of seed by the temples or wealthy landowners, but in these cases the borrowers may have been tenants. Ordinary business borrowing was effected at about 30%.

The Family. — Marriage was by purchase, arranged between the respective parents, the bridegroom's father providing the bride-price, and the bride's father her dowry. If the bride's father, after accepting presents, refused his daughter he had to return the presents doubled. The dowry might be real property, but was generally personal effects or household furniture. It remained the wife's for life, descending to her children, if any; otherwise returning to her family, when the husband could deduct the bride-price. Every lawful marriage had to be sanctioned by a contract, which usually stated the consequences to either party of repudiating the other. The couple formed a unit, especially for debt, the man being responsible for his wife's debts, even those contracted before marriage, but he could use her as a *mancipium*. The Code allows the proviso that a wife shall not be seized for her husband's pre-nuptial debts, in which case he also could not be sued for hers; in any case, both were responsible for post-nuptial debts. A man might make, by deed of gift, a settle-ment on his wife of a life-interest in part of his property, or even allow her to bequeath it to a favourite son.

A man might divorce his wife at will, but he had to restore the dowry, and she held the custody of her children. Suitable alimony had to be provided, which the wife shared equally with the children. If she had no children, he returned the dowry and paid her a sum equivalent to the bride-price, or a mina of silver, if there had been none. If she had been a bad wife, however, he might divorce her while keeping the children and the dowry, or he might reduce her to bare maintenance as a slave in his house. She on her part might sue him for cruelty or neg-lect, and might obtain a judicial separation, taking her dowry. If it was proved that the fault was upon her side she was to be drowned. If left in her husband's absence without maintenance she might cohabit with another man but must go back to her husband on his return, but if she had maintenance cohabitation would be adultery. When widowed, the wife took her husband's place and brought up the family, ultimately taking a child's share in the estate when the family grew up. She could remarry only by judicial consent, and subject to strict precautions that the first husband's estate should remain in trust for his children.

A childless wife might give her husband a maid to bear him children, who were reckoned hers. If the wife did this, the husband was not allowed a concubine; if not, he might take one. A concubine was free and a wife, though of inferior rank to the first. She could be divorced only on the same conditions as the first wife. Yet a third class of mothers were slave-girls. Their children by their masters were born free; the mother could not be sold, and was free on her master's death. Such children could be legitimized by the father's acknowledgment before wit-nesses. In that case they ranked equally in sharing the paternal estate, but if they were not adopted the wife's children shared alone. If a free woman married a slave the children were free, and at his death the wife took her dowry with half of their joint savings to share with her children; the other half went to the slave's master.

A father had complete control over his children until their marriage, to dispose of their labour, and even of their persons for his profit. Mothers had the same right in the absence of the father, and so had even elder brothers when both parents were dead. Daughters were entirely in their father's power to give in marriage, or as the votary of a god, or as a concubine. Priestesses had full disposal of their property, but other daughters enjoyed only a life-interest in their dowry, which afterwards went to their children, or back to their family if there were no children. A father might, however, execute a deed granting his daughter power to leave her property to a favourite brother or sister. A daughter's estate was usually managed by her brothers, but if dissatisfied she could appoint a steward. If she married, her husband managed it. The son also seems to have received his share on marriage, but did not always then leave his father's house; he might bring his wife there.

Foundlings were commonly adopted, particularly by childless persons, and several laws regulated this practice. Such a son could not be reclaimed by his natural parents when reared to maturity by an adoptive father, unless the latter had early sought to return him. It was forbidden to cut off a son once adopted when subsequently children of a man's own were born; the youth had a right to one-third of the personal property which would have fallen to him as heir, but the father was not bound to break up his real estate. Children adopted by eunuchs or temple-women (persons incapable of having natural children) were bound to them by absolute ties. No claim to recover possession of them could be entertained, and any attempt on the child's part to renounce the relation, or rejoin his natural parents, was visited with mutilation of the eye or tongue. A son adopted by a craftsman could be reclaimed only if he had not been taught the trade. From the contracts it appears that adoption was often effected by agreement between the adopters and the natural parents, specifying what was to be the child's patrimony, and the punishment for any attempt of either party to renounce the relation. Adoption is, in certain contracts from outside Babylonia, very largely a matter of form, covering various economic arrangements between the two parties.

All legitimate children shared equally in the father's estate at death. When there were two mothers all children at one time shared equally, but later the first family took two-thirds. Children shared their mother's, but not their stepmother's, property. If a son was to be disinherited the Code required judicial consent, granted only for repeated unfilial conduct.

For adultery both parties were liable to drowning, but if the aggrieved husband pardoned his wife the king might do as much for the paramour. Incest was visited with death or exile according to its heinousness; seduction was punished by fines; sodomy is not mentioned in the Code.

Criminal Law.—In the criminal law the ruling principle was the *lex talionis*. A primitive idea of exact justice prescribed the punishment of an offending member, as the cutting off of a hand that struck a father or stole a trust, the loss of an eye that pried into forbidden secrets. False accusation on a capital count was punished with death, and perjury in a matter of damages was visited with a penalty of the amount claimed. Death was freely awarded for various forms of theft, brigandage, disorder, shirking of State service, and criminal negligence. A specified form of the death penalty, such as gibbeting, burning, or drowning is inflicted on the perpetrator of certain crimes. A curious extension of the *talio* is the death of a creditor's son for his father having caused the death of a debtor's son while holding him as a *mancipium;* of a builder's son for a house being so carelessly built as to cause the death of the owner's son; of a daughter whose father was responsible for the death of another man's daughter.

Exile was inflicted for incest, disinheritance for repeated unfilial conduct. Branding was the penalty for slander on a married woman or a priestess. The corrupt judge was permanently deprived of office, the extravagant wife and unfilial children were enslaved. Imprisonment is not recognized by the Code. The commonest penalty, of course, was a fine. This is awarded for corporal injuries to a *muskinu* or slave, for damages to property, and breach of contract. The restoration of goods improperly acquired or negligently damaged was usually accompanied by a fine.

The importance of intention was recognized. If the defendant swore that he had committed manslaughter unintentionally, he was only fined according to the rank of the deceased. The Code does not specify the punishment of wilful murder, but it was doubtless death. The owner of an ox which gored a man in the street was responsible only if the beast was known to be vicious. Accidents, or anything beyond due provision, were not generally imputed as offences. Poverty excused bigamy on the part of a deserted wife. On the other hand, carelessness and neglect were severely punished. The unskilful surgeon's mistakes might cost him the loss of his hands, or heavy fines; the veterinary surgeon and the builder of houses or ships had equally good reason to see that their work was irreproachable. Suspicion, in all cases, was not enough. The criminal must be taken in the act; the thief found actually in possession of the stolen goods.

Courts.—In civil actions the plaintiff preferred his own plea, without the assistance of professional advocates. The judge heard the plea and called the other parties and witnesses before him. The usual procedure seems to have involved a preliminary hearing before one or two judges, who took the depositions of the parties and witnesses and sent them on to a larger tribunal. This was composed generally of priests or of civil officials. In course of time the latter came to predominate, and the priests fell more and more into the position of administering the oath before the gods. In matters beyond the knowledge of men ordeal by water was used, and judgment was given according as the parties sank or swam in the river. But where the defendant alone had knowledge of the matter, his oath was sufficient, if he would take it; such was the solemnity of this proceeding that perjury seems not to have been feared. But great stress was laid on the production of written evidence. In order to inform themselves of the facts, the court might go to view property in dispute. The verdict pronounced by the court seems not to have had in itself binding force until a document had been drawn up embodying the settlement and recording the agreement of the parties to accept it; infringement of this undertaking was punishable. If a cause was heard by the king himself, it appears that his decision was final, and imposed itself without mutual agreement or appeal.

THE ASSYRIAN LAWS

Three tablets have recently been discovered in the ruins of the ancient city of Ashur which are inscribed with about 90 articles from a collection of laws promulgated in about the 13th century B.C. In form the enactments refer to particular sets of circumstances rather than to universal principles. This gives them the appearance of being a collection of actual decisions of judges which have passed into law; so marked is this character, that the suggestion has even been made that these texts are rather a legal commentary than actual laws. It is more likely, however, that they reveal a written law in the making, which has not yet attained the maturity of Hammurabi's Code, though several centuries later in date. It must be recollected that the Assyrians were not of the same origin as the Babylonians, and had other traditions which would certainly make theinselves felt in legal custom.

The matters covered by the surviving laws are marriage, property, security, and offences, but a good deal may be gathered from them concerning the nature and the procedure of the courts. Space does not permit any comparison of their provisions with those of the Code.

A betrothal ceremony was the preliminary of marriage; in this the man anointed the woman, offered her various gifts, and in particular paid a bride-price to the woman, not her father, as was the Babylonian custom. In case of divorce the wife kept this money, and therefore the husband was not likely to divorce her inconsiderately. Assyrian custom recognized two forms of marriage, according as the wife went to her husband's house, or

stayed in her father's house and received her husband there. If she came to her husband, she brought a dowry and certain gifts from both families. This property was entailed to her sons, and could not be shared by the husband's brothers. If she remained at home she received a sum of money from the husband; this he resumed at her death or divorce. A widow, on remarriage, came into absolute possession of her husband's gifts if she continued to live at her home, while he had a similar right to hers if she came to live with him. Before leaving home on service the husband had to make suitable provision for his wife. If not, she might put any children there were out to work but might not remarry for five years. Should the husband return after that time and find her the wife of another he could do nothing, except in special circumstances. In case of special hardship the wife's period of waiting was reduced to two years, during which time she was to be assisted at the public expense, but if the husband returned he was obliged to reimburse such expenses. A wife's son by a former marriage had no part or lot in the second husband's estate. Wives owed absolute fidelity to their partners, and were severely punished even for indiscreet conduct, for continual gadding to the houses of gossips, for compromising business expeditions, or for appearing unveiled in the streets. For adultery the penalty was death, but the husband might be satisfied with mutilation or even forgiveness; in either case, the paramour shared her fate, though he could not be punished if he could prove ignorance of her being married. A bawd procuring a married woman was liable to the same penalty as befell the guilty pair; a married woman entrapped in a bawdy-house might escape punishment by immediate denunciation of the conspirators. The Mosaic law of levirate marriage is not directly affirmed, but certain particular cases are considered which obviously imply this custom. The wife who remained at home is (like the other kind) bound to marry the deceased husband's brother. A betrothed maiden must marry a brother of the man who was engaged to her if he died or disappeared; if there was no marriageable brother, the father must take her.

The surviving laws of property relate chiefly to real estate. Several articles are devoted to ensuring respect for landmarks and the equitable division of water for irrigation. A man might become the owner of an orchard by planting it, with the consent of the former owner, but had to find for him another plot of equal area. Clandestine use of land by a stranger was punished and the produce confiscated. When a father died his property might be divided among his sons, but sometimes this was not done; the land remained a whole and was cultivated in common by the brothers. In that case the eldest had the right to two shares of the harvest. Out of the common estate, however, each brother might lawfully extract the valuables which it was the custom to bestow upon his affianced wife. Within a family of brothers thus holding an undivided property there is, however, not an undivided responsibility for offences. When a sale of real property was contemplated it was important that the purchaser should not afterwards be confronted with genuine or bogus claims from third parties, and it was therefore required that he should make public announcement of his proposed acquisition by the town-crier, three times within the previous month. No claims lodged after this time were admitted.

As security for debt the creditor could attach the person of the debtor or one of his children. In either case the pledge must work for him until the value of the debt was paid off, but the creditor was strictly forbidden to sell the pledge into slavery. Any person who bought such a pledge was liable to lose his money. The only right of disposal that the creditor had was that of giving in marriage a girl whom he had received as a pledge; he might receive an agreed price for her from a suitor. The consent of her father was necessary, but in conditions of necessity could hardly be denied. If the father was dead, the girl's brothers could refuse consent to the marriage, but only if they were prepared to pay off the debt within a month. This disposal of girls in marriage sometimes led to complicated situations when it was found that other claims, besides those of the disposing creditor, lay against the father. A creditor who had ill-treated his pledge before selling her to a husband was held to have forfeited by such conduct any rights in her when once she had passed out of his control.

Theft is particularly regarded in the instances where the thief was a married woman. She who stole anything from the house when the husband was dead or sick was guilty of death, and so was the receiver. Thefts to the value of more than five minas of lead from the house of a stranger made a woman liable to be detained by the householder pending redress. Other thefts might be atoned for by the thief submitting himself to private retribution. Gross slander of immoral or unnatural conduct against man or woman was savagely punished by cudgelling, forced labour, a fine, and castration. Adultery and rape were alike capital offences, and the penalty could be inflicted privately by the aggrieved family, which had the option, however, of contenting itself with a milder satisfaction, or even of forgiveness. Indecent assault was avenged by the mutilation of the hands or face, by fines and beating, and assault leading to abortion by beating, forced labour, and a fine.

The source of justice was the king or his officers, sometimes assisted by the chief men of the locality. But a prominent feature of the Assyrian law is the wide allowance it gives to private retribution. Within the family the father is usually free to take such disciplinary measures, even of great severity, as seem good to him. Public sentences were carried out by an executioner who was ordered not to exceed the written instructions given to him. In general, the savagery of the corporal punishments prescribed or allowed is a disagreeable feature of the Assyrian lam; although the Code of Hammurabi is not sparing in denunciations of death it has none of the cruel and arbitrary woundings so freely awarded by Assyrian justice.

Two other matters involved by these laws are of interest; first, that in this period the ordinary medium of exchange is lead, not silver, financial penalties being always reckoned in this metal. Second is the use of the ordeal by water, which was also practised in Babylonia. In a criminal charge, if witnesses or other mode of proof were not available, the accused was thrown into the river, and was declared innocent if he floated. In a dispute, when both parties had taken oaths in a contradictory sense, the ordeal was used to decide between them.

THE HITTITE LAWS

So long ago as 1907 excavations near the Turkish village of Boghaz Keui, about 90m. east of Angora, lighted upon a great collection of clay tablets inscribed in cuneiform with a multitude of histcrical, religious, and political documents drawn up either in Babylonian or in one of several native languages, and dating from the 14th or early 13th century before the Christian era. Among these tablets were found two large and several smaller pieces which proved to contain laws written in the chief native language of the kingdom. Most of the difficulties of this language have lately been overcome, and the contents of the Hittite laws are now disclosed. Though belonging to a different culture, they were framed by a society closely in touch with Mesopotamia, and at a time shortly before the rise of Assyria to importance, so that some notice of them is indispensable.

The most striking peculiarity of the Hittite laws is their overt references to revision. In several cases it is said that "formerly" such-and-such was the practice, but "now" it has been altered. Occasionally it is custom which is thus modified, but more often it is an earlier recension of the law, as when the restitution for theft of cattle is reduced, or the considerations which determine whether there has been misappropriation of property are simplified. In general, the revised state of the law exhibits much milder provisions than the former.

The existing laws by no means cover all, or even the most important, relations with which a code might be expected to concern itself. Indeed there is no specific reference to such subjects as marriage, sale, heredity, or contract; the state of custom with respect to these is indicated only by directions aimed at avoiding disputes in connection with them. The chief purpose of these laws seems to be the maintenance of order, and there-

fore a good deal of their contents is occupied by exhaustive tariffs of fines or restorations after theft, and even of the fixed prices for land, animals, metals, food, and clothing. It is known that the Hittite rule extended at this period over many peoples different in race, language, and customs, for which the law consequently does not attempt to prescribe as it might in the case of a homogeneous population. The almost exclusively agricultural character of the subjects is revealed by the prominence of such topics in the laws; there is only one mention of merchants and only a few of craftsmen.

Property was completely private. In order to be formally recognized, a piece of real estate had to be solemnly put under the protection of the gods, and any new acquisition of the property required a further sacrifice. Several enactments are devoted to the conduct of fiefs granted to soldiers (and also to priests and weavers) by the king as maintenance. In the soldier's absence at the wars a civilian was detailed to cultivate his farm and furnish the dues which were attached to it. Should the soldier die the civilian could enlist in his place. Conversely, if the civilian died, the soldier could take up the fief and its dues, and put in a manager of his own. Sometimes the soldier took a partner, working the land and sharing in the produce. In the event of a quarrel and dissolution of partnership the associate was entitled to a definite, though smaller, share of the property.

The population was divided into free and slaves only. Marriage between two free persons was preceded by the giving of betrothal presents to the girl. If she changed her mind these had to be repaid; if the man did so he lost his money. The two kinds of marriage, according as the woman remains at home or goes to live with her husband, are recognized by Hittite as by Assyrian law. When the marriage was between slaves, or mixed, no betrothal presents were given. But if a slave made these gifts to a free woman, by accepting them she became a slave too. The levirate marriage was customary with the Hittites; a brother (or, if none, a father) must marry the deceased brother's wife. The husband had power of life and death over an adulterous wife, and the father might disinherit a son, but it was required that the son's misconduct should have been repeated. A picturesque custom was observed in these cases; the mother put the son's clothing outside the house to signify his banishment. If he was to be received back, the son carried out certain articles of furniture, which the mother then took back to their place.

That the person of a debtor might be taken as security for a debt is to be gathered from the rule that a third party might effect the release of such a one at the New Year by furnishing a substitute. As to other matters of contract the only indications are the very exhaustive tariffs for sale of animals (mules were dearest), skins, and garments, and for hire of animals, utensils, and craftsmen.

Most of the Hittite code is concerned with penal regulations, governing such offences as murder, assault, abortion, incest, sodomy, kidnapping, theft, and damage. Private revenge is allowed only in the case of an adulterous wife. The public penalties were death, forced labour, imprisonment, and facial mutilation, but the *lex talionis* is not in force. Death is inflicted only in the very moderate number of eight instances, forced labour for misappropriation of property, mutilation only upon slaves guilty of theft or arson. In general the sanctions are distinctly less severe than in either the Babylonian or the Assyrian laws.

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(C. J. G.)

BACĂU, a town of Rumania, capital of department of same name. Pop. (1930), about 31,260, including many Jews. Bacău lies in the foothills of the Carpathians, on the river Bistrița, 5 miles above its junction with the Pruth, and on the main Czernowitz-Ploești line. A branch railway runs to Piatra, in the Carpathians. Bacău is a modern town and important commercial centre with manufactures of paper, cloth and clothing, timber and petroleum. There is a chamber of commerce and industry at Bacău.

BACCARAT, a gambling card-game (origin of name unknown), supposed to have been introduced into France from Italy during the reign of Charles VIII. (c. 1490). There are two varieties of the game: *baccarat banque* and *baccarat chemin* de *fer.* The most usual form at the present time is *chemin de fer* which is played a great deal in France, not only in clubs and private houses, but also at casinos all over the country. It is also played at the casino at Monte Carlo. Six full packs of cards are used. They are shuffled by the croupier and by any of the players who may wish to do so. Any number of people may play, but the ordinary *chemin de fer* table has 12 seats, one for the croupier in the middle and the others numbered from 1 to 11.

After the cards are shuffled, the croupier puts them into a "shoe" which is a special sort of box from which the cards can easily be drawn one at a time. The shoe is then passed to the player on the right of the croupier, that is, in No. 1 seat, who becomes banker for the time being. The other players are called *punters.* The banker places on the table in front of him the sum which he wishes to stake, and the player on his right has the first chance of calling *Banco,* which means that he plays for the entire stake. If the next player does not wish to go *Banco* anyone else at the table can do so in their regular turn. When the banker wins, his stake becomes doubled and again anybody at the table can call *Banco,* but the player who lost the last coup has the first right, which he claims by saying *suivi.* If nobody calls *Banco,* which happens sometimes, especially when the banker has won several coups, any of the punters at the table can stake what they like up to the amount that is in the bank. The banker continues, if he wishes to, until he loses a coup, when the deal passes automatically to the player on his right, but a banker can retire and take in his winnings at any time, before he has dealt a card, on saying *la banque passe.*

The banker deals one card to the punter and one to himself, then a second one to his opponent and another to himself, all face downwards. The object is to get as near to nine as possible, but not over it. Court cards and tens count nothing, other cards count their face value. The punter looks at his two cards and, if they count eight or nine he puts them on the table face upwards. A seven and a two would be nine, or a king and a nine, as court cards do not count; a five and a three, making eight, would also be a natural and must be shown at once. If he has not got a natural the punter can ask for another card, which the banker is bound to give unless he has a natural himself. The banker does not look at his own hand until the punter either asks for another card by saying *Carte,* or refuses by saying *Non.* The banker then exposes his two cards on the table. If he has a natural he wins the coup, if not, he deals another card to the punter, face upwards, and can then decide whether to take another card himself or not. The rules about taking a card are clearly defined. If a player holds either six or seven he does not draw; if he hold five it is *à volonté,* he can do as he pleases; if he holds less than five he always takes a card. This is where the banker gets his advantage. He can decide about taking a card after he has seen the card given to his opponent. For instance, if he has given a court card, counting nothing, he will stand on a four. If he has given a seven he will draw on a six in the faint hope of getting a two or a three. Ties neither win nor lose and fresh cards are dealt. When a banker passes his bank and takes his profit, the bank is offered round the table by the croupier, and anyone at the table can take

it and carry it on by putting up the same amount that was in the bank. If anybody is willing to take it, the bank is put up to auction by the croupier and the highest bidder takes it.

Baccarat Banque is rarely played nowadays except when there is very high gambling at Deauville or at Monte Carlo. Three packs of cards, thoroughly shuffled, are used. One player holds the bank against all the others. He puts in a certain named sum or sometimes declares *Banque* Ouverte, which means that anyone can stake whatever he likes. There are two tableaux, the right and the left. The banker deals one card to the right, one to the left and one to himself, then another to the right, another to the left and another to himself, all face downwards. He then looks at his cards, and if he has not a natural, that is eight or nine, he says J'en *donne,* and offers a card to the tableau on his right, and then to the one on his left. The duty of accepting or refusing the card devolves upon each player at the table in turn, provided that he has a stake in front of him. When he loses a coup, it passes to the player next to him. Baccarat in any form is illegal in England, but it is very popular in France.

See Badoureau, *Étude mathématique sur le jeu* de Baccarat (1881); L. Billard, *Bréviarie* de Baccara *Expérimental* (1883); Rules for Baccarat by J. S. Bond (1882); Baccara and *Chemin-de-fer* by Peter (1923). (W. DA.)

BACCELLI, GUIDO (1830–1916), Italian physician and politician, was born at Rome, and after graduating in medicine at the university became assistant professor of medical jurisprudence in 1856, and some years later professor of clinical medicine. He devoted himself particularly to the study of malaria, his researches giving an impetus to the reclamation of the Roman Campagna. In 1873 he was elected deputy for a division of Rome, which he represented until his death. He was Minister of Education in various cabinets from 1879–99, and of Agriculture under Zanardelli (1901–03); from 1889 to 1893 he was vice-president of the Chamber. A keen classical scholar, he took an active interest in archaeological matters, although in some of his projects, such as the famous *Passeggiata Archeologica* in Rome, he showed more enthusiasm than judgment. His labours for the isolation of the Pantheon and the creation of the Museum of Ancient Art and of the Modern Art Gallery in Rome deserved and met with more general approval. He died in Rome Jan. 11 1916.

BACCHANALIA, the Latin name for the wild and mystic festivals of Bacchus (Dionysus [*q.v.*]). They were introduced into Rome from lower Italy by way of Etruria, and were held in secret, attended by women only, on three days in the year (Ovid, *Fasti* vi. 503). Subsequently, admission to the rites was extended to men and celebrations took place five times a month. The evil reputation of these festivals, at which the grossest debaucheries took place, and all kinds of crimes and political conspiracies were supposed to be planned, led in 186 B.C. to a decree of the senate—the so-called *Senatus consultum* de *Bacchanalibus*, inscribed on a bronze tablet discovered in Calabria (1640), now at Vienna—which prohibited the Bacchanalia throughout Italy, except in certain special cases. But, in spite of the severe punishment inflicted upon those implicated in the criminal practices disclosed, Bacchanalia were not suppressed in the south of Italy for a very long time.

BACCHIADAE, the name of the chief oligarchic family in ancient Corinth (*q.v.*).

BACCHYLPDES, Greek lyric poet, was born at Iulis, in the island of Ceos. His father's name was probably Meidon; his mother was a sister of Simonides, himself a native of Iulis. Eusebius says that Bacchylides "flourished" (ἤκμαζεν) in 01. 78. 2 (467 B.C.). As the term ἤκμαζεν commonly refers to about the 40th year we may suppose that Bacchylides was born circa 507 B.C. He would thus have been some 49 years younger than Simonides, and some 15 years younger than Pindar.

Bacchylides, like Simonides and Pindar, visited the court of Hieron I. of Syracuse (478–467). Ode iii. (468 B.C.) was possibly written at Syracuse, as verses 1 j and 16 suggest. He there pays a high compliment to Hieron's taste in poetry (ver. 3 ff.). A scholium on Pyth. ii. go (166) avers that Hieron preferred the Odes of Bacchylides to those of Pindar. The Alexandrian scholars interpreted a number of passages in Pindar as hostile allusions to Bacchylides or Simonides. If the scholiasts are right, it would appear that Pindar regarded the younger of the two Cean poets as a jealous rival (see 01. ii. 91–110). Yet it would be rash to assume that this tradition rested merely on surmise. It is tolerably certain that the three poets were visitors at Hieron's court at about the same time: Pindar and Bacchylides wrote odes of the same kind in his honour; and there was a tradition that he preferred the younger poet. It is noteworthy that, whereas in 476 and 470 both he and Bacchylides celebrated Hieron's victories, in 468 (the most important occasion of all) Bacchylides alone was commissioned to do so; although in that year Pindar composed an ode (Olymp. vi.) for another Syracusan victor at the same festival. Nor is it difficult to conceive that a despot such as Hieron may have found the genial Ionian a more agreeable courtier than Pindar, an aristocrat of the Boeoto-Aeolic type. But, whatever may have been the true bearing of Pindar's occasional innuendoes, it is at any rate pleasant to find that in the extant work of Bacchylides there is not the faintest semblance of hostile allusion to any rival.

Plutarch (de *Exilio*, p. 605 c) names Bacchylides in a list of writers, who after they had been banished from their native cities, were active and successful in literature. The passage implies that Peloponnesus was the region where the poet's genius ripened and where he did the work which established his fame. This points to a residence of considerable length; and it may be noted that some of the poems illustrate their author's intimate knowledge of Peloponnesus (*e.g.*, Odes viii., x., and dithyramb xix.).

The Alexandrian scholars included Bacchylides in their "canon" of the nine lyric poets. The Alexandrian grammarian Didymus (circa 30 B.C.) wrote a commentary on the epinikian odes of Bacchylides. Horace studied his works and imitated him (according to Porphyrion) in Odes, i. 15, where Nereus predicts the destruction of Troy. Quotations from Bacchylides, or references to him, occur in Dionysius of Halicarnassus, Strabo, Plutarch, Stobaeus, Athenaeus, Aulus Gellius, Zenobius, Hephaestion, Clement of Alexandria, and various grammarians or scholiasts. Ammianus Marcellinus (xxv. 4) says that the emperor Julian enjoyed reading Bacchylides. It is clear, then, that this poet continued to be popular during at least the first four centuries of our era. The only definite estimate of him by an ancient critic occurs in the treatise Περὶ Ὕψους ("On the Sublime") ascribed to Cassius Longinus (circ. A.D. 260), but more probably due to some writer of the first century of our era. In chapter xxxiii. of that treatise, the author asks whether we ought to prefer "greatness" in literature, with some attendant faults, to flawless merit on a lower level, and of course replies in the affirmative. In lyric poetry, he asks, who would be Bacchylides rather than Pindar? Yet Bacchylides is "faultless, with a style of perfect elegance and finish." In short, the essayist regards Bacchylides as a thoroughly finished poet of the second class, who never commits glaring faults, but never reaches the loftier heights.

The first and most general quality of style in Bacchylides is his perfect simplicity and clearness. Where the text is not corrupt, there are few sentences which are not lucid in meaning and simple in structure. This lucidity is partly due, no doubt, to the fact that he seldom attempts imagery of the bolder kind, and never has thoughts of a subtle or complex order. Yet it would be very unjust to regard such clearness as merely a compensatory merit of lyric mediocrity, or to ignore its intimate connection with the man's native grace of mind, with the artist's feeling for expression, with the poet's delicate skill.

Another prominent trait in the style of Bacchylides is his love of picturesque detail. This characteristic marks the fragment by which, before the discovery of the 1896 ms., he was best known—a passage, from one of his paeans, on the blessings of peace (fr. 13, Bergk; 3, Jebb); and it frequently appears in the Odes, especially in the mythical narratives. Observation and elegance do more for him than grasp or piercing insight; but his work is often of very high excellence in its own kind. In his

treatment of simile Bacchylides is intent on the decorative value of the details themselves. There are occasional flashes of brilliancy in his imagery, when it is lit up by his keen sense of beauty or splendour in external nature. A radiance, "as of fire," streams from the forms of the Nereids (xvi. 103 ff.). An athlete shines out among his fellows like "the bright moon of the mid-month night" among the stars (viii. 27 ff.). The sudden gleam of hope which comes to the Trojans by the withdrawal of Achilles is like a ray of sunshine "from beneath the edge of a storm-cloud" (xii. 105 ff.). The shades of the departed, as seen by Heracles on the banks of the Cocytus, are compared to the countless leaves fluttering in the wind on "the gleaming headlands of Ida" (v. 65 ff.)—an image not unworthy of Dante or of Milton.

Among the minor features of this poet's style the most remarkable is his use of epithets. A god or goddess nearly always receives some ornamental epithet; sometimes, indeed, two or even three (*e.g.* v. 98 f.). Such a trait is in unison with the epic manner, the straightforward narrative, which we find in some of the larger poems (as in v., x., and xvi.). On the other hand the copious use of such ornament has the disadvantage that it sometimes gives a tinge of conventionality to his work.

The poems contained in the ms. of Bacchylides found (see below) in 1896 are of two classes: I. Odes of Victory or epinikia; II. Dithyrambs. Simonides (b. *c.* 556 B.C.) was the earliest recorded writer of epinikia. His odes of this class are now represented only by a few very small fragments, some 20 lines in all. Two of these fragments, belonging to the description of a chariot-race, warrant the belief that Simonides, in his epinikia, differed from Pindar in dwelling more on the incidents of the particular victory. The same characteristic is found in the epinikia of Bacchylides. His fifth ode, and Pindar's first Olympian, alike celebrate the victory of the horse Pherenicus; but, while Pindar's reference to the race itself is slight and general (vv. 20–22), Bacchylides describes the running of the winner much more vividly and fully (vv. 37–49).

The ms. contains 14 epinikia, or 13 if Blass be right in supposing that Odes vi. and vii., as numbered by Kenyon in the editio princeps, are part of a single ode (for Lachon of Ceos). Four (or on the view just stated, three) of the odes relate to the Olympian festival; two to the Pythian; three to the Isthmian, three to the Nemean; and one to a Thessalian festival called the Πετραῖα. This comes last. The order in which the ms. arranges the other epinikia seems to bc casual; at least it does not follow (1) the alphabetical sequence of the victor's names or of the names of their cities; nor (2) chronological sequence; nor (3) classification by contests; nor (4) classification by festivals—except that the four great festivals precede the Petraea. The first ode, celebrating a victory of the Cean Argeios at the Isthmus, may possibly have been placed there for a biographical reason, viz., because the poet treated in it the early legends of his native island.

A mythical narrative, connected in some way with the victor or his city, usually occupies the central part of the Pindaric ode. Pindar's habit is to select certain moments or scenes of a legend, which he depicts with great force and vividness. Bacchylides, on the other hand, has a gentle flow of simple epic narrative; he relies on the interest of the story as a whole, rather than on his power of presenting situations. Another element, always present in the longer odes of victory, is that which may be called the "gnomic." Here, again, there is a contrast between the two poets. Pindar packs his γνῶμαι, his maxims or moral sentiments, into terse and sometimes obscure epigrams. The moralizing of Bacchylides is rather an utterance of quiet meditation sometimes recalling the strain of Ionian gnomic elegy.

The epinikia of Bacchylides are followed in the ms. by six compositions which the Alexandrians classed under the general name of διθύραμβοι (dithyrambs), using the word in a wide sense, as denoting simply a lyric poem occupied with a mythical narrative. The six dithyrambs of Bacchylides are arranged in (approximately) alphabetical order: Ἀντηνορίδαι, Ἡρακλῆς, Ἱππεῖς ἢ Θησεύς, Θησεύς, Ἰώ, Ἴδας. The principal feature, best exemplified by the first and third, is necessarily epic narrative—often adorned with touches of picturesque detail, and animated by short speeches in the epic manner.

Several other classes of composition are represented by those fragments of Bacchylides, preserved in ancient literature, which were known before the discovery of the new ms. (1) ὕμνοι. Among these we hear of the ἀποπεμπτικοί, hymns speeding some god on his way at the season when he passed from one haunt to another. (2) παιᾶνες, represented by the well-known fragment on the blessings of peace. (3) προσόδια, choral odes sung during processions to temples. (4) ὑπορχήματα, lively dance-songs for religious festivals. (5) ἐρωτικά, represented by five fragments of a class akin to σκόλια, drinking-songs. Under this head come some lively and humorous verses on the power of wine, imitated by Horace (Odes, iii. 21. 13–20). It may be conjectured that the facile grace and bright fancy of Bacchylides were seen to especial advantage in light compositions of this kind. (6) The elegiacs of Bacchylides are represented by two ἐπιγράμματα ἀναθηματικά, each of four lines, in the Palatine Anthology. The first (*Anth.* vi. 313) is an inscription for an offering commemorative of a victory gained by a chorus with a poem written by Bacchylides. The second (*Anth.* vi. 53) is an inscription for a shrine to Zephyrus. Its authenticity has been questioned.

The papyrus containing the odes of Bacchylides was found in Egypt by natives, and reached the British Museum in the autumn of 1896. It was then in about zoo pieces. By the skill and industry of Mr. F. G. Kenyon, the editor of the editio *princeps* (1897), the ms. was reconstructed from these lacerated members.

EDITIONS—F. G. Kenyon, Ed. princeps (1897); F. Blass, 3rd ed. (1904), re-ed. (Suers 1912); H. Jurenka (1898); N. Festa, text, translation and notes (1898). For a very full account of the life and works of Bacchylides, and a discussion of the ms. see the edition by Sir Richard Jebb (1905), with introduction, notes, translation, and bibliography; text only (1906). See also T. Zanghieri, Studi *su Bacchilide, Bibliografia Bacchilidea, 1897–1905* (1905).

BACCIO D'AGNOLO (c. 1460–1543), Florentine wood-carver, sculptor and architect. He started as a wood-carver, and between 1491 and 1502 did much of the decorative carving in the church of Santa Maria Novella and the Palazzo Vecchio in Florence. At the beginning of the 16th century he was engaged with Simon Pollajuolo in restoring the Palazzo Vecchio, and in 1506 he was commissioned to complete the drum of the cupola of the metropolitan church of Santa Maria del Fiore. The latter work, however, was interrupted on account of adverse criticisms from Michelangelo, and it remained unexecuted. Baccio d'Agnolo also planned the Villa Borghese and the Bartolini palace, with other fine palaces and villas. The Bartolini palace was the first house to be given frontispieces of columns to the door and windows, previously confined to churches; and he was ridiculed by the Florentines for his innovation. He designed the campanile of the church of Santo Spirito. His studio was the resort of the most celebrated artists of the day, Michelangelo, Sansovino, the brothers Sangallo and the young Raphael. He died in 1543, leaving three sons, all architects, the best-known being Giuliano.

BACH, JOHANN SEBASTIAN (1685–17jo), German musical composer. The Bach family was of importance in the history of music for nearly 200 years. Four branches of it were known at the beginning of the 16th century, and in 1561 we hear of Hans Bach of Wechmar who is believed to be the father of Veit Each (born about 1j55). The family genealogy, drawn up by J. Sebastian Bach himself and completed by his son Philipp Emanuel, describes Veit Bach as the founder of the family, a baker and a miller, "whose zither must have sounded very pretty among the clattering of the mill-wheels." His son, Hans Bach, "der Spielmann," is the first professional musician of the family.

Of Hans's large family the second son, Christoph, was the grandfather of Sebastian Each. Another son, Heinrich of Arnstadt, had two sons, Johann Rfichael and Johann Christoph, who are among the greatest of J. S. Bach's forerunners, Johann Christoph being probably the author of the splendid motet, *Ich lasse* dich *nicht* ("I wrestle and pray"), formerly ascribed to Sebastian Bach. Another descendent of Veit Bach, Johann Ludwig, was admired more than any other ancestor by Sebastian, who copied 12 of his church cantatas and sometimes added work of his own to them.

The Bach family never left Thuringia until the sons of Sebastian went into a wider world. Through all the misery of the peasantry during the period of the Thirty Years' War this clan maintained its position and produced musicians who, however local their fame, were among the greatest in Europe. So numerous and so eminent were they that in Erfurt musicians were known as "Bachs," even when there were no longer any members of the family in the town. Sebastian Bach thus inherited the artistic tradition of a united family aloof from all the musical fermentation which in the rest of Europe had destroyed polyphonic music throughout the 17th century.

LIFE

Early **Days.**—Johann Sebastian Bach was baptized at Eisenach on March 23, 1685. His parents died in his 10th year, and his elder brother, Johann Christoph, organist at Ohrdruf, took charge of him and taught him music. The elder brother is said to have been jealous of Sebastian's talent, and to have forbidden him access to a manuscript volume of works by Froberger, Buxtehude, and other great organists. Every night for six months Sebastian got up, put his hand through the lattice of the bookcase, and copied the volume out by moonlight, unfortunately to the permanent damage of his eyesight—as is shown by all the extant portraits of him at a later age and by the blindness of his last year. When he had finished, his brother discovered the copy and took it away from him.

In 1700 Sebastian, now 15 and thrown on his own resources by the death of his brother, went to Luneburg, where his unbroken soprano voice obtained for him an appointment at the school of St. Michael as chorister. We know little about his teachers, but we have abundant evidence of his own incessant study of earlier and contemporary composers, such as Frescobaldi (*c.* 1587), Caspar Kerl (1628–93), Buxtehude, Froberger, Muffat the elder, Pachelbel and probably Johann Joseph Fux (1660–1741), afterwards the author of the *Gradus ad Parnassum* (1725) on which Haydn trained himself a generation later.

A prettier legend than that of his brother's forbidden organ-volume tells how, on his return from one of the many holiday expeditions which Bach made to Hamburg on foot to hear the great organist Reinken, he sat outside an inn longing for the dinner which he could not afford, when two herring-heads were flung out of the window, and he found in each of them a ducat with which he promptly paid his way, not home, but back to Hamburg.

At Hamburg, also, Keiser was laying the foundations of German opera on a splendid scale which must have fired Bach's imagination, though it never directly influenced his style. On the other hand Keiser's church music was of immense importance in his development. In Celle the famous *Hofkapelle* brought the influence of French music to bear upon Bach's art, an influence which inspired nearly all his works in suite-form and to which his autograph copies of Couperin's music bear testimony. Indeed, there is no branch of music, from Palestrina onwards, conceivably accessible in Bach's time, of which we do not find specimens carefully copied in his own handwriting. Again, when Bach, at the age of 19, became organist at Arnstadt, he found Liibeck within easy distance, and there, in Oct. 1705, he went to hear Buxtehude, whose organ works show so close an affinity to Bach's style that only their lack of coherence as wholes reveals to the attentive listener that this noble music is more primitive than Bach's.

First Appointments.—Enthusiasm for Buxtehude caused Bach to outstay his leave by three months, and this, together with his habit of astonishing the congregation by the way he harmonized the chorales, got him into trouble. But he was already too great an ornament to be lightly dismissed; and though his answers to the complaints of the authorities (recorded in the archives of the church) were spirited rather than satisfactory, and the *consistorium* had to make what scandal they could about his allowing a "stranger-maiden" to sing privately in the church, Bach was able to maintain his position at Arnstadt until he obtained the organistship of St. Blasius in Mülhausen in 1707. Here he married his cousin, easily identified with the "stranger-maiden" of Arnstadt; and here he wrote his first great church cantatas, *Aus der Tiefe* and *Gottes Zeit. Gott ist mein Konig* he had written two years earlier.

In 1708 Bach went to Weimar where his successes were crowned by his appointment, in 1714, at the age of 29, as *Hofkonzertmeister* to the duke of Weimar. Here he found ample scope for sacred music, and the great cantata *Ich hatte viel Bekümmerniss* was probably the first work of his new office. In 1717 Bach visited Dresden in the course of a concert tour, and was induced to challenge the arrogant French organist, J. Louis Marchand. The two champions heard (or overheard) each other's playing. A musical tournament was arranged at court, but on the appointed day the only news of the French champion was that he had left Dresden by the earliest coach. This triumph was followed by Bach's appointment as *Kapellmeister* to the duke of Cöthen, a post which he held from 1717 to 1723. The Cöthen period is that of Bach's central instrumental works, such as the first book of *Das Wohltemperirte Klavier,* the solo violin and violoncello sonatas, the Brandenburg concertos, and the French and English suites.

Removal to **Leipzig.**—In 1723, finding his position at Cöthen uninspiring for choral music, he removed to Leipzig, where he became cantor of the Thomasschule, being still able to retain his post as visiting *Kapellmeister* at Cöthen, besides a similar position at Weissenfels. His wife had died in 1720, leaving seven children, of whom Friedemann and Philipp Emanuel had a great future before them. (For his sons *see* BACH, K.P.E., below.) In Dec. 1721 Bach married again, and for the beautiful soprano voice of his second wife he wrote many of his most inspired arias. She was a great help to him with all his work, and her musical handwriting soon became almost indistinguishable from his own. In 1729 Bach heard that Handel was for a second time visiting Halle on his way back to London from Italy. A former attempt of Bach's to meet Handel had failed; illness now prevented his travelling, and his son could not persuade Handel to visit Leipzig; so the two never met. Bach so admired Handel that he made a manuscript copy of his *Passion nach Brockes;* a fact of great significance. The poem of Brockes, a dreadful example of the literary taste of its day, purported to be a combination of the four Gospel narratives. It had been set by every German composer of the time, but it was transformed by Bach with real literary skill as the groundwork of the nonscriptural numbers in his Passion according to St. John.

Closing Years.—All Bach's most colossal achievements, such as the Passion according to St. Matthew and the B Minor Mass (*see* **ORATORIO** and MASS) date from his cantorship at Leipzig. His position there was important and congenial, and his temperament was equal to the strain of many a "breeze" with town councillors who would have preferred a less independent cantor and a more ecclesiastical style of music. But graver troubles were not to be avoided in any large family living on the wages of learning in those insanitary days. Of his seven children by his first wife only three survived him. By his second wife he had 13 children, of whom he lost four of the six sons. His post was more dignified than lucrative; and the inventory of his possessions, made after his death, tells a tale of thrift.

His eldest son, Friedemann, delighted him with the growth of a wonderful talent, which showed him to be, as the more famous son, Philipp Emanuel said, more nearly capable of replacirig his father than all the rest of the family together. Yet he gave his father much anxiety by a growing wildness which was destined to lead to an unproductive career and a squalid old age. The total eclipse of his own polyphonic art Bach faced with equanimity, saying of the new styles which in the hands of his sons Philipp Emanuel and Johann Christoph were soon to eclipse it for the next century, "The art has advanced to great heights: the old style of music no longer pleases our modern ears." Philipp Emanuel made a good career and was appointed court-composer to the king of Prussia. This led, in 1747, to Sebastian's being summoned to visit Frederick the Great at Potsdam, an incident which Bach always regarded as the culmination of his career, much as Dr. Johnson regarded his interview with George III.

Bach had to play on the newly invented pianofortes of Silbermann, of which the king had bought 15, and also to try the organs of the churches of Potsdam. Frederick, whose musical reputation rested on a genuine if narrow basis, gave him a splendid theme on which to extemporize; and on that theme Bach afterwards wrote *Das musikalische Opfer*. Two years afterwards his sight began to fail, and before long he shared the fate of Handel in becoming totally blind. (The same surgeon operated unsuccessfully on both composers.)

Bach died of apoplexy on July 28, 1750. His loss was deplored as that of one of the greatest organists and clavier players of his time. Of his compositions little was known outside the circle of his family and pupils. At his death his ms. works were divided amongst his sons, and many of them have, to the irreparable loss of the art, been irrecoverably lost; indeed, only a small proportion of his greater works was recovered when, after the lapse of nearly a century, the renascence of polyphony reversed the judgments of his immediate posterity. (X.; D. F. T.)

WORK AND INFLUENCE

Rediscovery. — The rediscovery of Bach's choral music dates from the boyhood of Mendelssohn, who at 12 years of age read the autograph of the Matthew Passion in the Royal Library at Berlin, and never rested until he had given a private performance of it, the first since Bach's death. In England the revival began still earlier by the performances and publications of Wesley and Crotch. In 1850, a century after his death, a society was started for the correct publication of all Bach's remaining works. Robert Franz, the song-writer, arranged some of Bach's finest works for modem performance; a valuable service, so long as the scholarship of the rediscovered art was in its infancy, but now superseded by the realization of Bach's own methods. The Porson of Bach-scholarship, however, is Wilhelm Rust, grandson of an interesting composer of that name, who wrote polyphonic suites and fantasias early in the 19th century. During the 14 years of his editorship of the *Bach-Gesellschaft* he displayed a steadily increasing insight into Bach's style, sometimes restoring harmonies of priceless value from incomplete texts, by means of research and reasoning which he sums up in a modest footnote that reads as something self-evident. Until Albert Schweitzer mastered Bach's art in its entirety, Rust's prefaces to the *Bach-Gesellschaft* volumes were by far the most valuable contributions to the criticism of the 18th-century music ever written, Spitta's biography not excepted.

Universal **Influence.**—Bach's influence in the history of music was powerful long before it was recognized by the musical world in general. In his lifetime his art-forms were already considered obsolete, and useful only as subjects of academic study. And yet; however much its purpose and significance may have been disguised and obscured by corrupt traditions and ignorance of its idioms, whenever any fragment of it gained the inner ear of a true composer the effect on the history of music was immediate and profound. Indeed, the recognized Each-revival that began with Mendelssohn is obviously connected with the "Romantic" movement in music. But Bach as "the first of the Romantics" is no larger a part of the real Bach than Shakespeare the sonneteer is of Shakespeare the dramatist.

The full influence of his whole work has hardly yet begun to show itself. Schumann died before the first editors of the *Bach-Gesellschaft* began to find more beauty than extravagance in Bach's ordinary musical language *(see*, for example, Hauptmann's letters, *The Letters of a Leipzig Cantor*, trans. by *A.* D. Coleridge, 1892), or, indeed, to grasp the main features of his designs. *(See* the wild conjectures of the editor of the Four Short Masses as to the "displacing" of structure in the kyrie of the G minor Mass [*B.-G., Jaltr.* viii. preface, with Rust's answer in the preface to *Jahr.* xxiii.]). The labours of the *Baclz-Gesellschaft* occupied more than 50 years, during which about four-fifths of Bach's choral works were published for the first time. In centuries no musician but a specialist will know this mass of work as every musician comes to know his Beethoven. Nor will anthologies hasten the attainment of such knowledge where the whole body of work so constantly attains that excellence for which the anthologist seeks. Except for practical difficulties (as when Bach writes for obsolete instruments) the only reason why some cantatas are better known than others is that a beginning must be made somewhere. Indeed, a cantata was once selected, on the ground of its popularity, for a choral competition in a small English country town the year before it was performed as a novelty in Berlin.

Mozart, Beethoven and Chopin. — Hence, the influence of Bach's art as an understood whole lies even yet in the future. In the past his influence was hardly suspected except by the great composers themselves; and, to any one contemplating the art of the generation after him, it might have seemed that both he and Handel had worked in vain. Yet his was the most subtle and universal force in the development of music, even when his musical language seemed hopelessly forgotten. Mozart, when rapidly advancing to the height of his mastery, had but to read Baron von Swieten's manuscript copies of the motets and of the *Wohltemperirte Klavier*, and his style, quite apart from his immediate essays in the old art-forms, and apart also from the influence of his study of Handel, developed a new polyphonic richness and depth of harmony which steadily increased until his untimely death.

Beethoven studied all the accessible works of Bach profoundly, and frequently quoted them in his sketch-books, often with a direct bearing on his own works. His rendering of the *Wohltemperirte Klavier* is said to be recorded in the marks of expression and *tempo* given in Czerny's edition; and if that record is true, Beethoven must have been completely in the dark as to Bach's meaning in many important respects. But art is full of such illustrations of the way in which great minds influence each other in spite of every barrier which diversity of language and time can set. Beethoven's great Thirty-Three Variations on a Waltz by Diabelli were actually described in the publisher's puff as worthy of their kinship with the Goldberg Variations of Bach; and that kinship is revealed in its truest light by a comparison between Beethoven's 31st variation and Bach's 25th; for here, just where the resemblance is most obvious, each composer utters his most intimate expression of feeling.

In the same way, Chopin is nowhere more characteristic than where he shows his love of the *Wohltemperirte Klavier* in his Études and Preludes. It was Schumann who, in a series of maxims for young musicians, said "Make *Das Wohltemperirte Klavier* your daily bread."

Mendelssohn, Wagner and **Brahms.**—In a more external, but no less significant way, the Passion according to St. Matthew made its mark on Mendelssohn from the time when he discovered it at the age of 12, and suggested to him many features in the general design of oratorios, by means of which he rescued that branch of art from the operatic influences that had ruined Beethoven's *Mount of Olives*. Without the renascence of Bach, Wagner's *Leitmotive* would less readily have attained that close polyphony which secures for his music a flow as continuous as that of the drama itself; and intimately connected with this is the whole subject of Wagner's harmonization, which, in many of its boldest characteristics was foreshadowed by Bach. A close study of the texture of Brahms's work shows that he develops Bach's and Beethoven's artistic devices *pari passu*, and that the result is a complete unification of that opposition between polyphony and form which in the infancy of the sonata (as in every transitional stage in musical history) threatened to wreck the art as a false antithesis wrecks a philosophy. Perhaps the only great composers who escaped the direct influence of Bach are Gluck and Berlioz. Even Gluck, whose art could owe nothing essential to Bach, echoed in every detail of harmony and figure no fewer than 12 bars of the gigue of Bach's B flat clavier partita in the aria "Je t'implore et je tremble" in *Iphigénie en Tauride*, a parallel far beyond the possibility of casual coincidence. The deep and all-pervading indirect influence of Bach no one could escape, for whatever in later music is not traceable to Sebastian Bach is traceable to his sons, who were encouraged by their father to cultivate those infant art-forms which were so soon to dazzle the world into the belief that his own work was obsolete.

A **Seeker** of **Truth.**—Bach's place in music is thus far higher than that of a reformer, or of an inventor of new forms. He is a spectator of all musical time and existence, to whom it is not of the smallest importance whether a thing be new or old, so long as it is true. It is doubtful whether even the forms most peculiar to him (such as the arpeggio prelude) are of his invention. Yet he left no form as he found it—not even that most conventional of all, the da capo aria. On the other hand, with every form he touched he said the last word. All the material that could be assimilated into a mature art he vitalized in his own way, and he had no imitators. The language of music changed at his death, and his influence became all-pervading just because he was not the prophet of the new art, but an unbiassed seeker of truth. Whether so great a man becomes "progressive" or "reactionary" depends on the artistic resources of his time. He will always work at the kind of art that is most coinplete and consistent in all its aspects The same spirit of truthfulness that makes Sebastian Bach hold himself aloof from the progressive art which he encouraged in his sons, drives Beethoven to invent new forms and new means of expression with every work he writes. Gluck abolished the da capo aria, because it was unfit for dramatic music. Bach retained and developed it, because he did not intend to write dramatic music. Mature musical art in Bach's time could not be dramatic, except in the loose sense in which enthusiasts apply the term to sunsets, cathedrals, and all kinds of impressive effect whatever. Dramatic expression, properly so called, can be attained in music only by the full development of resources that do not blend with those of Bach's art at all. Meanwhile there are many things unsuitable for the stage which are nevertheless valuable as pure music, and the da capo aria was one. We may regret with Schweitzer, that Bach allowed it to oust more German lyric forms.

Some of His Methods.—Under ARIA, CHORALE, CONTRAPUNTAL FORMS, CONCERTO, FUGUE and INSTRUMENTATION, will be found reference to Bach's handling of various art-forms. Here we may attempt to illustrate his methods in respect of such forms and characteristics as cannot be classified under those headings.

Treatment of the Toccata.—The toccatas of Buxtehude and his predecessors show how an effective musical scheme may be suggested by running over the keyboard of an organ as if to try the touch *(toccare)*, then bursting out into sustained and full harmony, and at last settling down to a fugue. But before Bach, no one seemed able to keep the fugue in motion long enough to make a convincing climax. It soon collapsed, and the process of quasi-extemporization began again, to culminate in a new fugue which often gave the whole work a deceptive suggestion of organic unity by having as its subject a variation of the subject of the first fugue. But in Bach's hands the toccata becomes one of the noblest and most plastic of forms. The introductory runs may be disjointed and exaggerated to grotesqueness, until the gaps between them gradually fill out, and they build themselves up into grand piles of musical architecture, as in the organ toccata in C; or they may be worked out on an enormous scale in long and smooth canonic passages with a definite theme, as in the greatest of all toccatas, that in F for organ, which is most artistically followed by a fugue unusually quiet for its size.

In one instance, the toccata at the beginning of the E minor clavier partita, the introductory runs, though retaining much of the extempore character from which the form derives its name, take shape in an organized and rounded-off group of contrasted themes. The fugue follows without change of time, and is developed in so leisurely a manner that it is fully as long as a normal fugue on a large scale by the time it reaches what sounds like its central episode. At this point some of the introductory matter quietly enters, and leads to a recapitulation of the whole introduction in the key now reached. The obvious sequel would be a counter-development of the fugue, at least as long as what has gone before, as in the clavier-toccata in C minor; but Bach does not choose to weary the hearer and weaken the impression of breadth he has already made here. Instead, he expands this restatement of the introduction, and makes its harmonies deliberately return to the fundamental key, and thus in an astonishingly short time the toccata is finished with the utmost effect of climax and satisfaction.

If such is Bach's treatment of a highly specialized art-form, an art which treats all forms and means of expression on this plane of thought will obviously demand an analysis of each individual work. School generalities are useless here. Fortunately, however, Bach gives us actual demonstrations of his general principles by frequently rearranging his own works. He almost seems to regard adaptability to fresh environment as the test of his art; and we cannot do better than review the evidence thus given to us—evidence hardly less significant than that of Beethoven's sketch-books.

Transplantations and Self-Criticism.—when a work of art is successfully transplanted to a fresh environment, we must distinguish between alterations produced by the environment and alterations that imply the composer's dissatisfaction with the original version. And here are traps for the unwary. Let us begin with the birthday cantata *Was mir behagt ist nur die muntre Jagd,* one of Bach's lightest occasional pieces, and see what became of its contents when they were distributed among two church cantatas, the great *Also hat Gott die Welt geliebt* and the cheerful *Man singet mit Freuden.*

In the birthday cantata the fine bass aria "Ein Fiirst ist seines Landes Pan" seems ill-proportioned with its breakneck return to the tonic and its perfunctory close. But the words assert that "a land without a Prince lacks its better part." So Bach is not thus to be caught napping! Nevertheless, his chief concern in adapting this aria for its place as "Du bist geboren mir zu Gute" in *Also hat Gott,* was to remedy a defect no longer justified by the words. On the other hand the use of the delightful ritornello for violoncello from the little aria, "Weil die wollenreichen Heerden," in the birthday cantata, and the restoration of the rejected long instrumental fugato that was to follow, were obviously brought about by the conception of the entirely new material for the voice in the famous aria, "Mein glaubiges Herze." And when the last chorus of *Was mir behagt* became the first chorus of *Man singet mit Freuden,* it was expanded to the proportions necessary for a triumphant opening (as distinguished from a cheerful finale) by the adroit insertion of new material between every joint in the design. This material, being new, could not produce the effect of diffuseness that would result from the expansion of old material already complete in its simplest form, and thus this instance does not imply criticism of the original idea.

Pure self-criticism is shown in the Passion according to St. John, which was twice revised, and each time reduced to a smaller scale by the omission of some of its finest numbers. The final result was a work of perfect proportions; and of the rejected numbers one (a magnificent aria with chorale) remained unused, two were replaced by finer substitutes, another took shape as part of one of the most perfect and remarkable of the church cantatas, *Du wahrer Gott,* while the greatest of the figured chorales was transferred to the Passion according to St. Matthew, of which it now crowns the first part.

Instrumental **Transcriptions.**—Such instances of self-criticisms have been paralleled by other composers; but there is no parallel in music to Bach's power of reproducing already perfect works in different media. The bare fact that a composer has transcribed his own work irom one medium to another is neither unusual nor instructive; the article on Handel will show that Handel did this as often as Bach, and sometimes with significant results. But Handel, is seldom, if ever, dissatisfied with a makeshift, while Bach always aims at, and often attains, a perfect effect of originality in the new form. The possibility of this depends on the identity of all his ritornello forms, including those of choruses. *(See* ARIA, CONCERTO, and also INSTRUMENTATION.) His power of adding parts to schemes already complete in harmony and counterpoint reveals many principles in his purely musical aesthetics; and the cases in which he adapts the same music to different words wiil help us to define his range of expression.

The *catalogue raisonné* at the end of this article shows that nearly all Bach's clavier concertos are arrangements of works for

violin. Here the new problem, solved with varying success or perfunctoriness, is to provide independent and apparently necessary material for the left hnnd of the cembalo player.

The greatest marvels begin with such transformations as that of the prelude of the E major partita for unaccompanied violin into the sinionia for organ obbligato accompanied by full orchestra (including three trumpets and a pair of drums) at the beginning of the church cantata, *Wir danken dir, Gott*. The original version is perhaps the most complete and natural of all the violin solos, for its arpeggios produce full harmony without recourse to the *tour de force* of playing on all four strings at once, which cannot be achieved with accurate rhythm. Yet in the sinfonia its proportions seem to reveal themselves for the first time. Not a bar is displaced and not a note of the new accompaniment is unnecessary. The whole is almost entirely without themes; for even this, the largest of all arpeggio preludes, consists essentially of the gradual unfolding of a scheme of harmony in which rhythmic and melodic organization is reduced to a minimum. Only in the first line does the incisive initial figure persist a little longer in the new accompaniment than in the original solo, but on the last page it reappears and pervades the whole orchestra, even the drums thundering out its rhythm at the climax where the holding notes of the trumpet span the torrent of harmony like a rainbow.

Deeper still is the thought that underlies the transformation of two movements of the great violin concerto in D minor (unfortunately lost except in its splendid arrangement for clavier) into parts of the church cantata *Wir müssen durch viel Trübsal in das Reich Gottes eingehen.* In both movements the violin is replaced by the organ an octave lower, the orchestral accompaniment remaining where it was. This treatment, with the addition of new and plaintive parts for wind instruments, turns the already very long and sombre first movement into an impressive idealization of the "much tribulation" that lies between us and the kingdom of heaven. The slow movement is still more solemn, and is arranged in the same way as regards the instruments; but from the first note to the last a four-part chorus sings, to the words of the title, a mass of quite new material (except for the bass and for numerous imitations of the solo-part), treated with every variety of vocal colouring and a grandeur of conception which is not dwarfed even by the Passion according to St. Matthew.

Adaptations and Transformation. — The four short masses, the Christmas Oratorio and the B minor mass, contain every variety of adaptation from earlier work. The four short masses are indeed obviously compiled for use in a church where the orchestra was small. Only four movements in the whole collection are not traceable to other extant works; and they were probably, like all the rest, from church cantatas.

The adaptations are not always significant; no attempt, for example, is made in the G minor mass to conceal how unfit for a "Kyrie eleison" is the tremendous denunciatory chorus, "Herr, deine Augen sehen nach dem Glauben." But the F major and G major Masses are very instructive; and the A major Mass, except for the damage done to the instrumentation, is a work that no one would conceive to be not original. The Kyrie is one of Bach's most individual utterances and could surely never have fitted any other text; but we should say the same of the Gloria if we did not possess the church cantata, *Halt im Gedächtniss.* The Gloria begins with a triumphant polyphonic chorus accompanied by a spirited symphony for strings. At the words "et in terra pax" the time changes, and two flutes softly accompany a single solemn melody in the altos. At the "laudamus te" the material of the beginning returns, and is interrupted again by the calm slow movement, this time in another key and for another voice, at the words "adoramus te." Twice the "laudamus" and "adoramus" alternate in a finely proportioned design; at last the words "gratias agimus tibi propter magnam gloriam tuam" are set for the full chorus to the music of the slow movement, the strings join with the flutes, and this most appropriate setting of those words is finished. And yet it is quite impossible to regard this as superseding the last chorus of *Halt im Gediichtniss.* Not one bar or harmony of the framework differs; yet the two versions are two independent works of art.

In the cantata the beginning is for instruments only; when the slow movement (here adequately scored for a flute and two *oboi d'amore)* begins, the basses, permanently separated from the rest of the chorus, sing "Peace be unto you." The other voices then sing the triumph of the faithful helped by the Saviour in their battle against the world. The slow movement is, of course, set for bass alone throughout, and at the last recurrence of the allegro the bass continues to sing "Friede sei mit euch" through the rest of the chorus, as if leading the chorus of humanity through strife to the kingdom of heaven; and then the single voice of peace remains to the end. Hardly a bar of the chorus material is on the same themes in the two versions.

The study of the sources of the Christmas Oratorio will complete the evidence on which we support our estimate of Bach's methods and range of expression. It is certain that the occasional cantatas, from which all except the chorale tune numbers and those set to words from the Bible were taken, date from shortly before the oratorio; and that Bach, being incapable of putting inferior work even into birthday odes, rescued his music from oblivion by having the verses for the oratorio built on the same rhythms as those of the odes in order that he might use those occasional works as a sketch *(see* B. *G., Jahr.* xxxiv. preface).

Be this as it may, the alterations are confined to details even where an aria is transposed a fourth or fifth; but the effect of them is startling. Pleasure (Wollust) sings a lovely soprano aria to allure Hercules from the paths of virtue, to which Hercules replies indignantly with an aria in a spirited staccato style. We may be shocked to find that Wollust's aria became the Virgin's cradle-song, while Hercules' reply became the alto aria in which Zion is bidden to "prepare for the Bridegroom." But this does not prove that Bach's music lacks definite characterization: on the contrary, these two arias are the best demonstration of his precise range of musical expression.

It never entered his conception of art that Wollust should be represented by a Wagnerian Venusberg-music; the obvious way to represent Pleasure was by writing pleasant music; and, with Bach's ideas of pleasance, the step from this to the solemn beauty of the sacred cradle-song was a mere matter of change of colour and *tempo.* The key is lowered from B flat to G, the strings are veiled with the tender reed tone of a group of oboe d'amore, the soprano becomes an alto whose notes are, as it were, surrounded with a nimbus by being doubled in the upper octave by a flute; and the aria becomes worthy of its new purpose, not by losing a grossness which it never possessed, but by gaining the richness which distinguishes the perfect work from the boldly executed draft.

In the aria of Hercules the change is in manner, while the character is essentially the same. Both Hercules and the faithful Christian of the oratorio are renouncing pomps and vanities for the claims of a higher life; in the one case indignantly, in the other case inspired "mit zartlichem Triebe." A change to a legato style, the substitution of a single oboe d'amore for tutti violins, the addition of delicate ornaments indicative of a slower pace, and the noble stream of melody preserves its identity while changing its aspect. Certain rolling basses that originally symbolized the serpents strangled by the infant Hercules in his cradle, now mean no more than arpeggio accompaniments. A cathedral reacts on the impressiveness of the rites performed within it, and nature reacts on a poet's thoughts, in the same ways as Bach's melodies react on their texts. They are greater than any possible mood of the moment, not because of any vagueness that pious evasiveness calls reserve, but because of their vital individuality. In their proper directions their changes are limitless; elsewhere change is inconceivable. No amount of *Umarbeitung* could, for instance, turn the aria of Hercules into the Virgin's cradle-song, or Wollust's aria into the exhortation of Zion to prepare for the Bridegroom. Bach's designs are not masks, but living types.

One of the best modern books on Bach is Pirro's *L'Esthétique de Jean-Sebastian Bach.* It is an account of the system of musical symbolism which Bach took over and developed from what he regarded as classical tradition. The only defect in the book is its title, which should have been *La Vocabulaire de J. S.*

Bach. The aesthetic system of Bach is a very different thing: it concerns his art-forms as wholes, and is remarkably independent of the vocabulary of musical symbols which he shares with the music of two previous centuries, and which makes him automatically set the word "high" to a high note even when the text merely mentions the High Priest.

An All-Embracing Art.—Within these limits, that is, short of dramatic expression in just so far as "the end of drama is not character but action," there is nothing good that Bach's art does not express. He has plenty of humour, in terms of an art which is always literal; an art in which jests are jests and serious things are treated with familiar directness, and all, whether in jest or earnest, is primarily beautiful.

In Der *Streit zwischen* Phoebus *und Pan,* Bach answers the critics who censured him for his pedantry and provincial ignorance of the grand Italian operatic style, by making effective use of that style in Pan's prize aria ("Zum Tanze, zum Sprunge, so wack-ack-ack-ackelt das Herz"), nobly representing his own style in Phoebus' aria, and promptly caricaturing it in the second part of Pan's ("Wenn der Ton zu muhsam klingt"). Midas votes for Pan—"denn nach meinen beiden Ohren singt er unvergleichlich schon." At the word "Ohren" the violins gave a pianissimo "hee-haw" which is as apt and as musical as Mendelssohn's clown theme in the overture to the Midsummer Night's Dream; and in the ensuing dialogue the prophecy is verified. As with many other great artists. Bach's playfulness occasionally showed itself inconveniently where little things shock little minds. The hilarious aria "Ermuntre dich," in the church cantata, "Schmucke dich, o liebe Seele," is one instance, and the quaint representation of the words "dimisit inanes" in the Magnificat is another.

This great work, one of the most terse and profound things Bach ever wrote, contains, among many other subtle inspirations one conception with which we may fitly end our survey, for it strongly suggests Bach himself and the destiny of all that work which he finished so lovingly, with no prospect of its becoming more than a family heirloom and a salutary tradition in his Leipzig choir-school. In the Magnificat he sets the words "quia respexit humilitatem ancillae suae" to a devout soprano solo accompanied by his favourite oboe d'amore. With the next sentence "ecce enim beatam me dicent" the tone brightens to a quiet joy, but Bach takes advantage of the syntax of the Latin in a way that defies translation, and the sentence is finished by the chorus. "Omnes generationes" seem indeed to pass before us in the crowded fugue which rises in perpetual stretto, the incessant entries of its subject now mounting the whole scale, each part a step higher than the last, and now collecting in unison with a climax of closeness and volume overwhelming in its impression of time and multitude.

SUMMARY OF BACH'S WORKS

Chronological sequence is not the primary interest in a catalogue of Bach's works. The changes in his style, though clear and evolutionary, are best appreciated after the bulk of the work has been digested. To describe them beforehand does not aid the student enough to make it worth while to expand this summary by an attempt to apportion its contents among the Arnstadt-Miilhausen period, the Weimar period, the Cöthen period (chiefly remarkable for instrumental music and comparatively uninteresting in its easy-going choral music), and the last period (1733–50) in which, while the choral works become at once more numerous and more terse (*e.g., Jesu,* der *du meine* Seele) the instrumental music, though never diffuse, shows an increasing preference for designs on a large scale. (Compare, for example, the second book of the *Wohltemperirte Klavier,* 1744, with the first, 1722.)

I. CHURCH MUSIC

A. With **Orchestra.**—190 church cantatas: besides several which are only known from fragmentary sets of parts. Of the 190, 40 are for solo voices, about 60 (including some solo cantatas) are more or less founded on chorales, and the rest, though almost invariably containing a chorale (for congregational singing). are practically short oratorios and frequently so entitled by Bach himself.

Three wedding cantatas; the Easter Oratorio (exactly like the above-mentioned oratorio-cantatas; and the Christmas Oratorio (six similar cantatas forming a connected design for performance on six separate days).

The Passions according to St. Matthew and St. John.

Funeral ode for the Duchess Eberhardine, now known to be arranged from portions of the lost Passion according to St. Mark.

Four short masses (*i.e.,* Kyrie and Gloria only) mainly compiled from church cantatas.

Mass in B minor; Magnificat in D; and a few other ecclesiastical Latin choruses.

B. Without Orchestra.—Five motets a capella (but the treatment of the bass shows that these were intended to be partly supported by the organ). A sixth motet has an obbligato figured-bass accompaniment.

A few early choruses, mostly turned to account in later works.

A large collection of plain chorales, including several original melodies.

II. SECULAR VOCAL MUSIC

Der *Streit zwischen Phoebus* und *Pan* and Der *zufrieden*-gestellte *Aeolus;* each entitled *Dramma* per *Musica,* but showing no more essential connection with the stage than Handel's Acis *and Galatea.*

Seven solo and seven choral cantatas, of which the latter three were almost entirely absorbed into the Christmas Oratorio and the B minor Mass. Of the solo cantatas two are Italian (one of these being Bach's only developed work for voice and clavier) and two are burlesque.

Several tunes with clavier bass, almost foreshadowing the song-style of the 19th century.

III. INSTRUMENTAL MUSIC

A. Orchestral.—Seven clavier concertos arranged from violin concertos and other sources. That in A major is evidently for oboe d'amore and was performed in a restored version for that instrument at Edinburgh in 1925.

Three concertos for two claviers (two being arranged from concertos for two violins).

Two concertos for three claviers.

The six Brandenburg concertos, for various combinations

Two violin concertos, and a colossal torso of a concerted violin movement forming the prelude to a lost church cantata.

One concerto for two violins.

Four orchestral suites. (The symphony in F in the same volume of the B.G. is only an earlier version of the first Brandenburg concerto.)

B. Chamber Music.—Three sonatas for clavier and flute (one doubtful); a suite (very doubtful) and six sonatas for clavier and violin, three for clavier and viola da gamba; two trios with figured bass; two flute-sonatas and a violin suite with figured bass; six sonatas (*i.e.* three sonatas and three partitas) for violin alone; six suites for violoncello alone.

C. Clavier and Organ **Music.**—Bach's own collections are:—

1. Das *Wohltemperirte Klavier* for clavichord (though neither expressly nor exclusively for that instrument): two books each containing 24 preludes and fugues, one in each major and minor key; with the object of stimulating tuning by "equal temperament" instead of sacrificing the euphony of remoter keys to that of the more usual ones.

2. *Klavier-Übung* (chiefly for harpsichord) in four books comprising: (i.) 15 two-part inventions and 15 three-part symphonies. (ii.) Six partitas. (iii.) The Goldberg variations, four duets, and an important collection of organ choral-preludes, with the "St. Anne" prelude and fugue in E flat. (iv.) The Italian concerto and French overture.

3. The six "French" and six "English" suites.

The other clavier works fill two Jahrgange of the B.G.

Bach's collections of organ music are (besides that included in the third part of the *Klavier-Übung*):—(1) Six sonatas (prob-

ably for pedal-harpsichord). (2) Four groups of six organ preludes and fugues. (3) *Das Orgelbüchlein,* a collection of short choral-preludes carefully planned—all the blank pages of the autograph being headed with the titles of the chorales intended for thein—but not half executed. (The projected whole would have been a larger volume than *Das Wohltemperirte Klavier.) (4)* 18 larger chorale-preludes, including Bach's last composition. (5) The six "Schiibler" chorales, all arranged from movements of cantatas.

Besides these there are the three great independent toccatas and the passacaglia. The remaining choral-preludes fill one *Jalzrgang* and the other organ works two more.

D. Schematic.— Two important instrumental works remain to be mentioned, viz., *Das Musikalische Opfer,* the volume of compositions (two great fugues, various puzzle-canons, and a splendid trio for flute, violin and figured bass) on the theme given to Bach by Frederick the Great; and *Die Kunst der Fuge,* a progressive series of fugues on one and the same subject, written in open score as if entirely abstract studies, but all (except two completely invertible fugues) in admirable clavier style and of great musical value.

IV. LOST WORKS

A. **Choral.**—J. N. Forkel's statement that Bach wrote five *Jahrgiinge* of church cantatas (*i.e.,* enough to provide one for each Sunday and holy day for five years) would indicate that some 80 are lost, but there is reason to believe that this is an exaggeration. Not more than six or seven cantatas are known to be lost, by the evidence of fragments, textbooks, etc.

Forkel says that Bach wrote five Passions. Besides the great Matthew and John Passions, there is one according to St. Luke in Bach's handwriting, but it is so worthless that the only possible plea for its authenticity is that nothing but personal interest could have induced Bach to make a copy of it.

The movements of the St. Mark Passion preserved in the Trauer-Ode are larger than anything in the St. John Passion; but the text-book has been found and proves to be on a very restricted scale.

Was there a *genuine* Lucas Passion? If so, Forkel's report of five Passions would be explained. Several lost secular works are partly preserved in those portions of the Christmas Oratorio of which the sources are not definitely known, but which, like the other duplicated numbers, are fair copies in the autograph.

B. Instrumental.— Three violin concertos and one for violin and oboe known only from the wonderful clavier versions.

Part of the first movement of the A major sonata for clavier and flute which was written in the spare staves at the bottom of a larger score. Some of these have been cut off.

V. ARRANGEMENTS OF WORKS BY OTHER COMPOSERS

Arrangements for harpsichord alone of 16 concertos, generally described as by Vivaldi, but including several by other composers.

Four Vivaldi concertos arranged for organ.

Many of these arrangements contain much original matter, such as entirely new slow movements, large cadenzas, etc.

Concerto in A minor for four claviers and orchestra, from Vivaldi's B minor concerto for four violins. This, though the most faithful to its original, is the richest and most Bach-like of all these arrangements, and is well worth performing in public.

Two sonatas from the *Hortus Musicus* of Reinken, arranged for clavier. (The ends of the slow movements are pure Bach.)

Finishing touches to cantatas by his uncle Johann Ludwig Bach. Also a very characteristic complete "Christe eleison" inserted in a Kyrie of Johann Ludwig's.

VI. DOUBTFUL AND SPURIOUS WORKS

Bach's autographs give the name of the composer on the outside sheet only. He was constantly making copies of all that interested him; and where the outside sheet is lost, only the music itself can tell us whether it is his or not. The above-mentioned Passion according to St. Luke is the chief case in point. The little music-books which he and his second wife wrote for their children are full of pieces in the most various styles, and the editors of the *Bach-Gesellschaft* have not completely identified them, even Couperin's well-known "Les Bergeries" escaping their scrutiny. A sonata for two claviers by Bach's eldest son, Wilhelm Friedemann, was detected by the editors after its inclusion in *Jahrgang* xliv. The second of the three sonatas for clavier and flute is extremely suggestive of Bach's sons, but Philipp Emanuel ascribes it to his father. However, he might easily have docketed it wrongly while arranging copies of his father's works. It has a twin brother (*B.* G. ix. Anhang. ii.) for which he has not vouched.

Four absurd church cantatas are printed for conscience sake in *Jahrgang* xliii. More important than these, because not so obviously ridiculous, is the well-known eight-part motet, *Lob, Ehr' und Weisheit* (blessing and glory and wisdom). It is poor, plausible stuff by a contemporary of Bach's named Wagner.

The beautiful motet, *Ich lasse dich nicht,* has long been known to be by one of Bach's uncles (Johann Christoph).

EDITIONS

Almost the only works of Bach published during his lifetime were the instrumental collections, most of which he engraved himself. Of the church cantatas only one, *Gott ist mein König,* (written when he was 19, but a very great work), was published in his lifetime.

Of modern editions that of the *Bach-Gesellschaft* is, of course, the only complete one. It is, inevitably, of very unequal merit. Its first editors could not realize their own ignorance of Bach's language; their immediate admiration of his larger choruses seemed to them proof of their competence to retain or dismiss details of ornamentation, figured bass, variants between score and parts, etc., without always stopping to see what light these might shed on questions of tempo and style—especially in the arias and recitatives, which they regarded as archaic almost in direct proportion to the depth of thought really displayed in them. In the 9th *Jahrgang* Wilhelm Rust introduced scholarly methods, with the happiest results. The *Wohltemperirte Klavier (Jahrgang* xiv.) was edited by Kroll, who had already made his text accessible in the Edition Peters (which till then had only Czerny's—an amazing result of corrupt tradition, still widely accepted). Kroll's and Rust's volumes are far the best in the *B.G.* On Rust's death the standard deteriorated for several years. The last ten volumes, however, are again satisfactory, and in *Jahrgang* xliv., the French and English suites are re-edited. Part of the B minor mass was also worked over again; and Kroll's text of the *Wohltemperirte Klavier* was supplemented by the evidence of the British Museum autograph.

The Steingraber edition of the clavier works, edited by Dr. Hans Bischoff, is incomparably the best, giving all the variants in footnotes and clearly distinguishing the extremely intelligent *nuances* and phrasing signs of the editor from the rare but significant indications of Bach himself. Nor does this wealth of scholarship interfere with the presentation of a straightforward, single text; though in addition there is every necessary explanation of the ornaments and kindred matters. There is still a great dearth of editions that distinguish Bach's text from the editor's taste—the publications of the *Neue Bachgesellschaft* by no means excepted. The Associated Board Edition of *Das Wohltemperirte Klavier* provides a pure text and analytical commentary.

The older vocal scores of cantatas in the Edition Peters are, though unfortunately but a selection, far better than the complete series issued by Breitkopf and Härtel in conformity with the *Bach-Gesellschaft* and therefore accepted as authoritative *(see* INSTRUMENTATION). The English vocal scores published by Novello are generally very good though covering but small ground. The Novello score of the Christmas Oratorio contains a fine analytic preface by Sir George Macfarren on lines by no means yet superseded. (D. F. T.)

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BACH, KARL PHILIPB EMANUEL (1714–1788), German musician and composer, the third son of Johann Sebastian Bach, was born at Weimar on March 14, 1714. When he was ten years old he entered the Thomasschule at Leipzig, of which in 1723 his father had become cantor, and continued his education as a student of jurisprudence at the universities of Leipzig (1731) and of Frankfurt-on-the-Oder (1735). In 1738 he took his degree, but at once abandoned all prospects of a legal career and determined to devote himself to music. A few months later he obtained an appointment in the service of the crown prince of Prussia, on whose accession in 1740 he became a member of the royal household. During his residence at Berlin he wrote a fine setting of the *Magnificat* (1749), in which he shows more traces than usual of his father's influence, an Easter cantata (1756), several symphonies and concerted works, at least three volumes of *songs*—*Geistliche Oden und Lieder,* to words by Gellert (1758), *Oden rnit Melodien* (1762) and *Sing-Oden* (1766)—and a few secular cantatas and other *pièces d'occasion.* But his main work was concentrated on the clavier, for which he composed, at this time, nearly zoo sonatas and other solos, including the set *mit veranderten Reprisen* (1760–68) and a few of those *für Kenner und Lieblzaber.* Meanwhile he placed himself in the forefront of European critics by his *Versuch über die wahre Art das Clavier zu spielen.* In 1768 he succeeded Georg Philipp Telemann as Kapellmeister at Hamburg, and in consequence of his new office began to turn his attention more towards church music. Next year he produced his oratorio *Die Israeliten in der Wüste,* and between 1769 and 1788 added over 20 settings of the Passion, a second oratorio *Die Auferstehung und Himmelfahrt Jesu* (1777), and some 70 cantatas, litanies, motets and other liturgical pieces. At the same time his genius for instrumental composition was further stimulated by the career of Haydn, to whom he sent a letter of high appreciation, and the climax of his art was reached in the six volumes of sonatas *fur Kenner und Lieblzaber,* to which he devoted the best work of his last ten years. He died at Hamburg on Dec. 14, 1788.

Through the latter half of the 18th century the reputation of K. P. E. Bach stood very high. Mozart said of him, "He is the father, we are the children"; the best part of Haydn's training was derived from a study of his work; Beethoven expressed for his genius the most cordial admiration and regard. This position he owes mainly to his clavier sonatas, which mark an important epoch in the history of musical form. The content of his work, though full of invention, lies within a somewhat narrow emotional range, but it is not less sincere in thought than polished and felicitous in phrase. Again he was probably the first composer of eminence who made free use of harmonic colour for its own sake, apart from the movement of contrapuntal parts, and in this way also he takes rank among the most important pioneers of the school of Vienna. His name has now fallen into undue neglect. but no student of music can afford to disregard his *Sonaten für Kenner und Liebhaber,* his oratorio *Die Israeliten in der Wüste,* and the two concertos (in G major and D major) which have been republished by Dr. Hugo Riemann.

A list of his voluminous compositions may be found in Eitner's *Quellen Lerikon* and in Wotquenne's *Thematisches Verzeichniss* (Leipzig, 1905), and a critical account of them is given in Bitter's *C. P. E. und W. F. Bach und deren Brüder* (2 vols., Berlin, 1868), and in Otto Vrieslander's *Philipp Emanuel Bach* (Munich, 1923).

Four more of Johann Sebastian Bach's sons grew to manhood and became musicians. The eldest of them, WILHELM FRIEDEMANN BACH (1710–1784), was by common repute the most gifted; a famous organist, a famous improviser and a complete master of counterpoint. But, unlike the rest of the family, he was a man of idle and dissolute habits, whose career was little more than a series of wasted opportunities. His compositions, very few of which were printed, include many church cantatas and instrumental works, of which the most notable are the fugues, polonaises and fantasias for clavier, an organ concerto and an interesting sextet for strings, clarinet and horns. This last work, which is included among his compositions by Bitter, is assigned by some scholars to Johann Christian Bach. Further particulars may be found in Khant's *Verzeichniss.*

The fourth son, JOHANN GOTTFRIED BERNHARD BACH (1715–1739), was, like his elder brothers, born at Weimar and educated at Leipzig. From 1735 to 1738 he held successively the organistships at Miihlhausen and Sangerhausen; in 1738 he threw up his appointment and went to study law at Jena; in 1739 he died, aged 24.

JOHANN CHRISTOPH FRIEDRICH BACH (1732–1795), the ninth son, was born at Leipzig, studied at the Thomasschule and the university, and in 1750 was appointed Kapellmeister at Bhckeburg. He was an industrious composer, especially of church music and opera, whose work reflects no discredit on the family name.

JOHANN CHRISTIAN BACH (1735–1782), the eleventh son, was born at Leipzig, and on the death of his father in 1750 became the pupil of his brother Emanuel at Berlin. In 1754 he went to Italy, where he studied under Padre Martini, and from 1760 to 1 j62 held the post of organist at Milan cathedral, for which he wrote two Masses. a *Requiem,* a *Te Deum* and other works. Having also gained some reputation as a composer of opera, he was in 1762 invited to London and there spent the rest of his life. For 20 years he was the most popular musician in England; his dramatic works, produced at the King's theatre, were received with great cordiality; he was appointed music master to the queen, and his concerts, given in partnership with Abel at the Hanover Square rooms, soon became the most fashionable of public entertainments. He is of some historical interest as the first composer who preferred the pianoforte to the older keyed-instruments.

A full account of J. C. Bach's career is given in the fourth volume of Burney's *History of Music,* while a complete thematic catalogue of his works is to be included in the authoritative study of the composer which Dr. C. Sanford Terry has in hand (1928). (W. H. H.)

BACHARACH, YAIR (1639–1702), German rabbi, was the author of *Hawwoth I'air,* a colleclion of *Responsa,* and other works.

BACHARACH, town, Rhenish Prussia, Germany, on left bank of Rhine, 3om. above Coblenz. Pop. (1933), 1,853. The ruins of town walls and St. Werner's (Gothic, 13th century) church are well-known. St. Peter's is an interesting late Romanesque (early 13th century) basilica. The castle of Stahleck above the town belonged, with those of Fiirstenberg and Stahlberg, to the counts palatine. Bacharach was a famous wine-staple till the 16th century and is still an important market for Rhenish wine.

BACHAUMONT, LOUIS PETIT DE (1690–1771), French littérateur, was of noble family and was brought up at the court of Versailles. He passed his whole life in Paris as the centre of the *salon* of Madame Doublet de Persan (1677–1771), where criticism of art and literature took the form of malicious gossip. A sort of register of news was kept in a journal of the *salon,* which dealt largely in scandals and contained accounts of books suppressed by the censor. Bachaumont's name is commonly connected with the first volumes of this register, which was published anonymously under the title *Mémoires secrets pour servir à l'histoire de la République des Lettres,* but his exact share in the authorship is a matter of controversy. It was continued by Pidansat de Mairobert (1707–79) and others, until it reached 36 volumes (1774–79). It is of some value as a historical source, especially for prohibited literature. Extracts were published by P. Lacroix in one volume, 1859. An incomplete edition (4 vols.) was undertaken in 1830 by Ravenal.

See, in addition to the memoirs of the time, the *Correspondance littéraire* of Grimm, Diderot, d'Alembert and others (new ed., 1878, 17 vols.); Ch. Aubertin, *L'Esprit public au XVIII^e siècle* (1872).

BACH CHOIR. There are several bodies bearing this name. The London body so known was founded in 1875, primarily for the purpose of studying Bach's Mass in B minor, of which many performances have been given, the earliest under the direction of Otto Goldschmidt, the first conductor of the choir. Later the scope of the choir was enlarged to include the works of other

composers and schools, while the subsequent conductors of the choir have been C. V. Stanford (1885–1902), H. Walford Davies (1902–07), H. P. Allen (1907–20), R. Vaughan Williams (1920–28) and Gustav Holst (1928), but latterly the choir has had no permanent conductor.

An earlier body established in London with the same objects was the Bach Society, founded in 1849 by Sterndale Bennett.

An American Bach choir was formed at Bethlehem (Pa.), in 1900 by Mrs. Ruth Porter Doster in conjunction with John Frederick Wolle, under whose direction many of the master's most important choral works have been performed in the course of a series of festivals.

BACME, ALEXANDER DALLAS (1806–1867), American physicist, great-grandson of Benjamin Franklin, was born at Philadelphia, Pa., July 19, 1806. After graduating at the United States Military Academy at West Point in 1825, and holding an assistant professorship there, he was for a year or two a lieutenant in the corps of engineers engaged on coast fortifications. He was professor of natural philosophy and chemistry in the University of Pennsylvania in 1828–41 and president of the trustees of Girard college in 1836. He visited Europe to examine European systems of education, and on his return published a very valuable report. In 1843, he was appointed superintendent of the U.S. coast survey. By means of the liberal aid which he succeeded in obtaining from Congress, he carried out a singularly comprehensive plan with great ability and most satisfactory results. By a skilful division of labour, and by the erection of numerous observing stations, the mapping out of the whole coast proceeded simultaneously under the supervision of Bache, and by this method a vast mass of magnetic and meteorological observations was collected. He died at Newport, R.I., Feb. 17, 1867.

BACHE, FRANCIS EDWARD (1833–1858), English musical composer, was born in Birmingham on Sept. 14, 1833. The pupil of Alfred Mellon for violin and Sterndale Bennett for composition, he afterwards went to Leipzig in 1853 and studied with Hauptmann and Plaidy. Considering the early age at which he died, his compositions are fairly numerous, the best being a trio for piano and strings, which in its day was highly esteemed. He died of consumption at Birmingham on Aug. 24, 1858. His younger brother, WALTER BACHE (1842–1888), was born in Birmingham on June 10, 1842, and followed him to the Leipzig Conservatorium, where he became an excellent pianist. From 1862 to 1865 he studied with Liszt in Rome, and for many years devoted himself to the task of winning popularity for his master's works in England. At his annual concerts in London nearly all Liszt's larger works were heard for the first time in England. He was professor of the pianoforte at the Royal Academy of Music for some years and was instrumental in founding the Liszt scholarship. He died in London on March 26, 1888.

See Constance Bache, Brother Muricians (1901).

BACME, FRANKLIN (1792–1864), American chemist, was born in Philadelphia, Pa., on Oct. 25, 1792, and graduated from the University of Pennsylvania in 1810. He served in the Army during the War of 1812, when he was appointed surgeon's mate and later surgeon. He was given his degree as doctor of medicine from the University of Pennsylvania in 1814. He began practice in Philadelphia in 1816 and published a treatise on chemistry in 1819. In 1833 he published, in conjunction with Dr. G. B. Wood, the first edition of The Dispensatory of the *United* States *of* America, which became the standard authority on drugs with physicians and pharmacists. He died in Philadelphia on March 19, 1864.

See G. B. Wood, Memoir of Franklin Bache (Philadelphia, 1865).

BACHE, HARTMAN (1797–1872), American engineer and army officer, was born in Philadelphia, Pa., in 1797. He graduated at West Point in 1818 and entered the engineer corps of the army, retiring as a brevet brigadier-general in 1867. He made numerous topographical and hydrographic surveys but is particularly remembered for his achievements as an engineer. He directed the construction of the Delaware breakwater and the Brandywine lighthouse and was successful in applying the iron screw pile in marine foundation work. He died in Philadelphia on Oct. 8, 1872.

BACHELLER, IRVING ADDISON (1859–), American novelist, was born in Pierpont, N.Y., on Sept. 26, 1859. He graduated at St. Lawrence university, Canton, N.Y., in 1882 and entered journalism, serving from 1898 to 1900 as an editor of the New York World. He became known as a writer of fiction and among his numerous productions in this field Eben *Holden* (1900) and D'ri and I (1901) were well received as popular interpretations of American character.

His writings include also Darrel of the Blessed Isles (1903), *Vergilius* (1904), *Silas* Strong (1906), The Hand Made Gentleman (1909), The Master (1910), Keeping Up *with Lizzie* (1911), Charge It (1912), The Turning of Griggsby (1913), The Light in the Clearing (1917), Keeping Up with William (1918), A Man for the Ages (1919), The Prodigal Village (1920), In the Days of Poor Richard (1922), The Scudders (1923), and Father Abraham (1925).

BACHELOR, a word commonly used to describe a man who has not been married; in various connections it implies subordination or inferiority of rank. It is derived from Med. Lat. *baccalarius,* with its late and rare variant *baccalaris—cf.* Ital. baccalare—through O.Fr. bacheler, in the most general sense of the word, a young man. The word, however, as it possesses several widely distinct applications, has passed through many meanings, and its ultimate origin is still involved in a certain amount of obscurity. It came to be applied to various categories of persons as follows: (1) Ecclesiastics of an inferior grade, *e.g.,* young monks or even recently appointed canons (Severtius, de *episcopis Lugdunensibus,* p. 377, in du Cange). (2) Those belonging to the lowest stage of knighthood. Knights bachelors were either poor vassals who could not afford to take the field under their own banner, or knights too young to support the responsibility and dignity of knights bannerets (see KNIGHTHOOD and CHIVALRY). (3) Those holding the preliminary degree of a university, enabling them to proceed to that of master (magister) which alone entitled them to teach. In this sense the word *baccalarius* or *baccalaureus* first appears at the University of Paris in the 13th century, in the system of degrees established under the auspices of Pope Gregory IX., as applied to scholars still in statu *pupillari.* Thus there were two classes of baccalarii: the baccalarii *cursores, i.e.,* theological candidates passed for admission to the divinity course, and the baccalarii *dispositi,* who, having completed this course, were entitled to proceed to the higher degrees. In modern universities the significance of the degree of bachelor, in relation to the others, varies; *e.g.,* at Oxford and Cambridge the bachelor can proceed to his mastership by simply retaining his name on the books and paying certain fees; at other universities a further examination is still necessary. But in no case is the bachelor a full member of the university. The degree of bachelor (of arts, etc.) is borne by women also. (4) The younger or inferior members of a trade gild or city company, otherwise known as "yeomen" (now obsolete). (5) Unmarried men, since these presumably have their fortunes yet to make and are not full citizens.

Penalization of Bachelors.—Bachelors, in the sense of unmarried men, have in many countries been subjected to penal laws. At Sparta, citizens who remained unmarried after a certain age suffered various penalties. They were not allowed to witness the gymnastic exercises of the maidens; and during winter they were compelled to march naked round the market-place, singing a song composed against themselves and expressing the justice of their punishment. The usual respect of the young to the old was not paid to bachelors (Plut. *Lyc.* 15). At Athens there was no definite legislation on this matter; but certain minor laws are evidently dictated by a spirit akin to the Spartan doctrine (see Schomann, Gr. Alterth. i. 548). At Rome, though there appear traces of some earlier legislation in the matter, the first clearly known law is that called the Lex Julia, passed about 18 B.C. It does not appear to have ever come into full operation; and in A.D. 9 it was incorporated with the Lex Papia et Poppaea, the two laws being frequently cited as one, Lex Julia et Papia Poppaea. This law, while restricting marriages between the several classes of the people, laid heavy penalties on unmarried persons, gave certain privileges to those citizens who had several children, and finally imposed lighter penalties on married persons who were

childless. Isolated instances of such penalties occur during the middle ages; e.g., by a charter of liberties granted by Matilda I, countess of Nevers, to Auxerre in 1223 an annual tax of five *solidi* is imposed on any man *qui non habet* uxorem et est bachelarius. In Britain there has been no direct legislation bearing on bachelors; but, occasionally, taxes have been made to bear more heavily on them than on others. Instances of this are the acts of 169j (6 and 7 Will. III.) which taxed bachelors to pay for the war with France; the income tax of 1798 also differentiated against bachelors. Since 1908 the British income-tax law, by giving special abatements to men of family, has in effect taxed bachelors. (See INCOME TAX: IN PRACTICE.)

BACH-GESELLSCHAFT. This German organization was formed in 1850, for the purpose of publishing a complete critical edition of J. S. Bach's works in celebration of the first centenary of his death, July 28, 1850, and the 46 volumes which it issued in the course of its 50 years' existence—it was dissolved in 1900—stand as an enduring evidence of its labours. Among that of several editors the work of W. Rust, a Bach scholar of unsurpassed learning and insight, who was responsible for 14 of the volumes, was especially noteworthy.

BACHIAN (Dutch, Batjan), a mountainous island of the Moluccas. It lies in the Molucca sea, close to the southwest coast of Halmaheira, and is in Ternate division, Netherlands Indies. It is 52 mi. long, with a mean width of 23 mi.; the northern part is volcanic; the centre is lower, with an isthmus; the greatest heights are in the south (Labuan Mt., reaching 6,000 ft.). There are no active volcanoes, but sulphurous springs exist, while in the south there are ancient and non-volcanic rocks. West of Bachian are Great Tawali, 19 mi. long and 15 wide, Mandioli, 17 mi. by 9 mi. and several smaller islands. The area of the whole group is just under 1,000 sq mi. Gold, copper, and coal exist in small quantities, but a company formed to exploit them later abandoned operations. Bachian's fauna includes a large black crested baboon, (*Cynopithecus nigrescens*), which exists elsewhere in the archipelago only in Celebes, Sulu, and Buru; Bachian is the most eastern point on the globe inhabited by any of the apes (*Quadrumana*). Other mammals are an eastern opossum, (Cuscus *ornatus*), a little flying opossum, (*Belideus ariel*), a civet cat, (*Viverra zebetha*), and several bats. Among the many birds is a bird of paradise, discovered by Wallace and named after him *Semioptera Wallacei*, or "Wallace's Standard Wing." Other birds are a red lory, (*Lorius garrulus*), little lorikeet, (Charmosyna *placentis*), green parrot, with red bill and head, (*Geoffroyus cyanicollis*), golden-capped sunbird, (*Nectarinea auriceps*), racquet-tailed kingfisher, (*Tanysiptera isis*), a rare goat-sucker, (*Batrachostomous crinifrons*) and a large and handsome fruit pigeon, with metallic green and rufous plumage. Among butterflies, Bachian possesses the fine blue *Papilio Ulysses*, and the beautiful "bird-winged butterfly." Wallace described Bachian as "an island that would perhaps repay the researches of a botanist better than any other in the whole archipelago." It has fine trees including screw-pines, a great variety of surface and soil, a number of small streams, some navigable for small boats for some distance, and its products include sago palm, coco-nut palm, clove, nutmeg and excellent Moluccas damar (from forests).

The population of Bachian in 1930 was 7,553, partly people from Ternate and Tidore engaged in collecting forest products, and Javanese and others, working on the plantations of the Bachian Exploitation company. The Bachianese are supposed to have come originally from Halmaheira, with whose people they have strong affinities. They cultivate the land on a small scale, fish, and make baskets. Other inhabitants include the Serani, or Christian descendants of the Portuguese, Macassarese, Malays, Halmaheira men, and a few Chinese and Arab traders. Bachian, at the foot of high mountains, is the capital and a port trading in damar, spices, cobra, timber, and mother-of-pearl. The little fort—Barneveld—was built by the Portuguese, and captured from them by the Dutch in 1609; Bachian, hitherto independent, was placed under the suzerainty of the sultan of Ternate; when the Dutch superseded him, in 1683, they made it subject to themselves. The sultan of Bachian still retained authority. Japan occupied the island in 1942.

BIBLIOGRAPHY.—A. R. Wallace, *The Malay Archipelago*, (10th ed., 1890). (E. E. L.; X.)

BACWMAN, JOHN (1790–1874), **U.S.** naturalist and minister, was born in Rhinebeck, New York. He became a Lutheran minister in 1813 and founded both the Lutheran Synod of South Carolina, of which he was first president, and the state's Lutheran Theological seminary. But he is most famous for his work with the naturalist, John James Audubon.

Bachman wrote most of the Audubon-illustrated Viviparous *Quadrupeds* of hTortk America and assisted Audubon in the preparation of his book on American birds. He was also the author of numerous other works, both on nature and on religion.

BACILLARIOPHYCEAE or **DIATOMS.** The diatoms are microscopic unicellular or colonial algae, and are specially distinguished by the complex structure of their cell-walls, which are usually strongly impregnated with silica. The majority are exceedingly minute, and one with a length of 1/200 in. (0.127 mm.) is well beyond the medium size. The first forms were discovered by O. F. Miiller towards the close of the 18th century. With the perfection of modern microscopes and microscopic methods, the study of these minute plants has been prosecuted with great vigour and over 5,500 species of diatoms have been described, while about 1,200 species are known to occur in the fresh waters and on the coasts of Great Britain and Ireland.

Occurrence and Distribution.—The conditions necessary ior the growth of diatoms are moisture and light, and wherever these coexist, these forms will almost invariably be found. They occur abundantly in cultivated soils, and mixed with other forms on the surface of moist rocks; in pools and other small pieces of water they form a brownish stratum on the surface of the mud, or cover the stems and leaves of water plants or floating twigs with a furry investment. Marine forms are usually attached to seaweeds, and many are found in the stomachs of molluscs, holothurians, ascidians, and other denizens of the ocean. Both in fresh waters and in the sea, moreover, there are myriads of free-floating diatoms, which at times indeed make up the main bulk of the plankton.

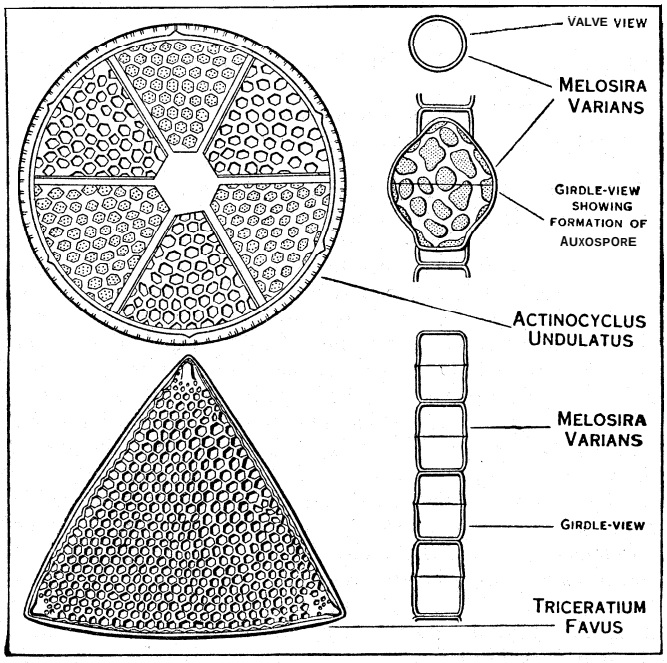
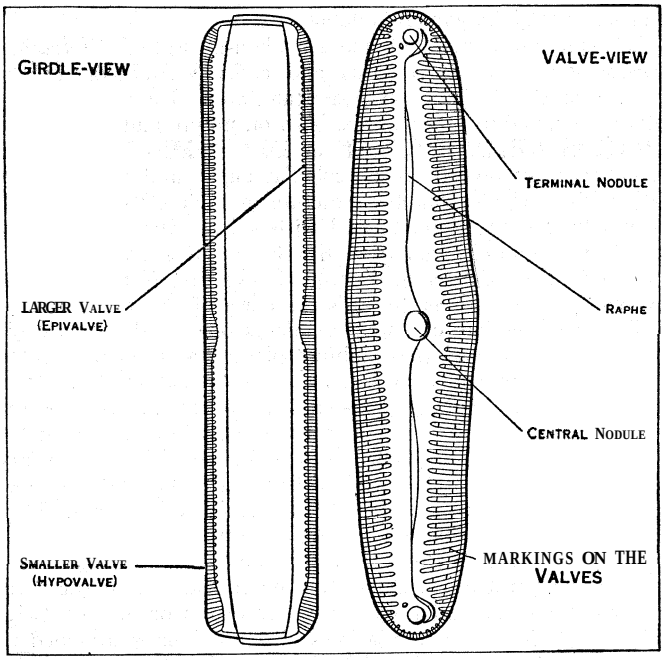


FIG. 1.—FRUSTULES (CELL WALLS) OF CENTRIC DIATOMS

Diatoms are most abundant in cold latitudes, having a general preference for cold water, and exist in prodigious numbers in the Arctic and Antarctic oceans. The fresh-water species are almost always distinct from those found in salt or brackish water.

Large numbers of fossil diatoms are known. Since the siliceous wall is practically imperishable, it persists after the death of the

individual, so that where diatoms occur abundantly there is an unceasing rain of their minute valves on to the bottom of sea or lake as the case may be. In this way extensive deposits of *diatomaceous* earth may arise, and such are not only being formed at the present but have been produced abundantly in the past. Deposits of diatomaceous earth have been discovered in various parts of the earth; some of fresh-water, others of marine origin. Most deposits are a few feet in thickness but some are much thicker.



PROM WEST, "ALGAE" BY PERMISSION OF THE CAMBRIDGE UNIVERSITY PRESS
FIG. 2.— SIDE (GIRDLE) AND TOP (VALVE) VIEWS OF THE CELL WALL (FRUSTULE) OF A PENNATE DIATOM

The thickest deposits thus far discovered are in the Santa Maria oil fields, California.

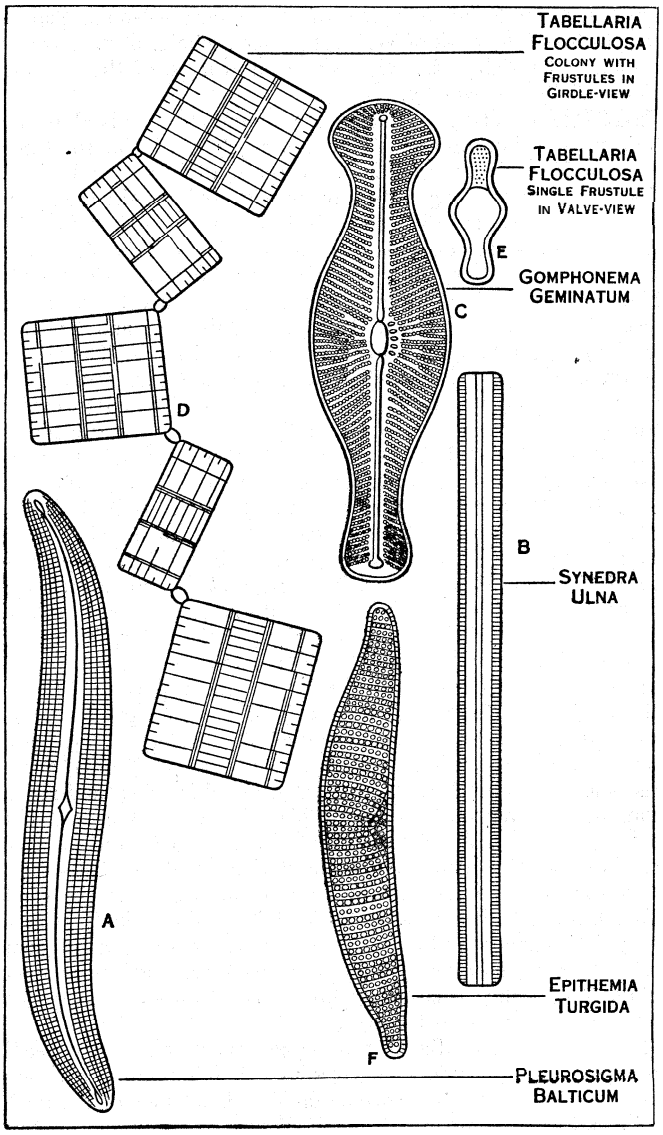
Oil wells drilled in this region show, after correction for dip, that there is a subterranean deposit about 3,000 ft. in thickness.

Most of the fossil deposits are in Tertiary rocks, although there are records of diatoms in the Trias.

Uses.—The industrial uses of diatomaceous earth are varied. Commercial production in the United States for the years 1936–38 was approximately 280,000 tons per annum and the average value for the three-year period was $4,300,000. The enormous quantity produced annually is more easily visualized when one realizes that a single ton has a volume of 65–260 cu.ft. Most of the diatomaceous earth sold in the United States comes from California and Oregon where the deposits are worked as open quarries.

One extensive industrial use is in the filtration of liquids, especially those of sugar refineries. Another major use is in the insulation of boilers, blast furnaces, and other places where high temperatures are maintained. At temperatures higher than 1000° F. diatomaceous earth is a more efficient insulator than asbestos or magnesia because it is more resistant to shrinkage and does not fail at red heat. The oldest and best-known commercial use is that of a very mild abrasive in metal polishes and tooth paste. The amount used in polishes has increased greatly in recent years with the utilization of diatomaceous dust as the base of polishes for automobiles finished in artificial lacquers.

Structure.— In spite of the immense number of diverse forms included in it, the class as a whole exhibits a remarkable uniformity of structure. The individual cells of diatoms are called *frustules,* and their wall consists of two similar halves (fig. 2), each composed of a slightly convex *valve* to whose incurved edges is attached at right angles a broad hoop-like connecting band. The two connecting bands together form the girdle. One half is slightly smaller than the other, the smaller fitting into the larger much as a box fits into its cover (fig. 2) and, according as one visualizes a circular, oval, or otherwise shaped box, one obtains a mental picture of the varied forms assumed by the frustules of diatoms; the sides of the box correspond to the connecting bands. As the protoplasmic contents increase in volume, the siliceous valves are pushed apart and the connecting bands become broader. Diatoms are usually described from two aspects, one in which the surface of the valve is exposed, the valve-view (fig. 2); and one in which the girdle is exposed, the girdle-view (fig. 2). The valve-view exhibits great variety of form; the girdle-view is much more uniform and commonly rectangular. The valves may be circular (fig. 1), triangular (fig. 1), or oval in outline. Some are linear. as *Synedra* ulna (fig. 3); others (Eunotia), more or less crescentic; others again are wedge-shaped (Podosphenia, *Gomphonema*, fig. 3); but the prevailing forms are boat-shaped (naviculoid), as in the genus *Navicula* (fig. 2), which embraces upwards of 1,000 species.

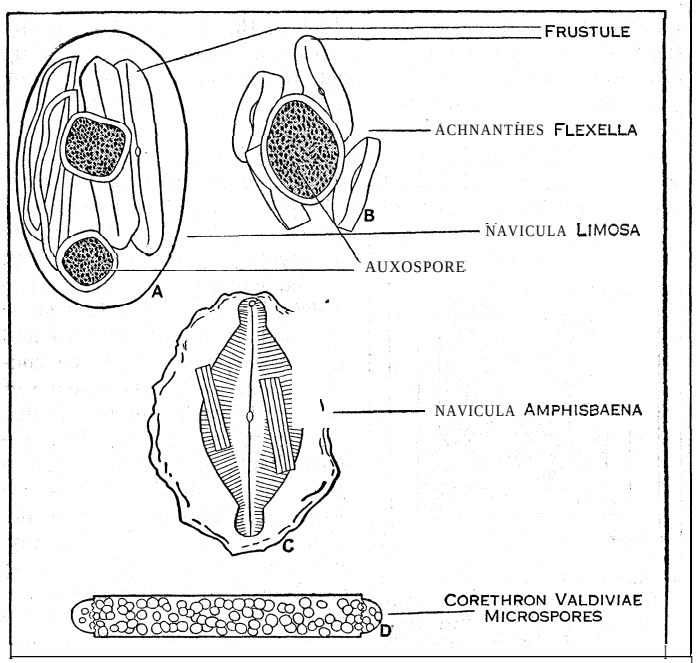


C AND D FROM SMITH, "BRITISH DIATOMACEAE"
FIG. 3.—TOP (VALVE) AND SIDE (GIRDLE) VIEWS OF THE CELL WALL (FRUSTULE) OF VARIOUS PENNATE DIATOMS

Many diatoms are free-floating, but some (*Gomphonema*) are attached to foreign bodies by simple or branched gelatinous stalks. The frustules of some are connected to form ribbon-shaped colonies (*Fragilaria*) or zigzag chains (fig. 3D). In a few genera numerous individuals are enclosed in a tube-like gelatinous envelope.

The valves are thin and transparent and generally ornamented with a variety of markings. The latter often appear as fine lines

(striae) on the face of the valve, and the best lenses show them in many cases to consist of a series of separate dots (punctae) which correspond to small cavities within the siliceous wall. The valves of certain marine genera exhibit a beautiful areolated structure due to the presence of larger chambers within the wall (fig. 1). A good many diatoms, especially those of the naviculoid type, have thickenings at the centre and at each extremity of the valve, known as nodules (fig. 2). These possess a complex structure and are generally connected by a long narrow cleft, the raphe (fig. 2), which appears as a straight or slightly undulating line in the valve-view.



FROM WEST, "ALGAE"

FIG. 4.— (A-C) AUXOSPORES AND EMPTY FRUSTULES OF THE CELLS FROM WHICH THEY WERE FORMED. (D) MICROSPORES BEFORE LIBERATION FROM A FRUSTULE

Some diatoms, while possessing nodules, lack a raphe, although in these cases the narrow area between the two rows of striae often simulates one (pseudoraphe).

The contents of diatom cells are very similar to those of other algae. Beneath the wall there is a lining cytoplasmic layer enclosing the cell-sap, and connected either by two broad bands or by a number of anastomosing strands with the central cytoplasm in which the nucleus is embedded.

The chromatophores are either one or two of large size, or numerous small lobed disks (fig. 1).

The former often include a variable number of glistening pyrenoids.

The characteristic brown colour is due to diatomin, a pigment resembling that of the brown algae and masking the chlorophyll.

The cells often contain abundant oil.

Many diatoms, but only those which possess a true raphe in their valves (*Navicula,* etc.), are able to move through the water, sometimes with considerable rapidity. The movements are doubtless in all cases related to the presence of the raphe, which in all probability contains streaming cytoplasm connected with that in the interior of the cell by a complex system of canals within the nodules. Some believe that the movements depend upon an 'extrusion of mucilage from the region of the raphe. In *Cocconeis,* whose disk-shaped frustules are found attached in enormous numbers to *Cladophora* and other fresh-water plants, only the valve in contact with the substratum possesses a raphe.

Reproduction.—The ordinary mode of multiplication is by cell-division, which usually occurs at night. The cell contents divide into two masses and the halves of the cell-wall commence to separate; thereupon fresh valves, which are at first very delicate, are secreted on the surfaces of the new protoplasmic masses opposite to the valves of the parent. The new valves are situated within the girdle of the original frustule, but as their own connecting bands develop, those of the parent separate. Each of the new individuals thus has one valve derived from the parent, and one that is newly formed and more or less parallel to it. This process of division is repeated at frequent intervals, and it has been calculated that from a single frustule 1,000,000,000 new individuals may arise in the course of a month.

The individual diatom, owing to the rigidity of the siliceous wall, is ordinarily incapable of any increase in length and, since the new valves are always formed within the girdle of the old ones, it would follow that one of the two cells in every succeeding cell generation is reduced in length by the thickness of the girdle.

This is not, however, strictly true, as daughter cells are sometimes formed which are larger than the parent cell, so that the reduction in size is not always proportional to the number of divisions.

The progressive diminution in size does not continue indefinitely because a small cell may produce a special rejuvenescent cell (*auxospore*), of considerably larger dimensions. In centric diatoms the auxospores are always formed singly within a cell (fig. 1, *Melosira*) and are asexual in nature. In pennate diatoms the auxospore is a zygote formed by union of two nonflagellate gametes. Two small cells become surrounded by a common gelatinous envelope and the valves of the cell walls spread apart. In some species the protoplast of each cell functions as a gamete and there is a formation of a single auxospore (figs. 4B, 4C). In other species each cell produces two gametes and there is a formation of two auxospores (Fig. 4A).

Marine centric diatoms may have the cell contents dividing to form 8, 16, 32, 64, or 128 flagellated microspores. This method of reproduction is rather frequent among plankton diatoms but as yet it is not definitely established whether the microspores are zoospores or gametes.

Classification.— The Bacillariophyceae are one of the three classes of the Chrysophyta (see ALGAE). The class is divided into two orders, Centrales and Pennales.

Valves of Centrales (fig. 1) have an ornamentation that is radial or concentric about a central point. The cells usually contain many chromatophores, are immobile, form microspores, and produce auxospores asexually.

The order includes about 100 genera and 2,400 species, the great majority of which are marine.

Valves of Pennales have an ornamentation that is bilaterally symmetrical or asymmetrical. The cells usually have but one or two chromatophores, never form microspores, and form auxospores by a fusion of two gametes. Species with a raphe move spontaneously. The order includes about 70 genera and 2,900 species.

The number of fresh-water species is somewhat smaller than the number of marine species.

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BACILLUS, a member of the group of rod-shaped forms constituting one variety of the non-chlorophyllaceous vegetable micro-organisms known as bacteria.

Certain bacilli cause disease in man and animals, *e.g.,* tuberculosis, diphtheria, plague; but the majority are non-pathogenic, though they occasion various putrefactive and other changes in vegetable and animal materials.

Loosely and incorrectly the term "bacilli" is sometimes used to denote bacteria in general.

(See BACTERIOLOGY; BACTERIA AND DISEASE.)

BACK, SIR GEORGE (1796–1878) British sailor, was born Nov. 6, 1796, at Stockport in Cheshire, and died in London on June 23, 1878. At the age of 12 he was a midshipman on the "Arethusa" and was captured by the French at Deba, in the Spanish campaign of 1809. On his return to England in 1814, after a long imprisonment in France, Back served on the "Akbar" against the French in North America. In 1818 he sailed with Buchan on a voyage to Spitsbergen, after which he joined Franklin's expedition to the Coppermine river in North America (1819–22), and to the Mackenzie river (1825–27). In 1833 Back offered to lead an expedition to the Arctic regions in search of Captain Ross, of whom there had been no news since 1829. The expedition wintered at Fort Reliance, near the Great Slave lake, where, in April 1834, news of the arrival of Ross in England reached Back; but the party proceeded to explore the Great Fish river (also known as the Back river), tracing it to its mouth in the polar sea. On his return in Oct. 1835, Back received the medal of the Royal Geographical Society. In 1836 he set forth on a new Polar expedition in the "Terror" intending to explore the remainder of the coastline of North America, but for four months the ship was icebound in Frozen channel, and he could not return until Sept. 1837. Ill-health, the result of continual strain, prevented Back's further activity and he retired on half-pay. In 1838 he was made a baronet. He wrote a Narrative of *the* Arctic Land Expedition to the *mouth* of *the* Great Fish River . . . *1833–35* (1836), and also, Narrative of *an expedition in H.M.S.* Terror . . . *in 1836–37* (1838).

BACK-BOND or BACK-LETTER, in Scots law, a deed qualifying the terms of another deed, or declaratory of the purposes for which another deed has been granted. Thus an ex facie absolute disposition, qualified by a back-bond expressing the limited nature of the right actually held by the person to whom the disposition is made, would constitute what in England is termed a deed of trust. This qualifying secondary instrument is not uncommon in other countries, *e.g.*, Argentina, C.C. 1030.

BACKBONE: see SKELETON; ANATOMY: *The* Back.

BACK-CHOIR or **RETRO-CHOIR,** a space behind the high altar in the choir of a church, in which there is, or was, a small altar standing back to back with the other.

BACKERGUNGE, a district of British India in the Dacca division of Bengal. It forms part of the joint delta of the Ganges and the Brahmaputra, and its area is 3,523sq.m. The general aspect of the district is that of a flat even country, dotted with clusters of bamboos and betel-nut trees, and intersected by a network of dark-coloured and sluggish streams. The level of the country is low, lying as it does on the fringe of the Gangetic delta; and the rivers, streams and water-courses are so numerous that there are few villages which cannot be reached by boat at any season of the year. Towards the north-west nothing is to be seen for miles but tracts of unreclaimed swamps and rice lands, with a few huts scattered here and there and raised on mounds of earth. In the. south of the district, along the coast of the Bay of Bengal, lie the forest tracts of the Sundarbans, now partially reclaimed, which extend over nearly 900 square miles. The islands on the sea-front are exposed to devastation by cyclonic storm-waves.

The principal rivers of the district are the Mcghna, the Arial Khan and the Madhumati or Baleswar, with their numerous offshoots. The Meghna represents the channel by which accumulated waters of the Brahmaputra and Ganges reach the sea. It flows along the eastern boundary for about 100m. till it debouches into the Bay of Bengal. During the latter part of its course this noble river expands into a large estuary containing many islands, the principal of which is that of Dakshin Shahbazpur. The channel between this island and the mainland was formerly 25m. wide, but it has contracted owing to accretions on either side till its width has been reduced to barely 5 miles. Most of the rivers in the district are subject to tidal action, and nearly all of them are navigable at high tide by country boats of all sizes. The rise of the tide is very considerable in the estuary of the Meghna, and a strong "bore" or tidal wave runs up it at spring tides.

The population was returned in 1931 at 2,939,050. Seven-tenths are Mohammedans, among whom the Farazi sect is numerous. There is a Buddhist section consisting of Maghs, as the Arakanese are called in Bengal, who first settled in Backergunge about 1800, and have made themselves very useful in the clearing of the Sundarbans. The soil is fertile, being annually enriched by the silt brought down by the rivers, and yields abundant harvests of rice, while the produce of coconut and betel-nut trees is a valuable source of income. Jhalakati is an important centre of trade, especially in betel-nuts. The climate is one of the healthiest in Eastern Bengal, owing to the flushing of the rivers and creeks by the tides, while the strong south-west monsoon, which comes up directly from the Bay of Bengal keeps the atmosphere cool.

Barisal, the headquarters station, has a population of 35,716

BACKGAMMON, a game played with draughtsmen and a special board, depending on the throw of dice. It is said to have been invented about the 10th century (Strutt). A similar game (*Ludus* duodecim *scriptorum,* the "twelve-line game") was known to the Romans, and Plato (*Republic,* bk. x.) alludes to a game in which dice were thrown and men were placed after due consideration. The etymology of the word "backgammon" is disputed; it is probably Saxon—baec, back, gamen, game, *i.e.,* a game in which the players are liable to be sent back. Other derivations are, Dan. bakke, tray, *gammen,* game (Wedgwood); and Welsh *bach,* little, *cammaun,* battle (Henry). Chaucer alludes to a game of "tables," played with three dice, in which "men" were moved from the opponent's "tables," the game (*ludus Anglicorum*) being described in the Harleian mss. (1527). The French name for backgammon is trictrac, imitative of the rattle of the dice.

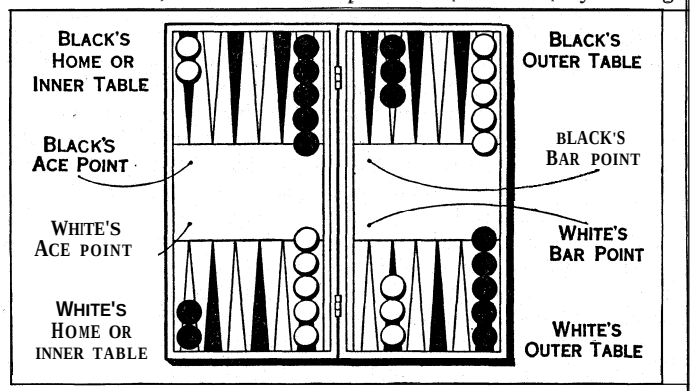
A GAME OF BACKGAMMON OR "TABLES" IN MEDIAEVAL ENGLAND From the Louterell Psalter. one of the earliest of illustrated books, first printed in 1499, in England, by Wynkyn de Worde

Backgammon is played by two persons. The "board" (see diagram) is divided into four "tables," each table being marked with six "points" coloured differently. The inner and outer tables sre separated from each other by a projecting Bar. The board (in the ordinary form of the game) is furnished with 15 white and 15 black men, "set" or arranged as in the diagram. It is usual to make the inner table the one nearest to the light. Two dice-boxes are required, one for each player, and a pair of dice, which are used by both players. The dice are marked with numbers on their six sides, from one to six, number one being called "ace"; two, "deuce"; three, "trey." Formerly the four was called "quatre" (pronounced "cater"); the five, "cinque" (pronounced either "sank" or "sink"); and the six, "sice."

For the right to start each player throws one or two dice; the one who throws the higher number has the right of playing first; and he may either adopt the numbers thrown or he may throw again, using both dice.

The men are moved on from point to point, according to the throws of the dice made by the players alternately. White moves from black's inner table to black's outer, and from this to white's outer table, and so on to white's inner table; and all black's moves must be in the contrary direction. A player may move any of his men a number of points corresponding to the numbers thrown by him, provided the point to which the move would bring him is not blocked by two or more of his adversary's men being on it. The whole throw may be taken with one man, or two men may be moved, one the exact number of points on one die, the other the number on the other die. If doublets are thrown (*e.g.,* two sixes), four moves of that number (*e.g.,* four moves of six points) may be made, either all by one man or separately by more. Thus, suppose white throws five, six, he may move one of his men from the left-hand corner of the black's inner table to the left-hand corner of black's outer table for six; he may, again, move the

same man five points farther on, when his move is completed; or he may move any other man five points. But white cannot move a man for five from the black's ace-point, because the six-point in that table is blocked. Any part of the throw which cannot be moved is of no effect, but it is compulsory for a player to move the whole throw unless blocked. Thus if the men were differently placed, and white could move a six and, having done so, could not move a five, his move is completed. If, however, by moving



A MODERN BACKGAMMON BOARD WITH PIECES IN POSITION AT THE BEGINNING OF PLAY

In addition to this special board, two dice are required to play the game

the five first, he can afterwards move a six, he must make the move in that manner. When a player so moves as to place two men on the same point he is said to "make a point."

When there is only a single man on a point, it is called a "blot." When a blot is left, the man there may be taken up (technically the blot may be "hit") by the adversary if he throws a number which will enable him to place a man on that point. The man hit is placed on the bar, and has to begin again by entering the adversary's home table again at the next throw should it result in a number that corresponds to an unblocked point. The points in the home tables count for this purpose as 1, 2, 3, 4, 5, 6, beginning from the ace-point. A player is not allowed to move any other man while he has one to enter. It is, therefore, an advantage to have made all the points in your own board, so that your adversary, if you take a man up, cannot enter; and you can then continue throwing until a point is opened.

The game proceeds until one of the players gets all his men into his inner table or *home.* Then he begins to take his men off the board or to bear them, *i.e.,* to remove a man from any point that corresponds in number with his throw. If such a point is unoccupied, a move must be made, if there is room for it, and a move may be taken, instead of bearing a man, at any time; but, when six is empty, if six is thrown a man may be borne from five and so on. If, after a player has commenced throwing off his men, he should be hit on a blot, he must enter on his adversary's inner table and must bring the man taken up into his own inner table before he can bear further.

Whoever first takes off all his men wins the game:—a single game (a "hit") if his adversary has begun bearing; a double game (a "gammon") if the adversary has not borne a man; and a triple game (a "backgammon") if, at the time the winner bears his last man, his adversary, not having borne a man, has one in the winner's inner table, or has a man up. When a series of games is played, the winner of a hit has the first throw in the succeeding game; but if a gammon is won the players each throw a single die to determine the first move of the next game.

In order to play backgammon well, it is necessary to know all the chances on two dice and to apply them in various ways. The number of different throws that can be made is thirty-six. By taking all the combinations of these throws which include given numbers, it is easily discovered where blots may be left with the least probability of being hit. For example, to find the chance of being hit where a blot can only be taken up by an ace, the adversary may throw two aces, or ace in combination with any other number up to six. and he may throw each of these in two different ways, so that there are in all eleven ways in which an ace may be thrown. This, deducted from 36 (the total number of throws), leaves 25; so that it is 25 to 11 against being hit on an ace. It is very important to bear in mind the chance of being hit on any number. The following table gives the odds against being hit on any number within the reach of one or two dice:—

It is	25	to	11,	or about	9 to 4,	against being hit on	1
,,	24	,,	12,	or	2 ,, 1,	,,	2
,,	22	,,	14,	or about	3 ,, 2,	,,	3
,,	21	,,	15,	or	7 ,, 5,	,,	4
,,	21	,	15,	,,	7 ,, 5,	,,	5
,,	9	,	17,	,,	9½ ,, 8½,	,,	6
,,	30	,,	6,	,,	5 ,, 1,	,,	7
,,	30	,,	6,	,,	5 ,, 1,	,,	8
,,	31	,,	5,	or about	6 ,, 1,	,,	9
,,	33	,,	3,	or	11 ,, 1,	,,	10
,,	34	,,	2,	,,	17 ,, 1,	,,	11
,,	33	,,	3,	,,	11 ,, 1,	,,	12

The table shows that if a blot must be left within the reach of one die, the nearer it is left to the adversary's man the less probability there is of its being hit. Also, that it is long odds against being hit on a blot which is only to be reached with double dice, and that, in that case (on any number from 7 to 11), the farther off the blot is the less chance there is of its being hit.

The table assumes that the board is open for every possible throw. If part of the throw is blocked by an intervening point being held by adverse men, the chance of being hit is less.

Two principles, then, have to be considered in moving the men:—(I) To make points where there is the best chance of obstructing the opponent. (2) When obliged to leave blots, to choose the position in which they are least likely to be hit.

The best points to secure are the five-point in your own inner table and the five-point in your adversary's inner table. The next best is your own bar-point; and the next best the four in your own inner table.

When your adversary is bearing his men, and you have two men in his table, say, on his ace-point, and several men in the outer table it is to your advantage to leave one man on the ace-point, because it prevents his bearing his men to the greatest advantage, and gives you the chance of his leaving a blot. But if you find that you can probably save the gammon by bringing both your men out of his table, do not wait for a blot. Eight points is the average throw.

The laws of backgammon (as given by Hoyle) are as follow:—

1. When a man is touched by the caster it must be played if possible; if impossible no penalty. 2. A man is not played till it is placed upon a point and quitted. 3. If a player omits a man from the board there is no penalty. 4. If he bears any number of men before he has entered a man taken up, men so borne must be entered again. 5. If he has mistaken his throw and played it, and his adversary has thrown, it is not in the choice of either of the players to alter it, unless they both agree to do so. 6. If one or both dice are "cocked," *i.e.,* do not lie fairly and squarely on the table, a fresh throw is imperative.

Russian Backgammon varies from the above game in that the men, instead of being set as in the diagram, are entered in the same table by throws of the dice, and both players move in the same direction round to the opposite table. There are various rules for this game. By some a player is not obliged to enter all his men before he moves any; he can take up blots at any time on entering, but while he has a man up, he must enter it before entering any more or moving any of those already entered. If he cannot enter the man that is up, he loses the benefit of the throw.

A player who throws doublets must play or enter not only the number thrown, but also doublets of the number corresponding to the opposite side of the dice; thus, if he throws sixes, he must first enter or move the sixes, as the case may be, and then aces, and he also has another throw. Some rules allow him to play either doublets first, but he must always complete one set before playing the other. If a player cannot play the whole of his throw, his adversary is sometimes allowed to play the unplayed portion, in which cases the caster is sometimes allowed to come in and complete his moves, if he can, and in the event of his having thrown deuce-ace or doublets to throw again. If he throws

doublets a second time, he moves and throws again, and so on. The privilege is sometimes restricted by not allowing this advantage to the first doublets thrown by each player. It is sometimes extended by allowing the thrower of the deuce-ace to choose any doublets he likes on the opposite side of the dice, and to throw again. The restriction with regard to the first doublets thrown does not apply to deuce-ace, nor does throwing it remove the restriction with regard to first doublets. A player must first be able to complete the doublets thrown. If the player cannot move the whole throw he cannot take the corresponding doublets, and he is not allowed another throw if he cannot move all the points to which he is entitled.

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BACKHUYSEN or BAKHUISEN, **LUDOLF** (1631–1708), Butch painter, was born on Dec. 18 1631, at Emden, Hanover, and died at Amsterdam on Nov. 17 1708. He studied under Allart van Everdingen and Hendrik Dubbels, and soon became celebrated for his sea-pieces. His numerous compositions are nearly all variations of one subject, and in a style peculiarly his own, marked by intense realism. In his later years Backhuysen employed his time in etching and calligraphy.

BACKNANG, an agricultural market town in the *Land* of Württemberg, 18 mi. N.E. of Stuttgart. Pop. (1939) 11,547. It has an interesting 12th century church, and important tanneries and leather factories.

BACKSCRATCHER, a long slender rod of wood, whalebone, tortoiseshell, horn or cane, with a carved hand, usually of ivory, mounted at the extremity. Its name suggests the primary use of the implement, but little is known of its history, and it was unquestionably also employed as a kind of rake to keep in order the huge "heads" of powdered hair worn by women during the 18th and early 19th centuries. The backscratcher varies in length from 12 to zoin., and the more elaborate examples, which were occasionally hung from the waist, are silver-mounted, and in rare instances the ivory fingers bear carved rings. The hand is sometimes outstretched, and sometimes the fingers are flexed; the modelling is frequently good, the fingers delicately formed and the nails well defined; the hand was sometimes replaced by a rake or a bird's claw. It was indifferently dexter or sinister, but the Chinese variety usually bears a right hand The backscratcher has become scarce, and is sought after by the modern collector.

BACK'S RIVER, a river in Mackenzie and Keewatin districts, Canada, rising in Sussex lake, a small body of water in 108° 20′ W. and 64° 25′ N., and flowing with a very tortuous course north-east to an inlet of the Arctic ocean, passing through several large lake-expansions—Pelly, Garry, MacDougall and Franklin.

BACKWARDATION, a technical term employed on the London Stock Exchange to express the amount charged for the loan of stock from one account to the other, and paid to the purchaser by the seller on a bear account (see BEAR), in order to allow the seller to defer the delivery of the stock. The seller, having sold for delivery on a certain date, stocks or shares which probably he does not possess, in the hope that he may be able, before the day fixed for delivery, to buy them at a cheaper price and so earn a profit, finds on settling day that the prices have not gone down according to his expectation, and therefore pays the purchaser an agreed amount of interest (backwardation) for the privilege of deferring the delivery, either in order to procure the stock, or else in the hope that there will be a shrinkage in the price which will enable him to gain a profit. (See also STOCK EXCHANGE)

BACKWARD CHILDREN. By backwardness is commonly meant the effects of delayed progress or development in the growing child. Backwardness may be either physical or mental. It is, however, chiefly in mental backwardness that scientific interest has centred Apart from exceptional cases of a medical or pathological nature such as cretinism or deferred puberty, physical immaturity has mainly been studied because of its apparent influence on the expansion of the mind. Quite recently efforts have been made to find a precise measure of physical backwardness—based, for example, on height, weight, or X-ray photographs of the structure of the bones. But these have been largely undertaken to compare anatomical growth and physiological development with advance in mental capacity.

Definition.—Mental backwardness may be of two kinds: inborn or acquired. In the one, the child is born with less than the average measure of intelligence. In the other, through ill health, absence from school or poor home circumstances, he fails to make normal progress in knowledge or learning. The proper treatment of both forms is one of the most urgent problems for the parent, teacher and education authority. The development of the child's mind is now usually measured in terms of a mental or educational ratio; that is, the proportion of the child's mental age, or of his educational attainments expressed in terms of equivalent years, to his physical age by the calendar. Not every child who falls a fraction below the general average is in need of special school provision. The following is the definition most generally accepted: a backward child is one who is so deeply retarded in mental development or attainments that by the middle of his school career he is unable to profit by the instruction given even in the class below that which is normal for his age. In terms of the mental ratio this means that a backward child is one who is retarded by 15% of his chronological age, and therefore has a mental ratio of less than 85%. A child who is backward by more than 305% of his actual age, whose mental ratio therefore is below 70%, is commonly regarded as mentally defective. In Great Britain the milder cases of retarded development have received an official recognition, since the definition of the mentally defective given in the Act of 1921 speaks of them as children who, "not being imbecile and not being merely dull and backward, are defective, that is to say, by reason of mental or physical defect, are incapable of receiving proper benefit from the instruction in the ordinary public elementary school."

Numbers.—Several surveys have been carried out to determine the number of children who are backward in this sense. It appears that in most large cities and in most industrial areas they amount to about 10% of the school population. From one district to another, however, the figures vary widely. In good neighbourhoods the proportion may be as low as 1% or 2%. In slums and in rural areas where the best elements in the population have been drained away to neighbouring towns, it may rise to 20% or 25%. In the whole of England and Wales it has been calculated the total number of dull and backward children between the ages of seven and 14 amounts approximately to 265,000.

Causes.—To discover the causes of educational backwardness, intensive investigations have been made of numerous typical instances. Psychological tests, supplemented by thorough case-histories for each child, are the methods mainly used.

(a) *Psychological.*—Of all the causes thus laid bare the commonest proves to be inborn inferiority in general intelligence. It appears that the unintelligent are always backward; but the backward are not necessarily unintelligent. Among other psychological factors are to be noted, first, special mental disabilities such as bad memory, unstable attention, poor auditory or visual imagery, incapacity for verbal or abstract symbols as distinct from practical or manual work, and, secondly, various temperamental troubles, issuing in emotional apathy, emotional instability, emotional conflicts, petty moral or disciplinary difficulties, lack of interest in school work, antagonism to a particular teacher or subject, worry about conditions at home and the like.

(b) *Physical.*—Physical handicaps seem almost as common. They include such specific conditions as defective vision. defective hearing, defective speech, lefthandedness and disturbances of the nervous system, and more general conditions such as malnutrition and lowered vitality from many different causes—rickets, rheumatism, recurrent catarrh, enlarged tonsils and adenoids, a run of infectious ailments, and the like. In either case the factors are nearly all of a remediable type, and are often so slight as to escape attention and treatment unless an intensive study is made of each individual. Grave incurable disease is far more rare.

The foregoing causes arise within the child himself. Other factors are extrinsic; and require not only an examination of the pupil, but a careful enquiry into his past history and home circumstances. The following are the chief :—

(c) Defects Within the School Organization Itself.—Among these may be included bad teaching, uninspiring or ill-adapted methods of instruction, too slow or too rapid promotion, and, above all, a sudden break in teaching methods, such as too often occurs when the child is transferred from the infants' to the senior department or from one school to another. Irregular attendance is responsible for about one case in ten.

(d) Social or Environment Handicaps.—Poverty and its manifold concomitants—insufficient or inappropriate food, overcrowding, want of sleep, lack of facilities for healthy recreation, lack of culture in the home, lack of parental sympathy with the school and its work—these have an effect which is indirect rather than direct, and is harder to estimate than is popularly supposed.

It will thus be seen that educational backwardness may be divided into two main causal types: those due to some inherent disability operating from birth, and those due to some accidental circumstance operating after the child is born. The former are sometimes called (in a somewhat technical sense) the "dull"; and the latter (in a somewhat specialized sense) the merely "backward." The distinction makes a world of difference in regard to treatment and outlook. In the one case the backwardness is irreparable; in the other, it is, in theory at any rate, curable.

Treatment.— It is now generally agreed that the backward child needs special provision along lines so-mewhat similar to those already accorded to the mentally deficient. Special classes or schools should be instituted, intermediate in type between the special school for the mentally defective and the ordinary standards for the normal. In special classes such as these, the great features will be small size and an easily graded syllabus. There will be less formal and academic work, more concrete practical and manual work, and, above all, individual attention to specific difficulties of each particular child. Throughout, success will be attained, not by a little extra coaching or drill, but by discovering, and attempting to remedy, the fundamental causes. To this end the efforts of the teacher in the classroom must be supplemented by special medical inspection and treatment, and by an effective social service directed towards the removal of handicaps in the home.

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BACOLOD, a municipality, capital of the province of Negros Occidental, and port on the western side of the island of Negros opposite the small island of Guimaras, in the Philippine Islands. Pop. (1939), 57,474, of whom 30,070 were males and 102 whites. Good automobile roads lead to other parts of the province and as a result Bacolod is an important centre for the sugar-industry. Its population nearly trebled between 1918 and 1939. It is a chartered city with 8 barrios (wards), an administrative centre and a meteorological station. It is also a port of entry, but large vessels cannot enter the harbour because of shallow water. The vernacular is a dialect of Bisaya. Bacolod is one of the most prosperous municipalities of the Philippines, but its prosperity ebbs and flows with the price of sugar.

(C. S. L.)

BACON, FRANCIS, BARON VERULAM, VISCOUNT ST. ALBANS (1561–1626), English philosopher, statesman and essayist, lord chancellor of England, was born at York House in the Strand, London, on Jan. 22, 1561. He was the youngest son of Sir Nicholas Bacon (*q.v.*), the lord keeper. His mother was a sister-in-law of Sir William Cecil, afterwards Lord Burghley. In April 1573 he was entered at Trinity college, Cambridge, where he applied himself diligently to the several sciences as then taught. Years later, he himself defined the quality of his mind and the nature of his real aspirations in the De *interpretatione naturae prooemium*:—

> I found that I was fitted for nothing so well as for the study of truth; as having a mind nimble and versatile enough to catch the resemblances of things (which is the chief point), and at the same time steady enough to fix and distinguish their subtler differences; as being gifted by nature with desire to seek, patience to doubt, fondness to meditate, slowness to assert, readiness to consider, carefulness to dispose and set in order; and as being a man that neither affects what is new nor admits what is old, and that hates every kind of imposture. So I thought my nature had a kind of familiarity and relation with Truth.

On June 27, 1576, Francis and his brother Anthony were entered at Gray's Inn, and a few months later he was sent abroad with Sir Amyas Paulet, English ambassador at Paris. He took up residence at Gray's Inn in 1579, and was admitted an outer barrister in 1582. In 1580 he applied, unsuccessfully, through his uncle, Burghley, the lord treasurer, for some post at court. In 1584 he took his seat in parliament for Melcombe Regis in Dorsetshire.

At the close of 1591 Bacon was acting as the confidential adviser of the earl of Essex, Elizabeth's favourite. In Feb. 1593 parliament was called, and Bacon took his seat for Middlesex. Bacon's opposition to the proposal to levy a double subsidy to meet the state necessities, though prompted by the desire to serve the queen, gave her deep and well-nigh ineradicable offence. He was accused of seeking popularity, and was for a time excluded from the court.

Essex at this time presented Bacon with a piece of land near Twickenham, and used his influence to procure for him the office of master of the rolls. Before anything came of this application, the Cadiz expedition had resulted in a brilliant success, and Essex became the idol of the army and the people. Bacon saw clearly that such a reputation would assuredly alienate the affections of the queen from his patron. He therefore addressed a letter to the earl, urging him to seek and secure the favour of the queen alone. His advice proved ineffectual.

Bacon, in the meantime, had increased his reputation by the publication in 1597 of his Essays, together with the Colours of Good and Evil and the *Meditationes* Sacrae.

The disgrace of Essex, after the unfortunate incidents of his campaign in Ireland in 1599, gave Bacon an opportunity of obtaining again the royal favour. The trial of Essex took place (June 1600) before a body of her majesty's councillors, and Bacon had an unimportant part in the accusation. Strangely enough Essex does not seem to have been hurt by his action in this matter, and shortly after his release he was again on friendly terms with his old client. Bacon did not then know that Essex had formed the desperate project of seizing the queen's person and compelling her to dismiss from her council his enemies, Raleigh, Cobham, and Cecil. The plot was, however, forced on prematurely and the rash attempt to rouse the city of London (Feb. 8, 1601) proved a complete fiasco. The leaders were arrested that night and thrown into prison.

Essex was tried along with the young earl of Southampton. Bacon, as one of her majesty's counsel, was present on the occasion and at times intervened in the course of the trial, to recall to the minds of those present the real question at issue. It seems to have been thought that had it not been for Bacon's speeches Essex might have escaped, or, at all events, have been afterwards pardoned. But this view of the matter depends on the supposition that Essex was guilty only of a rash outbreak. That this was not the case was well known to the queen and her council. After the execution of Essex it was thought necessary that some account of the facts should be circulated, to remove the prejudice against the queen's action in the matter. This was entrusted to Bacon, who drew up a Declaration of the Practices *and* Treasons attempted and committed by Robert, late Earl of Essex, his first draft being extensively altered and corrected by the queen and council. The ill-feeling against Bacon was not wholly removed, and some years later, in 1604, he published, in the form of a letter to Mountjoy, an Apology for his action in the case.

Though Bacon was to some extent trusted by Elizabeth, he seems to have seen that he had no chance of advancement. Her death in 1603, followed by the undisputed succession of James, gave him hopes which were not immediately realized. He procured, through his cousin Cecil, the dignity of knighthood, and was shortly afterwards formally installed as learned counsel. He was also appointed one of the commission to treat of the conditions necessary for the Union. The success of that body must be attributed mainly to his influence. During the recess he published his *Advancement of Learning*, dedicated to the king.

In the second parliament there was little scope for the exercise of Bacon's powers. In the course of this session Bacon married Alice Barnham, daughter of a London alderman.

Bacon's services were rewarded in June 1607 by the office of Solicitor. In Oct. 1608 he became treasurer of Gray's Inn. Meantime he had not forgotten his cherished project of reorganizing natural science. A survey of the ground had been made in the *Advancement*, and some short pieces not published at the time were probably written in the subsequent two or three years. Towards the close of 1607, he sent to his friends a small tract entitled *Cogitata et Visa*, probably the first draft of what we have under that title. In 1609 he wrote the panegyric, *In felicem memoriam Elizabethae*, and the learned and ingenious work, *De Sapientia Veterum;* and completed what seems to have been the *Redargutio Philosophiarum*, or treatise on the "idols of the theatre." In 1613 Bacon proposed to the king that Coke should be removed from the court of common pleas and transferred to the king's bench. The vacancy caused by Coke's promotion was then filled by Hobart, and Bacon stepped into the place of attorney general.

Bacon's services to the king had been most important; and as he had, at the same time, acquired great favour with Sir George Villiers, the king's new favourite, his prospects looked brighter than before. On March 7, 1617, the great seal was bestowed upon Bacon, with the title of lord keeper. On Jan. 7, 1618, he became lord chancellor; in July of the same year he was made Baron Verulam and in Jan. 1621 created Viscount St. Albans. His fame, too, had been increased by the publication in 1620 of his most celebrated work, the *Novum Organum*.

In Nov. 1620, when a new parliament was summoned to meet, Bacon earnestly pressed that the most obnoxious patents should be given up. This prudent advice was unfortunately rejected, and the session was not far advanced when the question of patents was brought up. It was even proposed to proceed against the referees (Bacon and Montagu), who had certified that there was no objection to them in point of law. This proposal, however, was allowed to drop, while the king and Buckingham agreed to give up the monopolies.

It is probable that this charge was dropped because a more powerful weapon had in the meantime been placed in the hands of Bacon's enemies. This was the accusation of bribery and corrupt dealings in Chancery suits, an accusation apparently wholly unexpected by Bacon, but, nevertheless, the cause of his downfall. The charges against him rapidly accumulated, and Bacon gave up all idea of defence and sent in a general confession to the Lords. On May 3, after considerable discussion, the Lords decided upon the sentence, which was, that he should undergo a fine of £40,000; that he should be imprisoned in the Tower during the king's pleasure; that he should for ever be incapable of any office in the State; and that he should never sit in parliament, or come within the verge of the court. This sentence was only partially executed. The fine was in effect remitted by the king; imprisonment in the Tower lasted for about four days; a general pardon was made out, and was passed probably in Nov. 1621. Bacon also received permission to come within the verge of the court, but he never sat again in parliament.

On the whole it appears that Bacon's own account of this painful episode is substantially correct. He confesses *(Letters and Life*, vii. 235–236) that he had received bribes from suitors *pendente lite*. Yet he affirms that his intention was never swayed by a bribe; and in several cases his judgment appears to have been given against the party bestowing the bribe.

Bacon was well aware that the practice was in itself indefensible. So far, then, as the mere taking bribes is concerned, he would permit no defence, and his own judgment on his action contains as severe a condemnation as has ever been passed upon him. Wet in the face of this he does not hesitate to call himself "the justest chancellor that hath been in the five changes since Sir Nicholas Bacon's time" *(Letters and Life*, vii. 560), and this on the plea that his intentions had always been pure and had never been affected by the presents received.

The remaining five years of his life were spent in work far more valuable to the world than anything he had accomplished in his high office. In March 1622 he presented to Prince Charles his *History of Henry VII*. In Nov. 1622 appeared the *Historia Ventorum;* in Jan. 1622/3 the *Historia Vitae et Mortis;* and in Oct. of the same year, the *De Augmentis Scientiarum*, a Latin translation, with many additions, of the *Advancement*. Finally, in Dec. 1624, he published his *Apothegms*, and *Translations of some of the Psalms*, dedicated to George Herbert; and, in 1625, a third and enlarged edition of the *Essays*.

His life now drew rapidly to a close. In March 1636, when driving one day near Highgate, he was taken with a desire to discover whether snow would delay the process of putrefaction. He stopped his carriage, purchased a fowl, and with his own hands assisted to stuff it with snow. He was seized with a sudden chill, and was conveyed to Lord Arundel's house, near at hand. The cold and chill had brought on bronchitis, and he died on April 9, 1626.

BACON'S WORKS AND PHILOSOPHY

Putting aside the letters and occasional writings, we may conveniently distribute the other works into three classes, *Professional, Literary, Philosophical*.

The professional works include the *Reading on the Statute of Uses*, the *Maxims of Law*, and the treatise (possibly spurious) on the *Use of the Law*. Bacon's legal writings exhibit a richness and ethical fulness that more than compensate for their lack of dry legal detail. Bacon was indeed a lawyer of the first order, with a keen scientific insight into the bearings of isolated facts and a power of generalization which admirably fitted him for the self-imposed task, unfortunately never completed, of digesting or codifying the chaotic mass of the English law.

Of the literary works the most valuable are the *Essays*, which are widely read and universally admired. The matter is of the familiar, practical kind, that "comes home to men's bosoms." The short, pithy sayings have become popular mottoes and household words. The short tract, *Colours of Good and Evil*, which with the *Meditationes Sacrae* originally accompanied the Essays, was afterwards incorporated with the *De Augmentis*. Along with these works may be classed the curiously learned piece, *De Sapientia Veterum*. The *Apophthegms*, though hardly deserving Macaulay's praise of being the best collection of jests in the world, contain a number of those significant anecdotes which Bacon used with such effect in his other writings. Of his historical works, besides a few fragments of the projected history of Britain, there remains the *History of Henry VII.*, a valuable work, giving a clear and animated narrative of the reign, and characterizing Henry with great skill. The series of the literary works is completed by the minor treatises on theological or ecclesiastical questions, including the *Meditationes Sacrae* and the *Confession of Faith*.

Philosophical Works.—Bacon's philosophical works may be classified under three heads: *(a)* Writings originally intended to form parts of the *Instauratio*, but which were afterwards superseded or thrown aside; *(b)* Works connected with the *Instauratio*, but not directly included in its plan; *(c)* Writings which actually formed part of the *Instauratio Magna*.

(a) The most valuable in this class are: (1) *The Advancement of Learning*, which is completely worked up into the *De Augmentis*, and takes its place as the first part of the *Instauratio*. (2) *Valeus Terminus*, composed probably about 1603, which contains a brief and somewhat obscure outline of the first two parts in the *Instauratio*. (3) *Temporis Artus Masculus*, another curious fragment, remarkable for its style, which is arrogant and offen-

sive, in this respect unlike any other writing of Bacon's. (4) *Redargutio Philosophorum,* composed probably about 1608 or 1609, and containing in pretty full detail much of what afterwards appears in connection with the Idola *Theatri* in book i. of the *Novum* Organum. (5) Cogitata et Visa, perhaps the most important of the minor philosophical writings, and containing the substance of the first book of the *Organum.* (6) The Descriptio *Globi* Intellectualis goes over in detail the general classification of the sciences. (7) The brief tract De *Interpretatione* Naturae *Sententiae Duoecim* is evidently a first sketch of part of the Novum Organum. (8) A few smaller pieces, such as the *Inquisitio* de Motu, the Calor et Frigus, the *Historia* Soni et *Auditus,* and the Phaenomena Universi, are early specimens of his Natural History, and exhibit the first tentative applications of the new method.

(b) The second group consists of treatises on subjects connected with the Instauratio, but not forming part of it. The most interesting is the philosophical romance, the New Atlantis, a description of an ideal state in which the principles of the new philosophy are carried out by political machinery and under state guidance. The work was to have been completed by the addition of a second part, treating of the laws of a model commonwealth, which was never written. Another important tract is the De *Principiis* atque Originibus *secundum* Fabulas *Cupidinis* et Caeli, where, under the disguise of two old mythological stories, he (in the manner of the *Sapientia* Veterum) finds the deepest truths.

Deserving of attention are also the *Cogitationes* de Natura *Rerum,* probably written early, perhaps in 1605, and the treatise on the theory of the tides, De *Fluxu* et *Refluxu Maris,* written about 1616.

(c) Consisted in the *Instauratio,* in its final form of six divisions.

(1) Partitiones *Scientiarum.*—The famous classification on which this survey of the sciences proceeds is based upon an analysis of the faculties and objects of human knowledge. This division is represented by the De Augmentis *Scientiarum.*[1]

(2) Interpretatio *Naturae.*—The new method, by which the mind of man is to be trained and directed in its progress towards the renovation of science. This division is represented, though only imperfectly, by the *Novum Organum,* particularly book ii.

(3) *Historia* Naturalis et *Experimentalis.*—The new method is valueless, because inapplicable, unless supplied with materials duly collected and presented—in fact, unless there be formed a competent natural history of the *Phaenomena* Universi. A short introductory sketch of the requisites of such a natural history is given in the tract Parasceve, appended to the *Novum* Organum. The principal works intended to form portions of the history, and either published by himself or left in manuscript, are *Historia Ventorum, Historia* Vitae et *Mortis, Historia* Densi et *Rari,* and the collection of facts and observations entitled Sylva Sylvarum..

(4) Scala Intellectus.—For practical purposes, Bacon interposed two divisions between the preliminaries and the philosophy itself. The first was intended to consist of types or examples of investigations conducted by the new method. Of this division there seems to be only one small fragment, the *Filum Labyrinthi.*

(5) Prodromi (forerunners of the new philosophy) was to contain certain speculations not formed by the new method but by the unassisted use of his understanding. There is extant a short preface to this division of the work, and some of the miscellaneous treatises, such as De *Principiis,* De *Fluxu* et *Refluxu,* Cogitationes de *Natura Rerum,* may have been prepared for inclusion under this head.

(6) The new philosophy, which is the work for future ages and the result of the new method.

Bacon's grand motive in his attempt to found the sciences anew was the conviction that the knowledge man possessed was of little service to him. Sovereignty over nature, which can be founded on knowledge alone, had been lost, and instead we have nothing but vain notions and blind experiments. To restore the original commerce between man and nature, and to re-establish the *imperium hominis,* is the object of all science. Failure had been due to many causes, but chiefly to the want of appreciation of the nature of philosophy and its real aim. The true philosophy is not the science of things divine and human; it is not the search after truth but is something altogether practical, nor is it of great matter what abstract notions one may entertain concerning the ultimate nature and the principles of things. Nevertheless, by following the new aim we shall also arrive at a true knowledge of the universe in which we are, for truth and utility are in ultimate aspect the same; "works themselves are of greater value as pledges of truth than as contributing to the comforts of life." Such was the conception of philosophy with which Bacon started, and in which he felt himself to be thoroughly original.

As his object was new, so the method he intended to employ differed, as he conceived, from all previous modes of investigation. He seems always to have felt that the first part of the new scheme must be a destructive criticism of all other methods. Opposition was to be expected, not only from previous philosophies, but especially from the human mind itself.

Before proceeding to unfold his method, Bacon found it necessary to discuss the obstacles to progress. As an insurance against error in collection of facts Bacon warned men against his four famous Idola, or false notions of things, erroneous ways of looking at nature. There were the Idola Tribus, the idols of the tribe, fallacies inherent in human kind in general, and notably man's proneness to suppose in nature greater order than is actually there. There were Idola *Specus,* idols of the cave, errors inherent in our individual constitution, our private and particular prejudices, as we may term them. There were the Idola *Fori,* idols of the marketplace, errors arising from the influence of mere words over our minds. There were the Idola Theafri, the idols of the theatre, errors arising from received systems of thought. But did not Bacon himself fail to discern a fifth set of idols, which we may term the Idola Academiae, the idols of the schools, the fallacy of supposing that a blind though learned rule can take the place of judgment? It was this fifth idol that prevented Bacon from entering into the promised land of which but a Pisgah view was granted to him.

To discover exactly Bacon's view of the characteristics and objects of natural philosophy it is necessary to examine the place it holds in the general scheme furnished in the *Advancement* or De *Augmentis.* All human knowledge, it is there laid down, may be referred either to man's memory or to his imagination or to his reason. Corresponding to memory is history, either natural or civil; corresponding to imagination is poesy; and corresponding to reason is philosophy. Natural philosophy is again divided into theoretical and practical, according as the end is contemplation or works. Theoretical natural philosophy has to deal with natural substances and qualities, and is subdivided into physics and metaphysics. The principal objects of physics are concrete substances, or abstract though physical qualities. The research into abstract qualities, the fundamental problem of physics, comes near to the metaphysical study of *forms.* Natural philosophy is, therefore, in ultimate resort, the study of *forms,* and consequently the fundamental problem of philosophy in general is the discovery of these forms.

A study of the various passages in the *Novum* Organum in which the definition of forms is attempted seems to show that Bacon's forms are no ideas or abstractions, but highly general physical properties. Further, it is hinted that these general qualities may be looked upon as the modes of action of simple bodies. Thus, by a knowledge of forms, Bacon believed that man's practical control of Nature would be enormously increased. For example, so long as we possess only certain practical recipes for the production of heat, these can only be applied when the requisite conditions are available. But, armed with the knowledge of what heat consists of, *i.e.,* the form of heat is violent, irregular, motion of particles, we can produce heat by any method which will induce such motion.

[1] The division of the sciences adopted in the great French *Encyclopédie* was founded upon this classification of Bacon's. See Diderot's Prospectus (Oeuvres, iii.) and d'Alembert's *Discours* (Oeuvres i.). The scheme should be compared with later attempts of the same nature by Ampère, Cournot, Comte, and Herbert Spencer.

This fruitful conception, however, Bacon does not work out; and though he uses the word *cause*, and identifies *form* with *formal cause*, yet it is perfectly apparent that the modern notions of cause as dynamical, and of nature as in a process of flow or development, are foreign to him, and that in his view nature was regarded in a purely statical aspect.

Francis Bacon, in common with his 13th century predecessor, Roger Bacon, held that the sciences are organically connected. At the basis of all he placed a body of general truth, common to all the sciences, which he called the *Prinza Philosophia*.

Following this summary philosophy come the sciences proper, rising like a pyramid in successive stages, the lowest stage being occupied by natural history or experience, the second by physics, the third, which is next the peak of unity, by metaphysics. The knowledge of the peak, or of the one law which binds nature together, is perhaps denied to man. Nature presented itself to Bacon's mind as a huge congeries of phenomena, the manifestations of some simple and primitive qualities, which were hidden from us by the complexity of things themselves. The world was a vast labyrinth, the clue to which, the *filum labyrinthi*, is the new method of *induction*. But the new method could not be applied until facts had been observed and collected.

Concealed among the facts presented to sense are the causes or *forms*, and the problem therefore is so to analyse experience that we shall with certainty and mechanical ease arrive at a true conclusion. For this purpose Bacon proposed to draw up three "tables of comparative instances." We must have before us instances in which any given nature is present, instances in which it is absent, and instances in which the nature is present in different degrees. To make clear the nature of these "tables" let us take for example the case of heat. We wish to discover the *form* of heat, *i.e.* the condition which is present or absent when heat is present or absent, and which increases or decreases as heat increases or decreases. To do this we begin with a process of elimination of all those inessential conditions which are not found always and only in conjunction with the phenomenon of heat. Bacon, for instance, excludes the property of rarity, since metals like gold are of very great density, even though heated. Thus, by a process of elimination, we should arrive at the true *form* of heat. But as it is exceedingly difficult to make our exclusive table at all exhaustive, Bacon proposes that we pause when a certain stage is reached, and a tentative survey be made of the state of the enquiry. This survey, which he calls the "first vintage" is probably Bacon's nearest approximation to our modern conception of the formation of a scientific hypotheses, the department in which Bacon's chief weakness lay. It is evident that if the tables were complete, and our notions of the respective phenomena clear, the process of exclusion would infallibly lead to the detection of the cause or *form*. But it is just as evident that these conditions can never be adequately fulfilled.

Such was the method devised by Bacon, and to which he ascribed the qualities of absolute certainty and mechanical simplicity. But even supposing that this method were accurate and completely unfolded, it is evident that it could only be made applicable and produce fruit when the phenomena of the universe have been very completely tabulated and arranged.

CRITICISM OF BACON'S PHILOSOPHY

It has been pointed out, and with perfect justice, that science in its progress has not followed the Baconian method. The reason of this is not far to seek.

The process of scientific discovery is essentially an act of judgment. Facts, phenomena, are infinite in number. We cannot choose them all, as Bacon would have had us do, and then pass them through a mill of logic and elicit a result. Still less dare we choose at random. The process of choosing facts is an act of judgment on the part of the man of science. His choice is doubtless limited by his knowledge of his art. He exercises his judgment to choose things which bear a certain relation to each other. But no knowledge of the nature of reasoning, however profound, nor even knowledge of his science, however complete, will make a man a scientific discoverer. The scientific man has, in fact, to practise two distinct mental processes, the making of the discovery and the demonstration of its truth. Essentially the two processes are distinct, and the one might be largely developed while the other was in a state of relative arrest.

This distinction between the act and demonstration of discovery was consistently missed during the middle ages. Mediaeval thought is further distinguished from our own by the persistent conviction in those ages that a wide measure of truth could be elicited from a very small series of observations by the extensive use of ratiocination. The latter error Bacon clearly discerned, and his discernment entitles him to rank as the herald of modern science. His claim that a direct appeal to nature was the only way to truth at once raised the functions of the observer while it tended to depress the vast mediaeval claims for ratiocination.

On the other point, in which our thought is separated from that of the middle ages, Bacon remained in darkness. He succeeded indeed in emphasizing the importance of the operation of collection of facts, but he failed to perceive how deeply the act of judgment must be involved in the effective collection of facts.

We may now turn to consider whether, in fact, the knowledge of his time would have enabled him to come to any other conclusions than those which he reached. What, we may enquire, were the actual, concrete, scientific achievements of his day, on which he might have tested his method? We may perhaps exonerate Bacon for having effectively ignored the astronomical ideas of his day. Copernicus (*q.v.*) (1473–1543), though he initiated a great movement, made no important observational contribution in his work, the first edition of which appeared in 1543. It was not till 1630, when Bacon had been in his grave for four years, that Galileo (1564–1642) gave the Copernican theory its formal observational justification, though Bacon had had news of Galileo's activities as early as 1616 from his friend, Sir Tobie Matthew (1577–1655), then travelling in Italy. Bacon missed, however, the *New Astronomy* (1609) of Kepler (*q.v.*) (1571–1630) which laid the foundation of modern astronomical views, set forth for the first time the laws of planetary motion, and developed a tenable theory of tides, a subject in which Bacon was specially interested.

Biology was less advanced than astronomical science, but there was one biological work of first-class importance from which Bacon might have learned of the distinction between the act of discovery and the demonstration of discovery. It had been written at Padua in 1543 by the Belgian, Andreas Vesalius (1514–64), and bore the title *On the Fabric of the Human Body*. It placed the study of anatomy at once on a scientific basis, and contained an enormous number of first-hand observations. But besides this, there were two men at home who were admirable exponents of the experimental method, and whom Bacon might have watched at work. One was William Gilbert (*q.v.*) (1544–1603) physician to Bacon's two royal masters, Elizabeth and James I., and founder of the science of electricity. Gilbert's great book *On the Magnet* was published in 1600. Now Gilbert so clearly perceived the character of the scientific process that he adopted in his book a special typographical method of marking and distinguishing his actual observations. Had Bacon followed these observations, he might have watched the practice of the art of discovery at the hand of a master. At Gilbert's house in London there used to foregather a society of men interested in the secrets of Nature. This may be regarded as the earliest scientific association in England, and perhaps the earliest in Europe. The inspiration of Bacon's philosophy and the magic of his pen produced in the generation that followed him the "secret college," which grew into the "Royal Society." It was an irony of fate that Bacon was no member of that secret college that was meeting at his very door.

The only other contemporary Englishman who was a first class exponent of the experimental method was William Harvey (1578–1657). Harvey was lecturing in London on the circulation of the blood as early as 1616, though he did not publish his discovery until 1628. Among his patients was Lord Chancellor Bacon. Yet Bacon not only knew nothing of Harvey's work, but failed to make any impression on the fine practical mind of the great

physiologist. Harvey would not allow him to be a great philosopher, though he esteemed him much for his wit and style. Speaking of Bacon, Harvey told Aubrey: "He writes philosophy (*i.e.* Science) like a lord chancellor." This shrewd saying may well contain the root of the matter.

It may be that it was just Bacon's legal powers and legal training that shut him out from a real appreciation of the scientific process. Often in history a legal bias has corrupted scientific method by giving a false conception of natural law. No less often has the legal form fixed the gaze of the investigator on the prospect of a scientific verdict so that he fails to focus exactly the details of scientific method.

We must glance at the influence of Bacon on posterity. It is significant that he has made himself more felt in the department of the moral and metaphysical sciences than in the physical. Furthermore, we observe that while many who have written about science have done him homage—and notable among them Voltaire and d'Alembert and the other contributors to the *Encyclopédie* by whom he was regarded as "*le* plus *grand, le* plus *universal,* et *le* plus *éloquent* des *philosophes*"—while men of science such as Leibnitz, Huygens, and above all Robert Boyle, have had him in good regard, yet there is not the least evidence that these or any other eminent scientific men have ever followed his method. Yet despite Bacon's failure in the field of the practical application of his method, the world certainly owes to him some developments of high importance. These we may sum up as threefold:—

1. He did in fact set forth clearly the widening intellectual breach which separated the men of his day from the middle ages. He perceived the vices of the scholastic method, and in the clearness of his vision and explanation he stands above his contemporaries, men such as Campanella (*q.v.*) (1548–1639) and Giordano Bruno (*q.v.*) (1548–1600), who, like him, were striving towards a new form of intellectual activity.

2. English writers of the later 17th century concur in ascribing to the impetus of Bacon's writings the foundation of the Royal Society. Thomas Sprat (1635–1713), Bishop of Rochester, the first historian of the Society, assures us of this, as does Oldenburg (1615–77), the most energetic of its early secretaries. The opinion is confirmed by Boyle (1627–91) and by many other of the earlv members.

3. It is perhaps in the department of psychological speculation that the influence of Bacon has been most marked. The basic principle of Locke's essay "Concerning Human Understanding" (1690), that all ideas are the product of sensation and of reflection, is implicit in the first aphorism of Bacon's Novum *Organum,* "Man, who is the servant and interpreter of nature, can act and understand no further than he has observed, either in operation or in contemplation, of the method and order of nature." The whole atmosphere of Locke's work is taken from, or at least is characteristic of, the *Novum Organum.* Through the "practical" tendency of his philosophy, and through Locke, Bacon was the father alike of English psychological speculation and of the empirical method in the department of ethics. Whatever his positive achievements may have been, we may thus accord to him his own claim that he "rang the bell which called the wits together."

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For Bacon-Shakespeare controversy *see* SHAKESPEARE. (C. SI.)

BACON, HENRY (1866–1924), American architect, was born at Watseka, Ill., Nov. 28 1866. In 1884 he entered the University of Illinois to study architecture. From 1888 to 1897 he was with McKim, Meade & White, in New York, except the years 1889–91, which he spent in Europe as Rotch Travelling Scholar. From 1897 to 1903 he was a member of the firm of Brite & Bacon, in New York. After that time he worked independently. He designed the Court of the Four Seasons at the Panama-Pacific Expositions; the Union Square Savings Bank, New York city; the Public Library, Paterson, N.J.; the Waterbury General hospital, Waterbury, Conn., and the Whittemore memorial bridge, Naugatuck, Connecticut. Of numerous monuments, some designed in collaboration with various sculptors, the following should be mentioned: the Lafayette monument, Brooklyn, N.Y.; the Lincoln monument, Lincoln, Neb.; the Longfellow monument, Cambridge, Mass.; the Republic monument and the Centennial monument, Chicago, Ill.; the President Harrison monument, Indianapolis, Ind.; the Civil War memorial and World War memorial, Yale University, and the Parnell monument, Dublin, Ireland. In 1920 the Lincoln memorial, at Washington, D.C., designed by him, was completed at a cost of more than $2,500,000. He died Feb. 16 1924, in New York city.

BACON, JOHN (1740–1799), British sculptor, was born in Southwark on Nov. 24 1740, the son of Thomas Bacon, a clothworker, and apprenticed at 14 in Crispe's porcelain manufactory at Lambeth. Here he was at first employed in painting the small ornamental pieces of china, but soon became modeller to the works. During his apprenticeship he improved the method of working statues in artificial stone, an art which he afterwards carried to perfection. Bacon first attempted working in marble about the year 1763, and improved the method of transferring the form of the model to the marble (technically "getting out

the points") by the invention of a more perfect instrument for the purpose. This instrument was more exact, took a correct measurement in every direction, was contained in a small compass, and could be used upon either the model or the marble. In the year 1769 he won the first gold medal for sculpture given by the Royal Academy, his work being a bas-relief representing the escape of Aeneas from Troy. In 1770 he exhibited a figure of Mars, which gained him the gold medal of the Society of Arts and his election as A.R.A. He was then engaged to execute a bust of George III., intended for Christ Church, Oxford. He died on Aug. 4 1799, and was buried in Whitfield's Tabernacle. His work may be studied in St. Paul's cathedral, London, Christ Church and Pembroke college, Oxford, the Abbey church, Bath, and Bristol cathedral. Perhaps his best works are to be found among the monuments in Westminster Abbey.

See Richard Cecil, *Memoirs of John Bacon, R.A.* (1801); and also Vol. i. of R. Cecil's works, ed. J. Pratt (1811).

BACON, LEONARD (1802–1881), American Congregational preacher and writer, was born at Detroit, Mich., on Feb. 19, 1802, the son of David Bacon (1771–1817), missionary among the Indians in Michigan and founder of the town of Tallmadge, O. The son graduated at Yale in 1820 and at the Andover Theological seminary in 1823, and from 1825 until his death on Dec. 24, 1881, was minister in the First Church (Congregational) in New Haven, although he gave up the active pastorate in 1866, He was, from 1826 to 1838, an editor of the *Christian Spectator;* was one of the founders of the *New Englander* (later the *Yale Review),* and with Dr. R. S. Storrs, H. C. Bowen and others, of the *Independent* (1848), of which he was an editor until 1863; and was acting professor of didactic theology in the theological department of Yale university from 1866 to 1871, and lecturer on church polity and American church history from 1871 until his death. Because of his prominence he was sometimes popularly referred to as "the Congregational pope of New England." An advocate of liberal orthodoxy himself, in all the heated theological controversies of the day he used his influence to bring about harmony, and in the councils of the Congregational churches he manifested great ability both as a debater and as a parliamentarian. In all matters concerning the welfare of his community or the nation, moreover, he took a deep and constant interest, and was particularly identified with the temperance and anti-slavery movements, in which, as in most other controversies, he took a moderate course. His *Slavery Discussed in Occasional Essays from 1833 to 1846* (1846) exercised considerable influence upon Abraham Lincoln. Bacon was early attracted to the study of the ecclesiastical history of New England and was frequently called upon to deliver commemorative addresses, such as are contained in his *Thirteen Historical Discourses* (1839). The most important of his historical works, however, is his *Genesis of the New England Churches* (1874). He published *A Manual for Young Church Members* (1833); edited, with a biography, the *Select Practical Writings of Richard Baxter* (1831); and was the author of a number of hymns.

Leonard Bacon's sister, DELIA BACON (1811–1859), born in Tallmadge, O., on Feb. 2, 1811, was a teacher in schools in Connecticut, New Jersey and New York, and then, until about 1852, conducted in various eastern cities classes for women in history and literature. She wrote *Tales of the Puritans* (1831), *The Bride of Fort Edward* (1839), and *The Philosophy of the Plays of Shakespeare Unfolded* (1857). The latter work was intended to prove that the plays attributed to Shakespeare were written by a coterie of men, including Francis Bacon, Sir Walter Raleigh and Edmund Spenser, for the purpose of inculcating a philosophic system, for which they felt that they themselves could not afford to assume the responsibility. Her devotion to this one idea, as Hawthorne says, "had thrown her off her balance," and while she was in England she lost her mind entirely. She died in Hartford, Conn., on Sept. 2, 1859.

For Leonard Bacon *see* the commemorative volume issued by his congregation (New Haven, 1882) and Williston Walker's *Ten New England Leaders* (1901). A nephew, Theodore Bacon, issued *Delia Bacon: A Sketch* (1888), and Nathaniel Hawthorne included "Recollections of a Gifted Woman" in *Our Old Home* (1863). (W. W.)

BACON, NATHANIEL (c. 1647–1676), a Virginian colonial politician and soldier, was born at Friston Hall in Suffolk, England. He graduated at Cambridge when about 21 years of age, but had interrupted his studies in 1663 to join a party which made an extended trip through the Netherlands, Germany, Italy and France. He later studied at the Inns of Court in London. In 1674 he married Elizabeth, the daughter of Sir Edward Duke, and sailed for Virginia late in the same year. There Bacon acquired several estates, one where Richmond now stands, and another where he made his home, on the Jarnes river, about 40m. above Jamestown. Having high social standing, ample financial means and a keen intelligence, he was soon appointed a member of the governor's council, in which he acquired the first-hand knowledge of Governor Berkeley's policy and character which induced him to undertake "Bacon's Rebellion." The report of the royal commission sent to Virginia after the rebellion describes him as "indifferent tall but slender, black-haired, and of an ominous, pensive, melancholy aspect; of a pestilent and prevalent logical discourse tending to atheism in most companies, not given to much talk, or to make sudden replies; of a most imperious and dangerous hidden pride of heart, despising the wisest of his neighbours for their ignorance and very ambitious and arrogant." This is manifestly the official portrait of an outlaw and is widely at variance with the report of his admirers, who represented him as of genial manners and, although himself an aristocrat, of democratic political convictions, which made him popular with all who disapproved of the absolutism of Governor Berkeley. It is increasingly apparent that the part played by Bacon in the formation of an American national consciousness was a great one; and the circumstances attending the rebellion make it evident that this part could be played only by a man of very distinctive personality. Bacon died during a campaign, probably of malaria, on Oct. 1, 1676.

See Gordon McCabe, "The Family of Nathaniel Bacon, the 'Rebel,' " in *Virginia Magazine of Hist. and Biog.* 1907–08.

BACON, SIR NICHOLAS (1509–1579), lord keeper of the great seal of England during the reign of Queen Elizabeth, was the second son of Robert Bacon of Drinkstone, Suffolk, and was born at Chislehurst. He was educated at Corpus Christi college, Cambridge, graduating B.A. in 1527, and afterwards spent some time in Paris. Having returned to England and entered Gray's Inn, he was called to the bar in 1533, and four years later began his public life as solicitor of the court of augmentations. In 1546 he was made attorney of the court of wards and liveries; in 1550 became a bencher and in 1552 treasurer of Gray's Inn. Although his sympathies were with the Protestants, he retained his office in the court of wards during Mary's reign, but an order was issued to prevent his leaving England. The important period in Bacon's life began with the accession of Elizabeth in 1558. Owing largely to his long and close friendship with Sir William Cecil, afterwards Lord Burghley, his brother-in-law, he was appointed lord keeper of the great seal in December of that year, and was soon afterwards made a privy councillor and a knight. In March 1559, Bacon was appointed to preside, with Heath, archbishop of York, over a conference between the Protestants and Catholics at Westminster; and Elizabeth left the management of religious affairs largely in his and Cecil's hands. In 1559 he was authorized to exercise the full jurisdiction of lord chancellor. In 1564 he fell temporarily into the royal disfavour and was dismissed from court, because Elizabeth suspected him of a share in a pamphlet, "A Declaration of the Succession of the Crowne Imperiall of Ingland," written by John Hales (*q.v.*), and favouring the claim of Lady Catherine Grey to the English throne. Bacon's innocence was admitted. He was restored to favour and replied to a writing by Sir Anthony Browne, who had again asserted the rights of the house of Suffolk, to which Lady Catherine belonged. He thoroughly distrusted Mary queen of Scots; objected to the proposal to marry her to the duke of Norfolk, and warned Elizabeth that serious consequences for England would follow her restoration. He died in London on Feb. 20, 1579, and was buried in St. Paul's cathedral, his death calling forth many tributes to his memory He was twice married and by his first wife, Jane, had three sons and

three daughters. His second wife was Anne (d. 1610), daughter of Sir Anthony Cooke, by whom he had two sons. Bacon's eldest son, Nicholas (*c.* 1540–1624), was member of parliament for the county of Suffolk and in 1611 was created premier baronet of England. His second and third sons, Nathaniel (c. 1550–1622) and Edward (c. 1550–1618), also took some part in public life. His sons by his second wife were Anthony (1558–1601), a diplomatist of some repute, and the illustrious Francis Bacon (*q.v.*).

See G. Whetstone, "Remembraunce of the life of Sir N. Bacon," in the *Frondes Caducae* (1816); J. A. Froude, *History of England, passim* (1881 f.).

BACON, ROBERT (1860–1919), American banker, was born in Boston (Mass.), on July 5, 1860. He graduated from Harvard in 1880, and the following year entered the banking business in Boston. In 1894 he joined the house of J. P. Morgan and Company in New York. He was assistant secretary of State, 1905–09, and then for a short time secretary of State. Ambassador to France from 1909–12, he was commissioned major in the U S. Reserves in 1917, being assigned to the staff of Gen. Pershing in France. He returned to America with the rank of colonel in 1918, and died in New York city on May 29, 1919.

BACON, ROGER (*c.* 1214–1294), English philosopher and man of science. known to his successors as *doctor mirabilis,* was born near Ilchester in the county of Somerset. About 1230, he seems to have been at Oxford, though not, as tradition asserts, at Merton or at Brasenose, neither of which had then been founded. After taking the degree of M.A., he went to Paris probably before 1236. There he also received the M.A., but there is no evidence for supposing that he ever became a doctor of divinity.

At Paris, where he remained (perhaps not uninterruptedly) until shortly after 1251, Bacon lectured on the pseudo-Aristotelian treatise *De Plantis* and wrote his *Quaestiones* on *Aristotle's Physics* and *Metaphysics*—writings which bear the impress of an immature but vigorous mind. About 1247, his scientific and philological interests began to awaken and it was probably during the years 1256–66, when ill-health required him to retire from academic activities, that he produced the *De Speculis, De Mirabili Potestate Artis et Naturae,* the *Metaphysica,* the *De Multiplicatione Specierum,* and certainly the *De Computo Naturali* which from internal evidence dates from 1263–64. On June 22, 1266, Guy de Foulques, who before his election as Pope Clement IV. had heard of Bacon's writings, wrote a second time to Bacon requesting him to send immediately a copy of his works, regardless of any forbidding Franciscan constitution (this is the first intimation that we have of Bacon being a Franciscan). Bacon's elation over the papal interest led him to begin the *Communia Naturalium* a proposed exhaustive account of the various branches of knowledge. He soon realized the size of the task which he had undertaken, and in Jan. 1267, laid aside the *Communia Naturalium* for the less pretentious encyclopaedia, the *Opus Maius.* In 1268, this latter work, together with the older *De Multiplicatione Specierum,* the *Opus Minus,* an alchemical treatise, and possibly the *Opus Tertium,* was despatched to the Pope. Bacon then proceeded with the *Communia Naturalium* and also produced his introduction to the pseudo-Aristotelian *Secretum Secretorum,* the Greek and fragmentary Hebrew grammars, and about 1272, the incomplete *Compendium Studii Philosophiae.*

In 12 jj, appeared Bishop Tempier's condemnation of 219 erroneous theories circulating in Paris. This seems to have stirred those in high office, for in the same year, we find Jerome de Ascoli, the Minister-General of the Franciscans, calling many of the Order to give an account of themselves, and among these was Bacon, summoned, according to the *Chronicle of the Twenty-four Generals,* because of certain suspected novelties. What these novelties were, we are not told. Certainly in the light of what we know about Grosseteste's interests, they could not have been of a scientific nature; and contrary to the common opinion, there seems to be nothing unique in the astrology or alchemy of Bacon. Again, his attack on the moral and intellectual standards of the Church could hardly have been the crux, for this was expressly written for the Pope, and moreover, the glorification of the Church was always Bacon's chief concern in promoting the study of languages, of mathematics, optics, geography and chronology Judging from his works, there can be little doubt that one of the main reasons for his condemnation was his obnoxious attack on his contemporaries — Franciscans, as well as Dominicans and seculars. Thus he refers to Richard of Cornwall as "an absolute fool," to Alexander of Hales, whom he admits was one of the great promoters of the Order, as "ignorant of natural philosophy and metaphysics," to Albert the Great, or St. Thomas as a "teacher yet unschooled" and one whose works are full of "puerile vanity and voluminous superfluity," to William of Moerbecke as an ignorant man undermining philosophy by his false translations, to the Dominicans of Paris as the greatest corruptors of the biblical text, and lastly, to the seculars as neglecting theology and philosophy, and relying on the Orders. Such remarks were bound to bring him into disfavour, but whether or not they were the accusations laid against him, we know that his works were condemned and he himself imprisoned from 1277 to 1292 when the Minister-General died. On his release, Bacon began the *Compendium Studii Theologiae,* but owing to his death in the same year that work was never finished.

No doubt the condemnation of Bacon's works is responsible for the lack of any marked influence on his immediate successors; however, as Prof. Duhem (see *infra)* says, there are resemblances between his astronomy and that of the Franciscan, Bernard of Verdun, and between his perspective and that of Pecham and William of Saint-Cloud. About 1315, William of Herbert, a Franciscan master at Oxford, was able to secure some of his manuscripts for the friary at Hereford, and about the same time, Peter Dubois, a pupil of Siger de Brabant, became interested in his experimental and mathematical teaching. By the end of the century, Franciscan chroniclers placed Bacon among the famous natural philosophers of the Order, and by the 15th century, disputants quoted him in the schools at Oxford, while an official letter of the university mentioned him among the "modern Oxonians" who had kept untarnished the brightness of Oxford's fame.

In estimating the importance of Bacon, it is well to state at once that it is foolish to regard him as a meteor, a rebel against the whole spirit of scholasticism, or an assertor of the freedom of thought. He is essentially the product of his day. During his residence in Paris, the famous teachers were Alexander of Hales who was attempting to correlate the old Augustinianism with the newly introduced philosophy of Aristotle, William of Auvergne, a great admirer of Aristotle and Avicebron, John de Garlandia, the zealous grammarian, Albert the Great whom Bacon refers to as "the first master of philosophy" and whose interests in science were considerable, Petrus Peregrinus of Maricourt, a mathematician, and Bonaventure. When he returned to Oxford, Grosseteste, Adam Marsh (de Marisco) and Thomas of York, had already established the claims of science and the freedom of thought. That Bacon simply took up the Oxford tradition is borne out by the late appearance of his scientific and philological interests, interests formed only in the works written after he had become a Franciscan and after he had access to the writings of the aforesaid men whom he calls "maiores clerici de mundo et perfecti in scientia divina et humana," and whom he ranks among the "anglicani qui satis inter alios homines sunt et fuerunt studiosi," contrasting them with the "capita vulgi philosophancium Parisius."

Between Bacon and Grosseteste, there are many striking similarities, especially in their theories of the value of philological and linguistic studies, of calendar reform, of meteorology, of the propagation of force, of optics, and of the importance of mathematics and experiment in natural science. In some of these spheres, however, Bacon makes a great advance on Grosseteste. Thus as far as the study of languages is concerned, apart from insisting on the necessity of linguistic science for the adequate comprehension of Scripture and philosophy, Bacon produced a Greek grammar, started a Hebrew one, and made a continual attack on the corrupt text of the Bible and the bad translations of Aristotle. As for optics, he had the advantage of enriching

the theories of Grosseteste with those of Alkindi and Alhazen, advancing beyond all of them in his study of parabolic mirrors and in his theory of the agent's propagation of species as a force which is nothing other than the momentarily modified medium between the agent and the patient. His concern for mathematics and experiment, often regarded as his crowning glory, is not as remarkable as one might be led to suppose. It is true that he insists that the man who knows not matheinatics cannot know other sciences, but his mathematical interest seems to be less in abstract than in applied mathematics. As far as experiment is concerned, Bacon may speak of it as the lord of all sciences, the door to knowledge, and the criterion of truth, but Mr. Thorndike *(Kist. of Magic and Experimental Science)* has shown that Bacon's advances beyond the contemporary practical experiments made by artisans and alchemists, were largely of an imaginary kind consisting chiefly in testing the results of speculation by practical utility rather than in induction through regulated and purposive observation. Perhaps the really outstanding manifestation of Bacon's scientific bent lies in that extraordinary foresight which led him to see the magnifying properties of convex lenses, the inherent power in gunpowder, and the possibility of flying machines and mechanically propelled boats, or of circumnavigating the globe.

Nevertheless, this same ability, which shows itself in other spheres as a knack of correlating the sciences, of grasping the unity in history or of seizing upon the causes of human error, was Bacon's weak point as far as philosophy was concerned. United with his energetic but imperious temperament, it shows itself as a confidence in his own peculiar capacity to interpret Aristotle rightly, as a tendency to dismiss theories with which he disagrees and as an inability to consider calmly the implications and value of his own philosophical innovations. Thus, after proclaiming that the individual is the most real thing in the universe, he dismisses the problem of individuation as stupid; again, he posits in things both a *materia prima universalis* together with a *forma universalis* and a *materia prima singularis* together with a *forma singularis* with elaborate sub-divisions under each of them, and by denying that they are differentiations *secundum modum loquendi* leaves us with two unrelated sets of entities in things. Bacon's most valuable philosophical contributions are his adoption of the Augustinian theory of *rationes seminales,* his analysis of the process of becoming, his rejection of the monistic doctrine of the numerical unity of matter in all things, his discussion as to whether generated forms appear instantaneously and as to what happens to the forms of elements which combine to produce mixtures, his assertion of a *forma corporeitatis* in man intended to preserve the independence of the rational soul, his emphasis on the activity of the soul in knowing, his support of the Divine illurnination theory (he regards the active intellect not as a part of the soul but as God or an angel), his belief in innate exemplars for a knowledge of all spiritual beings including God, the angels and our own soul, and his views on the similarity between the knowledge of the angels and that of separated souls, and the divine knowledge of creatures.

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BACON. The smoked meat product which is prepared from the sides, belly or back of hogs. A variety of bacon known as "bacon squares," which is used chiefly in cooking (as a garnish or flavouring agent), is prepared from the jowls. In the British trade, bacon ordinarily consists of the entire side or half of the hog, or the half with only the shoulder end removed. In the United States, bacon for the domestic trade consists of the smaller cuts previously mentioned.

In the days before modern methods of food preservation were introduced salt was universally used for preserving meat not required for immediate consumption. When farming practice did not include the provision of more than very limited supplies of winter keep for stock, farmers every autumn killed off all but a small number of their cattle, sheep and pigs and salted down the flesh for their meat supply until the following spring. Pigs were cut up, put in tubs of brine for a time and afterwards smoked in the open chimney. The principle of curing bacon is practically the same to-day although it is now carried out almost entirely at factories on a large scale. The "sides" (*i.e.,* one half the pig divided along the backbone without the head) are placed in large tanks containing a strong solution of salt. Salt is also thoroughly rubbed into them by hand, or brine is injected by means of a syringe. Hams are often cured separately and sugar or molasses are sometimes used as well as salt in the process. The details of treatment vary and the precise method of curing is often regarded as more or less of a trade secret on which a reputation for special quality and flavour is based.

The methods of cutting a side of bacon vary in different countries and in different districts, which give the name of the "cut." The most general is the "Wiltshire" cut. After chopping the carcass along the backbone and removing the head, feet, tail, vertebrae and shoulder-blades, the whole of the remaining side, including the ham, or gammon, and shoulder, is termed a "Wiltshire side." A very large proportion of the bacon cured in Great Britain, the whole of the supplies received from Denmark and other continental countries, a large proportion of the supplies from Canada and the Irish Free State, and part of the supplies from America are placed on the British market in this form.

Trade in Bacon.—According to the returns collected by the International Agricultural Institute the number of pigs in the world is about 140 millions, being about one-third the number of cattle or sheep. The returns are incomplete, an important omission being the number kept in China, which is unknown. As the importation of pigs from China was one of the chief factors in developing the present breeds of pigs in Europe and America the absence of statistical information from that country is regrettable. On the basis of available statistics about 54% of the world's pig stock is in North America and 40% in Europe. The numbers kept, and their distribution are affected by racial and religious considerations. Even the most precise statistics of the number of pigs would give little information as to the production of bacon. It may be surmised that much the largest proportion of the flesh of swine is consumed as pork and not converted into bacon. This is certainly the case in the United States which has the largest

stock of pigs of any country for which information is available. In England with its comparatively small stock, the total annual output of "pigmeat" is about 250,000 tons but how much of this is consumed as pork and how much as bacon is a matter of conjecture. As articles of commerce, however, the two commodities are distinct and consequently in dealing with international trade it is easy to discriminate.

Practically the whole of the international trade in bacon is with Great Britain as an importing country and other countries as exporters. Up to the middle of the 19th century the British Isles were self-supporting, and were indeed exporters of pig meat. In **1840** the imports of bacon and hams were **6,181** cwts., and the exports **27,832** cwts. in addition to 29,532 cwts. of pork imported and **80,440** cwts. exported. Practically all the imports of "bacon and hams" consisted of hams from Germany and all the pork was salted. Most of the exports went to India or the British West Indies. Since that time the importation of bacon and hams has steadily increased, with a slight falling off in the period 1864–70, due probably to the American Civil War. The United States began to send bacon and hams to the British Isles in **1846** and from that time to the end of the century dominated the trade. In 1854 the proportion of total imports received from that source was 90% and in 1880 reached **92%.** Thereafter there was a decline. In 1900 the proportion had fallen to **75%** and in 1910 to **43%.**

The reason for the relative decline in the British supplies from the United States was the appearance of competitors for the British trade. Both Canada and Denmark began about 1870 to send bacon and hams to the British market, but for a long time they were able to make very little progress. In 1870 Canada had secured only 1·3% and Denmark only 0·5% of the total trade Both had to meet the competition of a well-established rival. In a report published in **1926** by the Ministry of Agriculture on the marketing of pigs it is stated: "It is possible that the growth of the pig meat-packing industry about this time, which made it less profitable than formerly to export pig meat from America in the form of bacon and hams, assisted Canada and Denmark to penetrate a market almost monopolized by America. Canadian bacon and hams competed directly with American because of their similarity in quality, which accounts for the fact that until the War, Canada was unsuccessful in establishing a firm hold on the British market. The Danes on the other hand, created and supplied a new and important demand for a high quality, mild-cured, lean bacon; to only a slight extent did Danish bacon actually displace American. In fact, aided largely by the War, American bacon retained its hold on the north of England until the last few years, Danish bacon finding its principal market in London and the South." The relative position of the chief suppliers of bacon and hams to the British market just before the War was as shown in the table below. The total British imports in 1913 were, 5,712,885 cwts. and of this total each of the countries supplied the proportion indicated:—

United States	44·9%
Denmark	40·9
Canada	5·9
Russia	3·7
Sweden	0·1

In **1926** the quantity received from each of the principal sources of supply was as follows:—

It is noteworthy that while Denmark has increased its quota to 42%, and Canada to 11% the proportion from the United States has fallen to 25%.

Bacon Factories.— Although the private curing of bacon and hams still lingers in farmhouses, either because of their remoteness or of the tenacity of tradition the product is mainly, if not exclusively, for domestic consumption. The trade is based on the factory system. A bacon factory is an establishment equipped with the necessary plant and organization for slaughtering, dressing, curing, smoking and distributing pigs sent in by neighbouring farmers. The most striking instance of the development of a large trade in bacon based on the factory system is furnished by Denmark. There are at the present time **46** co-operative and 16 private bacon factories in that country. The first co-operative factory was built in 1887 when there were 770,000 pigs in Denmark. In 1927 there were 3,729,000 pigs and the co-operative bacon factories took about 85% of the annual output. The approximate membership of the co-operative societies which own factories is 140,000.

There are many bacon factories, some of them very large, in Great Britain but practically all of them are privately owned. The only part of the British Isles where co-operative factories have been established in any appreciable number is in Southern Ireland, now the Irish Free State. In England attempts have been made to establish co-operative bacon factories in different districts, but with only partial success. In a report published in **1925** by the Ministry of Agriculture some particulars were given of the co-operative bacon factories then existing in England:—

The first of these to be established was the St. Edmundsbury factory in Suffolk which was started in 1910. Two years later the Herts and Beds factory was started at Hitchin. The others were established since the War, and one ceased operations after a short period. But the difficulties encountered and the reasons for the comparative failure to establish bacon factories on a co-operative basis belong to the story of agricultural co-operation in Great Britain. (R. H. R.)

UNITED STATES

Curing.—In commercial practice in the United States, the cuts which are to be made into bacon, after a thorough chilling, are placed in a sweet pickle solution consisting of a carefully prepared mixture of salt brine, a sweetening agent, such as sugar or molasses, and a small quantity of nitrate or nitrite of soda. The salt protects the product and imparts an agreeable flavour; the sugar tends to soften the harshness of the salt and probably serves as a basis of fermentative changes which contribute an agreeable flavour. The nitrate or nitrite makes permanent the natural colour of the meat.

The basis of all pickles used in meat curing is a salt solution. The first step is to make up a salt solution of **saturation** salometer strength, *i.e.*, a saturated solution, which is then diluted to whatever strength may be desired for the various cures. Pure water and a good clean grade of salt are used. This pickle ordinarily is filtered through sponges to remove any suspended matter and is often filtered through a filter press and canvas cloth before being used on the meat.

The sugar and nitrate or nitrite, in the proportion desired by the packer and approved by practice and the regulations of the United States Bureau of Animal Industry, are dissolved in water and boiled for about five minutes. After boiling, the solution is added to the pickle and carefully mixed. The temperature of the finished pickle should be brought down to 36° F. and should be maintained there during the entire process of curing. The curing is done in vats of wood or concrete. The wooden vats, in

general, hold 1,400 pounds of product. The concrete vats are built for carrying capacities over 1,400 pounds. Formerly, considerable curing was done in tierces of standard size halding about 350 pounds of meat.

From 20 to 30 days are required to cure bacon properly, depending on the weight of the bacon and the method of cure. The rooms in which the curing is done must be kept at a steady temperature of 38° F. Bacon cuts are usually cured in a pickle of approximately 68° salometer strength. They are left in cure according to a ratio of approximately 2½ days to the pound. Thus, a ten-pound cut will be left in the cure for approximately 25 days. Bacon cuts in sweet pickle cure are overhauled at intervals during the curing period. Overhauling involves the transierring of cuts from one curing vat to another to make sure that all surfaces of the meat are exposed to the curing solution.

During recent years, a somewhat different method of cure has developed, known as the dry cure. Instead of using a sweet pickle, the meats are packed closely in water-tight containers, with a slight sprinkle of salt, sugar and nitrate or nitrite of soda between the pieces, and left to cure for roughly, 25 to 35 days. After curing, the meats are soaked in water to remove the surplus surface salt and a portion of the salt absorbed by the meat itself, and then thoroughly washed in water at 110° F. with the aid of brushes. After washing, the product is dried on the skin side by scraping with a bell-shaped scraping device. The product is then branded; that is, the trade mark of the packer is applied on the skin with indelible vegetable ink, sometimes with the use of heated iron dies.

Smoking, Chilling and Packing.— After being smoked for from 20 to 26 hours, depending on the weight of the cut and the intensity of smoke desired, the bacon is ready for the consumer. The temperature of the smokehouse varies from 100° to 125° F. Smoke from burning hardwood sawdust is used. Artificial smoke is prohibited by the regulations of the Bureau of Animal Industry. In the smoking process, as applied by some packers, a flexible cloth container, known as a stockinet, is applied to the bacon. The stockinet gives the bacon a smooth and neat appearance. Curing and smoking constitute a highly scientific process and one which demands careful handling and close attention. For example, the temperature of the curing solution is kept fairly constant and the initial strength of the curing solution is carefully controlled.

After smoking, the bacon is chilled to approximately 55° F. It is then wrapped: first in grease proof paper, then in a rag ham paper and finally in an attractively coloured and printed parchment paper covering, for sale in whole pieces or for slicing in the retail meat shop. The wrapping serves to some extent as a protective covering and helps insure arrival at the market in a clean and attractive condition. Sometimes bacon cuts are marketed without this wrapping, particularly when the product is consumed near the point of production. The bacon also may be sliced in the packing plant and packed in glass jars, paper cartons, or wrapped in a transparent wrapper in quantities suitable for small families. The packing and other operations are carried on under highly sanitary conditions. Through the use of gloves, forceps, etc., the product is often "not touched by human hands."

Food Value: Production Figures.— The chief value of bacon as a food lies in its store of readily available energy or calories. A pound of bacon will contain about 3,000 calories, which is about three times as much as the average person will consume in an entire meal. This high energy content is due to the large proportion of fat present. The fat in the bacon is very readily and completely digested. The protein in bacon is of a very high quality and high digestibility. The lean part of the bacon contains appreciable quantities of vitamin B and the fat part usually supplies modest amounts of vitamin A. The lean part also furnishes some mineral elements, especially phosphorus and iron. Of course, the quantities of these minerals and vitamin B in a pound of bacon are not very great, and depend upon the relative amount of lean present. **A** 250-pound hog will yield only from 12 to 15 per cent of its weight in ruts suitable for bacon.

Figures or: the production of bacon in the United Statrs are not available. Ho ever, according to the latest census reports (1925), the annual production of smoked pork, which includes, in addition to bacon, smoked hams, shoulders and butts, approximates 1,236,000,000 pounds, valued at the plant at $336,122,000. Bacon always has been an important item in exports of meat from the United States.[W] During 1919 exports of American bacon exceeded 1,230,000,000 pounds. Exports declined gradually after this time. In 1927, they approximated 105,649,020 pounds. (0. G. M.)

BACONIAN METHOD is the method of "interpreting nature" (or studying natural phenomena) formulated by Francis Bacon (*q.v.*). It was intended to replace the method of citing the views of "authorities" or of having recourse to fanciful guesses. It insisted on dismissing prejudices and preconceptions of all kinds, and on the close and methodical observation of the facts concerned. It was essentially an empirical method, and consisted of three main steps: first comes a description of the facts; next, a tabulation or classification of them into three classes showing (i.) instances of the presence of the characteristic or quality, etc., under investigation, (ii.) instances of its absence, and (iii.) instances of its presence in varying degrees; thirdly, the rejection or elimination of whatever appears, in the light of these tables, not to be connected with the phenomenon under investigation, and the determination of what is connected with it. In their essence Bacon may be credited with the recognition of the methods of agreement, the joint method, and the method of concomitant variations. (See SCIENTIFIC METHOD.) But he exaggerated the mechanical element in scientific investigation when he assumed that by following his method anybody might make sound scientific discoveries, much in the same way as anybody might, with the help of a pair of compasses, construct an almost perfect circle.

BACONTHORPE (BACON, BACO, BACCONIUS), **JOHN** (d. 1346), known as "the resolute doctor," a learned Carmelite monk, was born at Baconsthorpe in Norfolk. He seems to have been the grandnephew of Roger Bacon (Brit. Mus. Add ms. 19. 116). Brought up in the Carmelite monastery of Blakeney, near Walsingham, he studied at Oxford and Paris, and in 1329 was chosen 12th provincial of the English Carmelites. He appears to have anticipated Wycliffe in advocating the subordination of the clergy to the king. In 1333 he was sent for to Rome, where, we are told, he first maintained the pope's authority in cases of divorce; but this opinion he retracted. He died in London in 1346. His work, the Commentary on the Sentences by Peter the Lombard, was published at Venice, 1527. While it rejects the doctrine of monopsychism, it contends that the arguments of Thomas Aquinas against Averroes are not conclusive. It excuses Averroes whenever possible, hence, nearly three centuries later, it was still studied at Padua, the last home of Averroism.

See K. Prantl, *Ges.* d. *Logik,* iii. **318.**

BACSANYI, JANOS (1763–184j), Hungarian poet, founded a patriotic paper, the *Magyar* Museum, at Raschau in 1788 with the assistance of Baróti and Razinczy. The paper was suppressed in 1792, and in 1794 Bacsányi was imprisoned for a share in the conspiracy of Bishop Martinovich. He spent two years in the Spielberg. His life was uneventful until 1809 when he translated Napoleon's proclamation in Vienna. He fled to Paris, was surrendered in 1814, but was allowed to live on parole at Linz. His first work, a patriotic poem, "The Valour of the Magyars" appeared in 1785. He died at Linz, May 12, 1845.

BACTERIA AND DISEASE. Bacteria are minute one-celled organisms consisting of spherical, oblong, or cylindrical cells, widely distributed in air, water and soil. The action of bacteria as pathogenic agents is in great part merely an instance of their general action as producers of chemical change, yet bacteriology as a whole has become so extensive, and has so important a bearing on subjects widely different from one another, that division of it has become essential. The science will accordingly be treated in this section from the pathological standpoint only. It will be considered under the two following heads, viz., (1) the methods employed in the study; (2) the modes of action of bacteria and the effects produced by them. The facts and theories with regard to immunity against bacterial disease are dealt with in a separate article (*see* IMMUNITY).

Historical Summary. — The demonstration by Pasteur that definite diseases could be produced by bacteria, proved a great stimulus to research in the etiology of infective conditions, and the result was a rapid advance in knowledge. An all-important factor in this remarkable progress was the introduction by Koch of solid culture media, of the "plate-method," etc., an account of which he published in 1881. By means of these the modes of cultivation, and especially of separation, of bacteria were greatly simplified. Various modifications have since been made, but the routine methods in bacteriological procedure still employed are in great part those given by Koch. By 1876 the anthrax bacillus had been obtained in pure culture by Koch, and some other pathogenic bacteria had been observed in the tissues, but it was in the decade 1880–90 that the most important discoveries were made in this field. Thus the organisms of suppuration, tubercle, glanders, diphtheria, typhoid fever, cholera, tetanus, and others were identified, and their relationship to the individual diseases established. In the last decade of the 19th century the chief discoveries were of the bacilli of influenza (1892), of plague (1894) and of dysentery (1898). Immunity against diseases caused by bacteria has been the subject of systematic research from 1880 onwards. The modes by which bacteria produce their effects also became a subject of study, and attention was naturally turned to their toxic products. The earlier work, notably that of Brieger, chiefly concerned ptomaines (vide *infra*), but no great advance resulted. A new field of inquiry was, however, opened up when by filtration a bacterium-free toxic fluid was obtained which produced the important symptoms of the disease — in the case of diphtheria by Roux and Yersin (1888), and in the case of tetanus a little later by various observers. Research was thus directed towards ascertaining the nature of the toxic bodies in such a fluid, and Brieger and Fraenkel (1890) found that they were proteids, to which they gave the name "toxalbumins." Though subsequent researches have on the whole confirmed these results, it is still a matter of dispute whether these proteids are the true toxins or merely contain the toxic bodies precipitated along with them.

Immunity against toxins also became a subject of investigation, and the result was the discovery of the antitoxic action of the serum of animals immunized against tetanus toxin by Behring and Kitazato (1890), and by Tizzoni and Cattani. A similar result was also obtained in the case of diphtheria, and diphtheria antitoxin was introduced as a therapeutic agent in 1894. The technique of serum preparation has become since that time greatly elaborated and improved. The laws of passive immunity were shown to hold also in the case of immunity against living organisms by Pfeiffer (1894), and various anti-bacterial sera have been introduced. Of these the anti-streptococcic serum of Marmorek and anti-plague serum are the best known. The principles of protective inoculation have been developed and practically applied on a large scale, notably by Haffkine in the case of cholera (1893) and plague (1896), and more recently by Wright and Semple in the case of typhoid fever. One other discovery of great importance may be mentioned, viz. the agglutinative action of the serum of a patient suffering from a bacterial disease, first described in typhoid fever independently by Widal and by Grünbaum in 1896. Thus a new aid was added to medical science, viz. serum diagnosis of disease.

During the present century one of the most important discoveries was that of *Spirochaeta pallida* (or *Treponema pallidum*) in syphilis by Schaudinn and Hoffman in 1905. Other important discoveries which have been made in the course of recent years are as follows: —

Acute Infectious Jaundice or **Weil's** Disease. — This disease, which came into some prominence as a war disease, especially on the Western Front, was found by Inada and Ido (1914) to be due to a motile spirochaetal organism Leptospira *icterohaemorrhagiae*. In certain localities it appears to be a parasite in the kidneys of wild rats, and infection of food and water by the urine of such rats is the most likely mode of transmission. A similar organism has recently been found to be the cause of a disease in young dogs called *The* Yellows.

Yellow **Fever.**—Noguchi after 1918 brought forward excellent evidence that another Leptospira (L. icteroides) is responsible for yellow fever (*q.v.*), and the employment of therapeutic serum, prepared by immunizing horses with this *leptospira*, has very favourably influenced the course of the disease. Also good reports have been received of the use of prophylactic vaccines in lowering the incidence.

Tularaemia.—McCoy (1911) in the course of examining ground squirrels in California for evidence of plague infection discovered another plague-like disease in these rodents which was not due to B. *pestis*. In the following year, he and Chapin isolated the specific organism and it was given the name of B. *tularense* from Tulare co. in California where the epidemic in the ground squirrels was prevalent. During the years preceding the demonstration of the organism, cases of severe lymphangitis in man apparently following insect bites had been observed in the state of Utah. Since the discovery of the parasite several human cases of infection have occurred in some of the American states. The disease is rarely fatal but a very protracted convalescence is the rule. The mode of infection in the field is almost certainly by the bite of the horse-fly (*Chrysops discalis*) which has fed on infected ground squirrels or jack rabbits. In the laboratory, also, workers engaged on research into this disease have been attacked, *e.g.*, at the Washington Hygiene Laboratories and at the Lister Institute, London.

Melioidosis.—This disease was first described in 1913 by Whitmore as a "glanders-like disease" occurring in Rangoon, and indeed the clinical relationship to glanders, both in man and in horses, is very close. Their morbid anatomy also is very similar. It runs a more acute course, however, than glanders, and is usually fatal.

Rat-bite Fever. — This is a prolonged, febrile disease, of which inflammation of the lymphatics and a well-marked rash on the skin, together with wasting, are prominent symptoms. The course of the disease is very irregular and the fever intermittent. A spirochaete has been described and is generally accepted as the causal micro-organism.

Gas Gangrene. — During the World War the occurrence of large numbers of infections of wounds led to a close study of the bacteria responsible for them. The anaerobic bacilli in particular were investigated anew, and much confusion in their classification and nomenclature cleared up. To three species especially, B. *perfringens* (B. welclzii), Vibrion septique (B. oedematis maligni) and B. *oedematiens*, most of the cases of gas gangrene were found to be due. From these three species, moreover, toxins and antitoxins were prepared which were found to be of service clinically.

Methods of Study. — The methods employed in studying the relation of bacteria to disease are in principle comparatively simple, but experience and great care are necessary in applying them and in interpreting results. In any given disease there are three chief steps, viz. (1) the discovery of a bacterium in the affected tissues by means of the microscope; (2) the obtaining of the bacterium in pure culture; and (3) the production of the disease by inoculation with a pure culture. By means of microscopic examination more than one organism may sometimes be observed in the tissues, but one single organism by its constant presence and special relations to the tissue changes can usually be selected as the probable cause of the disease, and attempts towards its cultivation can then be made. Such microscopic examination requires the use of the finest lenses and the application of various staining methods. In these latter the basic aniline dyes in solution are almost exclusively used, on account of their special affinity for the bacterial protoplasm.

Sometimes a simple watery solution of the dye is sufficient, but very often the best result is obtained by increasing the staining power, *e.g.*, by addition of weak alkali, application of heat, etc., and by using some substance which acts as a mordant and tends to fix the stain to the bacteria. Excess of stain is afterwards removed from the tissues by the use of decolorizing agents, such as acids of varying strength and concentration, alcohol. etc. Different bacteria behave very differently to stains; some take

them up rapidly, others slowly, some resist decolorization, others are easily decolorized. Sometimes the stain can be removed from the tissues, leaving the bacteria alone coloured. *(See* CYTOLOGY.)

Dark Ground Illumination. — Much use has been made of this method of studying bacteria, whether in the live or fixed state. Its chief practical applications have been in the demonstration of slender objects such as the *Spirochaeta pallida* in material from syphilitic sores (see VENEREAL DISEASES), the detection of motility and the enumeration of bacteria in emulsions such as vaccines. To obtain the dark ground effect, the microscope requires to be fitted with a special form of condenser, and a powerful source of illumination is necessary. The rays from the source of light after reflection at the substage mirror can enter only the peripheral portion of the condenser and, owing to their obliquity, are then either wholly reflected from the upper surface of the cover-glass or, according to the type of condenser, refracted beyond the range of the objective lens. Should, however, small objects come in the way, such as bacilli possessing a different refractility from that of the fluid, the rays are dispersed by them, and are able to enter the objective. Bacilli then appear as white spots on a dark background.

Cultivation. — In cultivating bacteria outside the body various media to serve as food material must be prepared and sterilized by heat. The general principle in their preparation is to supply the nutriment for bacterial growth in a form as nearly similar as possible to that of the natural habitat of the organisms —in the case of pathogenic bacteria, the natural fluids of the body. The media are used either in a fluid or solid condition, the latter being obtained by coagulation, or the addition of a gelatinizing agent, and are placed in glass tubes or flasks plugged with cotton-wool. To mention examples, blood serum solidified at a suitable temperature is a highly suitable medium, and various media are made with extract of meat as a basis, with the addition of gelatine or agar as solidifying agents and of non-coagulable proteids (commercial "peptone") to make up for proteids lost by coagulation in the preparation. The reaction of the media must in every case be carefully attended to, a neutral or slightly alkaline reaction being, as a rule, most suitable; for delicate work it may be necessary to standardize the reaction by tritration methods. The media from the store-flasks are placed in glass test-tubes or small flasks, protected from contamination by cotton-wool plugs, and are sterilized by heat. For most purposes the solid media are to be preferred, since bacterial growth appears as a discrete mass and accidental contamination can be readily recognized. Cultures are made by transferring by means of a sterile platinum wire a little of the material containing the bacteria to the medium. The tubes, after being thus inoculated, are kept at suitable temperatures, usually either at 37° C., the temperature of the body, or at about 20° C., a warm summer temperature, until growth appears. For maintaining constant temperature, incubators (*q.v.*) with regulating apparatus are used. Subsequent cultures ("subcultures") may be made by inoculating fresh tubes, and in this way growth may be maintained often for an indefinite period. The simplest case is that in which only one variety of bacterium is present, and a "pure culture" may then be obtained at once. When, however, several species are present together, means must be adopted for separating them. For this purpose the most important is the *plate-method* of Koch. In this method the bacteria are distributed in a gelatine or agar medium liquefied by heat, and the medium is then poured out on sterile glass plates or in shallow glass dishes, and allowed to solidify. Each bacterium capable of growth gives rise to a colony visible to the naked eye, and if the colonies are sufficiently apart, an inoculation can be made from any one to a tube of culture-medium, and a pure culture obtained. Of course, in applying the method means must be adopted for suitably diluting the bacterial mixture. Another important method consists in inoculating an animal with some fluid containing the various bacteria. A pathogenic bacterium present may invade the body, and may be obtained in pure culture from the internal organs. This method applies especially to pathogenic bacteria whose growth on culture media is slow, *e.g.*, the tubercle bacillus. (See also below.)

Isolation and Cultivation of Single Bacterial Cells. — For the cultivation of "pure line" strains of micro-organisms it is essential to start from a single microbe. In Barber's method (1904) a single bacillus in an appropriately diluted emulsion is picked up into an extremely fine capillary pipette working on a special holder under microscopic control. In the method adopted by Burri, dilutions of the culture are mixed with india ink and drops of these are laid on gelatine or agar plates. Under the microscope these drops are examined, and if one is found containing a single bacillus it is marked and allowed to grow into colony form, or the single organism may be removed directly to a nutrient medium.

A recent method, elaborated by Barnard, depends on the fact that ultraviolet light destroys bacteria. A single bacillus is marked down, and between it and the entering rays a minute droplet of mercury is placed under microscopic control. The bacillus is thus protected, while the surrounding organisms are killed. It can then be dealt with culturally.

Methods of Culture. — Numerous improvements in cultural methods have been introduced of late years, such as the addition of egg to a nutrient basis of agar, or the use of solid, inspissated mixed white and yolk of egg, especially for the growth of tubercle bacilli. A medium composed of broth and serum, covered with liquid paraffin, and containing a piece of sterile, unheated rabbit's kidney was introduced by Noguchi for the growth of spirochaetes, and has been recommended for other organisms of difficult culture.

Anaërobiosis.—Anaërobic culture methods have been improved by the introduction of various patterns of jars to contain Petri dishes or test-tubes; the object of these is to facilitate the removal of all, or a part, of the oxygen with an air pump, and replace it with hydrogen or other indifferent gas. The removal of the oxygen is also attained by using the catalytic action of spongy platinum (or palladium) to produce slow combination of oxygen with hydrogen. After removing the greater part of the air with a pump and replacing it with hydrogen, the jar is closed and the catalyst contained in a small wire-gauze cage heated by an electric current. The remaining oxygen then combines with hydrogen and this action keeps the platinum hot until the oxygen is used up.

The full description of a particular bacterium implies an account not only of its microscopical characters, but also of its growth characters in various culture media, its biological properties, and the effects produced in animals by inoculation. To demonstrate readily its action on various substances, certain media have been devised. For example, various sugars — lactose, glucose, saccharose, etc.—are added to test the fermentative action of the bacterium on these substances; litmus is added to show changes in reaction, specially standardized media being used for estimating such changes; peptone solution is commonly employed for testing whether or not the bacterium forms indol; sterilized milk is used as a culture medium to determine whether or not it is curdled by the growth. Sometimes a bacterium can be readily recognized from one or two characters, but not infrequently a whole series of tests must be made before the species is determined. As our knowledge has advanced it has become abundantly evident that the so-called pathogenic bacteria are not organisms with special features, but that each is a member of a group of organisms possessing closely allied characters. From the point of view of evolution we may suppose that certain races of a group of bacteria have gradually acquired the power of invading the tissues of the body and producing disease. In the acquisition of pathogenic properties some of their original characters have become changed, but in many instances this has taken place only to a slight degree, and, furthermore, some of these changes are not of a permanent character. In the case of bacteria we can only judge of organisms being of different species by the stability of the characters which distinguish them, and numerous examples might be given where their characters become modified by comparatively slight change in their environment. The cultural as well as the microscopical characters of a pathogenic organism may be closely similar to other non-pathogenic members of the same group, and it thus comes to be a matter of ex-

treme difficulty in certain cases to state what criterion should be used in differentiating varieties. The tests which are applied for this purpose at present are chiefly of two kinds. In the first place, such organisms may be differentiated by the chemical change produced by them in various culture media. Thus a very important, and usually very reliable, method of distinguishing between allied races and species of bacteria is that founded on their fermentative action (production of acid or acid and gas) on various carbohydrates and alcohols. Secondly the various serum reactions to be described below have been called into requisition.

Inoculation. — In testing the effects of bacteria by inoculation the smaller rodents, rabbits, guinea-pigs, and mice, are usually employed. One great drawback in certain cases is that such animals are not susceptible to a given bacterium, or that the disease is different in character from that in the human subject. In some cases, *e.g.*, Malta fever and relapsing fever, monkeys have been used with success, but in others, *e.g.*, leprosy, none of the lower animals has been found to be susceptible. Discretion must therefore be exercised in interpreting negative results in the lower animals. For purposes of inoculation young vigorous cultures must be used. The bacteria are mixed with some indifferent fluid, or a fluid culture is employed. The injections are made by means of a hypodermic syringe into the subcutaneous tissue, a vein, one of the serous sacs, or more rarely into some special part of the body. The animal, after injection, must be kept in favourable surroundings, and any resulting symptoms noted. It may die, or may be killed at any time desired, and then a post-morten examination is made, the conditions of the organs, etc., being observed and noted.

Separation of Toxins. — Though the causal relationship of a bacterium to a disease may be completely established by the methods given, another very important part of bacteriology is concerned with the poisons or toxins formed by bacteria. These toxins may become free in the culture fluid, and the living bacteria may then be got rid of by filtering the fluid. The effects of the filtrate are then tested by the methods employed in pharmacology. In other instances the toxins are retained to a large extent within the bacteria, and in this case the dead bacteria are injected as a suspension in fluid. Methods have been introduced for the purpose of breaking up the bodies of bacteria and setting free the intracellular toxins. For this purpose Koch ground up tubercle bacilli in an agate mortar and treated them with distilled water until practically no deposit remained. Rowland and Macfadyen for the same purpose introduced the method of grinding the bacilli in liquid air. At this temperature the bacterial bodies are extremely brittle, and are thus readily broken up. Toxic substances have also been separated by corresponding methods from the bodies of those who have died of certain diseases, and the action of such substances on animals is in some cases an important point in the pathology of the disease.

Bacteria as Agents of Disease. — The fact that in anthrax, one of the first diseases to be fully studied, numerous bacilli are present in the blood of infected animals, gave origin to the idea that the organisms might produce their effect by using up the oxygen of the blood. Such action is now known to be quite subsidiary. And although effects may sometimes be produced in a mechanical manner by bacteria plugging capillaries of important organs, *e.g.*, brain and kidneys, it is now accepted that all the important results of bacteria in the tissues are due to poisonous bodies or toxins formed by them. Here, just as in the general subject of fermentation, we must inquire whether the bacteria form the substances in question directly or by means of non-living ferments or enzymes. With regard to toxin formation the following general statements may be made: In certain instances, *e.g.*, in the case of the tetanus and diphtheria bacilli, the production of soluble toxins can be readily demonstrated by filtering a culture in bouillon germ-free by means of a porcelain filter, and then injecting some of the filtrate into an animal. In this way the characteristic features of the disease can be reproduced. Such toxins being set free in the culture medium are often known as *extracellular*. In many cases, however, the filtrate, when injected, produces comparatively little effect, whilst toxic action is observed when the bacteria in a dead condition are used; this is the case with the organisms of tubercle, cholera, typhoid and many others. The toxins are here manifestly contained within the bodies of the bacteria. *i.e.*, are intracellular, though they may become free on disintegration of the bacteria. The distinction between the two varieties, though convenient, must not be pushed too far, as we know little regarding their mode of formation. Although the formation of toxins with characteristic action can be shown by the above methods, yet in some cases little or no toxic action can be demonstrated. This, for example, is the case with the anthrax bacillus; although the effect of this organism in the living body indicates the production of toxins which diffuse for a distance around the bacteria. This and similar facts have suggested that some toxins are only produced in the living body. A considerable amount of work has been done in connection with this subject, and many observers have found that fluids taken from the living body in which the organisms have been growing, contain toxic substances, to which the name of aggressins has been applied. Fluid containing these aggressins greatly increases the toxic effect of the corresponding bacteria, and may produce death at an earlier stage than ever occurs with the bacteria alone. They also appear to have in certain cases a paralyzing action on phagocytes. Not only are the general symptoms of poisoning in bacterial disease due to toxic substances, but also the tissue changes, many of them of inflammatory nature, in the neighbourhood of the bacteria. Thus diphtheria toxin produces inflammatory oedema which may be followed by necrosis; dead tubercle bacilli give rise to a tubercle-like nodule, etc. Furthermore, a bacillus may give rise to more than one toxic body, either as stages in one process of change or as distinct products.

Nature of Toxins. — Regarding the chemical nature of toxins less is known than regarding their physiological action. In spite of an enormous amount of work on the subject, no important bacterial toxin has as yet been obtained in a pure condition, and, though many of them are probably of proteid nature, even this cannot be asserted with absolute certainty. Brieger, in his earlier work, found that alkaloids were formed by bacteria in a variety of conditions, and that some of them were poisonous. These alkaloids he called *ptomaines*. The methods used in the investigations were, however, open to objection, and it is now recognized that although organic bases may sometimes be formed, and may be toxic, the important toxins are not of that nature. A later research by Brieger along with Fraenkel pointed to the extracellular toxins of diphtheria, tetanus and other diseases being of proteid nature, and various other observers have arrived at a like conclusion. The general result of such research has been to show that the toxic bodies are, like proteids, precipitable by alcohol and various salts; they are soluble in water, are somewhat easily dialysable, and are relatively unstable both to light and heat. Attempts to get a pure toxin by repeated precipitation and solution have resulted in the production of a whitish amorphous powder with highly toxic properties. Such a powder gives a proteid reaction, and is no doubt largely composed of albumoses, hence the name *toxalbumoses* has been applied. The question has, however, been raised whether the toxin is really itself a proteid, or whether it is not merely carried down with the precipitate.

These facts show the great difficulty of the problem, which is probably insoluble by present methods of analysis; the only test, in fact, for the existence of a toxin is its physiological effect. It may also be mentioned that many toxins have now been obtained by growing the particular organism in a proteid-free medium, a fact which shows that if the toxin is a proteid it may be formed synthetically by the bacterium as well as by modification of proteid already present. With regard to the nature of intracellular toxins, there is even greater difficulty in the investigation and still less is known. Many of them probably also of proteid nature, are much more resistant to heat; thus the intracellular toxins of the tubercle bacillus retain certain of their effects even after exposure to 100° C. Like the extracellular toxins they may be of

remarkable potency; for example, fever is produced in the human subject by the injection into the blood of an extremely minute quantity of dead typhoid bacilli.

Enzymes.—We cannot as yet speak definitely with regard to the part played by enzymes in these toxic processes. Certain toxins resemble enzyrnes in their conditions of precipitation and relative instability, and the fact that in most cases a considerable period intervenes between the time of injection and the occurrence of symptoms has been adduced in support of the view that enzymes are present. In diphtheria Sidney Martin obtained toxic albumoses in the spleen, which he considered were due to the digestive action of an enzyme formed by the bacillus in the membrane and absorbed into the circulation. According to this view, then, a part at least of the directly toxic substance is produced in the living body by enzymes present in the so-called toxin obtained from the bacterial culture. Recent researches go to show that enzymes play a greater part in fermentation by living ferments than was formerly supposed, and by analogy it is likely that they are also concerned in the processes of disease. The trend of modern work on this subject is to show that specific enzymes are probably necessary for the first stage in the attack on substances of different chemical or stereochemical constitution, but that the immediate products of this attack are frequently of the same character. These then become changed under the influence of a system of enzymes which is common to a considerable number of different organisms, yielding final products of a similar nature, but in differing proportions.

Thus, B. *coli* acts both on mannitol and glucose, probably by the aid of two distinct enzymes, but yields the same final products from both substances, in different proportions, corresponding to the difference in composition of the two compounds. On the other hand B. *lactis aerogenes*, which attacks the same two compounds and produces from them all the products yielded by B. *coli*, in addition converts a part of one of the intermediate compounds (probably acetaldehyde) into butylene glycol, which is not produced by B. *coli* and the formation of which is presumably due to the influence of a specific enzyme.

Bacterial Infection.— A bacterial infection when analysed is seen to be of the nature of an intoxication. There is, however, another all-important factor concerned, viz., the multiplication of the living organisms in the tissues; this is essential to, and regulates, the supply of toxins. It is important that these two essential factors should be kept clearly in view, since the means of defence against any disease may depend upon the power either of neutralizing toxins or of killing the organisms producing them. It is to be noted that there is no fixed relation between toxin production and bacterial multiplication in the body, some of the organisms most active as toxin producers having comparatively little power of invading the tissues.

The Production of **Disease.**—We shall now consider how bacteria may behave when they have gained entrance to the body, what effects may be produced, and what circumstances may modify the disease in any particular case. The extreme instance of bacterial invasion is found in some of the septicaemias in the lower animals, *e.g.*, anthrax septicaemia in guinea-pigs, pneumococcus septicaemia in rabbits. In such diseases the bacteria, when introduced into the subcutaneous tissue, rapidly gain entrance to the blood stream and multiply freely in it, and by means of their toxins cause symptoms of general poisoning. A widespread toxic action is indicated by the lesions found—cloudy swelling, which may be followed by fatty degeneration, in internal organs, capillary haemorrhages, etc. In septicaemia in the human subject, often due to streptococci, the process is similar, but the organisms are found especially in the capillaries of the internal organs and may not be detectable in the peripheral circulation during life. In another class of disease, the organisms first produce some well-marked local lesion, from which secondary extension takes place by the lymph or blood stream to other parts of the body, where corresponding lesions are formed. In still another class of diseases the bacteria are restricted to some particular part of the body, and the symptoms are due to toxins which are absorbed from it. Thus in cholera the bacteria are practically confined to the intestine, in diphtheria to the region of the false membrane, in tetanus to some wound.

Tissue Changes.— The effects produced by bacteria may be considered under the following heads: (1) tissue changes produced in the vicinity of the bacteria, either at the primary or secondary foci; (2) tissue changes produced at a distance by absorption of their toxins; (3) symptoms. The changes in the vicinity of bacteria are to be regarded partly as the *direct result* of the action of toxins on living cells, and partly as indicating a *reaction* on the part of the tissues. (Many such changes are usually grouped together under the heading of "inflammation" of varying degree—acute, subacute and chronic.) Degeneration and death of cells, haemorrhages, serous and fibrinous exudations, leucocyte emigration, proliferation of connective tissue and other cells, may be mentioned as some of the fundamental changes. Acute inflammation of various types, suppuration, granulation-tissue formation, etc., represent some of the complex resulting processes. The changes produced at a distance by distribution of toxins may be very manifold—cloudy swelling and fatty degeneration, serous effusions, capillary haemorrhages, various degenerations of muscle, hyaline degeneration of small blood-vessels, and, in certain chronic diseases, waxy degeneration, all of which may be widespread, are examples of the effects of toxins, rapid or slow in action.

Symptoms.— The lesions mentioned are in many instances necessarily accompanied by functional disturbances or clinical symptoms, varying according to site, and to the nature and degree of the affection. In addition, however, there occur in bacterial diseases symptoms to which the correlated structural changes have not yet been demonstrated. Amongst these the most important is fever with increased protein metabolism, attended with disturbances of the circulatory and respiratory systems. Nervous symptoms, somnolence, coma, spasms, convulsions and paralysis are of common occurrence. All such phenomena, however, are likewise due to the disturbance of the molecular constitution of living cells. Alterations in metabolism are found to be associated with some of these, but with others no corresponding physical change can be demonstrated. The action of toxins on various glands, producing diminished or increased functional activity, has a close analogy to that of certain drugs. In short, if we place aside the outstanding exception of tumour growth, we may say that practically all the important phenomena met with in disease may be experimentally produced by the injection of bacteria or of their toxins.

Susceptibility.— The result of the entrance of a virulent bacterium into the tissues of an animal is not a disease with hard and fast characters, but varies greatly with circumstances. With regard to the subject of infection the chief factor is susceptibility; with regard to the bacterium virulence is all-important. Susceptibility, as is well recognized, varies much under natural conditions in diiferent species, in different races of the same species, and amongst individuals of the same race. It also varies with the period of life, young subjects being more susceptible to certain diseases, *e.g.*, diphtheria, than adults. Further, there is the very important factor of acquired susceptibility. It has been experimentally shown that conditions such as fatigue, starvation, exposure to cold, etc., lower the general resisting powers and increase the susceptibility to bacterial infection. So also the local powers of resistance may be lowered by injury or depressed vitality. In this way conditions formerly believed to be the causes of disease are now recognized as playing their part in predisposing to the action of the true causal agent, viz. the bacterium. In health the blood and internal tissues are bacterium-free; after death they offer a most suitable pabulum for various bacteria; but between these two extremes lie states of varying liability to infection. It is also probable that in a state of health organisms do gain entrance to the blood from time to time and are rapidly killed off. The circumstances which alter the virulence of bacteria will be referred to again in connection with immunity, but it may be stated here that, as a general rule, the virulence of an organism towards an animal is increased by sojourn in the tissues of that animal. The increase of virulence becomes especially marked

when the organism is inoculated from animal to animal in series, the method of passage. This is chiefly to be regarded as an adaptation to surroundings, though the fact that the less virulent members of the bacterial species will be liable to be killed off also plays a part. Conversely, the virulence tends to diminish on cultivation on artificial media outside the body.

Antibodies. — During the production of active immunity (*see* IMMUNITY) certain substances appear in the blood serum of the animal treated, to which the name of antibodies is given, and these have been the subject of extensive study. It is by means of them that immunity (passive) can be transferred to a fresh animal. The development of antibodies is, however, not peculiar to bacteria, but occurs also when alien cells of various kinds, proteins, ferments, etc., are injected. In fact, organic molecules can be divided into two classes according as they give rise to them or fail to do so. Amongst the latter, the vegetable poisons of known constitution, alkaloids, glucosides, etc., are to be placed. The molecules which lead to the production of antibodies. are usually known as antigens, and each antigen has a specific combining affinity for its corresponding antibody, fitting it as a lock does a key. The antigens, as already indicated, may occur in bacteria, cells, etc., or they may occur free in a fluid. Antibodies may be arranged into three main groups. In the first group, the antibody simply combines with the antigen, without, so far as we know, producing any change in it. The antitoxins are examples of this variety. In the second group, the antibody, in addition to combining with the antigen, produces some recognizable physical change in it; the precipitins and agglutinins may be mentioned as examples. In the third group, the antibody, after it has combined with the antigen, leads to the union of a third body called complement (alexine or cytase of French writers), which is present in normal serum. As a result of the union of the three substances, a dissolving or digestive action is often to be observed. This is the mode of action in the case of a haemolytic or bacteriolytic serum. So far as bacterial immunity is concerned, the anti-serum exerts its action either on the toxin or on the bacterium itself; that is, its action is either antitoxic or anti-bacterial.

Antitoxic Serum. — The antitoxic serum when injected before the toxin confers immunity (passive) against it; when injected after the toxin it has within certain limits a curative action, though in this case its dose requires to be large. The antitoxic property is developed in a susceptible animal by successive and gradually increasing doses of the toxin. In the earlier experiments on smaller animals the potency of the toxin was modified for the first injections, but in preparing antitoxin for therapeutical purposes the toxin is used in its unaltered condition, the horse being the animal usually employed. The injections are made subcutaneously and afterwards intravenously; and, while the dose must be gradually increased, care must be taken that this is not done too quickly, otherwise the antitoxic power of the serum may fall and the health of the animal suffer. The serum of the animal is tested from time to time against a known amount of toxin, *i.e.,* is standardized. The unit of antitoxin is the amount requisite to antagonize 100 times the minimum lethal dose of a particular toxin to a guinea-pig of 250 grm. weight, the indication that the toxin has been antagonized being that a fatal result does not follow within five days after the injection. In the case of diphtheria the antitoxic power of the serum may reach 800 units per cubic centimetre, or even more.

Action of Antitoxin. — Two important questions must next be considered, viz., how does the antitoxin act? and how is it formed within the body? It is now accepted that antitoxin acts on toxin directly, *i.e.,* chemically or physically; the chief grounds for this view are as follows: (a) The action of antitoxin on toxin, as tested by neutralization effects, takes place more quickly in concentrated than in weak solutions, and more quickly at a warm (within certain limits) than at a cold temperature. (b) Antitoxin acts more powerfully when injected along with the toxin than when injected at the same time in another part of the body; if its action were on the tissue-cells one would expect that the site of injection would be immaterial. (c) The law of multiples is obeyed, the amount necessary to neutralize five times the lethal dose being determined, 20 times that amount will neutralize a hundred times the lethal dose. In the case of physiological antagonism of drugs this relationship does not hold. (d) In certain instances the toxin can be made to pass through a gelatine membrane, whereas the antitoxin cannot, its molecules being of larger size. If, however, toxin be mixed with antitoxin for some time, it can no longer be passed through, presumably because it has become combined with the antitoxin. (e) When a toxin has some action which can be demonstrated in a test-tube experiment, for example, a dissolving action on red corpuscles, this action may be annulled by previously adding the antitoxin to toxin; in such a case the intervention of the living tissues is excluded.

Since antitoxin has a direct action on toxin, theoretically this may take place in one of two ways. It may produce a disintegration of the toxin molecule, or it may combine with it to produce a body whose combining affinities are satisfied. The latter view, first advocated by Ehrlich, may now be regarded as established.

Formation of Antitoxin. — The origin of antitoxin is of course merely a part of the general question regarding the production of anti-substances in general, as these all combine in the same way with their homologous substances and have the same character of specificity. As, however, most of the work has been done with regard to antitoxin production we may consider here the theoretical aspect of the subject. There are three chief possibilities: (a) that the antitoxin is a modification of the toxin; (b) that it is a substance normally present, but produced in excess under stimulation of the toxin; (c) that it is an entirely new product. The first of these, which would imply a process of a very remarkable nature, is disproved by what is observed after bleeding an animal whose blood contains antitoxin. In such a case it has been shown that, without the introduction of fresh toxin, new antitoxin appears, and therefore must be produced by the living tissues. The second theory is the more probable a *priori,* and if established removes the necessity for the third. It was strongly supported by Ehrlich, who, in his so-called "side-chain" (Seitenkette) theory, explained antitoxin production as an instance of regeneration.

It may be added that in the case of all anti-substances, which are produced by a corresponding reaction, we have examples of the existence of traces of them in the blood serum under normal conditions. We are, accordingly, justified in definitely concluding that their appearance in large amount in the blood, as the result of active immunization, represents an increased production of molecules which are already present in the body.

Anti-bacterial Serum. — In preparing anti-bacterial sera the lines of procedure correspond to those followed in the case of antitoxins, but the bacteria themselves in the living or dead condition or their maceration products are always used in injections. Sometimes dead bacteria, living virulent bacteria, and living supervirulent bacteria, are used in succession, the object being to arrive ultimately at a high dosage, though the details vary in different instances. The serum of an animal thus actively immunized has powerful protective properties towards another animal, the amount necessary for protection being sometimes almost inconceivably small. As a rule it has no action on the corresponding toxin, *i.e.,* is not antitoxic. In addition to the protective action, such a serum may possess activities which can be demonstrated outside the body. Of these the most important are (a) bacteriolytic or lysogenic action, (b) agglutinative action, and (c) opsonic action.

(a) Lysogenic Action. — The first of these, lysogenic or bacteriolytic action, consists in the production of a change in the corresponding bacterium whereby it becomes granular, swells up and ultimately may undergo dissolution. It has been established that in lysogenesis there are two substances concerned, one specially developed or developed in excess, and the other present in normal serum. The former (*Immunkörper* of Ehrlich, substance *sensibilisatrice* of Bordet) is the more stable, resisting a temperature of 60° C., and though giving the specific character to the reaction cannot act alone. The latter (complement) is ferment-like and much more labile than the former, being readily

destroyed at 60° C. Furthermore, lysogenic action is not confined to the case of bacteria but obtains also with other organized structures, *e.g.,* red corpuscles (Bordet, Ehrlich and Morgenroth), leucocytes and spermatozoa (Metchnikoff). That is to say, if an animal be treated with injections of these bodies, its serum acquires the power of producing more disintegrative effect in them.

The development of the immune body with specific combining affinity thus presents an analogy to antitoxin production, the difference being that in lysogenesis another substance is necessary to complete the process. It can be shown that in many cases when bacteria are injected the serum of the treated animal has no bacteriolytic effect, and still an immune body is present, which leads to the fixation of complement; in this case bacteriolysis does not occur, because the organism is not susceptible to the action of the complement. In all cases the important action is the binding of complement to the bacterium by means of the corresponding immune body; whether or not death of the bacterium occurs, will depend upon its susceptibility to the action of the particular complement, the latter acting like a toxin or digestive ferment. In the process of immunization complement does not increase in amount; accordingly the immune serum comes to contain immune body much in excess of the necessary amount of complement.

An important point with regard to the therapeutic application of an anti-bacterial serum is that when the serum is kept in vitro the complement rapidly disappears, and accordingly the complement necessary for the production of the bactericidal action must be supplied by the blood of the patient treated. This latter complement may not suit the immune body, that is, may not be fixed to the bacterium by means of it, or if the latter event does occur, may fail to bring about the death of the bacteria. These circumstances serve, in part at least, to explain the fact that the success attending the use of anti-bacterial sera has been much inferior to that in the case of antitoxic sera.

Bacteriolysis may result from other processes than that just described. Thus it may be produced by the action of "lysozyme" (see ANTISEPTICS AND ASEPSIS) or by that of "bacteriophage." This represents a newly observed phenomenon, first described by F. W. Twort (1915) and F. d'Hérelle (1918). The former observed a lytic change accompanied by translucency of some colonies in certain cultures of *Staphylococcus* and found that this lysis could be communicated to other normal colonies by an extract of the affected culture which had been passed through a Berkefeld filter, and was itself free from bacteria. D'Hérelle, starting with a Berkefeld filtrate from the faeces of dysentery convalescents, was able by adding a drop of this to a culture of B. *dysenteriae* (Shiga) to produce lysis of the bacteria. A drop of the resulting solution after filtration could be used to repeat the phenomenon in a fresh culture, and in this way a renewal of the active principle could be brought about indefinitely. This principle d'Hérelle called the bacteriophage (*Bacteriophagum intestinale*), and he maintains that it is an ultramicroscopic, living organism, which is parasitic in the bacteria and reproduces itself. The solution containing the principle is often active in a dilution of 1 in 100 million, and five c.c. of broth containing bacteriophage in this dilution, if inoculated with the sensitive culture, will reproduce in 24 hours in the incubator a clear solution containing the bacteriophage in the original strength, which again is still active when similarly diluted.

If a tube of suitable diluted phage, inoculated with B. *dysenteriae*, is incubated for three hours, and a loop of it then inoculated on agar, confluent growth of the bacteria may be obtained with a number of small, round, clear areas where no growth of bacteria has occurred. These spaces d'Hérelle called *tâches* vierges and considered them to represent colonies of the bacteriophage which had devoured the bacteria. Other bacteria are attacked besides B. *dysenteriae, e.g.,* B. *typhosus,* B. *paratyphosus* and B. coli. Most strains of bacteriophage are specific for certain kinds of bacteria, or even for certain strains of these species. Thus some varieties of bacteriophage will act on "rough" variants of B. *dysenteriae* and on some strains of *B.* coli, but not on the corresponding normal or "smooth" cultures.

After the action of the bacteriophage on a broth culture and the resulting clearing of the original turbidity, it is usual for some bacteria to remain alive which, when cultured on agar, are found to be considerably altered in the appearance of their colonies. Their agglutinability by salts is also changed. These colonies are often resistant to the bacteriophage. There is no doubt that bacteriophage may be present in small quantities in cultures, but remain unnoticed, and it has been suggested that many variations, occurring apparently spontaneously, are in reality brought about by the presence of unrecognized bacteriophage. D'Hérelle has advocated the use of bacteriophage in the prevention and treatment of infective disease, but its value for this purpose is not widely recognized.

The question of the nature of the bacteriophage has stimulated a very large amount of research on account of its theoretical importance. If the more generally accepted view ascribing the properties of the bacteriophage to a non-living enzyme or catalyst were proved, the fact that it appears to infect and multiply in a culture of bacteria might by analogy throw light on some infective diseases associated with ultramicroscopic viruses affecting the higher forms of life. The characteristics which make it less probable that the bacteriophage is a living entity are its ready filtrability through a porcelain filter, its resistance to heat (60° to 65° C.), its resistance to acetone and chloroform and its inability to multiply in the absence of a living bacterial culture.

(b) Agglutination. — Another property which may be possessed by anti-bacterial serum is that of agglutination. By this is meant the aggregation into clumps of the bacteria uniformly distributed in an indifferent fluid; if the bacterium is motile its movement is arrested during the process. The process is of course observed by means of the microscope, but the clumps soon settle in the fluid and ultimately form a sediment, leaving the upper part clear. This change, visible to the naked eye, is called *sedimentation.* Charrin and Roger first showed in the case of B. *pyocyaneus* that when a small quantity of the homologous serum (*i.e.,* the serum of an animal immunized against the bacterium) was added to a fluid culture of this bacillus, growth formed a sediment instead of a uniform turbidity. Gruber and Durham showed that sedimentation occurred when a small quantity of the homologous serum was added to an emulsion of the bacterium in a small test-tube, and found that this obtained in all cases where Pfeiffer's lysogenic action could be demonstrated. Shortly afterwards Widal and also Griinbaum showed that the serum of patients suffering from typhoid fever, even at an early stage of the disease, agglutinates; the typhoid bacillus — a fact which laid the foundation of serum diagnosis. A similar phenomenon has been demonstrated in the case of Malta fever, cholera, plague, infection with B. coli, "meat-poisoning" due to Gärtner's bacillus, and various other infections. As regards the mode of action of agglutinins, Gruber and Durham considered that it consists in a change in the envelopes of the bacteria, by which they swell up and become adhesive. The view has various facts in its support, but Kruse and Nicolle have found that if a bacterial culture be filtered germ-free, an agglutinating serum still produces some change in it, so that particles suspended in it become gathered into clumps. Duclaux, for this reason, considers that agglutinins are coagulative ferments.

The phenomenon of agglutination depends essentially on the union of molecules in the bacteria — the agglutinogens — with the corresponding agglutinins, and is often highly specific. Nevertheless group agglutination occurs and recent work has been devoted largely to dividing apparently identical groups into sub-groups by absorption experiments with specially prepared agglutinating sera. In this way the salmonella, the meningococcal and the dysentery groups have been subdivided into distinct strains. It should also be stated that agglutinins are used up in the process of agglutination, apparently combining with some element of the bacterial structure. In view of all the facts it must be admitted that the agglutinins and immune bodies are the result of corresponding reactive processes, and are probably related to one another. The development of all antagonistic substances which confer the special character on antimicrobic sera, as well as anti-

toxins, may be expressed as the formation of bodies with specific combining affinity for the organic substance introduced into the system—toxin, bacterium, red corpuscle, etc., as the case may be.

The facts which have emerged during the recent extensive study of agglutination have given rise to the hypothesis that each bacterium contains a mosaic of antigens, some of which are highly specific and peculiar to each subspecies, some are common to the whole species or group and others appear to be entirely unrelated as regards phylogeny and occur in very diverse bacteria (*e.g.*, Forssmann's nonspecific antigens). It is probable that the identification and classification of bacteria by their antigens have their limits, though the data are often extremely valuable.

(c) Opsonic Action.—By opsonic action is meant the effect which a serum has on bacteria in making them more susceptible to phagocytosis by the white corpuscles of the blood (*q.v.*). Such an effect may be demonstrated outside the body by making a suitable mixture of (a) a suspension of the particular bacterium, (b) the serum to be tested, and (c) leucocytes of a normal animal or person. The mixture is placed in a thin capillary tube and incubated at 37° C. for half an hour; a film preparation is then made from it on a glass slide, stained by a suitable method and then examined microscopically. The number of bacteria contained within a number of, say 50, leucocytes can be counted and the average taken. In estimating the opsonic power of the serum in cases of disease a control with normal serum is made at the same time and under precisely the same conditions. The average number of bacteria contained within leucocytes in the case tested, divided by the number given by the normal serum, is called the phagocytic index. Wright and Douglas showed that under these conditions phagocytosis might occur when a small quantity of normal serum was present, whereas it was absent when normal salt solution was substituted for the serum; the serum thus contained substances which made the organisms susceptible to the action of the phagocytosis. They further showed that this substance acted by combining with the organisms and apparently producing some alteration in them; on the other hand it had no direct action on the leucocytes. This opsonin of normal serum is very labile, being rapidly destroyed at 55° C. Various observers had previously found that the serum of an animal immunized against a particular bacterium had a special action in bringing about phagocytosis of that organism, and it had been found that this property was retained when the serum was heated at 55° C. It is now generally admitted that at least two distinct classes of substances are concerned in opsonic action, that thermostable immune opsonins are developed as a result of active immunization and these possess the specific properties of antisubstances in general, that is, act only on the corresponding bacterium. On the contrary the labile opsonins of normal serum have a comparatively general action on different organisms. It is quite evident that the specific immune-opsonins may play a very important part in the phenomena of immunity, as by their means the organisms are taken up more actively by the phagocytic cells. The opsonic action of the serum has been employed by Sir **A.** Wright and his co-workers to control the treatment of bacterial infections by vaccines.

Complement Fixation.—This is the name given to a procedure by which the presence of antisubstances to bacteria can be recognized in the blood serum of animals. In principle it rests on the discovery by Bordet and Gengou that when a bacteriolytic serum containing bacteriolysin and a suspension of the corresponding bacteria are allowed to interact in the presence of fresh serum, a constituent of the latter (alexin or complement) joins the combination of bacteria and antisubstance, and remains fixed to it, this union resulting in the death and solution of the bacteria. To render this fixation of complement obvious even where lysis of the bacteria is not visible, another system which also needs complement for its consummation is added to the mixture, and the occurrence or not of the first reaction is determined by the completion or the non-completion of the second reaction.

The most commonly used antigen-antibody system for the second system is a mixture of a suspension in salt solution of the red-blood corpuscles of the sheep and of a serum which is known to be lytic for them but does not contain active complement. This latter desideratum can be assured by previously heating the haemolytic serum to 56° C. for 30 minutes. If there is free complement at liberty to join the red corpuscles and antiserum, the red cells break up, and the haemoglobin is set free as a clear solution in the surrounding medium. The colour and transparency of the solution is a readily observed indicator of the presence of free complement and, to some extent, of its amount. This by inference allows an estimate to be made of the reagents present in the first system. If no appropriate bacterial substance or no antisubstance is present, then no complement will be fixed in the first reaction, and consequently it will still be available for haemolysis.

National Collection of Type Cultures.—This collection of living cultures from all spheres of bacteriological activity was founded in 1920 at the Lister Institute, London, under the auspices of the Medical Research Council. It has been of great service to microbiologists in all parts of the world, over 2,000 strains being maintained in 1925. The second edition of the catalogue appeared in 1925 and can be procured from H.M. Stationery Office, London.

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BACTERIOLOGY. The common idea of bacteria in the minds of most people is that of a hidden and sinister scourge lying in wait for mankind. This popular conception is born of the fact that attention was first focused upon bacteria through the discovery, some 70 years ago, of the relationship of bacteria to disease in man, and that in its infancy the study of bacteriology was a branch of medical science. Relatively few people assign to bacteria the important position in the world of living things that they rightly occupy, for it is only a few of the bacteria known today that have developed in such a way that they can live in the human body, and for every one of this kind there are scores of others which are perfectly harmless and, far from being regarded as the enemies of mankind, must be numbered among his best friends. It is, in fact, no exaggeration to say that upon the activities of bacteria the very existence of man depends; nay more, that without bacteria there could be no other living thing in the world; for every animal and plant owes its existence to the fertility of the soil and this in turn depends upon the activity of the micro-organisms which inhabit the soil in almost inconceivable numbers. It is one of the main objects of this article to show how true is this statement; there will be found in it only passing reference to the organisms which produce disease in man and animals; for information on these see PATHOLOGY and IMMUNITY.

The Beginnings of Bacteriology.—It is quite clear that in such an article as this any attempt at a comprehensive survey of the history of the subject would be out of place. It is well, however, to select a few dates so that the reader, if he is not already aware of it, may realize that, in comparison with other sciences, bacteriology is young. Before going farther it would be well to have a definite idea of the nature of bacteria; they are the smallest living creatures known; it is difficult to realize how small they are; some idea, however, may be gained when it is stated that one of the full-stops in this print would cover about a quarter of a million average-sized bacteria. Because of their minute size they are often termed micro-organisms. Indeed, some bacteria are so tiny that the highest magnification it is possible to reach with the microscopes of to-day is insufficient to reveal them to the eye. They are only known by the results they produce and they are termed ultra-microscopic organisms or filter-passers.

Bacteria are all unicellular and consist of masses of protoplasm (*see* CYTOLOGY), which at one time were believed to be naked masses as are some of the Protozoa. They were on this account first placed in the animal kingdom; but by colouring the organisms with aniline dyes it can be shown that most of the bacteria are

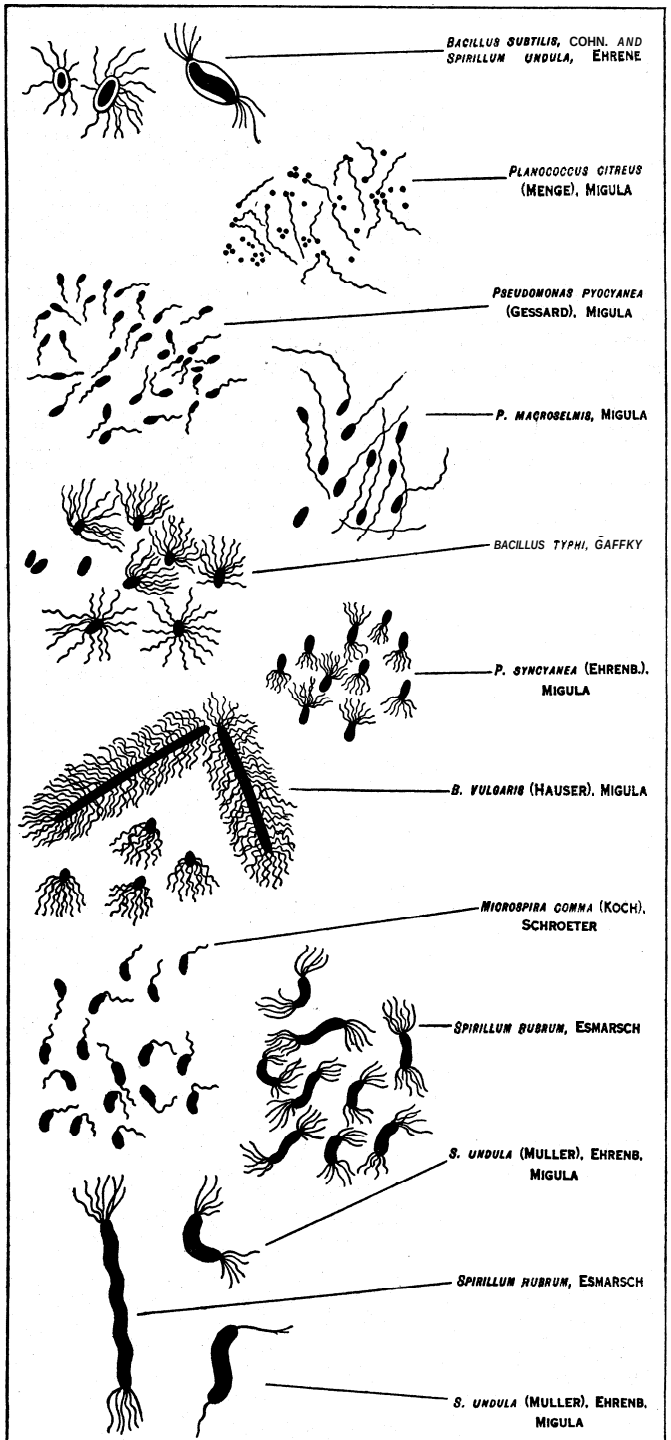


FIG. 1.— VARIOUS TYPES OF BACTERIA CAPABLE OF FREE MOVEMENT

surrounded by a cell-wall and are more correctly to be regarded as plants. They differ from the higher plants in being devoid of green colouring matter, in which respect they appear to be closely related to the Fungi. As to the contents of the protoplasm very little is known on account of the minute size of the cell. It is certain, however, that in the make-up of their protoplasm much variability exists as between one kind and another. This is indicated by their capacity to produce markedly different chemical changes which go far to distinguish one species from another. The denser part of the protoplasm, the nucleus of the cell, believed to play such an important rôle in controlling the heredity of higher plants and animals, is not known definitely to exist in the bacterial cell. The generally held view is that in the bacteria it is represented by a rudimentary form in which particles of nuclear matter, nucleoproteins, are distributed uniformly throughout the protoplasm in the form of granules or so-called chromidia. Recently, however, by the aid of microphotograph~and using the ultra-violet end of the spectrum, J. Barnard has obtained pictures of bacteria showing much more complicated structures than can be seen either by white light or in a stained preparation, and showing also granules which suggest strongly the presence of definite nuclear bodies. Nuclei have been observed in stained specimens of *Bacillus gammari,* B. *gigas* and *B. Bütschlii.* These organisms are so comparatively large as to make it at least a little doubtful whether they are correctly included among the bacteria.

Bacteria multiply as do other organisms, but they differ from most others in the absence of sexual reproduction; at any rate none has as yet been observed. It is well known that the fusion of sex nuclei tends to maintain constancy of a species. Absence of this feature may possibly account for the ease with which bacterial species tend to break up into races or strains. The characteristics of a species remain fixed only under rather narrowly prescribed conditions of cultivation. Departures from these conditions often produce profound changes in the shape, size and chemical behaviour of an organism—so much so that adaptation to environment may give rise to a strain of an organism which bears but little resemblance to the original form from which it developed. All of which tends to show that the nuclei, if present, do not function quite as do the sex nuclei of higher plants.

The shape of bacteria is simple, being modelled on three main types, the spherical or *coccus* form, the rod or *bacillus* type and the spirally twisted *spirillum;* many bacteria are provided also with thin whip-like appendages, projections of the protoplasm called flagella, which by lashing in the surrounding fluid propel the organisms with considerable rapidity. Some of the shapes assumed by the cells are shown in fig. 1.

The general advances which have been made of late years in the study of bacteria are clearly brought to mind when we reflect that in the middle of the 19th century these organisms were only known to a few experts and in a few forms as curiosities of the microscope, chiefly interesting for their minuteness and motility. The beginnings of bacteriology ran parallel with the development of the microscope. The first compound microscope was introduced by H. Jansen in 1590. This instrument gave only small magnification and it is doubtful whether **A.** Kircher, who wrote in 1659 of "minute living worms in putrid meat, milk, vinegar, etc.," had seen anything smaller than Protozoa or possibly the larvae of insects. The first to see micro-organisms was probably the Dutch naturalist **A.** van Leeuwenhoek who in 1683 sent a paper to the Royal Society in London in which he described some "Animalculae," as they were then called, in water, saliva and dental tartar. These had been seen with a simple lens magnifying some 100-150 diameters. The organisms (fig. 2) seem to correspond with some of the very large forms of bacteria such as *Bacillus buccalis maximus* and *Spirillum sputigenum.* In 1762 **M.** A. Plenciz propounded a theory of infectious disease, namely, that a special organism is associated with each disease and that the organisms are capable of reproduction outside the body and can be carried from place to place by the air. In this enlightened view, Plenciz was well in advance of his time, for little was known of these minute creatures before 1860. Great assistance came with the introduction of the oil-immersion lens by Dollond in 1844 but, though by the use of this instrument the magnification of 1,000 diameters became possible, the definition at this magnification was very imperfect till the light was focused on the object by means of the

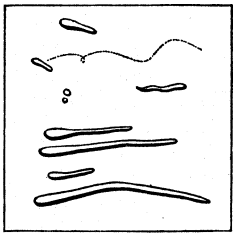
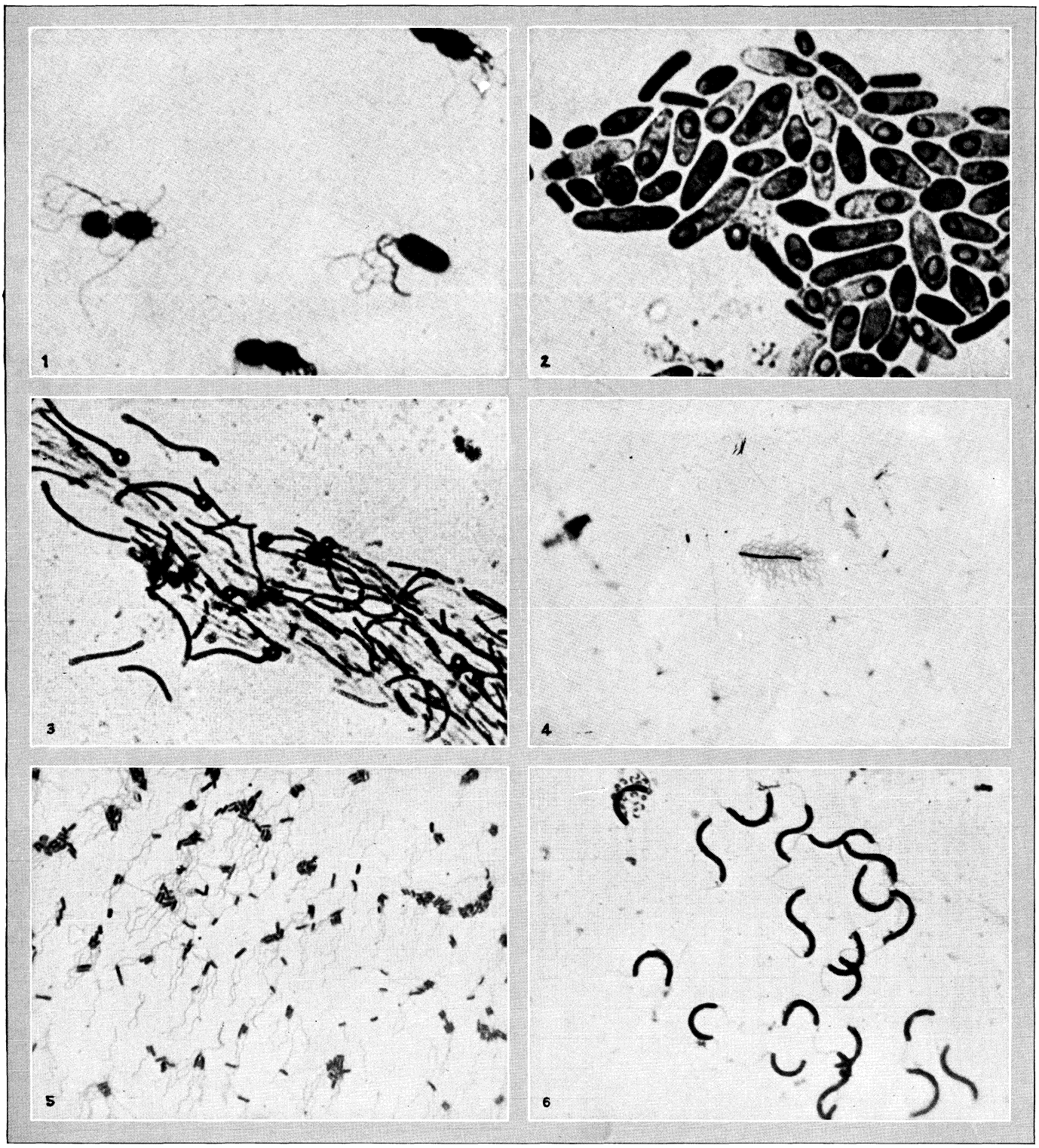


FIG. 2.—FIRST PICTORIAL REPRESENTATION OF BACTERIA, 1683

FROM JORDAN, "GENERAL BACTERIOLOGY" (W. B. SAUNDERS)

BACTERIOLOGY

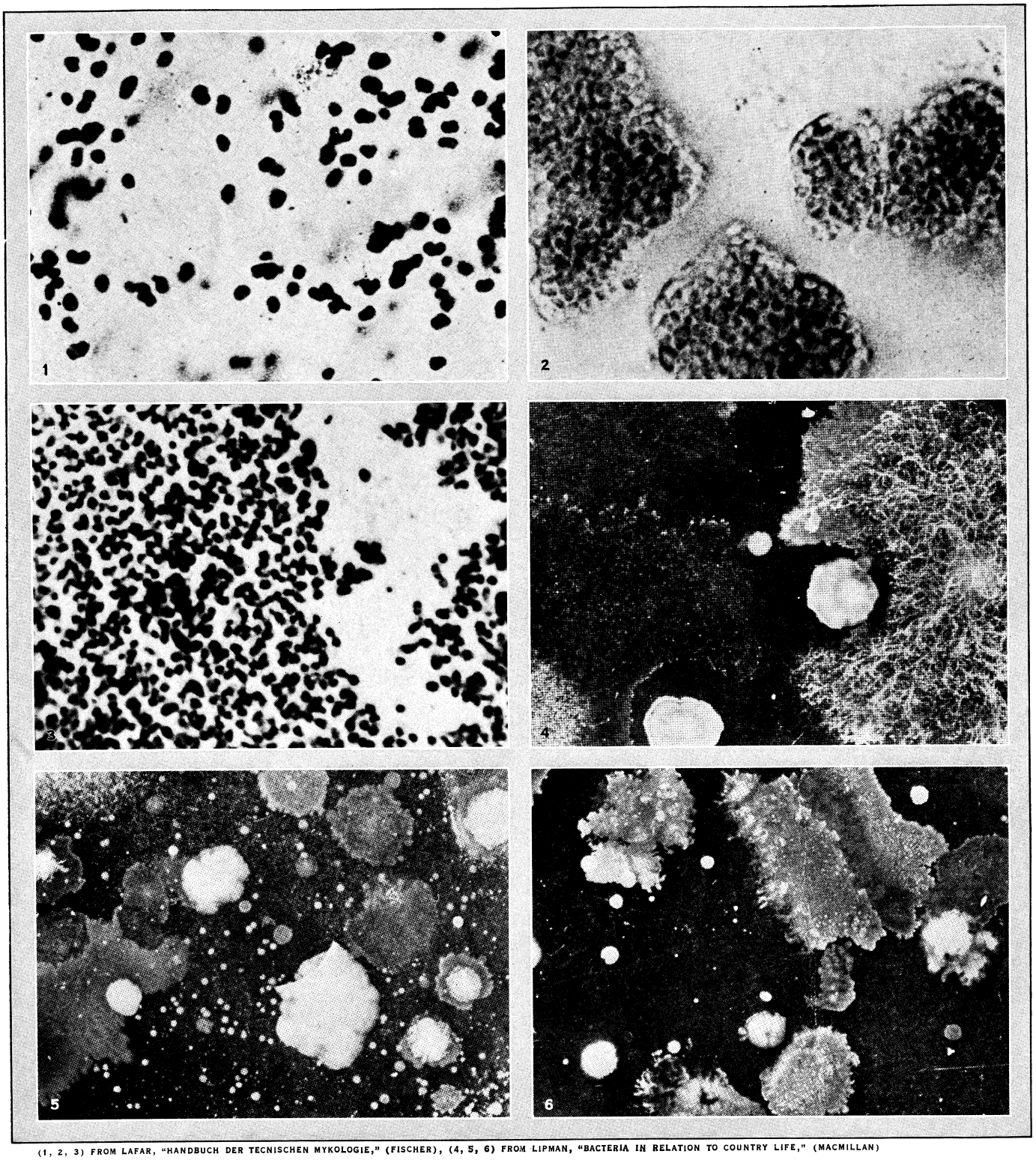


(1, 2, 3) FROM LAFAR "HANDBUCH DER TECHNISCHEN MYKOLOGIE," FISCHER, (4, 5, 6) FROM PLUMMER AND PAINE, "A NEW METHOD OF STAINING BACTERIAL FLAGELLA" IN THE "JOURNAL OF PATHOLOGY AND BACTERIOLOGY"

BACTERIA RELATED TO FOOD, DISEASE AND AGRICULTURE

1. *Azotobacter agilis,* a rapidly motile form of soil bacteria which fixes nitrogen of the air to other forms, making it available to green plants
2. *Clostridium* pastorianum, an anaerobic bacterium. Such forms live on food in the absence of a good oxygen supply, leaving in their path substances which are very toxic to animals
3. Cellulose ferment, found in all soils and at the bottom of ponds, lakes, rivers and canals, where the bacteria are concerned with the destruction of woody tissues under anaerobic conditions
4. Bacillus proteus, common in the digestive tracts of animals, where it works in conjunction with other forms of bacteria in dissolving and disintegrating proteins and other forms of nitrogenous compounds
5. Bacillus *atrosepticus,* the organism causing blackleg or black rot of the potato. This disease causes yellowing and wilting of the plant
6. Spirillum sp.—a sample of a group of organisms having more or less of a spiral form

BACTERIOLOGY



(1, 2, 3) FROM LAFAR, "HANDBUCH DER TECNISCHEN MYKOLOGIE," (FISCHER), (4, 5, 6) FROM LIPMAN, "BACTERIA IN RELATION TO COUNTRY LIFE," (MACMILLAN)

SOIL BACTERIA

1. *Nitrosomonas javanensis,* one of the nitrite-forming bacteria having to do with the transformation of nitrogen in soil
2. *Nitrosomonas* europaea, the common European species of nitrite-forming bacteria concerned with the transformation of nitrogen in soil
3. *Nitrobacter,* nitrate-producing bacteria which form a very important link in the nitrogen cycle of the soil. They work in conjunction with the various forms of Nitrosomonas
4. Culture plate of soil bacteria, showing bacterial colonies alter inoculation with soil samples. Each growth probably started from a single organism, which grew and produced many new cells. These radiated from the centre, giving the final growth a circular appearance
5. A second culture plate of soil bacteria, showing bacterial colonies after inoculation with soil samples. (See fig. 4)
6. A third culture plate of soil bacteria, showing bacterial colonies after inoculation with soil samples. (See figs. 4 and 5)

substage condenser. E. Abbé introduced his condenser in *1870* and C. Zeiss completed the microscopic equipment with his apochromatic lenses in *1880*. It is clear that bacteria were recognized before they were distinctly seen; O. F. Miiller knew several important forms in 1773, while F. Ehrenberg in *1830* had advanced to the commencement of a scientific separation and grouping of them, and in *1838* had proposed at least *16* species, distributing them into four groups or genera. Our modern more accurate knowledge of the forms of bacteria, however, dates from F. J. Cohn's brilliant researches, the chief results of which were published at various periods between *1853* and *1872*. Cohn's classification of bacteria, published in *1872* and extended in 1875, has in fact dominated the study of these organisms almost ever since. He based his classification on what may be considered the constancy of forms which he called species and genera. As to the constancy of form, however, Cohn maintained certain reservations which have been ignored by some of his followers. The fact that Schizomycetes produce spores appears to have been discovered by Cohn in *18;7*, though it was expressed dubiously in *1872*. In *1876*, however, Cohn had seen the spores germinate, and Robert Koch. O. Brefeld, P. van Tieghem, A. de Bary and others confirmed the discovery.

The supposed constancy of forms in Cohn's species and genera received a shock when E. R. Lankester in 1873 pointed out rhat 'his *Bacterium rubescens* (since named *Beggiatoa roseo-persicina*, Zopf) passes through phases which would have been described by most observers, influenced by the current doctrine, as so many separate species or even genera — that in fact forms known as *Bacterium*, *Micrococcus*, *Bacillus*, *Leptothrix*, etc., occur as stages in one life-history. J. Lister put forth similar ideas about the same time, and T. Billroth came forward in 1874 with the extravagant view that the various bacteria are only different states of one and the same organism which he called *Cocco-bacteria septica*. From that time the question of the pleomorphism (mutability of shape) of the bacteria has been hotly discussed: and quite recently pleomorphism exhibited in cultures of *Azotobacter chroococcum* has led *F*. Lohnis to the belief that all soil organisms are modifications of this one species. (F. Lohnis and N. R. Smith 1923.) It is now generally agreed that, while a certain number of forms may show different types of cell during the various phases of their life-history, yet the majority of forms are uniform, showing only one type of cell throughout their life. The question of species in the bacteria is essentially the same as in other groups of plants. Before a form can be placed in a satisfactory classificatory position its whole life-history must be studied, so that all the phases may be known. In the meantime, while various observers were building up our knowledge of the morphology of bacteria, others were laying the foundation of what is known of the relations of the organisms to fermentation and disease — that ancient will-o'-the-wisp, spontaneous generation, being revived by the way. When L. Pasteur in *1857* showed that lactic fermentation depends on the presence of an organism, it was already known from the researches of T. Schwann *(1837)* and H. L. F. v. Helmholtz *(1843)* that fermentation and putrefaction are intimately connected with the presence of organisms derived from the air, and that the preservation of putrescible substances depends on this principle. In *1862* Pasteur placed it beyond reasonable doubt that the ammoniacal fermentation of urea is due to the action of a minute bacterium. In *1864* this was confirmed by van Tieghem, and in *1874* by Cohn, who named the organism *Micrococcus ureae*. Pasteur and Cohn also pointed out that putrefaction is but a special case of fermentation, and before *1872* the doctrines of Pasteur were established with respect to bacteria. Meanwhile two branches of enquiry had arisen from the above. In the first place, the disputed question of spontaneous generation received fresh impetus from the difficulty of keeping such minute organisms as bacteria from reaching and developing in organic infusions; and, secondly, the long-suspected analogies between the phenomena of fermentation and those of certain diseases again made themselves felt as both became better understood Needham in 1745 had declared that heated infusions of organic matter were not deprived of living beings; Abbé Spallanzani (1777) had replied that more careful heating and other precautions prevent the appearance of organisms in the fluid. Various experiments by Schwann, Helmholtz, M. Schultze, K. Schroeder, Th. v. Dusch and others led to the refutation, step by step, of the belief that the more minute organisms, and particularly bacteria, arose *de novo* in the special cases quoted. Nevertheless, instances were adduced where the most careful heating of yolk of egg, milk, hay-infusions, etc., had failed — the boiled infusions, etc., turning putrid and swarming with bacteria after a few hours.

In *1862* Pasteur repeated and extended such experiments, and paved the way for a complete explanation of the anomalies; Cohn in *1872* published confirmatory results; and it became clear that no putrefaction can take place without bacteria or some other living organism. In the hands of O. Brefeld, A. de Bary, J. Tyndall, J. Lister and others, the various links in the chain of evidence grew stronger and stronger, and every case adduced as one of spontaneous generation fell to the ground when examined. No case of so-called spontaneous generation has withstood rigid investigation; but the discussion contributed to more exact ideas as to the ubiquity, minuteness and high powers of resistance to physical agents of the spores of bacteria, and led to more exact ideas of antiseptic treatment. Methods were also improved, and the application of some of them to surgery by J. Lister, Robert Koch and others has yielded results of the highest value.

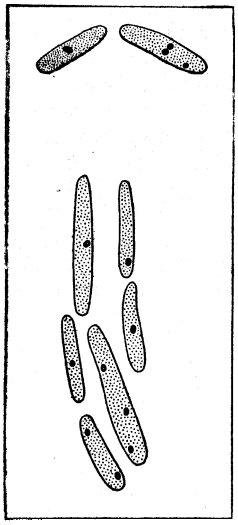
The methods of bacteriological technique which are employed to-day had their beginnings as recently as 1870–1885 with the introduction of the use of stains by C. Weigert in 1871 and the discovery by Robert Koch *(1881)* of the method of separating mixtures of organisms on plates of nutrient media solidified with gelatine and agar. Following closely on the introduction of this technique came the separation of pure cultures of many bacteria. In *1882* F. Loeffler and F. Schulze discovered the cause of glanders; in *1883* Koch isolated the organism of Asiatic cholera and the same year E. Rlebs found that of diphtheria. In 1885, A. Nicolaier observed the Tetanus bacillus in pus produced by inoculating mice and rabbits with soil. It was left, however, to the famous Japanese Ritasato to discover the way in which these organisms could be cultivated. In *1889* he showed that previous failures in this connection had been due to a lack of appreciation of the necessary conditions, namely, that complete absence of oxygen was essential. A very important discovery came in 1880 when Pasteur first showed that *Bacillus anthracis* cultivated in chicken broth at a temperature of 42°–43° C., lost its virulence after a few generations and ceased to kill even the mouse; this remarkable finding which was destined to lay the foundation of serum-therapy (treatment of disease by serum inoculation), like so many other great discoveries, resulted from an accident; the temperature regulation of the incubator being faulty the cultures were submitted to 42° C., instead of 37° C. More remarkable still, animals inoculated with such "attenuated" bacilli proved to be curiously resistant to the deadly effects of subsequent inoculations with the non-attenuated form. In other words, animals vaccinated with the cultivated bacillus showed immunity from disease when re-inoculated with the deadly wild form. The questions as to the causes and nature of the changes in the bacillus and in the host, as to the extent of immunity enjoyed by the latter, etc., are of the greatest interest and importance.

MULTIPLICATION OF BACTERIA

Mode of Reproduction. — When a bacterial cell is about to divide, the material of the cell is gradually increased till its volume is practically doubled, spherical forms become oval and rod forms stretch to nearly double their length, the cell then becomes constricted at the middle and the constriction deepens till finally the contents are held in two compartments separated by a wall formed at the line of constriction. The two new cells remain adhering for some time and, sooner or later, they separate and form two new individuals or daughter cells which are the exact counterpart of the mother cell and of each other. Bacteria in view of this method of growth are by some spoken of as the fission fungi and are designated by the Greek word *Schizomycetes*.

For many bacterial species fission reuresents the only form of

reproduction. Some species are better favoured, however, in the possession of an alternative process, that of sporulation or multiplication by spores. Spores are formed in some organisms only when the conditions for growth by the method of fission described above have become unsatisfactory, it may be drought, or excessive heat or cold, or the presence of some poisonous chemical substance, in others sporulation follows in a regular sequence in time according to the temperature to which they are exposed. The first visible sign of spore formation is the appearance of a light spot in the body of the organism viewed under the microscope in the unstained condition. This is due to a change in the refraction of the light rays by some newly formed substance or physical state. This differentiated portion of the contents of the cell increases in size and soon appears as a rounded, or more usually oval, body enclosed by a wall, at first thin but quickly becoming thicker until at maturity the spore coat is of considerable thickness. Having formed its spore the rest of the cell disappears and sometimes it is only with difficulty that any trace of it can be found These spores are highly resistant to heat and drought and serve to tide the organism over a period of stress, so much so that sporulating organisms have been known to remain alive and viable for longer than ten years and in all probability they can exist very much longer, while organisms capable of multiplication only by the method of simple division are usually dead in 12 months and sometimes much less than that. When more suitable conditions return, germination of the spore takes place in one of two ways, either-the spore wall softens, thins down, becomes plastic and the cell reverts to the ordinary type, or the wall of the spore thins and breaks down at a certain spot either at the end or the middle of the cell. Through the ruptured wall the contents emerge, leaving behind the empty spore shell, and assume the typical active form.



FROM JORDAN GENERAL BACTERIOLOGY" AFTER ZETTNOW

FIG. 3.— CHROMATIN GRANULES IN "BACILLUS MEGATHERIUM." ,,,,, CARRY THE HEREDITARY CHARACTERISTICS

Sterilization.— Methods of sterilization have to be chosen in full appreciation of the high resistance to heat of the bacterial spore cell. The ordinary cells are destroyed at temperatures of 50° to 60° C., hence a single boiling of a fluid or even Pasteurization (application of heat of 60° C.) is sufficient to destroy them or most of them. The spores, however, require very prolonged heating at these temperatures for their destruction and in order to produce sterility of a liquid in a reasonably short space of time temperatures above 120° C., obtained by steam under pressure, are employed. Dry spores withstand even higher temperatures; but 150°, maintained for 20 minutes? will usually destroy them.

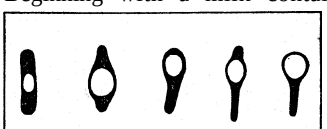
Rate **of Multiplication.**—Given suitable conditions for growth the rate of multiplication of bacteria is very rapid; whenever experiments have been conducted to determine this rate, under conditions purposely made most favourable, it has been found that a division of the cell is repeated every 20 or 30 minutes.

Rate of Growth **of** *Bacillus mycoïdes* at different temperatures.
H. Marshall Ward.

Temperature. C.	*Time* of *one Division.* *Mins.*
5–6°	00
10–12°	300–400
14°	200
16°	100
18°	70–80
20°	60–70
22–24°	50
24-26'	40
28–37°	30–35
39–40°	00

A little consideration of what this means will bring out the importance of bacteria in everyday household affairs.

Assuming that conditions are conducive to a rate of one division every 30 minutes, a single individual cell will have produced four cells at the expiry of the first hour, 16 at the end of two hours, 64 at three hours. At the end of eight hours these 64 will have become approximately 64,000, and at the end of 15 hours there will be roughly 1,000,000,000. It can be calculated that these would occupy a space of 1cu.mm. Such a mass of bacteria, easily visible to the naked eye, is called a colony and it may here be said that it is no unusual thing in bacteriological practice to obtain colonies of this size as the result of one night's growth. Returning to our calculation the cubic millimetre will have reached the proportion of 65c.c. in 23 hours or enough solid bacteria to fill an egg cup, and at the end of 3j hours the progeny of this single cell will occupy a space of 1,000 cubic metres. F. Lohnis, who was responsible for this calculation, states it would require a goods train of 100 wagons to transport this mass of bacteria. In practice these conditions are not met with in nature or at any rate not for long, but that such conditions may actually arise temporarily is shown by experiments in which milk ster ilized by long heating was inoculated and incubated at the temperature at which it leaves the cow, that is, about 36° C. In the foregoing table it will be seen that the increase in number at 36° C. corresponds very closely to the figure calculated for a doubling every 30 minutes. Even at the temperature of rather cool air, 12·5° C.. the rate of growth is sufficiently astonishing and emphasizes the difficulties to be overcome in maintaining a clean milk supply. Conditions for bacterial growth, fortunately for man's position in the world, never remain favourable for such unrestricted growth very long. In order to produce any mass of bacteria there must be an equivalent weight of suitable food material. Besides shortage of food there are other factors; running parallel with increase in numbers comes an accumulation of substances, the by-products of bacterial activity, which, unless removed, and in nature they seldom are removed, militate against bacterial growth. It is very noticeable when cultivating bacteria in the laboratory upon plates of nutrient media that growth which in the initial stages of incubation is extremely rapid, so that a visible colony may appear in six to ten hours, gradually becomes less rapid and usually comes to a complete standstill after 30 or 36 hours. Many of the by-products of bacterial growth are acid in character and acids generally are unfavourable to growth. The result of such an accumulation of acids is seen every day in the souring and later the curdling of milk caused by bacterial conversion of milk sugar into lactic acid. The effect of this accumulation of acids in milk is shown in experiments following the course of bacterial growth in milk at 30° C., during the whole of 24 hours. Beginning with a milk containing 370,000 organisms per c.c., at the end of six hours there were 226 million, and at 12 hours 8,070 million, at 18 hours 32,243 million. That 32,000 million organisms may be yresent in a cubic centimetre, *i.e.*, in less than a third of a teaspoonful, helps one to realize the extreme smallness of bacteria. After this time the injurious effect of the accumulation of acid made its appearance, growth was not merely stopped but many of the organisms were actually killed and at 24 hours the number of living organisms had been reduced to 2,286 million.

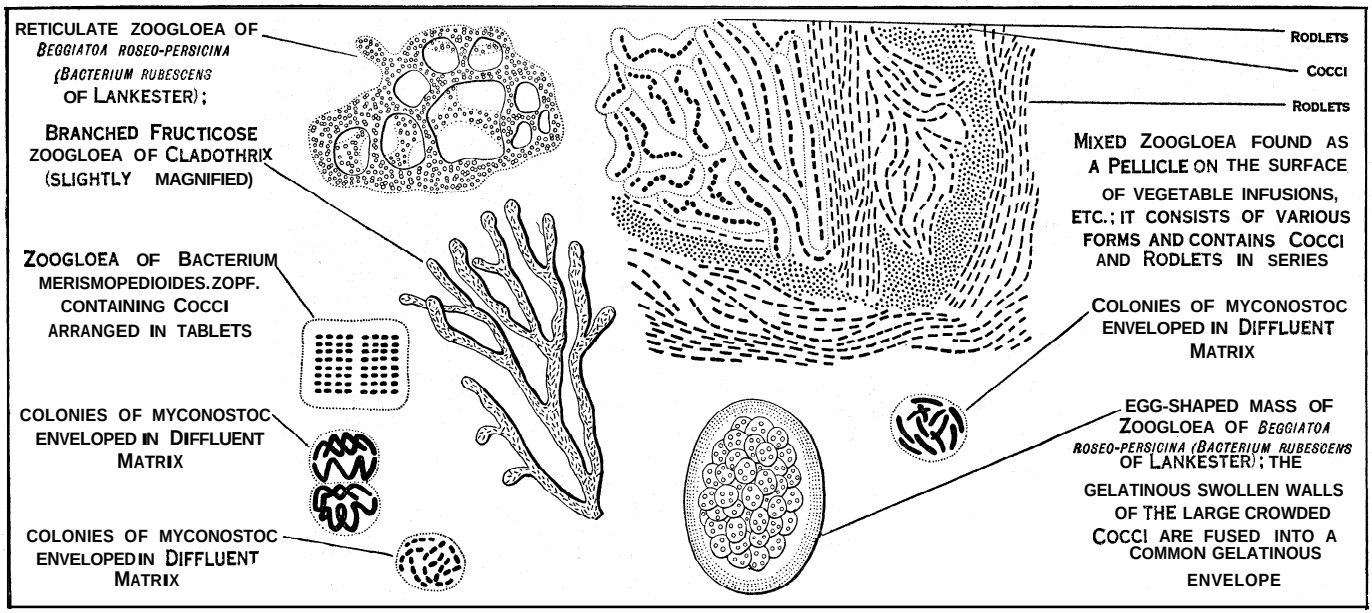


FROM HISS AND ZINSSER, "TEXT-BOOK OF BACTERIOLOGY"

FIG. 4.— VARIOUS POSITIONS OF SPORES IN THE BACTERIAL CELLS

CONDITIONS AFFECTING THE GROWTH OF BACTERIA

Food Requirements.— The supply of food is obviously the most important condition. It has been seen that milk can support the life of bacteria at or near its optimum height, it is in fact as admirable a food for the majority of bacteria as it is for human beings. From this it might appear that bacteria should be considered as animals rather than plants if it were not for the fact that the food of plants is in chemical essence the same as that of animals. Every living cell be it plant or animal requires certain food ingredients the chief of which are sugars or other carbohydrates, proteins or other nitrogenous substances, phosphates,



AFTER KOPF

FIG. 5. — VARIOUS TYPES OF ZOOGLOEA. OR COLONIES OF BACTERIA EMBEDDED IN A JELLY-LIKE SUBSTANCE FORMED BY THE SWELLING OF THE CELL MEMBRANES THROUGH ABSORPTION OF WATER. THIS DEVELOPMENT OCCURS REGULARLY IN MOST SPECIES

sulphates, chlorides, calcium, magnesium, potassium, sodium and traces of other materials. The only real difference between plants and animals is in the power of the plant to utilize energy from the sun by which it is able to build up its necessary carbo-hydrates from the carbon dioxide of the atmosphere. Bacteria are non-green plants and in consequence are unable to invoke the aid of the sun in this direction and are therefore, with two exceptions, dependent upon some other source of carbon. The exceptions are the nitrifying bacteria and certain sulphur bacteria which obtain the necessary energy for the assimilation of carbon dioxide by the oxidation of ammonia and sulphides respectively. One kind of bacterium is known, *Bacillus oligocarbophilus*, which can obtain its carbon from carbon monoxide, and one other *Bacillus methanicus* can make use of marsh gas for this purpose. All other kinds require some sugar or other material like the higher alcohols which can readily be converted into sugar in order to build up their body substance. Most bacteria require a source of nitrogen in combination with organic matter; this requirement is met in milk and in beef extract by the proteins in which these materials are rich, but in using beef extract as an artificial culture medium it has become usual to add a certain amount of peptone as this is an easily digestible ingredient and gives the organisms every encouragement to make rapid initial growth. The nitrifying bacteria, on the other hand. can make no use of such combined forms of nitrogen but are able to build up their own protein from such simple molecules as ammonia and nitrous acid. Other organisms, the so-called nitrogen-fixers, can even make use of elemental nitrogen which they assimilate from the air. The requirements of bacteria in phosphorus, sulphur and other inorganic ingredients is so small that the amount necessary for bacterial development is almost universally present in nature. When these have to be incorporated in artificial culture media they are usually supplied in the form of potassium and sodium phosphates, calcium and magnesium sulphates and sodium chloride with traces of ferric chloride.

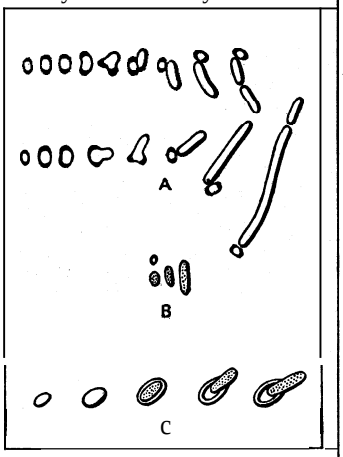
Moisture. — Experiments on soil have shown that there is no growth of bacteria when the water content is 2 to 3%, but bacteria become active at 4 to 5% and reach their optimum, depending on the character of the soil, at 25 to 40%, in fact, at approximately one-half the water-holding capacity of the soil.

The importance of moisture for bacterial growth will be clearly seen if it is realized that bacteria have no mouth parts and that all their food must be imbibed in a soluble form by the process of diffusion through the cell wall; without sufficient moisture therefore the inflow of food and the outflow of excreta becomes impossible. A very small percentage of water, however, is capable of preventing death of organisms by desiccation. That which is held hygroscopically by substances in the air-dry condition is as a rule sufficient; for instance, a fluid suspension of bacteria can be dried down on cotton wool or on filter paper and the bacteria will remain alive for upwards of 12 months, whereas the same suspension dried down on glass may be dead in 24 hours. As stated earlier the spores of bacteria are considerably more resistant to drying than are the vegetative cells.

Temperature.—For every organism there are certain cardinal points of temperature; there is first the minimum point below which growth is impossible; this varies with individuals, but for the majority it lies between 5° and 6° C.; some marine bacteria and certain soil types are active below 0° C., but this is exceptional. The optimum, depending largely on the usual habitat of the organism, is around 2j° C. for soil organisms and about 37° C. for animal parasites. The maximum, above which again no growth is possible, for many organisms lies between 38° C. and 48° C. Death of the organism does not as a rule occur at the maximum temperature for growth, but at a point some ten or 1j degrees higher. The actual death temperature can only be considered in relation to time, a low temperature acting for a long time will produce the same effect as a high temperature applied for a short time. A thermal death point standard has been chosen arbitrarily by bacteriologists and represents the lowest temperature which, when applied for exactly ten minutes, will destroy every individual in a fluid suspension of the organism. Temperatures below the minimum prevent bacterial growth but there appears to be no equivalent thermal death point at low temperatures. It is known that typhoid and other disease germs survive quite a long inclusion in ice, and instances are known where typhoid epidemics have been spread by the vendor of ice cream. J. MacFadyan and S. Rowland found that organisms frozen in liquid air and even in liquid hydrogen at −252° C. were still capable of development when restored to normal incubation temperature.

Thermophilic **Bacteria.**—Everyone knows that if hay be stacked in too moist a condition it is liable to ferment, begin to steam and finally become so hot that it bursts into flame; but it was only with the advance of bacteriological knowledge that the explanation of this phenomenon was found. There has been discovered in soil and manure heaps a group of bacteria whose relations to temperature are entirely different from those stated above. These bacteria are all of the sporing kind and seldom in the ordinary way of things do they get a chance to germinate, for their minimum temperature for growth is a point above the maxi-

mum for most organisms and even above the thermal death point of many; *e.g.*, *Bacterium ludwigii* has its minimum at 50° C., reaches its optimum at 55° C.–57° C. and its maximum at 80° C. Fermentation in the haystack is started by moulds, yeasts and bacteria, and heat is thereby developed which enables these thermophilic organisms to become active carrying the temperature to 80° C. Chemical oxidation then becomes so rapid that the spontaneous ignition point of the gases is reached and the stack bursts into flame. The writer well remembers seeing potatoes in a storage clamp cooked to that desirable floury condition by the action of thermophilic bacteria. The source of heat in this case was derived from the rotting of the potatoes in the lower region of the clamp, though the potatoes above this region were sound but cooked, for the temperature registered on a thermometer with its bulb nine inches below the surface of the clamp was 70° C. and steam was rising to a height of 10 or 12ft. above the clamp.



FROM HISS AND ZINSSER, "TEXT-BOOK OF BACTERIOLOGY" (APPLETON & CO.)

FIG. 6.— GERMINATION OF SPORES
A. *Bacillus subtilis*, equatorial spore formation
B. *Bacillus anthracis*, germination by simple fission, the spontaneous division of an organism into two organisms
C. *Clostrydium butryicum*, polar germination

Relation to Oxygen.— It is remarkable to find in organisms, which under the microscope appear exactly alike, such differences in thermal behaviour as between the thermophilic and the ordinarv forms of bacteria. It must in fact be a very peculiar form of protoplasm which will remain alive at 80° C. No less remarkable perhaps are the differences which bacteria of various kinds exhibit in their relation to oxygen. All races of human beings, and in fact all other animals, make use of oxygen in the same way, yet with bacteria some are known to be aerobic, *i.e.*, they function only in presence of air while for others precisely the reverse holds and the smallest quantity of oxygen prevents their growth; others again, and in this class fall the majority, can tolerate both conditions. These are spoken of among bacteriologists as *facultative anaerobes*. The fact that many bacteria can exist in the anaerobic condition often renders food in hermetically sealed tins unfit for human consumption. Tie decomposition of organicmatter is entirely different in presence or in absence of oxygen. In the former case the process is that of decay in which the breakdown is ultimately complete, the carbon being oxidized to carbon dioxide, the hydrogen to water, the phosphorus and sulphur to phosphates and sulphates, while the nitrogen may be given off as ammonia or may be oxidized to the form of nitrates. In the latter case the decomposition is putrefactive, the result being only a partial breakdown of the organic matter with the accompaniment of very offensive smells and the formation of poisonous substances, the ptomaines, such as putrescene and cadaverine. Ptomaine poisoning is usually the result of anaërobic bacterial action; *Bacillus botulinus*, the bacillus which is the cause of botulism, is perhaps the worst offender.

The Influence of Light.— The development of bacteria is favoured by darkness, many bacteria which are actively motile in the dark become sluggish when moved into the light and in direct sunlight bacteria exposed in thin layers, as for instance on the surface of an agar plate culture, rapidly die; some organisms under these conditions survive only for ten or 15 minutes. Experiments on the bacterial formation of nitrate in ammonia solution exposed in shallow dishes to the two conditions showed the relative speed of action in the dark to that in the light to be as 86 to 19. It is common knowledge that sunlight is regarded as one of the most powerful agencies in the destruction of pathogenic germs. The part of sunlight which possesses this lethal effect is that at the ultra-violet end of the spectrum. Experiments with ultra-violet light from a Cooper-Hewitt mercury-vapour lamp, of the type now used for treating rheumatism, have shown that *Bacillus coli* exposed at a distance of one foot from the lamp survives the action of the light for only three minutes.

The Effect of Antiseptics.— In order that bacteria may be cultivated, substances of antiseptic nature must be absent. Antiseptic surgery has now given place to aseptic surgery wherein the hands of the surgeon and nurses and every instrument used are sterilized before and during the operation. Antiseptics still have considerable use in industry and in the household, where carbolic acid and chloride of lime are extensively used. Chlorine is a very powerful antiseptic and in the form of sodium hypochlorite is used at the waterworks of large towns to reduce the number of bacteria in the water-supply. It is interesting to note that, whereas, in the main, antiseptics behave similarly towards all organisms, differences exist as between one organism and another in the concentration of poison which they can withstand; e.g., *Bacillus typhosus* will not grow in bouillon containing as little as one part of formalin in 15,000, while *Bacillus coli*, an organism in many respects closely related to it, develops vigorously in a concentration of one part in 3,000. Moreover there have been isolated from soil some organisms which are not only insensitive to the poisonous action of phenol and toluene but can actually utilize these substances as their source of carbon.

The Reaction of the Culture Medium.— The reaction of the culture medium, that is, the amount of free acid or free alkali present in it, is of the greatest importance for bacterial development. A culture medium which is neither acid nor alkaline is said to be neutral and is best adapted to the growth of many kinds of bacteria. There are numerous organisms that are favoured in their growth by a faintly acid medium and others again that prefer the medium to be slightly alkaline. It seems rather to depend upon the way in which they have been brought up; *i.e.*, upon the reaction of the medium in which the organisms normally exist. Many of the common inhabitants of milk, a medium that as we have seen readily becomes acid, grow better in artificial culture media whose H. ion concentration is on the acid side of neutrality, whereas as a rule the animal parasites, whose normal habitat (blood) is slightly alkaline, make better initial growth on media whose H. ion concentration is on the alkaline side of neutrality. In a few instances bacteria will develop vigorously in distinctly acid media; a common example of this kind is the familiar "mother of vinegar," which gelatinous material when examined by the microscope is revealed as a colony of bacteria adhering so closely together that they are difficult to separate.

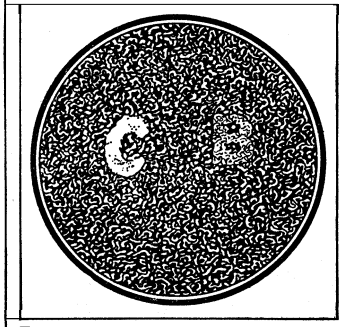
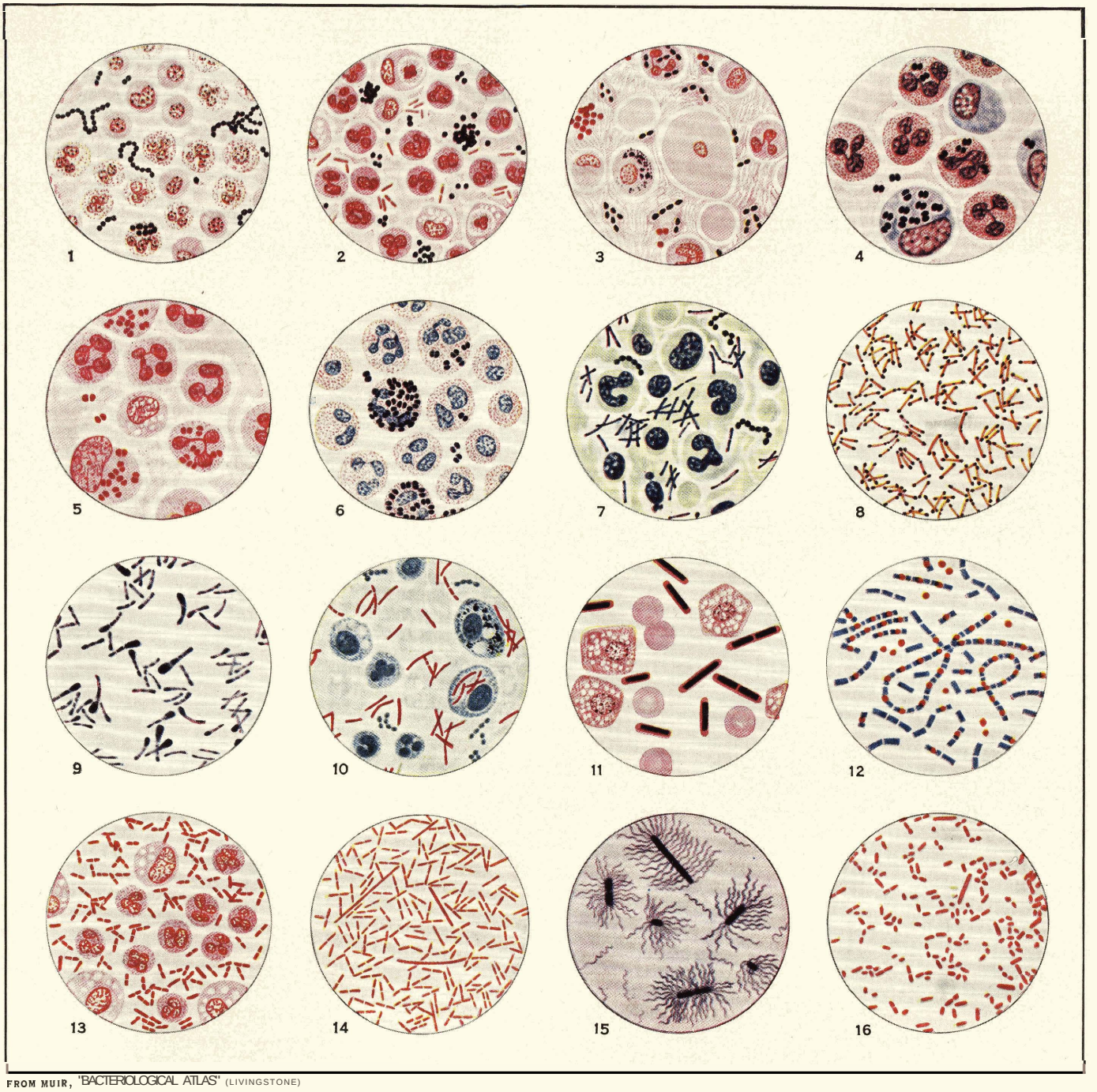


FIG. 7.— RESULTS OF AN EXPERIMENT IN WHICH A PLATE-CULTURE OF BACILLUS WAS EXPOSED FOR 4 HRS. BEHIND A STENCIL IN WHICH THE LETTERS C AND B WERE CUT
The light traversed a screen of water before passing through C, and one of aesculin, which filters out the blue and violet rays, before passing the B. The plate was then incubated. It shows that the bacteria on the C-shaped area were all killed, whereas they developed elsewhere. B is just visible to the right and covered with an opaque growth

Zoogloea.—Such a mass is termed a zoogloea and forms a remarkable phenomenon in the life-history of certain bacteria. A zoogloea may occur as a membrane on the surface of the medium, or as irregular clumps or branched masses (sometimes several inches across) submerged in it. Such growths represent a resting condition, the various elements being glued together, as it were, by their enormously thickened and mucilaginous cell-walls. Such thickened cell-walls are called capsules and the organisms in which this thickening occurs are said to be capsulated. Under favourable conditions the elements in the zoogloea again become active, move out of the matrix and distribute themselves in the surrounding medium to grow and multiply as before. If the zoogloea is formed on a solid substratum it may become firm and horny; the subsequent immersion in water softens it and the organisms become active as described.



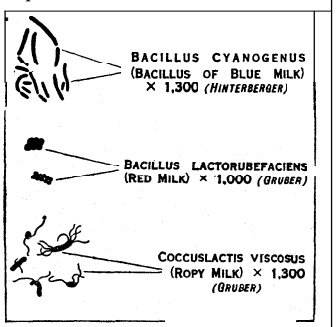
FROM MUIR, 'BACTERIOLOGICAL ATLAS' (LIVINGSTONE)

DISEASE-PRODUCING BACTERIA VIEWED THROUGH THE MICROSCOPE

1. Streptococcus pyogenes in pus. X (magnified) 1,500. Stain: Gram, neutral red. This is one of the common species of streptococsi. It is a very common pus-forming organism and is often associated in "mixed infections" or "secondary infections." S erysipelatis causes the long-known skin disease, erysipelas. (See also fig. 10)
2. Staphylococcus pyogenes aureus (dark spheres) and Bacillus pyocyaneus (pink rods) in pus. X 1,500. Stain: Gram, neutral red. Staphylococci are commonly found in boils, abscesses, carbuncles and other suppurative processes in man. S pyogenes aureus is characterized by the golden-yellow pigment formed in pus. Bacillus pyocyaneus is found in man associated with streptococci and staphylococci. It may also be found in pure culture in some cases of pneumonia
3. Pneumococcus (encapsuled dark ellipses) and Micrococcus catarrhalis (red spheres in clumps) in sputum. X 1,500. Stain: Gram, neutral red. The majority of pneumonia cases are caused by pneumococci
4. Meningococcus (encapsuled diplococci) from cerebro-spinal fluid in epidemic cerebro-spinal meningitis. X 1,500. Stain: Leishman
5. Same stained Gram, neutral red. The diplococci are mainly intracellular
6. Gonococcus from pus in gonorrhoea. X 1,500. Stain: Methylene blue, eosin. The diplococci are mainly intracellular
7. Bacillus diphtheriae (rods) and a few chains of streptococci from a smear of the throat lesion in diphtheria. X 1,500. Stain: Thionin blue
8. Bacillus diphtheriae from 12 hours' culture on Löffler's serum medium. X 1,500. Stain: Neisser's method with methylene blue and Bismarck brown. Note the bipolar staining of the metachromatic granules
9. Bacillus diphtheriae: involution forms. From a 5-day agar culture. X 1,500. Such are often found in the throat lesion. Stain: Thionin blue
13. Bacillus tubarculoeis (human type). From sputum in a case of pulmonary tuberculosis. X 1,500. Stain: Ziehl-Neelsen's method, methylene blue. A few streptococci (blue) are seen
11. Bacillus anthracis from liver of a diseased guinea-pig (experimental anthrax). X 1,500. Stain: Muir's method to show Gram-positive reaction and capsule staining. (See also fig. 15, Plate II)
12. Bacillus anthracis from 3 days' agar culture to show spores (red) within the bacilli. X 1,500. Stain: Ziehl-Neelsen's method with 0.5 per cent. sulphuric acid methylene blue
13. Bacillus coli from case of cystitis. X 1,500. Stain: Gram, neutral red. This bacillus is widely distributed in nature and has been isolated from air, water and soil. It occurs abundantly in the intestinal tract of man and derives its name "coli" from the fact that it is found most abundantly in the colon. Though these organisms may be present in large quantities without causing specific disease, they sometimes invade the gall-bladder and bile-ducts, causing cholangitis and cholecystitis, and produce lesions of the urinary tracts, causing cystitis
14. Bacillus typhosus from young agar culture. X 1,500. Stain: Gram, neutral red. This intestinal tract organism causes typhoid fever
15. Same to show flagella: 12 hours' agar culture. X 1,500. Stain: Muir's method
16. Bacillus dysenteriae (Shiga): young agar culture. X 1,500. Stain: Gram. neutral red. This is one of a group of four or more organisms of the intestinal tract causing dysentery in man

BACTERIA IN AIR AND WATER

That bacteria have existed from very early periods is clear from their presence in fossils; the researches of B. Renault and P. van Tieghem have shown that large numbers of bacteria existed in Carboniferous and Devonian times. To-day they are universally present in still ponds and ditches, in running streams and rivers, in the sea, especially in drains, rubbish and manure heaps, in the soil and wherever organic matter is allowed to stand for a short time. Any liquid (blood, urine, milk, beer, etc.) containing organic matter, or any solid food-stuff (meat, bread, potatoes, etc.,) allowed to stand exposed to the air soon swarms with bacteria if sufficient moisture is present and the temperature is not abnormally cold. Though they occur all the world over in the air their distribution is by no means equal in all parts. As might be conjectured they are most numerous in the air of towns, but even here the number of living germs is not so great as one would expect considering the enormous number of dust particles. Every mote in the air doubtless carries its quantum of bacteria, but the conditions of rapid drying and the exposure to ultra-violet light are responsible for the death of the majority of organisms that are raised by the mind from the earth's surface. The air of the country is relatively pure as compared with that of the towns and in forest areas the presence of bacteria in the atmosphere is usually hard to demonstrate. the leaves of trees seeming to act as efficient bacterial filters. The atmosphere of the ocean becomes more and more free from organisms the farther one goes out from the coast. Notwithstanding the large number of bacteria in the atmosphere the breath of individuals is practically germ-free. This means that the micro-organisms are retained in the nose, mouth and throat; the number thus retained must be very great. It is obvious then that other things being equal the danger from infection is greatest among town dwellers and those whose life is spent in ill-ventilated factories and least among sailors and dwellers on the mountain-side. The danger of infection from breathing disease germs is, however, not great in proportion to the numbers of such germs which are respired, since it can be shown that of the disease germs that fall upon an exposed plate of culture media, though many remain viable, only a few of these retain their virulent property. It can, however, be shown that the organisms of the common cold can be received on a plate of media held at a distance of seven feet from a person who sneezes openly. The explosive force of coughing and even speaking and whispering carries disease germs to some considerable distance.



LIPMAN, "BACTERIA IN RELATION TO ..." (MACMILLAN CO.)

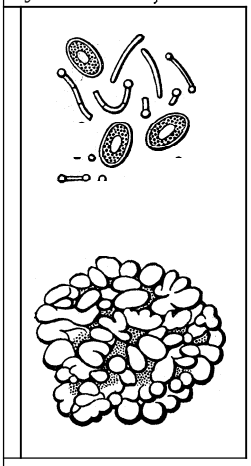
FIG. 8.—BACTERIA PRODUCING FAULTS IN MILK

BACTERIA IN MILK AND DAIRY PRODUCE

It has been stated already that milk is a perfect food for the development of bacteria. Without bacteria or other micro-organisms milk undergoes no change which can be detected by the senses and it may be kept in its original state almost indefinitely. The length of time during which milk will remain wholesome depends very largely upon its initial bacterial content. Appreciation of this fact has led the progressive dairyman to adopt methods to secure milk as free from bacteria as is consistent with its economical production; by steam sterilization of all vessels used, by washing the udders and cleaning the cows, by sterilizing the hands of all milkers, and by absolute cleanliness of the byre, the production of "Certified" milk guaranteed to contain fewer than 30,000 organisms per cu.cm. has been rendered possible.

Milk that has become sour is considered undesirable for drinking purposes in this country, but in different parts of Europe and Asia natural beverages are prepared by submitting milk to conditions which favour the development of certain acid-producing bacteria. The Bulgars, for instance, drink a great deal of milk soured by E. Metchnikoff's organism *Bacillus bulgaricus.* In other parts alcoholic beverages, kefir, kumiss, matzoon, etc., are brewed in the homes by the combined action of various yeasts with *Bacillus acidi lactici* and other acid-producing bacteria.

Butter-making.—Much use is made of the acid-forming bacteria in the preparation of cream for butter-making. It is possible to produce butter from fresh cream and in some of the European countries there is a strong demand for such butter. The keeping qualities of this fresh cream butter, however, are very poor and it therefore must be consumed within a short time of its production. This defect is to a large extent disposed of by allowing cream to sour before it is churned. In this bacterial "ripening" of cream the globules of fat are altered in that the protein envelope of the fat is practically digested by the bacteria and the enclosed fat is more readily coalesced to form butter. Further, since acids prevent the development of most bacteria, the high degree of acidity reached at the time of churning eliminates many of the bacterial kinds responsible for the rapid spoiling of butter made from fresh cream. In ordinary farm practice the cream is allowed to ripen in an almost uncontrolled manner by any organisms falling from the air into the cream accumulated from day to day until the quantity is sufficient for the churn. In this way the butter produced varies considerably in flavour and texture in accordance with the character of the bacterial flora. In modern dairy practice, on the other hand, the ripening process is scientifically controlled; mixed cultures of organisms (starters) chosen for their power to produce quickly a high degree of acidity and to enhance the flavour of the final product are employed. The temperature of the inoculated cream is kept practically constant so that when it enters the churn bacterially and chemically it is in a uniform condition. The result is a uniform butter free from undesirable taints and possessed of excellent keeping qualities. Such butter will be good for two or three weeks but sooner or later undesirable flavours will develop. Chief among these is the familiar rancidity produced by the conversion of lactic acid into butyric acid by *Bacillus butyricus* and a number of other organisms. Mottled, putrid, bitter and tallowy butter are faults that can usually be traced, sometimes with considerable difficulty, to certain contaminating bacteria and these are not always in the ripened cream but are introduced into the butter with the wash water. Even creameries with an established reputation for excellent butter are sometimes faced with the problem of eradicating some micro-organism causing rapid deterioration of their product. Similar faults arise in milk through certain bacteria gaining the upper hand and producing taints and colours; for example, blue milk, red milk, ropy milk and bitter milk.



FROM LIPMAN, "BACTERIA IN RELATION TO COUNTRY LIFE"

FIG. 9.—KEFIR GRAINS AND MICRO-ORGANISMS OF KEFIR

Cheese-ripening.— The starting material for all cheeses is practically the same, namely a curd produced by the action of rennet upon milk. The differences which characterize the various cheeses arise during the ripening process and are the result of the temperature and moisture conditions under which the curd is maintained during the ripening process. For the manufacture of hard cheese the curd is pressed to greater or less degree and more or less fat is retained in the curd according to the kind of cheese it is desired to produce. For the manufacture of soft cheeses the curd is merely drained or submitted to slight pressure only. The curd for hard cheese comes from the press in a hard, partly dry form whereas for a soft cheese the curd is left very wet. The latter condition is much more favourable to the growth of organisms, one therefore finds that soft cheeses ripen much more quickly than hard cheeses. The whole story of the ripening of cheese has not yet been revealed, but it is known that it is not entirely due to bacterial action. Some of the softening which the curd undergoes is a chemical process slowly developed under the influence of enzymes (catalytic agents

or chemical stimuli). These agents probably play a much larger part in hard than in soft cheese, but the flavours and texture which distinguish the different cheeses are undoubtedly the result of the growth of organisms, bacteria, yeasts and moulds. Most of the bacteria in cheese ripening are of the acid-forming type and these are not all equally suitable for the purpose. Artificial cultures or "cheese starters" are therefore sometimes employed, though their

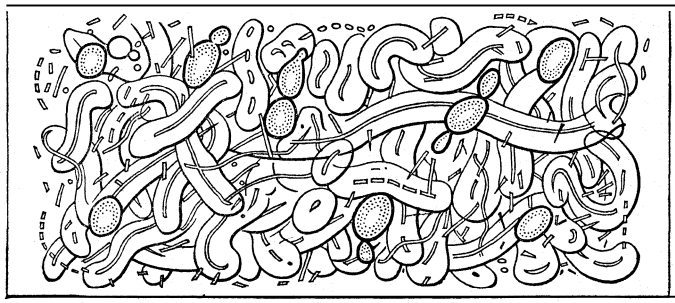


FIG. 10.—GINGER-BEER PLANT. SHOWING YEAST (SACCHAROMYCES PYRIFORMIS) ENTANGLED IN THE MESHES OF THE BACTERIUM (B. VERMIFORME)

use is by no means so general as is the use of "butter starters." The famous Edam cheese of Holland is started by adding to the milk to be curdled some slimy milk formed by a pure culture of the "ropy-milk" organism. From the nature of the case it will readily be seen that bacteria of the wrong kind may dominate the situation and may seriously affect the flavour and appearance of the cheese. Many faults may arise in this way; chief among these is a gassy condition, caused by *Bacillus lactis aërogenes;* other faults are sweet flavour, putrefaction, and variously coloured spots. These last are sometimes due to yeasts and sometimes to moulds.

BACTERIA IN RELATION TO SOIL FERTILITY

During the middle ages and the early part of the present era the fertility of soil was the subject of much speculation; varied and fantastic, and very wide of the truth were the views regarding the food requirements of plants. These views however were without their influence upon the methods of farming practice. These methods have throughout the ages been slowly evolved by experience, and even the science of the past century, apart from the introduction of artificial manures, has done little to change them. The composition of soil and its condition of cultivation have remained constant so long that gradually certain combinations or associations of micro-organisms specially adapted to the soil habitat have established themselves. Thus soil has come to have a special microscopic flora and fauna which vary only slightly in different localities and at difierent times of the year. These associations consist of certain well-defined groups of organisms each with its characteristic function to perform and such variations as exist show themselves in the relative ascendancy of one group over others as indicated by the prevalence, permanent or temporary, of the specific function which attaches to that group.

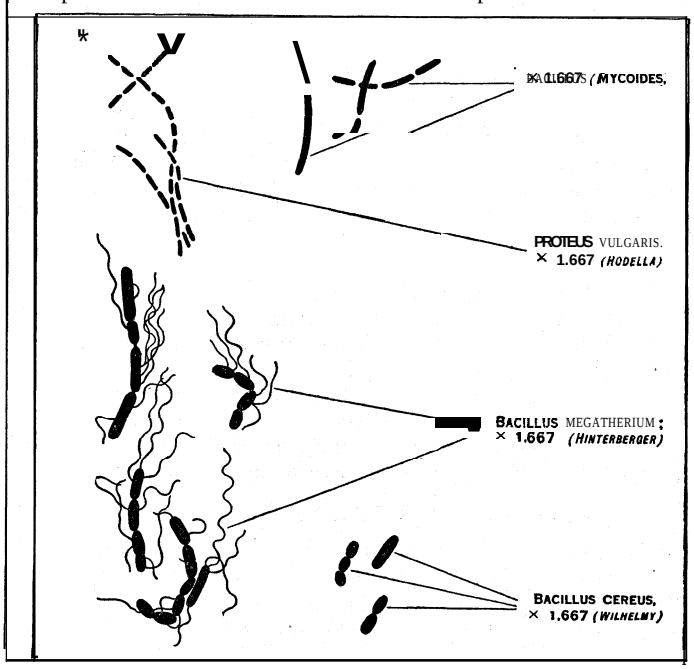
The combined efforts of all these groups result in the complete breakdown of organic remains of plants and animals and of inorganic rock particles and in the elaboration from them of simple substances which may act as plant food; in other words, they result in the fertility of the soil.

The soil population is so complex, and the functions of one group are so closely associated with the activities of others, that the bacteriologist can often do no better than study the working of the soil as a whole under artificially imposed changes in the soil conditions. Variations in the access of air, in the amount of moisture, in the temperature and in the H. ion concentration of the soil have led to considerable knowledge of the biological activities of loose well-aerated and dry soils (sandy soils and sandy loams) as compared with closely packed and relatively wet soils (heavy loams, clays and peaty loams). On the other hand, individual species isolated from soil have been studied in pure culture, and the chemical phenomena that they exhibit under these conditions have led to much enlightenment of the changes brought about in the soil by the group of organisms to which they belong.

Carbohydrate and Cellulose Fermentations. — The organic matter in the soil, the dark brown substance which distinguishes the fertile surface layers from the light coloured infertile sub-soil, is termed "humus" and consists of plant and animal remains in all stages of decomposition.

Starches and Sugars. — The most easily decomposed part of plants are rapidly fermented by yeasts, moulds and bacteria, and being themselves free from nitrogen their removal leaves the remaining humus relatively richer in nitrogen, and since these fermentations are oxidation processes they occur with greatest rapidity in well aerated soils and in the upper layers of the soil. The humus is therefore found to be progressively richer in nitrogen as one passes from depth to depth. Moreover, the rapidity of action of these oxidizing organisms is so great in sandy soils and in hot climates that the maintenance of sufficient organic matter in such soils is a matter of considerable difficulty. The fermentation of cellulose is but little slower than that of starch; many anaerobic bacteria are known to be capable of destroying cellulose and until recently anaerobic organisms alone had been shown to possess this power. It is, however, clear that the cellulose of buried plant material is rapidly attacked in open soils and that such parts lose their identity even more rapidly in well aerated than they do in badly aerated soils. Some oxidative processes of decay are obviously at work and recently it has been shown that English soils contain two organisms at least, *Spirochaete cytophaga* and *Microspira agar liquefaciens,* which under aerobic conditions in laboratory cultures have been found to destroy the cellulose of filter-paper in so short a time as three weeks. Some part of the cellulose is converted into a mucilaginous material which is incapable of further oxidation, and which has its counterpart in the mucilaginous nature of well rotted farmyard manure.

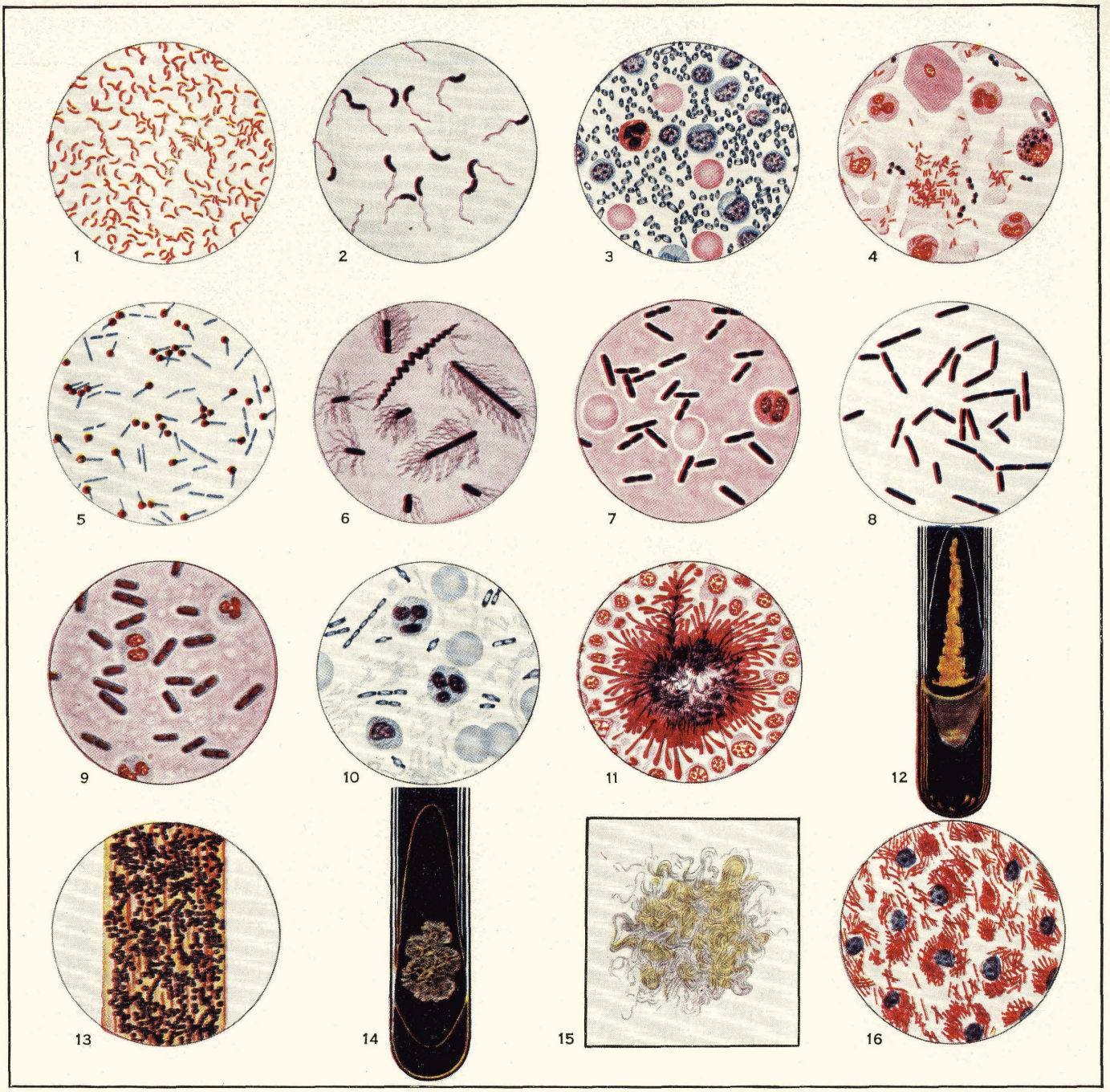
Ammonification.—Under this term is included a number of complicated and little understood chemical phenomena which result in the breakdown of the nitrogenous matter of the humus and its conversion into ammonia. The nitrogen of plant and animal remains is for the most part locked up in very large molecules, the proteins, and as such is not available as food for plants. Many bacteria are known to be capable of attacking the protein molecule with ease; by virtue of an enzyme which is exuded from them, the proteins of gelatine that form the basis of the medium on which the bacteria are cultivated are digested and liquefaction



FROM LIPMAN, "BACTERIA IN RELATION TO COUNTRY LIFE" (MACMILLAN CO.)

FIG. 11.—TYPES OF BACTERIA CAPABLE OF PRODUCING AMMONIA

Plants take up most of their nitrogen in the form of nitrates, which are simple substances compared with the humus from which they are drawn. There are three steps: 1. production of ammonia, 2. changing ammonia to nitrites. 3. changing nitrites to nitrates. Each step is usually carried out by a different kind of bacteria



(1-11) FROM MUIR, "BACTERIOLOGICAL ATLAS" (LIVINGSTONE), (12, 14, 15) FROM LEHMAN-NEUMANN, "BACTERIOLOGISCHE DIAGNOSTIK" (LEHMAN)

DISEASE-PRODUCING BACTERIA VIEWED THROUGH THE MICROSCOPE

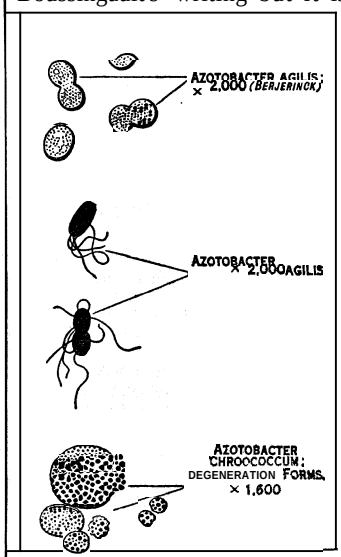
1. **Vibrio cholerae** asiaticae: 24 hours' agar culture. X magnified 1,500. Stain: Carbol fuchsin. Formerly known as "Comma bacillus," causing cholera
2. Same as fig. 1, to show flagella: 12 hours' agar culture. X 1,500. Stain: Muir's method
3. **Bacillus pestis from bubo in case of Oriental plague.** X 1,500. Stain: Methylene blue, eosin
4. Bacillus **influenzae** (Pfeiffer) from sputum in case of **influenzal** pneumonia. X 1,500. Stain: Gram, neutral red. Note presence of a few **pneumococci** in pairs (dark). (See also fig. 3, Plate III)
5. Bacillus tetani showing bacilli and terminal spores ("drum-sticks") from 3 days' **glucose** agar stab culture. X 1,200. **Stain: Ziehl-Neelsen,** decolourized with 5 per cent. **sulphuric** acid, washed (water) mordanted with saturated watery potash-alum, washed (water) methylene blue. This is the blood-poisoning (lockjaw) organism which grows best with a very low oxygen supply. For this reason the bacilli develop in deep, dirty wounds, though these may be relatively as small as pin pricks
6. Same as fig. 5, to show flagella: 12 hours' anaerobic agar culture. Stain: Muir's method. X 1,200. The wavy mass at top is a cluster of shed flagella
7. Bacillus Welchii **(perfrigens)** from a case of gas gangrene. X 1,500. Stain: Gram, neutral red
8. Same as fig. 7, from young agar culture grown **anaerobically.** X 1,500. Stain: Gram
9. Same as fig. 7. X 1,500. Stain: Muir's method to show capsule
10. **Vibrio septica from subcutaneous tissue in case of malignant oedema** with gas gangrene. X 1,200. Stain: Methylene blue. Note numerous spore-bearing bacilli singly or in chains
11. **Streptothrix actinomyces** ("ray fungus") from lesion in **tongue** of cow. X 800. Stain: Gram. eosin. Note that the **mycelial** filaments are **Gram-positive,** the clubs are Gram-negative. Around the colony mononuclear cells predominate
12. Naked-eye **culture** of **Staphylococcus** pyogenes aureus on gelatine slope: at the bottom the gelatine is liquefied. (See fig. 2, Plate III)
13. **Microsporon Audonini.** Hair from scalp in case of ringworm. **X 800.** Stain: Adamson's modification of Gram's method. The violet spheres are spores of the fungus on the surface of the hair
14. Naked-eye culture of bacillus tuberculosis of stycerm agar. (See fig. **10,** Plate III)
15. Impression of minute colony of Bacillus anthracis. X about 20. Unstained. Note the "Medusa locks" arrangement of the filament of bacilli. The demonstration by Robert Koch in 1876 of the causal relation between anthrax (splenic fever) and a specific bacillus marks the beginning of modern bacteriology. See **"Life** of Pasteur," New York, 1902. (See fig. **11,** Plate III)
16. Bacillus lepraea in tissue. From subcutaneous nodule in case of leprosy. **X** 1,500. Stain: Carbol fuchsin, methylene blue

of the medium follows. E. Marchal (1893) showed that of 31 species of organisms isolated from soil no less than 17 liquefied gelatine and a great many others have since been added. All these have the power of converting humus proteins into simple soluble nitrogenous compounds, amino acids, many go farther than this and produce ammonia. Besides these there are in soil many organisms which, though not so vigorous as the above, have the power of peptonizing the protein molecule much in the same way as digestion of protein takes place in the human stomach. All these organisms, since they are associated with the ultimate conversion of protein into ammonia, are included in the group of ammonifiers. Another group which is also included here, and which deserves special notice on account of the importance of its particular function, is a small group of urea bacteria, organisms which bring about the conversion to ammonium carbonate of the large quantity of nitrogen eliminated by animals in the form of urea. So rapidly do they effect this conversion and so common are they in the air that urine always smells of ammonia within a short time of its leaving the animal's body.

Nitrification. — Now, while it is possible for plants to assimilate ammonia, the chief form in which nitrogen is taken up by plants is that of nitrate and it has been recognized for a long time that ammonium carbonate is readily converted into nitrate, but it was not till near the end of the 19th century that this was definitely shown to be a biological problem. In 1877 two Dutchmen, J. H. Schloessing and C. A. Muntz, showed that the process came to an immediate stop when the soil was heated or was treated with chloroform. Although this pointed to a living agent, and experiments which followed indicated this to be bacterial, for some time all attempts to isolate these bacteria failed. Among the foremost workers were R. Warington in England and S. Winogradski in Russia. These two independently and almost simultaneously found the cause of their frequent disappointments lay in the fact that the nitrifying bacteria would not grow on ordinary nutrient media. It was Winogradski who first published his results; he cultivated the organisms in a solution of ammonium sulphate containing potassium phosphate and a small quantity of basic magnesium carbonate. In this medium nitrification occurred vigorously and from it he inoculated plates of gelatinous silica impregnated with these salts and isolated two kinds of bacteria. He found that neither of these organisms produced nitrate from ammonia. But having no trace of any other organisms, Winogradski thought to try a double inoculation of the ammonia solution and found that both organisms were required, and that the process took place in two stages.

The first stage in the oxidation of ammonia is brought about by a class included by Winogradski in the genus Nitrosomonas. They produce nitrite only, pure cultures can carry nitrification no farther. In the stages of culture an incubation period of five or six days at 25° C. occurs during which the organisms are found in a aoogloeal state attached to the particles of magnesium carbonate, and during this period little or no oxidation takes place. After this the zoogloea loosens and free-swimming organisms are found, and the first stage in the oxidation at once sets in. The other group which oxidizes nitrites to nitrates but which is powerless to oxidize ammonium salts is included in the genus Nitrobacter. These are smaller than the nitrite formers and are non-motile. With the conversion of ammonia to nitrite thus explained the complete return of the nitrogen contained in dead plants and animals to a form in which it is readily available for the building up of young plants again is completely accounted for. When one considers that in the process of cropping the greater part of the nitrogen taken up by the plant is lost to the land, only the small amount present in the roots and the stubble remaining, it is obvious that this wastage of nitrogen must in some way be made good or the soil would soon become exhausted and would no longer support the growth of plants. The farmer makes up a large part of this wastage by the application of dressings of farmyard manure and of sulphate of ammonia, etc. Forest land, however, never receives dressings of fertilizers, yet one knows that forests have continued to produce trees with unabated vigour for many centuries. Moreover it is well recognized that one way of enriching land is to allow it for a time to remain fallow, that is, bare of vegetation, and it can easily be shown by analysis that such fallow land gains in nitrogen content,.

Nitrogen Fixation. — "Vegetable earth contains not only dead organic matter but living organisms. The mycoderms have only an ephemeral existence and they leave their detritus in the soil which in turn may give rise to ammonia and nitric acid." Thus wrote J. B. J. D. Boussingault in 1858 and though he was not aware of the fact the statement contains the explanation of the gain of nitrogen in fallow land. There are in the soil certain organisms, the most notable of which are *Azotobacter chroococcum* and Clostridium *pastorianum*, which, in the absence of other forms of nitrogen, can utilize the nitrogen gas dissolved in the soil solution. These organisms were not discovered till 35 years after Boussingault's writing but it is now known that the enrichment of the soil is due to their assimilation of nitrogen from the air and the storage of it in their own bodies till such time as they are absorbed by the Protozoa. On the death of the protozoa the combined nitrogen becomes food for the plant through the agency of the ammonifiers and nitrifiers. Till recently it was believed that the nitrogen-fixers required to have nitrogen presented to them in the gaseous form. It is now recognized that they do not differ from other forms of life in taking the path of least resistance. They fix nitrogen not because they must but because they are able to do so. If it is possible for them to acquire their necessary nitrogen with smaller expenditure of energy no nitrogen will be fixed. In the presence of much ammonia and relatively little carbohydrate material; as when too heavy dressings of rich nitrogenous fertilizers like dried blood or cow dung are made, these organisms will multiply very rapidly, and will actually go into competition with the plant for the available supply of ammonia, and the plants temporarily will actually suffer nitrogen starvation.



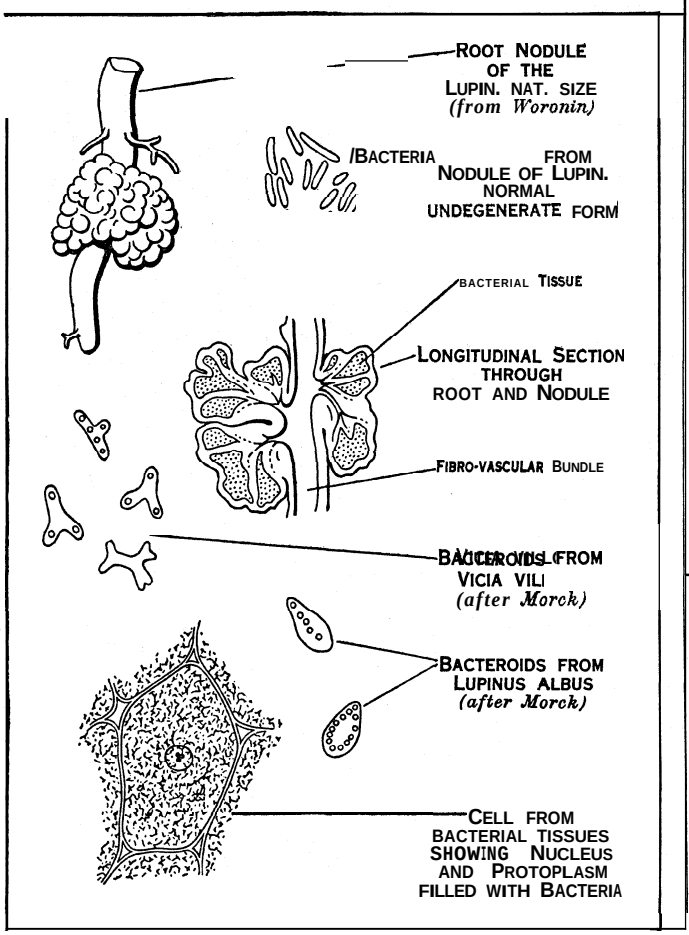
FROM LIPMAN, "BACTERIA IN RELATION TO COUNTRY LIFE"

FIG. 12. — TYPES OF BACTERIA, LIVING **INDEPENDENTLY IN SOIL, HAVING THE POWER TO EXTRACT** NITROGEN FROM THE AIR AND TURN IT **INTO** PLANT FOOD

Nitrogen Fixation by Symbiotic Organisms. — A further way in which the soil is enriched is through the growth of plants of the family *Leguminosae* (including peas, beans, clover, etc.).

By analysis it was shown by Schulz-Lupitz in 1887 that the way in which these plants enrich the soil is by increasing the nitrogen-content. The only possible source for this increase was the atmospheric nitrogen. It had been, however, an axiom with botanists that the green plants were unable to use the nitrogen of the air. The apparent contradiction was explained by the experiments of H. Hellriegel and H. Wilfarth in 1888. They showed that, when grown on sterilized sand with the addition of mineral salts, the *Leguminosae* were no more able to use the atmospheric nitrogen than other plants such as oats and barley. Both kinds of plants required the addition of nitrates to the soil. But if a little water in which arable soil has been shaken up was added to the sand, then the leguminous plants flourished in the absence of nitrates and showed an increase in nitrogenous material. They had clearly made use of the nitrogen in the air. When these plants were examined they had small swellings or nodules on their roots, while those grown in sterile sand without soil-extract had no nodules. Now these peculiar nodules are characteristic of the roots of leguminous plants grown in ordinary soil. The experiments above mentioned made clear the nature and activity of these nodules. They are the result of infection (if the soil extract was boiled before addition to the sand no nodules were produced), and their presence enabled the plant to absorb the nitrogen of the air.

The work of recent investigators has made clear the whole process. In ordinary arable soil there exists motile rod-like bacteria. *Bacterium radicicola.* These enter the root-hairs of leguminous plants, and passing down the hair in the form of a long, slimy (zoogloea) thread, penetrate the tissues of the root. As a result the tissues become hypertrophied, producing the well-known nodule. In the cells of the nodule the bacteria multiply and develop,



FROM "VORLESUNGEN UEBER BAKTERIEN," BY PERMISSION OF GUSTAV FISCHER

FIG. 13.— THE ROOTS OF LEGUMINOUS PLANTS. AS BEANS, PEAS, ETC., SUPPORT BACTERIAL GROWTHS CALLED NODULES OR TUBERCLES

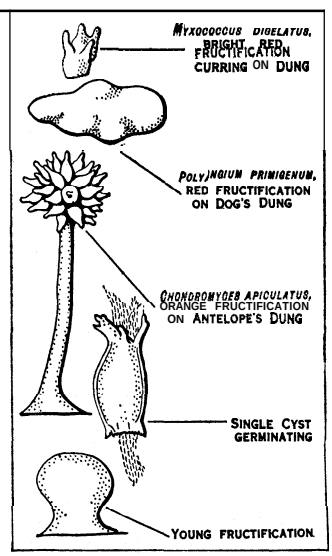
drawing material from their host. Many of the bacteria exhibit curious involution forms ("bacteroids"), which are finally broken down and their products absorbed by the plant. The nitrogen of the air is absorbed by the nodules, being built up into the bacterial cell and later handed on to the host-plant. It appears from the observations of Mazé that the bacterium can even absorb free nitrogen when grown in cultures outside the plant. We have a very interesting case of symbiosis, the green plant always keeps the upper hand, restricting the bacteria to the nodules and later absorbing them for its own use. Different genera require different races of the bacterium for the production of nodules.

Another case of symbiotic nitrogen fixation is met in certain members of the plant families *Rubiaceae* and *Myrsinaceae.* Here the bacteria invade the leaf tissue through a large stomata1 opening which seems to have evolved specially for this purpose, they become established in spherical glands which are conspicuous as blisters on the surface of the leaves. These glands were previously regarded as protein glands, but through the researches of H. Miehe, A. Zimmerman and F. C. von Faber it is now known that what were formerly regarded as protein crystals are in truth bacteroids of a species of bacteria, *Pseudomonas rubiacearum,* which, like *Pseudomonas radicicola,* has the power of fixing atmospheric nitrogen.

Sulphur Bacteria.— There are in soil certain organisms which bring about a sulphur cycle similar to that of nitrogen. F. Cohn long ago showed that certain glistening particles in the cells of *Beggiatoa* consist of sulphur and S. Winogradski and M. W. Beigerinck have shown that a whole series of sulphur bacteria exist. In the process of decay the sulphur contained in protein is for a large part converted into hydrogen sulphide and in its presence sulphur bacteria thrive; they oxidize the molecule into sulphuric acid, at the same time storing up some of the sulphur in their own bodies, so that, if the hydrogen sulphide in the soil runs short, they have this reserve of sulphur, and so long as it lasts the organisms remain alive but death by starvation occurs when the last traces of sulphur are gone. The sulphuric acid formed finds its use in the soil in rendering soluble the insoluble calcium phosphate (apatite, bones, fish meal, etc.)

Beigerinck has shown that *Spirillum desulphuricans,* a definite anaerobic form, attacks and reduces sulphates, thus undoing the work of the sulphur bacteria. This phenomenon has its parallel in the action of certain de-nitrifying bacteria in reversing the operations of the nitrifying bacteria.

Iron Bacteria.— This group of organisms is present in all soils and especially abundant in regions bordering on iron-stone deposits; ponds in such regions may show a bright rust colour due to the presence of these bacteria for they are characterized by the possession of a thick sheath-like envelope in which ferric hydroxide, a substance akin to iron rust, is deposited. They are all thread-like forms, some species being flattened filaments having the appearance under the microscope of twisted ribbons. It is doubtful whether they are in any way useful but, on the other hand, they may prove extremely troublesome in the maintenance of the water supply for large towns for, given suitable conditions, they grow with extreme rapidity and the cells, when they die, leave behind minute tubes of iron oxide, and these have been known to choke completely the service pipes. Berlin had trouble of this kind in 1877 and the whole of the water mains had to be renewed. But perhaps the most striking calamity on record befell Rotterdam in 1887. The reservoirs first became contaminated by growths of mussels, polyzoa and sponges with which the walls of the reservoirs became thickly encrusted. These, however, did little harm, they produced a certain amount of increase of organic matter through their excreta, but by their habit of feeding they reduced the bacterial content of the water and they were consequently allowed to remain. The trouble came when the organic matter increased to such an extent that iron bacteria had their chance and all this mass of molluscs became coated with a $\frac{1}{4}$ to $\frac{1}{2}$-inch covering of filamentous iron bacteria. These found their way into the service mains and made the water quite undrinkable.



FROM STRASBURGER, "LEHRBUCH DER BOTANIK" A B, AFTER QUEHL C TO E AFTER THAXTER. BY PERMISSION OF GUSTAV FISCHER

FIG. 14.— TYPES OF FRUCTIFYING BACTERIA

THE DISPOSAL OF SEWAGE

The disposal of the sewage of large cities is one of the most difficult problems with which the engineer is faced. Sewage contains, beside the waste products of human beings, the waste products of factories and the whole of the water used in the city in its multifarious daily operations. The bulk of sewage to be dealt with amounts to approximately thirty gallons per head of the population. In small communities the matter is simple since the relatively small amount of material can be run into streams without serious pollution or can be applied to the land, where the nitrogenous matter is decomposed and follows the cycle of changes described above. The land thus fertilized can be turned to good account in the cultivation of cabbages and other crops for the feeding of cattle. In tropical countries, where bacterial action is hastened by high temperatures, the sewage of even large towns

may be similarly disposed of, but in the more temperate climates similar rapidity of bacterial action has to be induced by special engineering methods. In all these methods the soil organisms are brought into play. In the majority of town syslems the sedimentation tank, the septic tank and coke or sand filter beds figure in the process. The greater part of the solid matter settles in the first tank the turbid liquid passing over into the second tank from which a rather less turbid and less evil-smelling liquid passes on to the filter beds.

In both tanks the action of bacteria is for the most part anaerobic, under which the breakdown of the excretal matter is very rapid, but the destruction is only partial, resulting in simple soluble nitrogenous substances possessed of the evil smells one associates with the process of putrefaction. This putrefying matter is sprinkled on to beds of coke some twenty to fifty feet wide and four to five feet deep through which it rapidly percolates. In its passage it is so much exposed to air that the aerobic processes of ammonification and nitrification follow with extreme rapidity. In many systems the time of passage through the filters is as short as 20 or 2 j minutes, after which the noxious substances have been converted almost entirely into nitrates and so forth, perfectly innocuous matter. These form an effluent that can be run into the river without fear of causing pollution of the stream.

Activated Sludge Process.—The purification of sewage by the aerobic bacteria which it normally contains is so slow, requiring many days for completion, that sewage disposal by this means alone has long been regarded as impracticable. A method of hastening the process was, however, discovered in 1913, and since 1916 the activated sludge process has actually been in successful operation. When sewage is well aerated the suspended matter gradually disappears, being acted upon by aerobic bacteria, and gives place to a granular brown mass which rapidly settles, leaving a clear solution of the inorganic salts, such as chlorides and nitrates, with only quite small amounts of soluble organic matter. It was discovered that the brown sediment added to a fresh supply of sewage and aerated by a blast of very fine air bubbles considerably hastened the oxidation process. On repetition each increase in the amount of sediment in relation to the volume of sewage is accompanied by an increase in the rate of oxidation, so that, when the relative amount of sediment approaches 30% of the total volume, oxidation is complete in the space of a few hours. This brown sediment forms the so-called activated sludge and consists very largely of a mass of living organisms, bacteria and protozoa.

In practice two tanks are employed: (1) the aeration tank in which the sewage and activated sludge are blown with air delivered in tiny bubbles by being forced through porous porcelain; (2) the settling tank in which the sludge is deposited and from which an effluent that requires no filtration is run away. Any excess of sludge over and above that required to maintain the necessary quantity of 25% to 30% in the aeration tank is spread out to dry by evaporation and forms a valuable fertilizer.

THE AFFINITIES OF THE BACTERIA

So far but little mention has been made of the classification of bacteria, the reader will find this adequately given in any textbook. All that need be said here is that the system or systems of classification adopted are based on no sure foundation, there being among bacteria, in contrast with other plants and animals, no clear indications as to the sequence in which various groups or families have arisen in the course of evolution. Similarly the affinities of bacteria with other forms of life are quite obscure; on the one hand they bear certain likeness to the protozoa, one group, the *Spirochoetes,* which used to be classed as bacteria has even been transferred to the protozoa, mainly on the ground of their character of dividing longitudinally as do the protozoa instead of transversely, the method universally present in the bacteria; on the other hand, as stated earlier, bacteria seem to possess affinity to the fungi, both being non-chlorophyll-containing plants. Whether the bacteria have evolved by degeneration from some more elaborate form of fungus, or whether they are to be regarded as the primitive form from which other forms of life have developed, are questions which have formed the basis of much discussion.

One group of bacteria which Thaxter has named the Myxobacteria shows very close relationship to a certain group of fungi, the Myxomycetes or slime fungi. The slime fungi are masses of naked protoplasm, or plasmodia, which at a stage in their life-history form cyst-like bodies in which the whole of the protoplasm changes into the form of spores. The Myxobacteria behave in a very similar way, equally elaborate spore-containing cysts are formed and in fact the characters of the group are those of the Myxomycetes except that a bacterial zoogloea takes the place of the plasmodial mass of the slime fungi. This group then seems to form one end of a bridge connecting the bacteria with the fungi and it is in fact the sole indication of any such affinity which up to the present has been discovered. (S. G. P.)

BACTERIOLOGY IN INDUSTRY. The industrial aspect of bacteriology which, in the early days of the science, exercised an almost dominating influence on the workers devoting their energies to the study of the microscopic world was gradually lost sight of when Pasteur, and the other early pioneers with him, turned their attention from the study of fermentations to that of putrefaction and of infectious diseases. For many years the bacteriological problems connected with industry were allowed to drift and few efforts were made to utilize the unique catalytic properties of bacteria, or to stem the destruction caused by these organisms in industries based on the handling of decomposable raw materials. To-day the industrial aspect of bacteriology is again receiving some attention, though unfortunately not always by the best qualified investigators; but much remains to be done to bring this branch of bacteriology on a level with the better-known sections—medical bacteriology, plant pathology and soil bacteriology.

A division of the subject under discussion into one part, dealing with the application of bacterial activity to industry, and another, outlining the destruction caused by bacteria in industrial undertakings, cannot, of course, be a very clear cut division. **A** number of problems of economic importance thereby remain unconsidered, for instance, the formation of peat, coal, shale oil and natural gas. However, the clearer view of the subject thereby obtained fully iustifies the adoption of this division.

INDUSTRIAL APPLICATION OF BACTERIAL ACTIVITIES

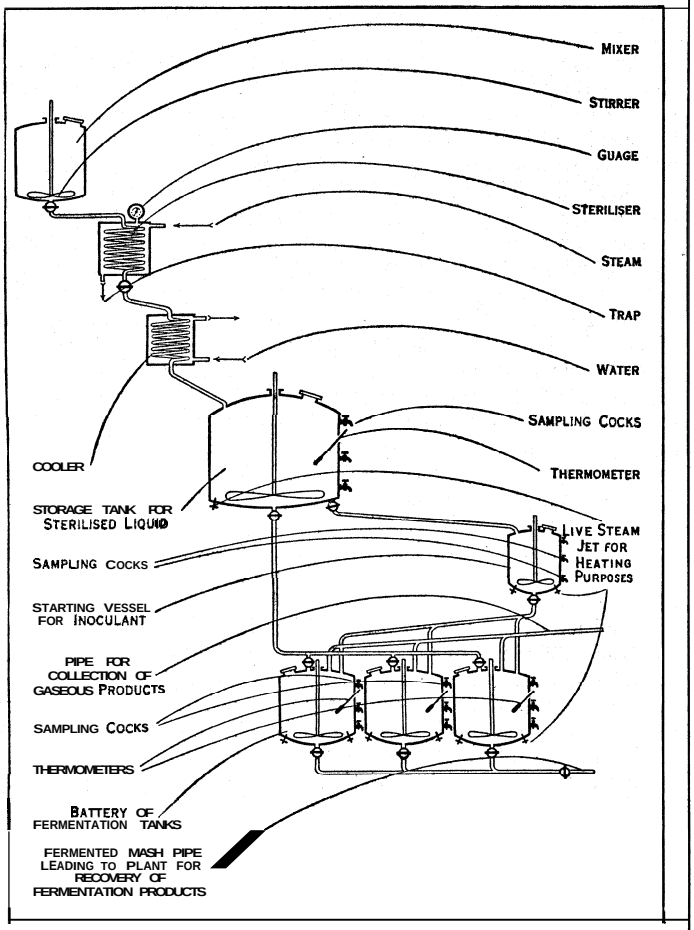
Baking.—The proper regulation of the fermentation which takes place during the raising of the dough is one of the most important problems of bread making. To-day this fermentation is artificially induced, in the making of the wheaten loaf, by the addition of suitable types of yeast—bakers' yeast—and by shortening the time of dough raising, the varied *microflora* of the flour is purposely prevented from taking part in the process. In those types of bread where the dough fermentation is induced by the addition of barms, the normal flora of the flour still plays an active role. The use of barms however is restricted to-day almost exclusively to the making of rye bread.

Bacterial Decomposition of Pectin.—The bacterial fermentation by which the pectinous middle lamellae of plant tissues are decomposed have long been industrially exploited for the retting of fibre plants. The best-known example is that of the retting of flax. In recent years this process has been greatly improved, particularly through the elimination of the putrefactive side reactions which prevailed in the earlier methods. The most important recent retting processes are those of Ochmann conducted in running water at low temperatures and in the presence of oxygen, the Rossi process, carried out at blood temperature in the presence of oxygen, and the Carbone process worked at blood temperature in the absence of oxygen.

Bacterial Decomposition of Starch and Sugars.—Leaving out of consideration the old established industries of brewing and wine making, there is a very large number of other processes by which the starch and sugar decomposing enzymes of bacteria—and of yeast—can be utilized for the production of industrially important products.

Glycerine and Lactic Acid.—The production of glycerine by yeast through the breakdown of sugars is based on Neuberg's and on Connstein's observations that sodium sulphite and certain other

alkaline salts, when added to a fermenting sugar solution, interfere with the normal course of the reaction and cause glycerine and acetaldehyde to accumulate in the fermenting liquid at the expense of alcohol and carbon dioxide. On a technical scale yields of 25% of glycerine, calculated on the sugar fermented, have been obtained.



A PLANT FOR THE ASEPTIC PRODUCTION OF LACTIC ACID AND MANY TYPES OF FERMENTATION UNDER SEMI-CONTINUOUS CONDITIONS

By employing certain bacteria, known as lactic acid bacteria, sugar solutions can be made to undergo another type of fermentation which results in the accumulation of very high yields of lactic acid. The fermentation has been industrially exploited since the middle of the 19th century, but only comparatively recently have efforts been made to conduct it under aseptic conditions, so as to avoid undesirable secondary fermentations which frequently seriously reduce the yields, and in the presence of pure cultures of the most suitable bacteria.

A diagram of a plant suitable for the aseptic production of lactic acid, and of many other types of fermentations, under semi-continuous conditions, is shown above.

Butyric Acid.—Like lactic acid butyric acid has been prepared industrially since the middle of the 19th century by the fermentation of sugars. The process has not yet been carefully investigated from the point of view of the most efficient procedure to be adopted. The responsible bacteria, which in most cases require the complete absence of oxygen—air—to develop, occur widespread in nature, particularly in the soil and on substances coming in contact with soil, for instance, milk and flour.

Citric Acid.—The conversion of sugars into citric acid can be performed by certain lower fungi, notably by species of *Aspergillus,* but this fermentation process has not yet met with economic success owing to insufficient knowledge of the most suitable conditions for the conversion. In recent years it has been shown that an adjustment of the reaction of the sugar solution to one of a fairly high acidity facilitates the production. There is little doubt that the application of this fact should make it possible to produce citric acid by fermentation at a price capable of competing with the product obtained from lemons.

Gluconic Acid.—Gluconic acid, an oxidation product of glucose, is produced by those lower fungi which form citric acid, and by certain bacteria. It has been suggested as a substitute for vinegar for domestic purposes, and has the advantage over vinegar of possessing a higher nutritive value. So far its industrial production by fermentation has not been attempted.

Alcohols.—During the World War the demand for acetone far exceeded the available supplies and new sources for the production of this solvent had to be devised. The foresight of the British Government made it possible to evolve a fermentation process in which certain bacteria, related to the butyric acid bacteria, were utilized for the conversion of starch into a mixture of butyl alcohol and acetone. With the increasing demand for butyl alcohol, which is used as a base in many dopes and varnishes, this fermentation process has become well established.

Apart from the use of sugars, such as molasses, for the production of power alcohol, recent investigations have shown that certain sugars, pentoses, which cannot be fermented by yeast, can be converted by bacteria into a mixture of ethyl alcohol and acetone. These sugars occur as a condensation product in a very large number of plants and are available in many parts of the world, notably in tropical and sub-tropical countries, in the waste products from agricultural industries. A fermentation process has recently been developed for the production of power alcohol from pentoses, and it is claimed that as much as zo imperial gallons of this liquid fuel has been obtained in this way from one ton of waste.

Many other fermentation processes, involving in these cases the breaking down of hemicelluloses and of cellulose, are of considerable industrial importance, the preparation of synthetic farmyard manure, for instance, and the production of natural indigo, but space does not permit.to discuss them in detail. They have been dealt with in considerable detail by Thaysen and Bunker.

Bacterial Decomposition of Organic Nitrogen Compounds.—Apart from the dairy industry, which may perhaps be most conveniently classed under the above heading, though the activity of bacteria in milk involves both its sugar and its casein content, the bacterial decomposition of organic nitrogen compounds may quite conceivably become of economic importance in the future in other directions—in the degumming of natural silk, for instance, and in the synthesis of nitrogen compounds which are costly to prepare by chemical means. Ehrlich has drawn attention to such cases, among them the preparation of an important part of the essential oil of roses.

It has been suggested that certain sulphur bacteria might be used for converting naturally occurring zinc minerals into zinc sulphate under conditions which would render the zinc more easily recoverable, and recently observations have been recorded that the inert gas argon had been detected in yeast during the fermentation of sugars.

The Destructive Activity of Bacteria in Industry.—However desirable the utilization of bacteria may be, it is still more important, sometimes even essential, to arrest and to prevent their activity in many industries. In the textile industries, for instance, damage involving millions of pounds yearly is caused through the destruction and milde ing of fibres and fabrics. In the wood industries equally serious losses occur through the action of micro-organisms, chiefly of fungi. In the sugar industries the freshly pressed juice is often inverted by bacteria and the crystallization of the sugar rendered difficult. In dairying, and in many other industries too numerous to enumerate, serious destruction by bacteria is frequently recorded.

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BACTRIA (Bactriana), the ancient name of the country between the range of the Hindu Kush (Paropamisus) and the

Oxus (Amu Darya), with the capital Bactra (now Balkh); in the Persian inscriptions, Bākhtri. It is a mountainous country with a moderate climate. Water is abundant and the land is very fertile. Bactria was the home of one of the Iranian tribes (see PERSIA: *Ancient* History). The name is sometimes used, erroneously, to describe the whole of eastern Iran, and the Zend language was for some time called "Old Bactrian," from Zoroaster's living and teaching in Bactria. Falsely, too, was Bactria called the cradle of the Indo-European race. Iranian tradition has done much, with the help of the imagination of later students, to give Old Bactria an empire of great extent, whose kings won great victories over the Turanians. This is but a reflex of the great Achaemenid Sassanian empire of the Iranians. It is quite uncertain whether the Aryans came from central Asia in the same way as afterwards the Indo-Scythians, the Turks and others, or from some part of Europe, where now many scholars look for the home of the Indo-Europeans. The Bactrians and their neighbours were ruled by petty kings, one of whom was Vishtaspa, Zoroaster's protector. Ctesias in his history of the Assyrian empire (Diodor. Sic. ii. 6 ff.) narrates a war waged by Ninus and Semiramis against the king of Bactria, but his whole history is nothing but a fantastic fiction. From the Assyrian inscriptions we know that the Assyrians never entered the eastern parts of Iran.

Whether Bactria formed part of the Median empire is uncertain, but it was subjugated by Cyrus and from then formed one of the satrapies of the Persian empire. When Alexander had defeated Darius III., his murderer, Bessus, the satrap of Bactria, tried to organize a national resistance in the east. But Bactria was conquered by Alexander without much difficulty; it was only farther in the north, beyond the Oxus, in Sogdiana, that he met with strong resistance. Bactria became a province of the Macedonian empire, and soon came under the rule of Seleucus, king of Asia *(see* SELEUCID DYNASTY and HELLENISM). The Macedonians (and especially Seleucus I. and his son Antiochus I.) founded a great many Greek towns in eastern Iran, and the Greek language became for some time dominant there. The many difficulties against which the Seleucid kings had to fight, and the attacks of Ptolemy II., gave to Diodotus, satrap of Bactria, the opportunity of making himself independent (about 2 j j B.C.) and of conquering Sogdiana. He was the founder of the Graeco-Bactrian kingdom. Diodotus and his homonymous successor were able to maintain themselves against the attacks of the Seleucids; and when Antiochus III. "the Great" had defeated the next king, the usurper Euthydemus, he nevertheless acknowledged him as independent sovereign; he saw that his empire would be unable permanently to maintain these remote provinces and to protect the Greek settlers against the invasions of the eastern barbarians. After his defeat by the Romans (190 B.C.) the Bactrian king Euthydemus and his son Demetrius crossed the Hindu Kush and began the conquest of eastern Iran and the Indus valley. For a short time they wielded great power; a great Greek empire seemed to have arisen far in the East. But this empire was torn by internal dissensions and continual usurpations. When Demetrius advanced far into India one of his generals, Eucratides, made himself king of Bactria; and soon in every province there arose new usurpers, who proclaimed themselves kings and fought one against the other. Most of them we know only by their coins, a great many of which are found in Afghanistan and India. By these wars the dominant position of the Greeks was undermined even more quickly than would otherwise have been the case. After Demetrius and Eucratides, the kings abandoned the Attic standard of coinage and introduced a native standard; at the same time the native language came into use by the side of the Greek. On the coins struck in India the well-known Indian alphabet (called Brahmi by the Indians, the older form of the Devanagari) is used; on the coins struck in Afghanistan and in the Punjab the Kharoshṭhi alphabet. Politically, the Graeco-Bactrian kingdom, "the empire of 1,000 cities" as a Greek historian calls it, was an ephemeral creation of short duration; but for the development of eastern civilization it has been a factor of the greatest permanent importance. By it Greek art has been introduced into India; in the Gandhava sculptures from the Kabul valley and on the coins of the later kings we see how Greek art was adopted by the Indians and the forms of Greek gods and heroes applied to the representation of Buddhist saints and divinities. From here the Graeco-Buddhist art spread into central Asia; and its influence has changed the whole art of eastern Asia and determinated the further development of the art of China and Japan.

The weakness of the Graeco-Bactrian kingdoms was shown by their sudden and complete overthrow. In the west the Arsacid empire had risen, and Mithradates I. and Phraates II. began to conquer some of their western districts, especially Areia (Herat). But in the north a new race appeared, Mongolian tribes, called Scythians by the Greeks, among which the Tochari, identical with the Yue-chi (*q.v.*) of the Chinese, were the most important. In 159 B.C., according to Chinese sources, they entered Sogdiana, in 139 they conquered Bactria, and during the next generation they had made an end to the Greek rule in eastern Iran. Only in India the Greek conquerors (Menander, Apollodotus) maintained themselves some time longer. But in the middle of the 1st century B.C. the whole of eastern Iran and western India belonged to the great "Indo-Scythian" empire. The ruling dynasty had the name Kushan (Kushana), by which they are called on their coins and in the Persian sources. The most famous of these kings is Kanishka (*c.* 123–153), the great protector of Buddhism. The principal seat of the Tochari and the Kushan dynasty seems to have been Bactria; but they always maintained the eastern parts of modern Afghanistan and Baluchistan, while the western regions (Aria, *i.e.*, Herat, Seistan and part of the Helmund valley) were conquered by the Arsacids. In the 3rd century the Kushan dynasty began to decay; about A.D. 320 the Gupta empire was founded in India. Thus the Kushanas were reduced to eastern Iran, where they had to fight against the Sassanids. In the 5th century a new people came from the east, the Ephthalites (*q.v.*) or "white Huns," who subjected Bactria (about 450); and they were followed by the Turks, who first appear in history about A.D. 560 and subjugated the country north of the Oxus. Most of the small principalities of the Tochari or Kushan became subject to them. But when the Sassanian empire was overthrown by the Arabs the conquerors immediately advanced eastwards, and in a few years Bactria and the whole Iran to the banks of the Jaxartes had submitted to the rule of the caliph and of Islam. *(See* PERSIA.)

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(ED. M.)

BACUP, municipal borough, Lancashire, England, on the river Irwell, 22m. N. by E. from Manchester, on the L.M.S. railway. Population (1931) 20,606. It is finely situated in a narrow valley, surrounded by wild, high-lying moorland. It is wholly of modern growth, although a prominent hill-top camp on the moorland near by suggests that there is a long history of settlement in the region. Cotton-spinning, power-loom weaving and metal-working are the chief of numerous manufacturing industries, and there are collieries in the vicinity. There is a mechanics institute and library as well as finely laid out recreation grounds. As usual

in Lancashire co-operation is strongly developed and the co-operative institution at Bacup has a free library for its members. The borough was incorporated in 1882 and the corporation consists of a mayor, six aldermen and 17 councillors. Bacup is in the Rossendale parliamentary division of Lancashire. Area of municipal borough 9.6 sq.mi.

BAD (=bath), a title often prefixed to names of German towns which are health resorts. The articles on these are given under the names of the towns apart from the title bad.

BADAGA, (1) **a** term applied to Telugu people who invaded the Tamil country from Vijayanagara in the latter middle ages and especially in the 16th century (Tamil vadugan, "northerner"); *(2)* an agricultural tribe of the Nilgiris in southern India, which may have occupied those hills before A.D. 1200, as Badagas still worship carved cromlechs in them. But traditionally they migrated there from Mysore between that year and 1600. In type they are akin to the pastoral Todas (*q.v.*), but they speak a corrupt Kanarese. They pay tribute to the Todas, influenced perhaps by fear of Toda sorcery. A highly composite body with several clans and a variety of customs, they are now mainly Lingayats (*q.v.*), and Shaivas.

See E. Thurston, *Castes and Tribes* of *Southern* ***India,*** i., Madras (1909), which gives full extracts from earlier writers; H. Yule and A. G. Burnell, *Hobson-Jobson,* ed. W. Crooke, (1903).

BADAJOZ, a frontier province of western Spain, formed in 1833 of districts taken from the province of Estremadura (*q.v.*). Pop. (1939) 755,558; area, 8,451 sq.mi.; density 89.4 per sq.mi. Badajoz is thus the largest province of the whole kingdom. It extends from the foothills of the Sierras de San Pedro, Montbnchez and Guadalupe, in the north, to the heart of the Sierra Morena in the south, and is crossed from east to west near its northern border by the river Guadiana. La Serena, the largest of the celebrated Estremaduran winter pasture grounds, lies in the east of the province, which is mainly pastoral. The only really productive soils are found in the *Tierra* de Barros, a region lying to the west of La *Serena.* The rainfall is scanty in average years, and the torrential rivers do not lend themselves to irrigation. The fertility of the soil varies widely, some zones, such as the Tierra de Barros, being famous for their high cereal yield. About two million acres are devoted to rough pasture, woodland and scrub. Cereals are grown to some extent, however, in every district, though with a low average yield; as in other pastoral provinces, the tendency has betn to break up natural pasture for indifferent ploughland; about 3,000,000 ac. are ordinarily under cultivation, principally for wheat and barley. Vine growing is important in certain zones, and the advance of phylloxera was checked by replanting with American stocks and on fresh ground. The olive is widely cultivated; the yield is large but the quality poor. Agricultural property is mostly in large holdings; rural communications are bad, hindering the development of mineral resources.

Badajoz is aniong the provinces best supplied with livestock of all kinds, but especially with sheep, goats and swine. Its acorn-fed swine are celebrated for their hams and bacon. Horned cattle are raised chiefly on the richer pastures on the banks of the Guadiana. Badajoz produces lead, copper and slate, but not in important quantities. Manufactures are woollen and cotton textiles, beer, soaps, oils, cork and leather. Commercial interests are more important than industrial, because of transit trade with Portugal. Education is backward. Many areas are comparatively inaccessible. The Madrid-Lisbon railway passes through Villanueva de la Serena, Mérida and Badajoz; at Mérida it joins the north-south lines from Cbceres south to Zafra, where the railways from Huelva and Seville unite. The capital is Badajoz (*q.v.*) (pop. 1940, 51,720); other cities, (1930 pop.) are Almendralejo (17,597), Azuaga (16,577), Don Benito (21,196), Jerez de los Caballeros (15,021), Mérida (19,354), Villanueva de la Serena (15,351) (*qq.v.*), and Villafranca de los Barros (13,521).

A Nationalist army fought northward through Badajoz to join a northern army during the civil war of 1936–39, capturing the city of Badajoz Aug. 14, 1936, and cutting the route to Portugal. The fall of Badajoz prepared the way for a concerted advance on Madrid from the north and west.

BADAJOZ, capital of the Spanish province of that name and the see of a bishop. Pop. (1940) 51,720. Badajoz overlooks the Guadiana from a slight eminence, crowned by the ruins of a Moorish castle. A bastioned wall with moat and outworks and forts on the surrounding heights gives an appearance of great strength. The river, which flows between the castle hill and the fort of San Cristóbal, is crossed by a granite bridge, built 1460, repaired 1597 and rebuilt 1833. The aspect of Badajoz recalls its stormy history; even the cathedral, built in 1258, resembles a fortress, with massive embattled walls. Badajoz was the birthplace of the statesman Manuel Godoy, duke of Alcudia (1767–1851), and of the painter Luis Morales "the divine" (1509–86). Two pictures by Morales, unfortunately retouched in modern times, are in the cathedral. Owing to its position the city enjoys a considerable transit trade with Portugal; its principal industries are the manufacture of foodstuffs of various kinds, alcoholic and other drinks, basket work, blankets and wax. Badajoz first rose to importance under Moorish rule, becoming in 1031 the capital of a small Moorish kingdom, which retained a fitful independence until 1229, when it was captured by Alphonso IX of Leon. During the Peninsular War Badajoz was unsuccessfully attacked by the French in 1808 and 1809; but on March 10, 1811, the Spanish commander was bribed into surrendering to the French. A British army endeavoured to retake it, and on May 16 defeated a relieving force at Albuera, but the siege was abandoned in June. For the operations preceding and following the siege of Badajoz in 1812, see PENINSULAR WAR. Its fortifications in 1812 were of great strength, while the high ground overlooking the town was covered by the forts of Pardaleras, Picurina and San Cristobal. In 1811 Wellington and Beresford had each attacked Badajoz unsuccessfully from the north; Wellington now chose the southeast corner, between the bastions of Trinidad and Santa Maria, for his point of attack. But first it was necessary to capture Ft. Picurina, which covered this angle; after one day's bombardment, 600 men of the 3rd division stormed Picurina, unbreached, losing half their number but capturing 200 prisoners. Batteries and parallels were dug and on March 30 fire was opened on the fortress; by April 5, 1812, breaches had been made in both bastions and in curtain between. The Light and 4th divisions mere detailed to storm the breaches while Picton's 3rd division escaladed the castle at the northeast corner of the town, and Leith's 5th division the San Vincente bastion at the northwest. At first the assault upon the breaches was a terrible and bloody failure. For two hours the gallant soldiers of the Light and 4th divisions struggled, stormed and died in vain. At midnight the survivors were recalled, leaving 2,000 dead and dying behind them. Picton's attempt to escalade the unbreached castle had also been beaten off with heavy loss. Failure stared Wellington in the face. But after Picton's attack had died away, a small group of his officers and men with two ladders found a quiet way up on to the walls of the castle while its defenders were listening to the battle at the breaches; reinforcements dashed up, and in a few minutes the castle was in the hands of the British. Almost simultaneously, Leith gained a footing in the San Vincente bastion, a late start having lulled its garrison into a state of false security. Sweeping along the battlements and through the deserted streets of the town, he took the defenders of the breaches in rear; at the same time the Light and 4th divisions dashed forward again and the town was won. The French commander, Phillipon, retired across the river to Ft. Cristobal and there surrendered. Again, as at Ciudad Rodrigo, the glory of the assault was dimmed by the excesses of the storming troops, who for three days were completely out of hand. The British losses were very heavy, amounting to 5,000, three-quarters of them in the assault; the French garrison of 5,000 were either killed or captured with 140 guns.

The fall of Badajoz to the Nationalists of Francisco Franco Aug. 14, 1936, during the Spanish Civil War was followed by a massacre in which hundreds were slain.

BADAKSHAN, including Wakhan, a province on the northeast frontier of Afghanistan, adjoining Russian territory. Its northeastern boundaries were decided by the Anglo-Russian agreement of 1873, which expressly acknowledged "Badakshan with its

dependent district Wakhan" as "fully belonging to the amir of Kabul," and limited it to the left or southern bank of the Oxus. On the west, Badakshan is bounded by a line which crosses the Turkestan plains southwards from the junction of the Kunduz and Oxus rivers till it touches the eastern water-divide of the Tash-kurghan river (here called the Koh-i-Chungar), and then runs south-east, crossing the Sarkhab affluent of the Khanabad (Kunduz), till it strikes the Hindu Kush. The southern boundary is carried along the crest of the Hindu Kush as far as the Khawak pass, leading from Eadakshan into the Panjshir valley. Eeyond this it is indefinite. The southern limits of Badakshan become definite again at the Dorah pass. The Dorah connects Zebak and Ishkashim at the elbow, or bend, of the Oxus with the Lutku valley leading to Chitral. From the Dorah eastwards the crest of the Hindu Kush again becomes the boundary till it effects a junction with the Muztagh and Sarikol ranges, which shut off China from Russia and India. Skirting round the head of the Tagdumbash Pamir, it finally merges into the Pamir boundary, and turns westwards, following the course of the Oxus, to the junction of that river and the Khanabad (Kunduz). So far as the northern boundary follows the Oxus stream, under the northern slopes of the Hindu Kush, it is separated only by the length of these slopes (some 8 or 10 m.) from the southern boundary along the crest. Eefore the boundary settlement of 1873 the small states of Roshan and Shignan extended to the left bank of the Oxus, and the province of Darwaz, on the other hand, extended to the right bank. Now, however, the Darwaz extension northwards is exchanged for the Russian Pamir extension westwards, and the river throughout is the boundary between Russian and Afghan territory; the political boundaries of those provinces and those of Wakhan being no longer coincident with their geographical limits.

The following are the chief provincial subdivisions of Badakshan, omitting Roshan and Shignan:—On the west Rustak, Kataghan, Ghori, Narin and Anderab; on the north Darwaz, Ragh and Shiwa; on the east Charan, Ishkashim, Zebak and Wakhan; and in the centre Faizabad, Farkhar, Minjan and Kishm. There are other minor subdivisions.

The Kokcha river traverses Badakshan from south-east to north-west, and, with the Kunduz, drains all the northern slopes of the Hindu Kush west of the Dorah pass. Some of its sources are near Zebak, close to the great bend of the Oxus northwards, so that it cuts off all the mountainous area included within that bend from the rest of Badakshan.

Its chief affluent is the Minjan, which Sir George Robertson found to be a considerable stream where it approaches the Hindu Kush close under the Dorah. Like the Kunduz, it probably drains the northern slopes of the Hindu Kush by deep lateral valleys, more or less parallel to the crest, reaching westwards towards the Khawak pass. From the Oxus (1,000 ft.) to Faizabad (4,000 ft.) and Zebak (8,500 ft.) the course of the Kokcha offers a high road across Badakshan; between Zebak and Ishkashim, at the Oxus bend, there is but an insignificant pass of 9,500 ft.; and from Ishkashim by the Panja, through the Pamirs, is the continuation of what must once have been a much-traversed trade-route connecting Afghan Turkestan with Kashgar and China. North of the Kokcha, within the Oxus bend, is the mountainous district of Darwaz, of which the physiography belongs rather to the Pamir type than to that of the Hindu Kush.

A very remarkable meridional range extends for 100 m. northwards from the Hindu Kush (it is across this range that the route from Zebak to Ishkashim lies), which determines the great bend of the Oxus river northwards from Ishkashim, and narrows the valley of that river into the formation of a trough as far as the next bend westwards at Kala Wamar. The western slopes of this range drain to the Oxus north-westwards, by the Kokcha and the Ragh, or else they twist their streams into the Shiwa, which runs due north across Darwaz. Here again we find the main routes which traverse the country following the rivers closely.

The principal domestic animal is the yak. There are also large flocks of sheep, cows, goats, ponies, fine dogs and Bactrian camels. The more important wild animals are a large wild sheep (*Ovis poli*), foxes, wolves, jackals, bears, boars, deer and leopards; amongst birds, there are partridges, pheasants, ravens, jays, sparrows, larks, a famous breed of hawks, etc.

Eadakshan proper is peopled by Tajiks, Turks and Arabs, who speak the Persian and Turki languages, and profess the orthodox doctrines of the Mohammedan law adopted by the Sunnite sect; while the mountainous districts are inhabited by Tajiks, professing the Shi'ite creed and speaking distinct dialects in different districts.

History.—Badakshan, part of the Greek Bactria, was visited by Hsüan Tsang in 630 and 644. The Arabian geographers of the 10th century speak of its mines of ruby and lapis lazuli, and of the commerce and large towns of Waksh and Khotl, regions in part corresponding with Badakshan. In 1272–73 Marco Polo and his companions stayed for a time in Badakshan. During this and the following centuries the country was governed by kings who claimed to be descendants of Alexander the Great. The last was Shah Mohammed, who died in the middle of the 15th century, leaving only his married daughters to represent the royal line. Early in the middle of the 16th century the Usbegs obtained possession but were soon expelled, and then the country was generally governed by descendants of the old royal dynasty by the female line. About the middle of the 18th century the present dynasty of Mirs established its footing in the place of the old one which had become extinct. In 1763 the country was invaded and ravaged by the ruler of Kabul. During the first three decades of the 19th century it was overrun and depopulated by Kohan Beg and his son Murad Beg, chiefs of the Kataghan Usbegs of Kunduz. When Murad Beg died, the power passed into the hands of another Usbeg, Mohammed Amir Khan. In 1859 the Kataghan Usbegs were expelled; and Mir Jahander Shah, the representative of the modern royal line, was reinstated at Faizabad under the supremacy of the Afghans. In 1867 he was expelled by Abdur Rahman and replaced by Mir Mohammed Shah, and other representatives of the same family.

BADALOCCHIO, SISTO, surnamed ROSA (1581–1647), Italian painter and engraver, was born at Parma and died at Bologna. He was of the school of Annibale Carracci. His principal engravings are the series known as Raphael's Eible, executed by him in conjunction with Lanfranco, another pupil of Carracci. The best of his paintings, which are few in number, are at Parma.

BADALONA, a town of north-eastern Spain, in the province of Barcelona; 6m. N.E. of the city of Barcelona, at the mouth of the small river Besós. Pop (1930), 44,291. Badalona is an industrial suburb of Earcelona, to which it is joined by railroad, tramways and roads; it manufactures chemicals, glass and several other commodities, and has a small harbour, chiefly important for its fishing and boat building trades. It is interesting for its Roman remains and other historical associations.

See Cayetano Soler, *Badalona histórica* (Barcelona, *1898)*; Solá y Seriol, *Memorias histdricas* de *Badalona* (Barcelona, 1879).

BADBY, JOHN (d. 1410), one of the early Lollard martyrs, was a tailor (or perhaps a blacksmith) in the west Midlands. He was burned at Smithfield for his denial of transubstantiation.

BADDELEY, ROBERT (*c.* 1732–1794), English actor, is said to have been first a cook to Samuel Foote, and then a valet, before he appeared on the stage. In 1761, described as "of Drury Lane theatre," he was seen at the theatre in Smock Alley, Dublin, as Gomez in Dryden's *Spanish Friar.* Two years later he was a regular member of the Drury Lane company in London, where he had a great success in the low comedy and servants' parts. He remained at this theatre and the Haymarket until his death. He was the original Moses in *The School for Scandal.* Baddeley died on Nov. 20, 1794. He bequeathed property to found a home for infirm actors, and also £3 per annum to provide wine and cake in the green-room of Drury Lane theatre on Twelfth Night. The ceremony of the Baddeley cake has remained a regular institution.

His wife SOPHIA BADDELEY (1745–86), an actress and singer, was born in London, the daughter of a sergeant-trumpeter named Snow. At the age of 18 she ran away with Baddeley, then acting at Drury Lane, and made her first appearance on the stage there on April 27 1765, as Ophelia. Later, as a singer, she obtained engagements at Ranelagh and Vauxhall.

See *Memoirs of Mistress Sophia Baddeley,* by Mrs. Elizabeth Steele (1781).

BADEN, a spa in Lower Austria, 17m. south of Vienna, beautifully situated at the foot of the Wiener Wald, where it is pierced by the romantic Helenental. The warm springs (72° F–97° F), from which its name and existence are derived, possess radioactive properties and have a high content of sulphate of lime. They are 14 in number, rising for the most part at the foot of the Calvarienberg (1,070ft.), a mass of dolomitic limestone, and are used for bathing. Most of the baths are in the old town where, too, are found the Rathaus, the parish church, a fine example of late Gothic architecture, dating from the end of the 15th century, and many fine monuments. West of the old town lie several fine parks and the Rollett museum, rich in local prehistoric and Roman finds. Evidences of a continuous settlement since early times are also to be seen in the old town, and Baden appears to have maintained its present function through the ages. Pop. (1939) 25,701.

See J. Schwarz, *Die Heilquellen von Baden bei Wien* (1900).

BADEN, a Land lying in the south-west corner of Germany, bounded on the north by Bavaria and Hesse; on the west by the Rhine with France and the Bavarian palatinate beyond; on the south by Switzerland; and on the east by Württemberg and part of Bavaria. The country consists of the eastern half of the fertile Rhine valley and of the adjoining mountains, especially the Schwarzwald (see BLACK **FOREST**) which fills the great angle made by the river between Schaffhausen and Strasbourg. The highest areas are south of the deep Kinzig valley which opens on to that of the Rhine south-east of Strasbourg. The Feldberg, the highest summit of the southern Schwarzwald, reaches nearly 5,000 feet. Westwards the hills are faulted steeply over the plain, which is broken only by the conspicuous Kaiserstuhl (1,800ft), a volcanic group north-west of Freiburg. To the north and north-east, beyond the Neckar, is the Odenwald range; while between that river and the northern end of the Black Forest the State includes a belt of lower land stretching from Pforzheim to Heidelberg. The greater part of Baden thus belongs to the basin of the Rhine, which receives upwards of 20 tributaries from its highlands. A part, however, of the eastern slope of the Black Forest belongs to the basin of the Danube, which there takes its rise in a number of mountain streams.

There are great physical contrasts within the *Land,* eg., the Rhine valley is the warmest district in Germany but the higher parts of the Black Forest record the greatest degrees of cold experienced in the south. The mean temperature of the Rhine valley is approximately 50° and that of the high table-land, 43°. Many minerals are found in small quantities, but little is worked save salt and building stone. Cultivable land including forests occupies 94% of the total area. Mineral springs are very numerous and famous, those of Baden-Baden, Badenweiler, Antogast, Griesbach, Freiersbach and Petersthal being the most frequented. In the valleys the soil is particularly fertile, yielding rye, wheat, barley, potatoes, hemp, hops, beetroot, turnips, chicory and tobacco. Cattle are reared in large quantities, and sheep, horses, pigs and goats. The culture of the vine increases; the wines are characterized by a mildness of flavour. Fruit-growing and bee-keeping are widespread. Forests, in which the predominant trees are fir, pine and chestnut, cover 39% of the total area; they have profoundly influenced life in the hills, and form a source of considerable wealth.

At the beginning of the 19th century Baden was only a margravate, with an area little exceeding 1,300 sq.mi., and a population of 210,000. Area and population progressively increased until the respective figures amounted in 1939 to 5,817 sq.mi. and 2,518,103 inhabitants. The religious division in 1933 was 1,408,j32 Roman Catholics, 943,540 Protestants, and 20,617 Jews.

District	Chief tonns	Pop. (1939)
(1) Mannheim	Mannheim	283,801
	Heidelberg	87,327
(2) Karlsruhe	Karlsruhe	189,8jo
	Pforzheim	78784
(3) Freiburg-im-Breisgau	Freiburg	111,860
(4) Konstanz	Konstanz	38,469

The capital of the Land is Karlsruhe, and important towns other than the above are Rastatt, Baden-Baden, Bruchsal Durlach, Oifenburg and Lahr. The population is greatest in the north and in the neighbourhood of the Swiss town of Basle.

The principal manufactures are machinery, cotton tissues, silk ribbons, paper, cigars, leather, clocks, jewellery, musical instruments, wood-work, brushes and chemicals. Beet sugar is also largely manufactured. The inhabitants of the Black Forest have long been celebrated for their dexterity in the manufacture of wooden ornaments, toys and musical instruments. The railways of Baden reach a total length of 2,110·6km., and transit trade is an important element. Mannheim is the great Rhine emporium, the chief manufacturing town and the seat of administrative government for the northern portion of the country.

Education is free and compulsory: schools are under State authority. There are two universities, the Protestant at Heidelberg and the Roman Catholic at Freiburg and a commercial high school at Mannheim, a technical high school and an academy of arts. The Roman Catholic Church has an archbishop at Freiburg; the Protestant Church is governed by a synod.

The constitution of the original republic of Baden was made by the National Assembly and is dated March 21, 1919. By it all privileges of birth, religion and caste were abolished. There was only one chamber (Landtag), the members of which were elected for four years. The suffrage was granted to all males and females over 20 years of age. The cabinet included four ministers and two State councillors; the president (officially "State President") was elected by the *Landtag.* Chief administrative authority after 1933 was in the hands of the nazi district leader (Gauleiter) and federal governor (Reichsstatthalter), Robert Wagner. (X.)

History.— The history of Baden as a state began in 1112 when Hermann, grandson of Bertold, duke of Carinthia and count of Zahringen, assumed the title of margrave of Baden. Ninety years later his descendants divided up their territories and formed two houses: Baden-Baden and Baden-Hochberg. A century later a new house of Baden-Sausenberg came into being as an offshoot of that of Baden-Hochberg. This latter line failed in 1418, and that of Baden-Sausenberg in 1503, when the whole of Baden passed under the rule of the margrave Christopher I, of Baden-Baden. This prince combined in 1512 with the Elector Palatine, duke of Wiirttemberg, bishop of Würzburg, and in 1515 with Frederick the Wise of Saxony, to set up a counter-alliance to the Swabian League, an action that was instrumental in preventing any effective organization of the Empire as a single unit. Christopher was also a promoter of discord within his own family by partitioning his estates between his three sons. Throughout the 16th century Baden suffered severely from the internecine warfare of its rulers, and the Reformation only served to add religious bitterness to territorial rivalries. The Thirty Years' War further accentuated these disputes and it was not until after the signature in 1648 of the Treaty of Westphalia that the family feuds finally disappeared. Nor was it until the Baden-Baden line failed in 1771, and their land passed to Charles Frederick of Baden-Durlach, that Baden came to play a conspicuous part in German history.

During his long reign (1749–1811) Charles Frederick quadrupled the territory of his state and proved himself a wise and humane ruler. Nor was he slow to seize the unequalled opportunity for territorial aggrandizement presented to him by the Napoleonic Wars. Siding first with the Austrians, and subsequently with Napoleon, he obtained benefits from both his allies. In 1806 he became a member of the Confederation of the Rhine, and adopted the style of a grand-duke. The treaties of Pressburg (1805) and Vienna (1809) brought him very substantial gains. On his death in 1811 he was succeeded by his grandson, Charles, who was married to Stephanie de Beauharnais, the adopted daughter of Napoleon I. As astute as his grandfather, Charles lost no time in transferring his allegiance from the French to the Allied side when once Napoleon's fortunes seemed finally on the wane. Baden had joined the Germanic confederation in 1815, but the vexed question of the succession to the grand-duchy was left unsettled by the Congress of Vienna. A treaty of April 16, 1816, between Austria and Bavaria had guaranteed the succession to Maximilian I., king of Bavaria, in

the event of the extinction of the Zähringen line. A year later Charles issued a pragmatic sanction (*Hausgesetz*) in which he declared that the succession should pass to the issue of a morganatic marriage between Charles Frederick and Luise Geyer von Geyersberg (created Countess Hochberg). The subsequent dispute between Baden and Bavaria over the succession question was finally settled in favour of the Hochbergs by the treaty of Frankfurt of July 10, 1819. One outcome of this dispute was of far-reaching importance. In order to gain popular support for the Hochberg claims Charles in 1818 had granted Baden a liberal constitution by which two chambers were set up with power over legislation and taxation. This experiment in constitutional government was watched with deep interest by all the German states, and its eventual failure was hailed with joy in reactionary circles all over Germany.

The July Revolution of 1830 left Baden undisturbed under the liberal rule of Leopold, the first grand-duke of the Hochberg line. But with the first news of the Paris revolution in 1848 the storm burst and the people demanded that a number of resolutions passed in the previous year by a Radical demonstration at Offenburg should be at once enacted. At first the Government obtained some measure of success against the insurgents, who had taken up arms, but in 1849 the storm burst again with redoubled fury. The promulgation of a new constitution on the Frankfurt model had pleased neither the Radicals nor the Conservatives, and the former again sought the arbitrament of arms. The army rose in revolt, and the grand-duke and his government sought safety in flight. Finally, in June, the aid of Prussia having been sought and obtained by the grand-duke, a Prussian army invaded Baden under the command of the future emperor William I. With its coming the revolution was doomed, and by August all show of resistance was at an end. The new diet passed a series of reactionary decrees with the object of strengthening the hands of the government, and the grand-duke returned to his capital. As the price for her assistance Prussia obtained the adhesion of Baden to the League of the Three Kings.

With the crushing of the revolution Baden entered upon a long period of uneventful prosperity that only terminated with World War I. In the war of 1866 her army fought on the side of Austria, although the sympathy of her ruler, the grand-duke Frederick, who was a son-in-law of the emperor William, was definitely on the side of Prussia. Indeed his was the voice that in 1871 first hailed the king of Prussia as German emperor in the Hall of Mirrors at Versailles. The only event of real interest in the history of Baden after the revolution was the battle that raged there as elsewhere in Germany between Clericals and Liberals for the control of education. In Baden this fight was not ended until 1880 when a reconciliation was effected with the Holy See and the archbishopric of Freiburg, which had been vacant since 1868, was once again filled up. The grand-duke Frederick, who had ruled Baden with wisdom and moderation for half a century and been an authoritative voice in the counsels of the Empire, died in Sept. 1907, and was succeeded by his son, the grand-duke Frederick 31.

World War I brought revolution in its train to Baden; and the dynasty that had ruled for 800 years gave place (Nov. 1918) to a democratic republic. A new constitution established (May 1919) a single legislative chamber with a cabinet responsible to and chosen by that chamber. Further the chamber selected from the cabinet the minister-president, who acted in the dual capacity of prime minister and president of the state. Baden was drawn into the Ruhr conflict of 1923–25 when French troops occupied the towns of Offenburg, Karlsruhe and Mannheim and seized their transportation facilities and customs houses. Though the University of Heidelberg, both students and faculty, accepted and expounded nazi ideology with enthusiasm after 1933, the Roman Catholic population and priests of southern Baden offered more opposition to nazification than most other parts of Germany.

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BADEN or **BADEN-BADEN** (to distinguish it from other places of the name), fashionable watering-place, Germany, in the *Land* of Baden, 23 mi. S. by W. of Karlsruhe. Situated 600 ft. high in the Black forest, the surroundings are laid out in gardens and pleasure-grounds which attract numerous visitors. Resident population (1939) 36,056. The springs of Baden were known to the Romans. The name *Aurelia Aquensis* was given to it in honour of Aurelius Severus. In 1847 remains of Roman vapour baths were discovered just below the New Castle. The margraves resided at Baden from the 14th to the 17th centuries, first in the Old Castle, the ruins of which exist above the town, but after 1479 in the New Castle, situated nearer the town, and remarkable for its subterranean dungeons. During the Thirty Years' War Baden suffered severely. Since the early 19th century the Government has greatly fostered the growth of the town. The 29 hot springs, varying from 115° to 153°F, flow from the castle rock at the rate of 90 gallons per minute, and the water supplies the various baths. There are two chief bathing-establishments. The town proper is on the right bank of the Oos, but the principal resorts of visitors are on the left. Baden was bombed by British planes in World War II. The city's large hotels were used as hospitals for wounded German soldiers during the war.

BADEN, a town in the Swiss canton of Aargau, on the left bank of the river Limmat, 14m. N.W. of Ziirich The much frequented hot sulphur springs, mentioned by Tacitus, were fashionable in the 15th and 16th centuries. They are efficacious in cases of gouty and rheumatic affections, and attracted 6,400 visitors, chiefly Swiss, in 1920. They are approached from the old town by a fine boulevard. Many Roman remains have been found in the gardens of the Kursaal. The town is very picturesque, with its steep and narrow streets, and its one surviving gateway; it is dominated on the west by the ruined castle of Stein, formerly a stronghold of the Habsburgs. In 1415 Baden (with the Aargau) was conquered by the Eight Swiss confederates, whose bailiff inhabited the other castle, on the right bank of the Limmat, which defends the ancient bridge. The delegates of the confederates met at Baden, from 1426 to about 1712, so that during that period Baden was virtually the capital of Switzerland. The diet sat in the old town hall or *ratkaus*. Baden was the capital of the canton of Baden from 1798 to 1803, when the canton of Aargau was created. To the north-west of the baths a new industrial quarter, with large electrical engineering works, has sprung up. In 1941 the permanent population of the town of Baden was 10,313 (German-speaking, mainly Catholic, with many Jews). The whole agglomeration of Baden had 20,871 inhabitants in 1930.

One mile south of Baden, on the Limmat, is the famous Cistercian monastery of Wettingen (1227–1841—the monks are now at Mehrerau near Bregenz), with splendid old painted glass in the cloisters and magnificent early 17th-century carved stalls in the choir of the church. Six miles west of Baden is Brugg (4,415 inhabitants) in a fine position on the Aar. Near by are remains of the Roman colony of *Vindonissa* (Windisch), and the monastery (founded 1310) of Königsfelden, formerly the burial-place of the early Habsburgs, still retaining much fine painted glass.

See Barth. Fricker, *Geschichte der Stadt und Bader zu Baden* (Aarau, 1880); also Henri Mercier, *La Ville et les Bains de Bade* (Lausanne, 1922).

BADENI, KASIMPR, COUNT (1846–1909) Austrian statesman, was born Oct. 14, 1846, at Surochow in Galicia. He entered the civil service from which he resigned in 1886, but two years later was appointed governor *(Statthalter)* of Galicia. In Sept. 1895 he was appointed Austrian prime minister and his attitude was at first satisfactory to the German-Austrians. In 1897, however, in order to gain the support of the Czechs for the new *Ausgleich* with Hungary, he made certain important concessions

in respect of the use of the Czech language in Bohemia. This was done by ordinance, without parliamentary sanction, and met with violent opposition from the German deputies, some of whom were imprisoned. This led to Badeni's downfall on Nov. 28, 1897. He died at Radziechow, near Lemberg, July 9, 1909.

BADENOCH, a district of south-east Inverness-shire, Scotland, bounded on the north by the Monadhliath mountains, on the east by the Cairngorms and Braemar, on the south by Atholl and the Grampians, and on the west by Lochaber. *See* INVERNESS-SHIRE.

BADEN-POWELL, ROBERT STEPHENSON SMYTH BADEN-POWELL, 1st Baron (1857–1941), born in London, Feb. 22, 1857, sixth son of Professor Baden-Powell of Oxford. He was educated at Charterhouse, and in 1876 joined the 13th Hussars regiment, with which he served in India. Afghanistan, and South Africa. In 1895 he was appointed to command the native levies in Ashanti, and was chief staff officer in the campaign of 1896–97 in Matabeleland. After his famous defence of Mafeking (1899–1900) Baden-Powell was promoted major-general, becoming lieutenant-general in 1908. He organized the South African constabulary (1900–03) and in 1908 founded the organization of Boy Scouts (*q.v.*), which led, in 1910, to his founding the Girl Guides (*q.v.*) with the co-operation of his sister, Miss Agnes Baden-Powell, movements which have spread in most civilized countries. He retired from the army in 1910. His honours include the G.C.M.G., G.C.V.O., and K.C.B. He was created a baronet in 1922, and a baron in 1929 In 1937 he was awarded the O M.

His works include *The Matahele Campaign* (1896); *Quick Training for War* (1914); *My Adventures as a Spy* (1915); *Pigsticking* (rev. ed. 1924); *Paddle Your Own Canoe* (1939); and many books for scouts. He exhibited sculptures at the Royal Academy exhibition of 1907. *See* J. S. Fletcher, *Baden-Powell of Mafeking* (1900); R. J. Bremner Smith, *Col.* R. S. *S. Baden-Powell* (1900); *W.* F. Aitken, *The Chief Scout, Sir Robert Baden-Powell* (1912).

BADENWEILER, watering place in the *Land* of Baden, Germany, 28m. N. by E. of Basle at the western foot of the Black Forest, sheltered by the Blauen (3,820ft.). The 11th century castle, formerly belonging to the margraves of Baden, was destroyed by the French in the 18th century. The warm mineral springs and the picturesque surroundings attract numerous visitors. In 1784 well-preserved Roman baths were discovered here. Resident population (1933) 1,207.

BADGE, a distinctive emblem, originally worn by knights and their followers in battle as a mark of identification. Badges are now worn as a sign of membership of a society, or of the holding of an office, etc.

The heraldic badge is of great antiquity, the Plantagenet "broom," for instance, appearing on the seal of Richard I.; in the 14th and 15th centuries badges were borne on horse-trappings, bed-hangings, etc. (See HERALDRY.)

The fourth Lateran Council (1215) laid down a regulation by which Jews were compelled to wear a distinguishing badge on their outer garment or gaberdine (*q.v.*). It was worn on the breast and usually consisted of a circular piece of cloth. In France its colour was originally yellow, and later red and white; in England it was formed by two white or yellow bands, and in Edward I.'s reign it was made in the shape of the Tables of the Law. (See the Jewish Encyclopaedia, *s.v.* "Costume.")

BADGER, the name for any member of the Musteline subfamily *Melinae* or the genus *Meles* (*see* CARNIVORA). A feature of the genus is the way in which the lower jaw is locked into a long cavity of the cranium, thus enabling the animal to maintain its hold with great tenacity. The common badger (M. *taxus*) is 25–29 in. long, with a tail of about 8 in.; in colour it is grey above and black below, with a white head, on either side of which is a black stripe. It is nowhere abundant, but is generally distributed over Europe and Asia. Nocturnal in habits, it feeds on roots, fruits, eggs, small quadrupeds and insects. Allied species occur in various parts of Asia. The American badger (*Taxidea americana*) ranges over most of the United States of America. All these resemble *M. taxus* in habits. Badger hair is used for shaving-brushes and trimmings.

The old "sports" of badger-drawing and badger-baiting were prohibited in Great Britain about the middle of the 19th century. "To badger" (*i.e.,* to worry) is a metaphorical derivative, in use since 1794.

BADGER. A term of uncertain derivation (possibly derived from bagger, in allusion to the hawker's bag) for a dealer in food, such as corn or victuals (more expressly fish, butter or cheese), which he has purchased in one place and brought for sale to another place; an itinerant dealer, corresponding to the modern hawker or huckster. An English statute of 1552 which summarized, and prescribed penalties against, the offences of engrossing, forestalling and regrating, specially exempted badgers from these penalties, but required them to be licensed by three justices of the peace for the county in which they dwelt. A statute of 1562–63, after declaring that many people took up the trade of badgering "seeking only to live easily and to leave their honest labour," enacted that badgers should be licensed for a year only, should be householders of three years' standing in the county in which they were licensed, and should enter into recognizances not to engross or forestall. An act of 1844 abolished the offence of badgering, and repealed the statutes passed in relation to it.

BADGES, GOOD CONDUCT: see STRIPE.

BADGHIS, a district of north-west Afghanistan, between the Murghab and Hari Rud rivers, extending as far north as the edge of the desert of Sarakhs. It includes the Chul formations of the Russo-Afghan boundary surveyed in 1885. Since that date it has been largely settled by the amir with purely Afghan tribes.

BADWAM, CHARLES (1813–1884), English classical scholar, was born at Ludlow, in Shropshire, England. His father, Charles Badham, translator of Juvenal and an excellent classical scholar, was regius professor of physic at Glasgow; his mother was a cousin of Thomas Campbell, the poet. When about seven years old, Badham was sent to Switzerland, where he became a pupil of Pestalozzi. He was educated at Eton and Oxford, afterwards travelling in Italy to study ancient manuscripts, in particular those of the Vatican library. It was here that he began a life-long friendship with G. C. Cobet. He was headmaster at Louth and then at Edgbaston, and in 1866 went to Australia to be professor of classics and logic at Sydney university. Dr. Badham's classical attainments were recognized by the most famous European critics.

Badham published editions of Euripides, *Helena* and *Iphigenia in Tauris* (1851), *Ion* (1851); Plato's *Philebus* (1855, 1878), *Laches* and *Euthydemus* (1865), *Phaedrus* (1851), *Symposium* (1866) and *De Platonis Epistolis* (1866). He also contributed to *Mnemosyne* (Cobet's journal) and other classical periodicals. His *Adhortatio ad Discipulos Academiae Sydniensis* (1869) contains a number of emendations of Thucydides and other classical authors. He also published an article on "The Text of Shakespere" in *Cambridge Essays* (1856); *Criticism applied to Shakespere* (1846); *Thoughts on Classzcal and Commercial Education* (1864). *A* collected edition of his *Speeches and Lectures delivered in Australia* (Sydney, 1890) contains a memoir by Thomas Butler.

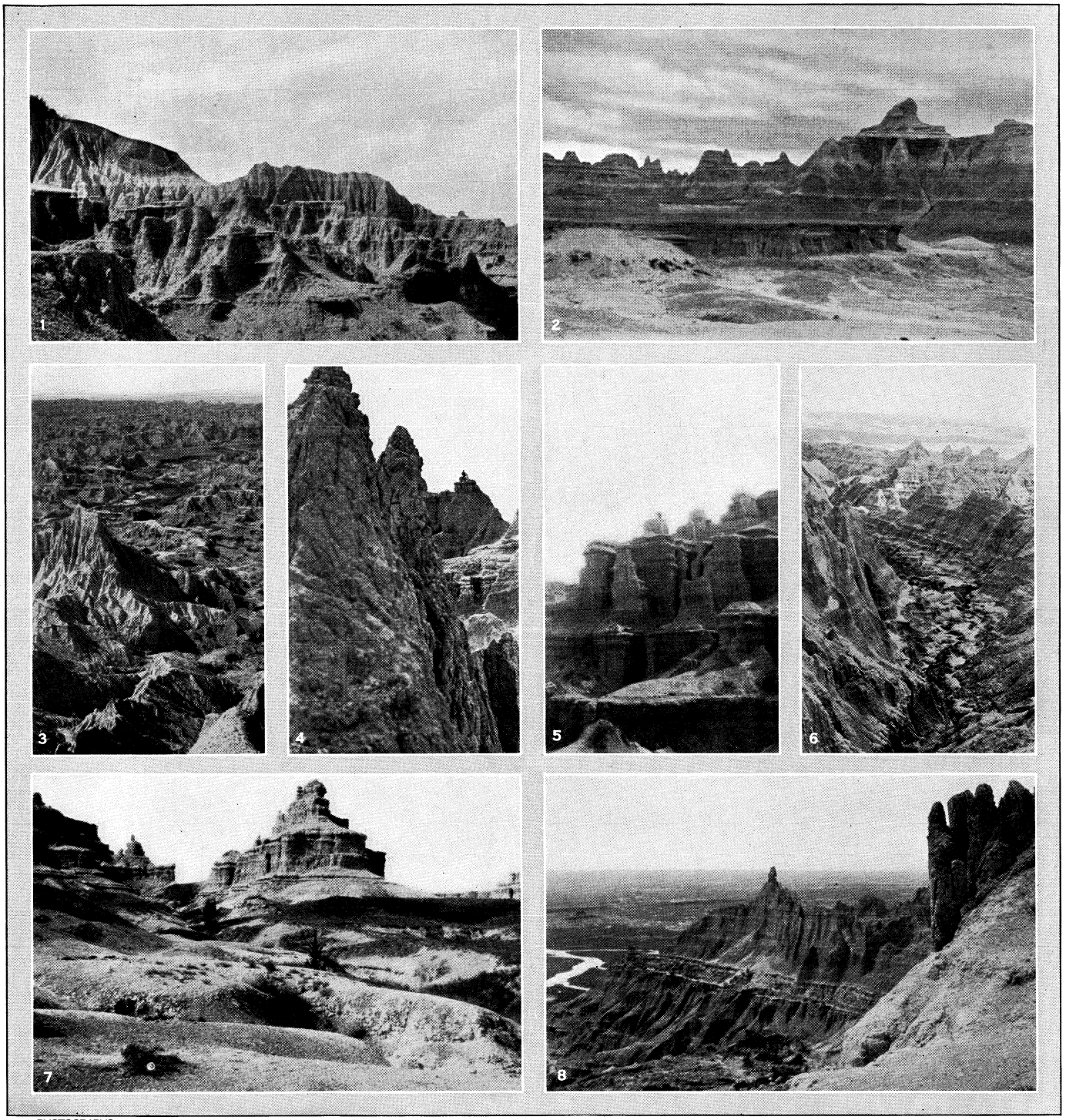
BADIA Y LEBEICH (1766–1818): see ALI BEY.

BADIUS, JODOCUS or **JOSSE** (1462–1535), sometimes called BADIUS ASCENSIUS from the village of Asche, near Brussels, where he was born, an eminent printer at Paris, whose establishment was celebrated under the name of *Prelum Ascensianum.* He was himself a scholar of considerable repute, had studied at Brussels and Ferrara, and before settling in Paris had taught Greek for several years at Lyons. He illustrated with notes several of the classics which he printed, and was the author of numerous pieces, amongst which are a life of Thomas à Kempis, and a satire on the follies of women, entitled *Navicula Stultarum Mulierum.*

See P. Renouard, *Bibliographie des impressions et des oeuvres de Josse Badius Ascensius* (1908).

BAD LANDS, a term originally applied to certain areas in western South Dakota which, because of their extreme roughness and inhospitability to man, were called Maka Sicha (*maka,* bad; *sicha,* lands) by the Dakota Indians, *Mauvaises* Terres by the French Canadian trappers of the region, and later "bad lands" by the white settlers. More recently the term has come to have only a topographic significance and is applied to regions sharing characteristics of the type area—the White river region of South Dakota. Other areas of bad lands occur in Korth Dakota, Nebraska, Montana, Wyoming, Colorado. New Mexico, Arizona, Utah

BAD LANDS



PHOTOGRAPHS, RISE STUDIO, RAPID CITY, SOUTH DAKOIA

VIEWS OF ROCK FORMATIONS IN THE REGION KNOWN AS THE "BAD LANDS" OF SOUTH DAKOTA

The roughness of the district and its general inhospitality to man have given the White river region of South Dakota the name of the "bad lands." The area is covered with deep gullies, precipitous wails and fantastic rock formations which jut forth irregularly. These are largely the result of the erosive work of surface running water, although underground streams, wind erosion and other agencies are thought by some to have played a minor part in the shaping of some of the forms

1. Detail of valley side showing differential erosion in hard and soft beds
2. View across section of the bad lands showing differential erosion on rocks of varying resistance
3. View across a bad land area from eroded plateau above
4. Detail of a stream divide alona the White river bed
5. Detail of valley wall showing differential erosion
6. View down a gully of the bad lands
7. Buttes in the bad lands that have been isolated by erosion
8. View from bad lands district into the valley of a master stream

and other Western States and in various regions of other continents, notably South America and Asia.

The South Dakota bad lands are still known as the most picturesque and rugged areas of their kind in the world. They are variously known as the White River Bad Lands, the Big Bad Lands or even the Bad Lands.

Typical bad lands are areas intimately dissected by running water into innumerable, winding, narrow, steep-sided gullies separated by narrow, serrate divides. They are found fringing the outer valley walls of some master stream to which the gullies are tributary or in a zone bordering table-lands that lie a few hundred feet above the general level of the surrounding country. The width of the dissected area varies considerably but seldom exceeds a few miles. In depth, the gullies usually vary from a few tens of feet to a few hundred feet. Gradients of stream courses in the valley bottoms are normally high, increasing toward their sources, where they may become nearly, if not quite, vertical. On the side-walls there are many alternations of steep slopes, projecting ledges and more gentle slopes. Divides between gullies are narrow, tortuous in direction and are interspersed with pinnacles and sags. Isolated peaks, pillars and pulpit rocks capped by more resistant portions of rock abound. The coalescing of gullies frequently leaves isolated flat-topped buttes, pyramidal or conical-shaped hills or wedge-shaped short ridges.

Viewed from the valley of the master stream to which the dissecting gullies are tributary, the fringe of bad lands appears against the sky-line much as a sawtooth mountain range appears from a greater distance. From the upland area one may approach the bad lands over level country with no hint of their presence until the head of a ravine is reached, when the whole intricate maze of gullies, ridges and peaks is seen suddenly.

Origin.—Bad lands are chiefly the result of the erosive work of running water. Erosion by the wind, the dissolving action of underground water and other agencies may play a part in the shaping of some forms, *e.g.*, by the etching out of the less resistant portions of rock, but these are merely incidental to the cutting of gullies.

For the formation of bad lands three factors seem to be the determinants: (1) the nature of the underlying rock material; (2) the gradient or slope of the land surface; (3) the climate of the region.

The most favourable rock material is a fine-grained, poorly cemented one of low permeability to water, such as clay or soft shale with perhaps some friable, fine sandstone or volcanic ash. When moistened, many of these clays expand and when dried may curl up in flakes and spring loose from the underlying mass or they may swell into spongy masses and dry in loose, incoherent aggregates resembling cauliflower heads. Such material is readily removed by slope wash during successive rains. The fineness of the material facilitates rapid transportation so that the chances for accumulation or deposition are small so long as water is flowing over the surface.

Stratified clays and shales are often alternately interbedded with sandstones, conglomerates, limestones or other more resistant layers. Shales, furthermore, often contain hard spherical concretions that may offer greater resistance to removal. Erosion of such material results in isolated resistant masses such as concretions or conglomerate boulders and gives rise to pillars of clay capped by these harder rocks. Pulpit rocks, toadstool rocks and like forms capped by slabs of sandstone or limestone are formed in a similar manner.

In bad lands the down cutting action of streams dominates over the side cutting. In order that this may take place the gradient of stream valleys must be steep. In many cases steep gradients are made possible by the rapid excavation of a large valley by a master stream which heads in some region of more abundant rainfall and which erodes its valley more rapidly than the tributaries from the bad lands areas where there is less rainfall.

The climate of regions of bad lands is mostly arid or semi-arid. Daily as well as yearly variations in temperature are great. Humidity is low. Rainfall is likely to be concentrated in heavy showers within short intervals alternating with longer periods of drought. During the sudden downpours of rain, slopes are washed clean of the fine clays loosened during the preceding period of moistening and drying, and any small vegetation that may have gained a foothold is quickly swept away. The great concentration of water from the bare side slopes rushes down the gullies, removing material from the bottom, and deepens the trenches.

Life.—In the bad lands proper there is little vegetation of any kind partly because of the deficiency of rainfall, but largely because of the difficulty plants have in maintaining a foothold under the severe conditions of erosion. Animal life in the bad lands is likewise scarce because of the meagre supply of plant food. A few birds, an occasional rabbit, gopher, prairie-dog, mouse, snake or coyote are likely inhabitants of such a region.

Fossils.—The rock formations of bad lands probably contain fossils in not greater abundance than the rocks of other regions, but the bare slopes and the rapid erosion make fossil-finding in these areas easier. Among the fossils found are those of the horse, camel, rhinoceros, dog, cat, tapir, deer, rodent, insect eater, turtle, crocodile, eggs of birds and the remains of many animals now extinct.

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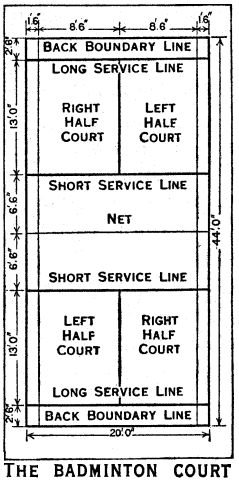
BADLESMERE, BARTHOLOMEW, BARON (1275–1322), English nobleman, was the son and heir of Gunselm de Badlesmere (d. 1301), and fought in the English army both in France and Scotland during the later years of the reign of Edward I. In 1307 he became governor of Bristol castle, and afterwards steward of his household to Edward II. He conspired with some other noblemen to gain supreme influence in the royal council. Although very hostile to Earl Thomas of Lancaster, Badlesmere helped to make peace between the king and the earl in 1318, and was a member of the middle party which detested alike Edward's minions, like the Despensers, and his violent enemies like Lancaster. The king's conduct, however, drew him to the side of the earl, and he had already joined Edward's enemies when, in Oct. 1321, his wife, Margaret de Clare, refused to admit Queen Isabella to her husband's castle at Leeds in Kent. The king captured the castle, seized and imprisoned Lady Badlesmere, and civil war began. After the defeat of Lancaster at Boroughbridge, Badlesmere was taken and hanged at Canterbury on April 14, 1322. His son and heir, Giles, died without children in 1338.

BADMINTON or **GREAT BADMINTON,** village in the Cotswold Hills, Gloucestershire, England, 100 mi. W. of London by the Great Western railway (direct line to south Wales). Here is Badminton House, the seat of the dukes of Beaufort, standing in a park some ten miles in circumference. The manor of Badminton was acquired in 1608 from Nicholas Boteler (to whose family it had belonged for several centuries) by Thomas, Viscount Somerset (d. 1650 or 1651), 3rd son of Edward, 4th earl of Worcester, and was given by his daughter and heiress Elizabeth to Henry Somerset, 3rd marquess of Worcester and 1st duke of Beaufort (1629–99), who built the present mansion (1482) on the site of the old manor house. Population of parish (1931) 356

BADMINTON, a game played with rackets and shuttlecocks, its name being taken from the duke of Beaufort's seat in Gloucestershire, England. The game appears to have been first played in England about 1873, but before that time it was played in India, where it is still popular to some extent. The Badminton Association in England was founded in 1895, and its laws were framed from a code of rules drawn up in 1887 for the Bath Badminton Club and based on the original Poona (1876) rules. These rules apply to the game as played in America and in practically every other country where Badminton is played. In clubs controlled by the Badminton Association only the covered court game is recognized. The All-England championships for gentlemen's doubles, ladies' doubles, and mixed doubles were instituted in 1899, and for gentlemen's singles and ladies' singles in 1900; and the first International Match between England and Ireland was played in 1903. Badminton may be played by daylight or by

artificial light, either with **two** players on each side (the four-handed or double game) or with one player on each side (the two-handed or single game). The game consists entirely of volleying and is extremely fast, a single at Badminton being admitted to require more staying power than a single at lawn tennis. There is much scope for judgment and skill; *e.g.*, in "dropping" (hitting the shuttle gently just over the net) and in "smashing" (hitting the shuttle with a hard downward stroke). The measurements of the Badminton court are shown on the accompanying plan.

Diagram of *Court.*—In the two-handed game, the width of the court is reduced to 17ft. and the long service lines are dispensed with, the back boundary lines being used as the long service lines, and the lines dividing the half courts being produced to meet the back boundary lines. The net posts are placed either on the side boundary lines or at any distance not exceeding 2ft. outside the said lines; thus in the four-handed game, the distance between the posts is from 20 to 24ft., and in the two-handed game, from 17 to 27ft. *N.B.*—With the exception of the net line, the dotted lines on the court apply only to the court for the two-handed game.



THE BADMINTON COURT
For the four-handed game the court is full-sized; for the two-handed, it is 3 ft. narrower as indicated

The Badminton hall should, if possible, be not less than 25ft. in height above the middle of the net. Along the net line is stretched a net join. deep and from 17 to 24ft. long, according to the position of the posts, and edged on the top with white tape 3in. wide. The top of the net should be 5ft. from the ground at the centre and 5ft. 1in. at the posts. The shuttlecock (or shuttle) has from 14 to 16 feathers from $2\frac{1}{2}$ to $2\frac{3}{4}$in. long, and weighs from 73 to 85 grains. The racket (which is of no specified size, shape or weight) is strung with strong fine gut and weighs as a rule between 5 and 6oz.

The game is for 15 or, rarely, for 21 aces, except in ladies' singles, when it is for 11 aces; and a rubber is the best of three games. Where 21 aces are played (as only occurs in handicap contests) matches are decided by a single game. The right to choose ends or to serve first in the first game of the rubber is decided by tossing. If the side which wins the toss chooses first service, the other side chooses ends, and vice versa; but the side which wins the toss may call upon the other side to make first choice. The sides change ends at the beginning of the second game, and again at the beginning of the third game, if a third game is necessary. In the third game the sides change ends when the side which is leading reaches eight in a game of 15 aces, and 6 in a game of 11 aces, or, in handicap games, when the score of either side reaches half the number of aces required to win the game. In matches of one game (21 aces) the sides change ends when the side which is leading has scored 11 aces. The side winning a game serves first in the next game, and, in the four-handed game, either player on the side that has won the last game may take first service in the next game.

The single-handed and double-handed game consists of 15 aces; when the score is "13 all" the side which first reaches 13 has the option of "setting" the game to 5, and when the score is "14 all" the side which first reaches 14 has the option of "setting" the game to 3; *i.e.*, the side which first scores 5 or 3 aces, according as the game has been "set" at "13 all" or "14 all" wins. In ladies' singles, when the score is "9 all" the side first reaching g may "set" the game to 5, and when the score is "10 all" the side which first reaches 10 may "set" the game to 3. In three-handed or in four-handed games, the game consists of 21 aces, the first "set" is at "19 all"; second set is at "20 all." There is no "setting" in handicap games.

In the four-handed game the player who serves first stands in his right-hand half court and serves to the player who is standing in the opposite right-hand half court, the other players meanwhile standing anywhere on their side of the net. As soon as the shuttle is hit by the server's racket, all the players may stand anywhere on their side of the net. If the player served to returns the shuttle —*i.e.*, hits it into any part of his opponents' court before it touches the ground—it has to be returned by one of the "in" (serving) side, and then by one of the "out" (non-serving) side, and so on, until a "fault" is made or the shuttle ceases to be "in play." (The shuttle is "in play" from the time it is struck by the server's racket until it touches the ground, or touches the net without going over, or until a "fault" is made.) If the "in" side makes a "fault," the server loses his "hand" (serve), and the player served to becomes the server; but no score accrues. If the "out" side makes a "fault," the "in" side scores an ace, and the players on the "in" side change half courts, the server then serving from his left half court to the player in the opposite left half court, who has not yet been served to. Only the player served to may take the service, and only the "in" side can score an ace. The first service in each innings is made from the right-hand half court. The side that starts a game has only one "hand" in its first innings; in every subsequent innings each player on each side has a "hand," the partners serving consecutively. While a side remains "in," service is made alternately from each half court into the half court diagonally opposite, the change of half courts taking place whenever an ace is scored. If, in play, the shuttle strikes the net but still goes over, the stroke is good; but if this happens in service and the service is otherwise good, it is a "let"; *i.e.*, the stroke does not count, and the server must serve again, even if the shuttle has been struck by the player served to, in which case it is assumed that the shuttle would have fallen into the proper half court. It is a "let," too, if the server, in attempting to serve, misses the shuttle altogether. It is a good stroke, in service or in play, if the shuttle falls on a line, or, in play, if it is followed over the net with the striker's racket, or passes outside either of the net-posts and then drops inside any of the boundary lines of the opposite court. *Mutatis* mutandis, the above remarks apply to the two-handed game, the main points of difference being that, in the two-handed game, both sides change half courts after each ace is scored and the same player takes consecutive serves. whereas in the double game only the serving side changes half courts at an added ace and a player may not take two consecutive serves in the same game. Furthermore, since 1921, it has been laid down that in the two-handed game the players shall serve from and receive service in the right-hand half courts only when the server's score is 0, or when he has scored an even number of aces in the game, the service being delivered from and received in the left-hand half courts when the server has scored an odd number of aces.

It is a "fault" (a) if the service is overhand; *i.e.*, if the shuttle when struck is higher than the server's waist; (b) if, in serving, the shuttle does not fall into the half court diagonally opposite that from which service is made; (c) if the service falls short of the service line or outside the boundary lines; (d) unless both the server's feet are in his own court; a foot on a line is held to be out of court; (e) if either in service or in play the shuttlecock falls outside the bounds of the court; (f) if the shuttlecock in service or play, passes through or under the net, or hangs in the net, or touches the roof or side walls of the hall or the person or dress of any player, or anything except the bat of the striker, or the top of the net; (g) if the shuttle is struck twice successively by the same player, or if it is struck by a player and his partner; (h) if the shuttle be struck before it crosses to the striker's side of the net; (i) if the striker touch the net or its supports with his racket or otherwise.

The development of Badminton in Great Britain and Ireland since 1910 is evidenced by the increase in the number of clubs affiliated with its central organization, the Badminton Association. In 1910 only 302 clubs were so affiliated, including Scottish clubs, while at the end of 1927 the number totalled nearly 700 in England alone. A further total of over 360 clubs belonged to the Irish, Scottish and Welsh Badminton Unions.

The World War necessarily checked the progress of the game, but since 1918 it has steadily gained in popularity, and with the aid of exhibition matches, which for some seasons have been held all over England, a better knowledge of the possibilities of Badminton has been acquired. Another symptom of the game's

advance is the increase in the number of county associations, the chief object of which is the promotion of inter-county matches and competitions.

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For full information as to the Laws of Badminton, the reader is referred to The Badminton Association's Annual Handbook (London). *The Badminton Gazette*, established in Nov. 1907, is the official organ of the Association, and appears monthly throughout the season. Also *see* Spalding's *Lawn Sports* for official rules and full details of the game.

BADNUR, a town of British India, the headquarters of the district of Betul in the Central Provinces, pop. about 7,000. Not far from Badnur is Kherla, the former residence of the Gond rajahs, where there is an old fort, now in ruins.

BADOGLIO, PIETRO (1871–), Italian general, was born at Grazzano Monferrato, Sept. 28, 1871. In the Italo-Turkish War he served in Tripoli on the staff. During World War I he planned and carried out the successful attack on Monte Sabotino which preceded the fall of Gorizia in Aug. 1916, and commanded the 27th corps at the battle of Caporetto. From Feb. 1918, he acted as sole sub-chief-of-staff under Diaz. He conducted the armistice preliminaries at Villa Giusti and signed the armistice on behalf of Italy. Appointed to the rank of army general, he was chief of the general staff until 1921. He was ambassador to Brazil, 1923–25, and governor-general of Libya, 1929–33. On Nov. 28, 1935, he was appointed commander-in-chief of operations in Abyssinia. From May to June 1936 he was viceroy of Abyssinia The title of duke of Addis Ababa was conferred on him. In June 1940 he was made chief of staff of the Italian army but he resigned in December of that year after the Italian armies were defeated in Greece, a campaign he had reputedly opposed. When Premier Benito Mussolini resigned July 25, 1943, Badoglio was made premier in his place. Less than two months later, on Sept. 8, Badoglio and King Victor Emmanuel agreed to Italy's unconditional surrender to the United Nations.

BAD OLDESLOE, a spa in the southeast of the Prussian province of Schleswig-Holstein, on the Trave, and a junction on the railway from Liibeck to Hamburg. Pop. (1933), 7.859.

BADRINATH, a village and celebrated temple in British India, in the Garhwal district of the United Provinces. It is situated among mountains rising to a height of 23,000 ft., and the altitude of the great temple itself is 10,294 ft. It is about 40 or 50 ft. in height, built in the form of a cone, with a small cupola, on the top of which is a gilt ball and spire, and contains the shrine of Badrinath, dedicated to an incarnation of Vishnu. The principal idol is of black stone and is 3 ft. in height. Badrinath is a favourite resort of pilgrims from all parts of India; and the long and toilsome route by which it is reached enhances the merits of the pilgrimage.

BADULLA, the administrative capital of the province of Uva, Ceylon, 54 mi. southeast of Kandy, and the terminus of the mountain railway. It was in Kandyan times the home of a prince who ruled Uva as a principality. Badulla stands 2,222 ft. above sea-level; the average annual rainfall is 78½ in.; the average temperature, 73°. The population of the town is 9,849; of the Uva Province (1931) 303,419. The town which is almost encircled by a river, the Badulla-Oya, and over-shadowed by the Naminacooly Kande range of mountains (highest peak 6,680 ft.) is very picturesquely situated. It is the centre of a thriving tea and rubber planting district.

BAEDEKER, KARL (1801–1859), German publisher, was born at Essen, Nov. 3, 1801. His father had a printing establishment and bookshop there, and Karl followed the same business independently in Coblenz. Here he began to issue the first of the series of guide-books with which his name is associated. They followed the model of the English series instituted by John Murray, but developed in the course of years so as to cover the greater part of the civilized world, and later were issued in English and French as well as German. Baedeker's son Fritz carried on the business, which in 1872 was transferred to Leipzig. Baedeker's success was due to systematic personal hard work. He is said to have been in the habit of travelling incognito and noting the minutest particulars of management in the hotels he visited. The firm maintained a tradition of employing good scholars and geographers in the preparation of its guide books.

BAEKELAND, LEO HENDRIK (1863–), the inventor of bakelite, was born in Ghent, Belgium. In 1889, he went to the United States, where he became active as research chemist, particularly in the manufacture of photographic materials, a subject in which he had been interested since student days at Ghent. In 1893 he founded the Nepera Chemical company, in Yonkers, N.Y., for the manufacture of photographic papers. The most successful was Velox paper, which utilized a special colloidal chloride of silver relatively unsensitive to yellowish and greenish light, but much more sensitive to blue and violet rays. Hence, it could be exposed and developed rapidly and conveniently. Baekeland then devoted himself to chemical research, developing the apparatus used in commercial production of caustic soda and chlorine by passing electric current through a solution of brine.

In 1906, he undertook a new line of research which resulted in his invention of Bakelite materials, synthetic phenol resinoids obtained by action of phenols upon aldehydes. Baekeland's product resembled shellac or amber in colour and form, but was otherwise so totally different that it formed the basis for an entirely new industry. Here was a super-resin which nature had not furnished; it had been built to specification in the research laboratory. This invention should probably be considered Baekeland's leading work, so broadly useful have resinoids become in nearly every phase of human activity. They have been used for electrical purposes and endless other industrial applications where natural resins, rubber or celluloid are unsuited. These applications range from radio and wireless telegraphy and other electrical devices to gears, grindstones, aeroplane propellers, self-lubricating bearings, jewellery and ornamental articles.

Baekeland founded (1910) and was first president of the General Bakelite company, which later became the Bakelite corporation. He was honorary professor of chemical engineering at Columbia university from 1917. For his achievements he was decorated by the governments of Belgium and France and received numerous awards and honorary degrees in Europe and the United States.

BAEL FRUIT (Aegle Marmelos). Aegle is a genus of the family Rutaceae, containing three species, two in tropical Asia and one in west tropical Africa. The plants are trees bearing strong spines, with alternate, compound leaves each with three leaflets and panicles of sweet-scented white flowers. Aegle *Marmelos*, the bael- or bel-fruit tree (also known as Bengal quince). is found wild or cultivated throughout India. The tree is valued for its fruit, which is oblong to pyriform in shape, 2 to 5 in. in diameter and has a grey or yellow rind and a sweet, thick orange-coloured pulp. The unripe fruit is cut up in slices, sun-dried and used as a remedy for dysentery; the ripe fruit is described as sweet, aromatic and cooling. The wood is yellowish-white and hard but not durable.

BAENA, a town of southern Spain, in the province of Córdova. Population 21,289. Baena is picturesquely situated near the river Marbella, on the slope of a hill crowned with a castle. which formerly belonged to the famous captain Gonzalo de Córdova. Farming and horse-breeding are the chief local industries The nearest railway station is Luque (pop. 5,750), 4 mi. southeast on the Jaén-Lucena line. The site of the Roman town (Baniana or Biniana) can still be traced.

BAER, KARL ERNST VON (1792–1876), German biologist, was born at Piep, Estonia, on Feb. 29, 1792. His father, a small landowner, sent him to school at Reval, which he left in his 18th year to study medicine at Dorpat university. The lectures of K. F. Burdach (1776–1847) suggested research in the wider field of life-history, and as at that time Germany offered more facilities for and greater encouragement to scientific work. von Baer went to Wiirzburg, where J. I. J. Dollinger (1770–1841), father of the Catholic theologian, was professor of anatomy. He collaborated with C. H. Pander (1794–1865) in researches on the evolution of the chick, the results of which were first published

in Burdach's treatise on physiology. Continuing his investigations alone von Baer extended them to the evolution of organisms generally, and after a sojourn at Berlin he was invited by his old teacher Burdach, who hsd become professor of anatomy at Königsberg, to join him as prosector and chief of the new zoological museum (1817). Von Baer's discovery of the human ovum is the subject of his *Epistola* de Ovo *Mammalium* et *Hominis* Genesi (Leipzig, 1827), and in the following year he published the first part of his History of the Development of *Animals* (*Ueber* die *Entwickelungsgeschichte* der Thiere), the second part following in 1837. In this work he demonstrated that the Graafian follicles in the ovary are not the actual eggs, but that they contain the true ovum. He next showed that in all vertebrates the primary stage of cleavage of the fertilized egg is followed by modification into leaf-like germ-layers (skin, muscular, vascular and mucous) whence arise the several organs of the body by differentiation. He further discovered the gelatinous, cylindrical cord, known as the notochord which passes along the body of the embryo of vertebrates, in the lower types of which it is limited to the entire inner skeleton, while in the higher the backbone and skull are developed round it. In his *History* of Development he suggests, "Are not all animals in the beginning of their development essentially alike, and is there not a primary form common to all?" (i. p. 223). Notwithstanding this, the "telic" idea, with the archetypal theory which it involved, possessed von Baer to the end of his life, and explains his inability to accept the theory of unbroken descent with modification when it was propounded by Charles Darwin and A. R. Wallace in 1858. The influence of von Baer's discoveries has been far-reaching and abiding. Not only was he the pioneer in that branch of biological science to which Francis Balfour, gathering up the labours of many fellow-workers, gave coherence in his *Comparative* Embryology (1881), but the impetus to T. H. Huxley's researches on the structure of the medusae came from him (Life, i. 163), and Herbert Spencer found in von Baer's "law of development" the "law of all development" (Essays, i. 30). In 1834 von Baer was appointed librarian of the Academy of Sciences of St. Petersburg (Leningrad). In 1835 he published his Development of Fishes, and as the result of collection of all available information concerning the fauna and flora of the Polar regions of the empire, he was appointed leader of an Arctic expedition in 1837. The remainder of his active life was occupied in divers fields of research, geological as well as biological, an outcome of the latter being his fine monograph on the fishes of the Baltic and Caspian seas. One of the last works from his prolific pen was an interesting autobiography published at the expense of the Estonian nobles on the celebration of the jubilee of his doctorate in 1864. Three years afterwards he received the Copley medal. He died at Dorpat on Nov. 28, 1876.

BAER, WILLIAM JACOB (1860–1941), U.S. painter, was born on Jan. 29, 1860, in Cincinnati, Ohio. He studied at Munich in 1880–84. He had much to do with the revival in America of the art of miniature-painting, to which he turned in 1892, and was the first president of the Society of Painters in Miniature, New York. Among his miniatures are "The Golden Hour," "Daphne," "In Arcadia" and "Madonna with the Auburn Hair." He died Sept. 21, 1941.

BAETYLUS (bē'tę-lus), a Greek word of Semitic origin (=bethel) denoting a sacred stone. Numerous holy or fetish stones existed in antiquity, and were generally attached to the cult of some particular god, and looked upon as his abiding-place or symbol. A famous example is the holy stone at Delphi (Pausan. x. 24), said to have been the one which Cronus (*q.v.*) swallowed. Another famous stone was that of Cybele, at Pessinus. See GREAT MOTHER OF THE GODS. In some cases an attempt was made to give a more regular form to the original shapeless stone. See HERMAE.

See Bosigk, *De Baetyliis (1854)*; and the exhaustive article by F. Lenormant in Daremberg and Saglio's *Dictionnaire* des *Antiquités.*

BAEUER, JOHANN FRIEDRICH WILHELM ADOLF VON (1835–1917), German chemist, was born at Berlin on Oct. 31, 1835, his father being Johann Jacob von Baeyer (1794–1885), chief of the Berlin Geodetical Institute from 1870. He studied chemistry under R. W. Bunsen and F. A. Kekulé, and in 1858 took his degree as Ph.D. at Berlin, becoming privatdocent a few years afterwards and assistant professor in 1866. Five years later he was appointed professor of chemistry at Strassbourg, and in 1875 he migrated in the same capacity to Munich. He devoted himself mainly to investigations in organic chemistry, and in particular to synthetical studies by the aid of "condensation" reactions. The Royal Society of London awarded him the Davy medal in 1881 for his researches on indigo, the nature and composition of which he did more to elucidate than any other single chemist, and which he also succeeded in preparing artificially, though his methods were not found commercially practicable. To celebrate his seventieth birthday his scientific papers were collected and published in two volumes (*Gesammelte* Werke, Brunswick, 1905), and the names of the headings under which they are grouped give some idea of the range and extent of his chemical work:—(I) organic arsenic compounds, (2) uric acid group, (3) indigo, (4) papers arising from indigo researches, (5) pyrrol and pyridine bases, (6) experiments on the elimination of water and on condensation, (7) the phthaleins, (8) the hydro-aromatic compounds, (9) the terpenes, (10) nitroso compounds, (11) furfurol, (12) acetylene compounds and "strain" (*Spannungs*) theory, (13) peroxides, (14) basic properties of oxygen, (15) dibenzalacetone and triphenylamine, (16) various researches on the aromatic and (17) the aliphatic series. Baeyer died at Munich on Sept. 5, 1917.

BAÉZA, a town of southern Spain, in the province of Jaén; in the Loma de Ubeda, a mountain range between the river Guadalquivir on the south and its tributary the Guadalimar on the north. Population 15,326. Its chief buildings are those of the university (founded in 1533, and now occupied by the Institute of Secondary Education), the cathedral and the Franciscan monastery. Its fortifications, now in ruins, were of great strength. The town has little trade except in farm-produce; but its red dye, made from the native cochineal, was formerly celebrated. In the middle ages Baéza was a flourishing Moorish city, said to contain 50,000 inhabitants; but it was sacked in 1239 by Ferdinand III. of Castile, who in 1248 transferred its bishopric to Jaén. It was the birthplace of the sculptor and painter, Gaspar Becarra.

BAFFIN, WILLIAM (1584–1622), English navigator and discoverer. The earliest mention of his name occurs in 1612, in connection with an expedition in search of a North-West Passage, under the orders of Captain James Hall, whom he accompanied as chief pilot. Captain Hall was murdered in a fight with the natives on the west coast of Greenland, and during the two following years Baffin served in the Spitsbergen whale-fishery, at that time controlled by the Muscovy Company. In 1615 he entered the service of the company for the discovery of the North-West Passage, and accompanied Captain Robert Bylot as pilot of the little ship "Discovery," and now carefully examined Hudson Strait. The accuracy of Baffin's tidal and astronomical observations on this voyage was confirmed in a remarkable manner by Sir Edward Parry, when passing over the same ground two centuries later (1821). In the following year Baffin again sailed as pilot of the "Discovery," and passing up Davis Strait discovered the fine bay to the north which now bears his name, together with the magnificent series of straits which radiate from its head and were named by him Lancaster, Smith and Jones Sounds, in honour of the generous patrons of his voyages. Onthisvoyagehehadsailed over 300m. farther north than his predecessor Davis, and for 236 years his farthest north (about lat. 77°45′) remained unsurpassed in that sea. All hopes, however, seemed now ended of discovering a passage to India by this route, and in course of time even Baffin's discoveries came to be doubted until they were re-discovered by Captain Ross in 1818. Baffin next took service with the East India Company, and in 1617–19 performed a voyage to Surat in British India, and on his return received the special recognition of the company for certain valuable surveys of the Red Sea and Persian Gulf which he had made in the course of the voyage. Early in 1620 he again sailed to the East, and in the Anglo-Persian attack on Kishm in the Persian Gulf, preparatory to the reduction

of Ormuz, he received his death-wound, and died on Jan. 23, 1622. Baffin made numerous scientific and magnetic observations, for one of which (the determination of longitude at sea by lunar observation) the honour is claimed of being the first of its kind on record.

BAFFIN BAY and **BAFFIN LAND,** an Arctic sea and island named after the explorer William Baffin. The former extends from about 69° to 78° N.. and forms part of the long strait separating Greenland from Baffin Land. The latter is a barren tract included in Franklin district, Canada. Area, 236,000 square miles. (See CANADIAN ARCTIC ISLANDS.) Pop. (1941) 2,052.

BAGA, a coarse-featured people related to the Nalu and Landuman who practise scarification. They lire on the coast of French Guinea between Cape Verga and Konakri in independent villages by unhealthy swamps. There are traces of totemism. Marriage is obligatory between (i.) the husband's brothers and his wife's sisters, and (ii) the younger brother or nephew and the widow. Polygamy is allowed The first wife has superior standing in the community. Inheritance passes in the maternal line; family ownership of property is combined with individual possession of personalty. They practise husbandry and aboriculture (rice, banana, cabbage-palm, kola), most of the labour falling on the women. The dead are exposed, before being buried in sacred groves, and some of their grain and parts of their personal possessions are collected in their houses which are then burnt. They are animists. *See* Arcin, La *Guinée Française* (1907).

BAGAMOYO, seaport, Tanganyika Territory, East Africa, in 6° 27′ S., 38° 55′ E. Pop. (1921) 5,200. As the mainland port nearest Zanzibar, 26m. distant, Bagamoyo became the starting-point for caravans to the great lakes, and thus an entrepôt of trade for the interior of the continent. Of the explorers who began their journeys inland from Bagamoyo the most illustrious were Sir Richard Eurton, J. H. Speke, J. A. Grant and Sir H M. Stanley. Having only an open roadstead it was superseded to a large extent in the last quarter of the 19th century by the development of the port of Dar es Salaam, 36m. south. It retained, however, a considerabie coastal trade. The Mission *du Sacré Coeur* has a large establishment here and the town is the seat of a Roman Catholic bishopric. Bagamoyo is the centre of an administrative division which had in 1921 a population of 57,000.

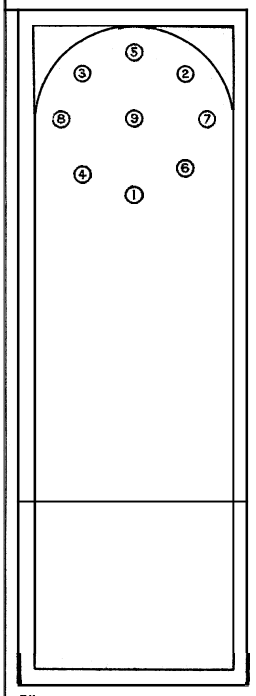
BAGASSE (ba-găs′), the name given to the fibrous residue resulting from the crushing of sugar-cane and the expression of its juices. Originally the term was applied in Provence, France, to refuse from olive-oil mills, hence anything worthless. The word was also used to describe a disreputable woman, and it appears in English as "baggage." The root of bagasse is the Anglo-Saxon baeg, referring to the olive skin as a bag.

Sugar-cane bagasse, known also as pumice, megasse and cane straw, comprising refuse of the milling and extracting operations, averages about 12% by weight of insoluble matter. Bagasse is not returned to the soil for in the extraction of the cane juices substantially all of the soluble minerals are carried off in solution leaving only the tough fibres which are very resistant to decay. Experiments to develop the use of bagasse as ensilage, as direct food or as a carrier for molasses, have been unsuccessful. Its use for a fuel, however, was worked out by developing special types of furnaces, and in most sugar-producing countries it furnishes the fuel for the sugar grinding.

Many attempts have been made to produce from bagasse a fibre suitable for paper making but hitherto the processes have been too costly or did not produce an entirely satisfactory paper, though in Hawaii small quantities of mulch paper are manufactured from it.

In 1921 the manufacture was begun in Louisiana of a bagasse fibre insulating board.

BAGATELLE, primarily a thing of trifling importance (Fr. from Ital. bagatella, bagata, a trifle). The name, though French, is given to a game which is probably of English origin, though its connection with the shovel-board of Cotton's Complete Gamester is very doubtful. Strutt does not mention it. The game is very likely a modification of billiards, and is played on an oblong board or table varying in size from 6ft. by 1½ft. to 10ft. by 3ft. The bed of the table is generally made of slate, although, in the smaller sizes, wood covered with green cloth is often used. The sides are cushioned with india-rubber. The head is semi-circular and fitted with nine numbered cups set into the bed, their numbers showing the amount scored by putting a ball into them. An ordinary billiard-cue and nine balls, one black, four red, and four white, are used. The black ball is placed upon a spot about 4in. in front of hole 1, and about 18in. from the player's end of the board. A line (the baulk) is drawn across it, behind which is another spot for the player's ball. (These measurements of course differ according to the size of the table.) Some modern tables have pockets as well as cups.



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THE BAGATELLE BOARD
Scoring depends on making cannons, and in getting the balls into the numbered CUPS

Bagatelle Proper.—The black ball having been placed on the upper spot, the players "string" for the lead, the winner being that player who plays his ball into the highest hole. Any number may play, either separately, or in sides. Each player in turn plays all eight balls up the table. no score being allowed until a ball has touched the black ball, the object being to play as many balls as possible into the holes, the black ball counting double. Balls missing the black at the beginning, those rolling back across the baulkline, and those forced off the table are "dead" for that round and removed. The game is decided by the aggregate score made in an agreed number of rounds.

Sans **Egal.**—This is a French form of the game. Two players take part, one using the red and one the white balls. After "stringing" for lead, the leader plays at the black, forfeiting a ball if he misses. His opponent then plays at the black if it has not been touched, otherwise any way he likes, and each then plays alternately, the object being to hole the black and his own balls, the winner being the one who scores the highest number of points. If a player holes one of his opponent's balls it is scored for his opponent. The game is decided by a certain number of rounds, or by points, usually 21 or 31. In other matters the rules of bagatelle apply.

The Cannon Game.—This is usually considered the best and most scientific of bagatelle varieties. Tables without cups are sometimes used. As in billiards three balls are required, the white. spot-white and black, the last being spotted and the non-striker's ball placed midway between holes 1 and 9. The object of the game is to make cannons (caroms), balls played into holes, at the same time counting the number of the holes, but if a ball falls into a hole during a play in which no cannon is made the score counts for the adversary. If the striker's ball is holed he plays from baulk; if an object-ball, it is spotted as at the beginning of the game. A cannon counts two; missing the white object-ball scores 1 to the adversary; missing the black, 5 to the adversary. If there are pockets, the striker scores 2 for holing the white object-ball and 3 for holing the black, but a cannon must be made by the same stroke; otherwise the score counts for the adversary.

Mississippi.—This variation is played with a bridge pierced with nine or more arches, according to the size of the table, the arches being numbered from 1 upwards. All nine balls are usually played, though the black is sometimes omitted, each player having a round, the object being to send the balls through the arches. This may not be done directly, but the balls must strike a cushion first, the black, if used, counting double the arch made. If a ball is played through an arch, without first striking a cushion, the score goes to the adversary, but another ball, lying in front of the bridge, may be sent through by the cue-ball if the latter has struck

a cushion. If a ball falls into a cup the striker scores the value of the cup as well as of the arch.

In music, Bagatelle is a name sometimes given to a short instrumental piece of a light character. Beethoven wrote a number of such pieces for the pianolorte which were so entitled.

BAGÉ, a town end municipality of the State of Rio Grande do Sul, Brazil, about 176 mi. by rail W.N.W. of the city of Rio Grande do Sul. Pop. of the municipality (1940) 59,686; of the town 30,000. It is situated in a hilly region 774 ft. above sea level, and is the commercial centre of a large district on the Uruguayan border in which pastoral occupations are predominant. This region is the watershed for southern Rio Grande do Sul, from which streams flow east and south-east to the Atlantic coast, and north-west and south-west to the Uruguay river. The town dates from colonial times, and has always been considered a place of military importance because of its nearness to the Uruguayan frontier, only 25m. distant. It was captured by the Argentine general Lavalle in 1827, and figured conspicuously in most of the civil wars of Argentina. It is also much frequented by Uruguayan revolutionists.

BAGEHOT, WALTER (baj'ŏt) (1826-IS;^), English economist, editor of the *Economist* newspaper from 1860 to his death, was born at Langport, Somerset, his father being a banker at that place. His life was comparatively uneventful, as he early gave up to literature the energies which might have gained him a large fortune in business or a great position in the political world. He took his degree at the London University in 1848, and was called to the bar in 1852, but from an early date he joined his father in the banking business of Stuckey and Co. in the west of England, and during a great part of his life, while he was editor of the *Economist,* he managed the London agency of the bank, lending its surplus money in "Lombard Street," and otherwise attending to its London affairs. He became also an underwriter at Lloyd's, taking no part, however, in the active detailed business, which was done for him by proxy by a person or persons acting on his behalf.

Bagehot's connection with the *Economist* began in 1858, about which time he married a daughter of the first editor, the Right Hon. James Wilson, at that time secretary of the Treasury, and aiterwards secretary of finance in India. Partly through this connection he was brought into the inside of the political life of the time. He was an intimate friend of Sir George Cornewall Lewis, and was afterwards in constant communication with many of the political chiefs, especially with Gladstone, Robert Lowe and Grant Duff, and with the permanent heads of the great departments of state. In the City in the same way he was intimate with the governor and directors of the Bank of England, and with leading magnates in the banking and commercial world; while his connection with the Political Economy Club brought him into contact in another way with both City and politics. His active life in business and politics, however. was not of so absorbing a kind as to prevent his real devotion to literature, but the literature largely grew out of his activities, and of no one can it be said more truly than of Bagehot that the atmosphere in which he lived gave tone and colour and direction to his studies, one thing of course acting and reacting on another. The special note of his books, apart from his remarkable gift of conversational epigrammatic style, which gives a peculiar zest to the writing, is the quality of scientific, dispassionate description of matters which were hardly thought of previously as subjects of scientific study. This is specially the case with the two books which perhaps brought him the most reputation, *The English Constitutzon* (1867), and *Lombard Street* (1873). They are both books of observation and description. The English constitution is described, not from law books as a lawyer would describe it, but from the actual working. as Bagehot himself had witnessed it, in his contact with ministers and the heads of government departments, and with the life of the society in which the politicians moved The true springs and method of action are consequently described with a vivid freshness which gives the book a wonderful charm. and makes it really a new departure in the study of politics It is the same with *Lombard Street.* The money market is there pictured as it really was in 1850–70, and as Bagehot saw it with philosophic eyes.

Lombard Street was based on a series of articles which Bagehot wrote in 1858 in the *Economist,* though it was not published till the early '70s, after it had been twice rewritten and revised with infinite labour and care. *Lombard Street,* like *The English Constitution* in political studies, is thus a new departure in economic and financial studies, applying the same sort of keen observation which Adam Smith used in the analysis of business generally to the special business of banking and finance in the complex modern world. It is, perhaps, not going too far to say that the whole theory of a one-reserve system of banking and how to work it, and of the practical means of fixing an "apprehension minimum" below which the reserve should not fall, originated in *Lombard Street* and the articles which were the foundation of it; and the subsequent conduct of banking in England and throughout the world has been infinitely better and safer in consequence. A like note is also struck in *Physics and Politics* (1869), which is a description of the evolution of communities of men. The materials here are derived mainly from books, the surface to be observed being so extensive, but the attitude is precisely the same, that of a scientific observer. To a certain extent the *Physics and Politics* had even a more remarkable influence on opinion, at least on foreign opinion, than *The English Constitution* or *Lombard Street.* It "caught on" as a development of the theory of evolution in a new direction, and Darwin himself was greatly interested, while one of the pleasures of Bagehot's later years was to receive a translation of the book into the Russian language. In *Literary Studies* (1879) and *Economic Studies* (1880), published after his death, there is more scope than in the books already mentioned for other characteristics besides those of the scientific observer; but observation always comes to the front. as in the account of Ricardo, whom Bagehot describes as often, when he is most theoretical, really describing what a first-rate man of business would do and think in actual transactions. The observation, of course, is that of a type of business man in the City to which Ricardo as well as Bagehot belonged, though Ricardo could hardly look at it from the outside as Bagchot was able to do.

Bagehot had great City, political and literary influence, to which all his activities contributed, and much of his influence was las'ing. In politics and economics especially, his habit of scientific observation affected the tone of discussion, and both the English constitution and the money market have been better understood generally because he wrote and talked and diffused his ideas in every possible way. He was unsuccessful in two or three attempts to enter parliament, but he had the influence of far more than an ordinary member, as director of the *Economist* and as the adviser behind the scenes of the ministers and permanent heads of departments who consulted him. His death occurred at Langport very suddenly.

See the "Life" prefixed by R. H. Hutton to his edition of the *Literary Studies* (1905); the introduction by Hartley Withers to *Lombard Street* (ed., with notes, by A. W. Wright, 1915); and the biography by Mrs. Russell Barrington in her *Works* and ***Life*** of *Walter Bagehot* (1915). (R. Gi)

BAGGAGEMASTER, in the United States the official responsible for the transportation of passenger baggage and mail on railways, steamship lines and other systems of public conveyance. In England the army officer in charge of brigade or divisional baggage in the field is called the baggagemaster. This position in the United States calls for a common school education, a physical examination that includes hearing, eyesight and colour discrimination and general experience within the transporting system. At one of the New York city terminals the baggagemaster controls the handling of $3\frac{1}{4}$ million pieces of baggage annually and 2,000 tons of mail daily. He supervises the work of the parcel rooms and the movement of the daily newspapers—in all involving a force of 500 people. The keeping of records represents one of the most important phases of the work of the baggagemaster. On file in his office on various types of cards and sheets are recorded the name of the express company or hotel from which the baggage is received, the name and address

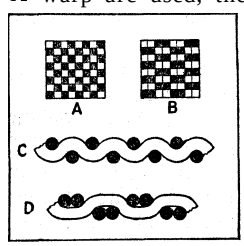
of sender, the check number, weight, size, day and hour of arrival, description of the type and condition of casing, destination and general remarks. A declaration of value, required by law, is also kept on file. For further protective purposes, in cases where delivery is made from a taxicab the number of the cab is noted; if a transfer company not well known to the agent acts as intermediary the driver's licence is recorded. The amount of personal baggage handled by railroads has been reduced to a marked extent because of the tendency of the travelling public to carry less and less persona1 baggage, the decrease in the amount of display goods carried by commercial travellers and trend of urban holiday-makers to establish permanent summer homes rather than carry back and forth with them large numbers of trunks containing household furnishings According to the census of 1940 there were approximately 5,959 baggagemasters and baggagemen per million population in the United States.

BAGGĀRA (Cattlemen), African "Arabs" of Semitic origin, great cattle owners and breeders, found west of the White Nile between the Shilluk territory and Dar Nuba, principally in Kordofan. They intermarried little with the Nuba. The date of their arrival in the Sudan is uncertain. They move from pasture to pasture, as food becomes deficient, and employ oxen as saddle and pack animals, carry no shield, but use a long, full-bladed spear, while many possess firearms. They were resolute fighters and slave-traders and were the first, as they were certainly the most fervent, supporters of the mahdi in 1882. They constituted his real fighting force, and to their fanatical courage his victories were due. The mahdi's successor, the khalifa Abdullah, was a Baggāra, and throughout his rule the tribe held the first place in his favour. As hunters of big game, they attack even elephants with sword and spear. The men are types of physical beauty, with fine heads, erect athletic bodies and sinewy limbs. There is little that is Semitic in their appearance. Their skins vary in colour from a dark red-brown to a deep black; but their features are regular and free of negro characteristics. In mental power they are much superior to the indigenous races around them. They have a passion for fine clothes and ornaments, tricking themselves out with glass trinkets, rings and articles of ivory and horn. Their mode of hair-dressing (mop-fashion) earned them, in common with the Hadendoa, the name of "Fuzzy-wuzzies" among the British soldiers in the campaigns of 1884–98. The women wear lumps of amber, bosses of silver, large earrings and nose rings.

See H. A. MacMichael, *History of the Arabs of the Sudan* (1922).

BAGGESEN, JENS IMMANUEL (1764–1826), Danish poet, was born at Korsor. His parents were very poor, and before he was 12 he was sent to copy documents at the office of the clerk of the district. He was a melancholy, feeble child, and before this he had attempted suicide more than once. By dint of indomitable perseverance he found his way in 1782 to the University of Copenhagen. His *Comical Tales* (1792) in verse took the town by storm, and the struggling young poet found himself a popular favourite at twenty-one. He left Denmark in pique at the failure of his opera, *Holge* Danske (1789), and spent the next years in Germany, France and Switzerland, returning for a short period in 1790, when he published his fine descriptive poem, the *Labyrinth*. The next 20 years were spent in incessant restless wanderings over the north of Europe, Paris latterly becoming his nominal home. He continued to publish volumes alternately in Danish and German. Of the latter the most important was the idyllic epos in hexameters called *Parthenais* (1803). In 1806 he returned to Copenhagen to find the young Öhlenschläger installed as the popular poet of the day. Until 1820 he resided in Copenhagen, engaged in constant literary feuds. He then left Denmark for the last time and went back to his beloved Paris, where he lost his second wife and youngest child in 1822, and after the miseries of an imprisonment for debt fell at last into a state of hopeless melancholy madness. He died Oct. 3, 1826, in the hospital at Hamburg on his way back to Denmark. Danish literature owes Baggesen a great debt for the firmness, polish and form which he introduced into it—his style being always finished and elegant. With all his faults he stands as the greatest figure between Holberg and Öhlenschläger. Of all his poems, however, the loveliest and best is a little simple song, "There was a time when I was very little," which every Dane, high or low, knows by heart, and which is matchless in its simplicity and pathos.

BAGGING AND BAGS. The textile stuff used for making bags was originally Baltic hemp, while in the beginning of the 19th century Sunn hemp or India hemp was also employed. Modern requirements call for so many different types of bagging that many kinds of fibres are used for this purpose. Most bagging is now made from yarns of the jute fibre. The cloth is, in general, woven with the plain weave, and the warp threads run in pairs, but large quantities of bags are made from cloths with single warp threads. In both cases the weave used for the cloth is thst shown at A in the figure, but when double threads of warp are used, the arrangement is equivalent to the weave shown at B. The interlacings of the two sets of warp and weft for single and double warp are shown respectively at C and D, the black marks indicating the warp threads, and the white or blanks showing the weft. The particular style of bagging depends, naturally, upon the kind of material it is intended to hold. The coarsest type of bagging is perhaps that known as "cotton bagging," which derives its name from the fact that it is used in the manufacture of bags for transporting raw cotton. It is a heavy fabric 42in. wide, and weighs from 2 to 2½lb. per yard. A similar, but rather finer make, is used for Sea Island and other fine cotton, and for any species of fibrous material; but for grain, spices, sugar, flour, coffee, manure, etc., the threads of warp and weft must lie closer, and the warp is usually single. For transporting such substances as sugar it is not uncommon to line the bag with paper, which excludes foreign matter and minimizes the loss. Although there are large quantities of seamless bags woven in the loom, the greater part of the cloth is woven in the ordinary way. It is then cut up into the required sizes by hand and by special machines, and afterwards sewn by chain-stitch or straight-stitch bag sewing machines. *(See* SACKING AND SACK MANUFACTURE.)



THE WEAVE OF BAGGING CLOTH

BAGHAL, a small native state in the Punjab, India. It is one of the Simla Hill states and has an area of 124sq.m. Pop. (1931) 26,352. The revenue amounts to £3,300 per annum.

BAGHDAD. The foremost city of Mesopotamia and the capital of modern Iraq is situated in lat. 33° 20′ N. and long. 44° 24′ E. on the Tigris at the point where that river and the Euphrates approach their closest approximation — to 25 miles. The city was originally built on the west bank of the river, but for over 1,000 years the greater part of the town has been on the E. bank. Today there is, however, a large and growing suburb, including a railway station on the west side, the two banks being connected by a bridge of boats. Baghdad is described by a traveller who visited it in 1583 as being "a towne not very grente but very populous and of greate trafficke of strangers for that is the way to Persia, Turkie and Arabia, and from thence doe goe Caravans for these and other places." Though the town has grown since that description was written, in other respects the words are still true and caravans, today by motor car and aeroplane, still run to Persia (Iran) and "Turkie"

Baghdad lies at a central point in the Middle East and there has been from Sumerian times an important town either on this very spot or close at hand. In early Sumerian times the ancient capital lay at Kish on the Euphrates and when that river changed its course Babylon succeeded to Kish. In later times Ctesiphon and subsequently Seleucia on the west bank of the Tigris opposite Ctesiphon succeeded to the supremacy. Baghdad itself, although on a site which has been occupied since very early times and still preserves the name which it has held for at least 4.000 years, did not rise to the position of a city of the first rank until the foundation of the Arab town on the west bank in the latter half of the 8th century A.D. Since that time the Abode of Peace although it has enjoyed very varying fortunes has always been the most

important city of Mesopotamia. Various factors have contributed to these changes, geographical, political and, as always in Mesopotamia, religious. Baghdad forms the meeting point of the land-routes of S.W. Asia. Uatil the discovery by the seafaring nations of Western Europe of a sea route to the Far East, Baghdad was the nodal point in the caravan routes between East and West. It commanded the two waterways of the Tigris and Euphrates and was close to the limit of navigation upwards of the former stream. It was the natural centre for the roads through the upland country to the north, for the ways through the gap of Khurasan, and for the practicable routes across the desert both to the Mediterranean and to the Holy Cities of Islam. Its commercial position was therefore unrivalled. The more stable condition of the Tigris, which is less given to moving its course than the Euphrates, makes the site, in spite of the constant danger from floods, more favourable to the continued existence of a city than the alternative Kish or Babylon.

So long as Mesopotamia remained a fertile land of gardens, whose fruitfulness could excite the wonder of all who visited her, Baghdad was truly the abode of peace and plenty. At the height of her fame during the early years of the 9th century Baghdad was the home of wealthy merchants and learned scholars who flourished under the shadow of an enlightened Caliphate. Under Mamun, the successor of Harun-al-Raschid it rose to be the centre of Islam at a time when Islam represented the highest civilization of the West. Renowned for learning, famous for silks, and for gorgeous tiled buildings, Baghdad became the city of the Arabian Nights and seemed certain, so favoured was its geographical situation, to enjoy a long period of prosperity. But political circumstances were destined to prevent the realization of this dream. For nearly two generations in the middle of the 9th century the city was deserted in favour of Samarra and, when the central power did return to Baghdad, the Commanders of the Faithful had degenerated to the position of mere shadow kings in the hands of the Turkish bodyguard which their predecessors had founded. Mesopotamia however still remained the fruitful country which it had been in antiquity, and Baghdad, though shorn of her former splendours, was still an important centre to which merchants and pilgrims resorted.

The real downfall of Baghdad did not come till 1258 when Hulaku the Mongol and his hordes overran Mesopotamia. They destroyed the Arab civilization and, by systematically breaking down the irrigation system, converted what had formerly been an agricultural land into a waste of steppe suited only to pastoral nomadism. A period of political instability ensued. Both these factors contributed to the downfall of Baghdad. She depended for her position on a continuation of a prosperous trade which in an unsettled and devastated country was impossible. Further a new situation had arisen. From the coming of the Mongols until the 20th century apart from short intervals Baghdad was never an independent capital. She was dependent first on the Mongol Emperor of Persia, then she became the southern capital of a smaller Mongol state. At the beginning of the 11th century she fell under Turkoman domination and a century later became part of the Persian kingdom. A prey to the warring factions of Turks and Persians the city was more than once put to the sword but relapsed into comparative obscurity after its final capture by the Sultan Murad IV. An independent Pashalik, attacked by Nadir Shah, and then once more at the beginning of the 19th century restored to full Turkish control, Baghdad remained a remote town far from the centres of political importance but often the unfortunate victim of political ambition. But the ancient fame and commercial possibilities of the country led at the end of the 19th century to the idea of a Baghdad railway, to connect Central Europe with the Middle East. Finally, in the readjustment of frontiers which followed the War of 1914–18 Baghdad was made once more the capital of an independent Arab state. It is significant that this restoration of the city to her old position should be associated with a supreme effort to undo the work of the Mongols and to convert the steppe once more into agricultural land.

This changing political position has coincided with far-reaching developments in methods of transport which have restored to Baghdad much of its former importance on the trade-routes. Before 1914 Baghdad lay outside these, and the railway was built only as far north as Shergat and therefore served no useful purpose. Apart from the uncertainty of river routes Baghdad remained isolated. Since this time a line has been built down the Euphrates to Basra—the Tigris line was merely a war-time measure. Of greater importance however has been the establishment of a big aerodrome at Hinaidi, a suburb of Baghdad and the development of aircraft services to Cairo and Basra. Further than this the old desert roads are now used at regular intervals by motorcars so that the journey from London to Baghdad can now be made in a week Baghdad has direct air connection with London and nith India and the Far East. The completion of the railroad to Turkey resulted in a direct rail connection with the Mediterranean.

Owing, no doubt, to the improvement in communications Baghdad in the 20th century began once more to regain her rightful place as the great market of the Middle East. The principal exports are carpets, wool, gum, hides and dates. A considerable import trade is carried on, especially in cotton and tea, most of which is re-exported. The Persian trade once more became of value and Mosul looked to Baghdad as the natural channel through which to sell her grain.

The traveller who wishes to see a purely eastern city will not find it in Baghdad except in the byways and in the few old mosques which remain. Hilla has preserved better its purely oriental character and recalls many of the features which characterized Baghdad before it was westernized. During the 20th century changes have taken place in the city itself which have altered it out of all recognition. Some of the main roads have been straightened and a macadam surface laid down, so that a great part of the city is available for motor traffic. There are a telephone and taxi-cab service; a modern water system replaces the old canals and insanitary methods of drawing water from the Tigris and its subsidiary channels, and there has consequently been considerable improvement of public health, though in spite of registration, statistics are not yet reliable. Pop. (1935) 287,000; (est. 1938) 400,000. Inside the town itself, although the old covered bazaars still survive, there are numerous stores on western lines, a hospital and modern hotels. Near the racecourse what is practically a garden suburb is rapidly developing and there is another large settlement growing up round the aerodrome at Hinaidi. Not the least interesting feature of the new regime is the establishment of a museum of Mesopotamian antiquities—largely through the energy and enthusiasm of Miss Gertrude Bell (*q.v.*). It receives a share of all the antiquities excavated in Iraq.

BIBLIOGRAPHY.—S. H. Longrigg, *Four Centuries of Modern Iraq*, 1925 (very complete bibliography). The most modern phase can be studied in Miss Bell's letters (edited by Lady Bell, 1927). Facts and figures will be found in the official reports especially *British Colonial Office, Mandated Territories, Iraq* (ann.).

For an account of the military operations which culminated in the capture of Baghdad on March 11, 1917, see MESOPOTAMIA, OPERATIONS IN. The vicinity of Baghdad and its airfields were again the scene of a short military campaign in World War II, when the British overthrew a pro-axis Iraqi government in May 1941.

BAGHDAD RAILWAY. The Baghdad railway in its origin was essentially a German enterprise. Politically, its bearings mere far reaching and formed the keystone of German activities in the Near East, especially in the Ottoman Empire. It was therefore a considerable menace to British interests, to Russia, and to the French power in Anatolia and Syria. There can be little doubt also that it was one of the important factors in influencing Turkey to join the central European Powers in World War I. Originally planned in 1889, the railway was to be built in 200 kilometre sections and to be completed in eight years first as a single line, with subsequent extension to a double line Eventually, after a long and unsatisfactory financial and diplomatic historv an agreement was made early in 1914 between the French and German interests, and in June of that year the British and German agreement practically settled all the previous difficulties. The war entirely altered the situation; during that period

the line was of great strategical importance, enabling Turkish troops to be moved both towards the Bosporus and to Mesopotamia, and for military purposes certain extensions were added to the line. After the war Russia had ceased to be a factor in the situation and the German dream of Berlin to Baghdad had vanished. The subsequent negotiations resulted eventually in the railway practically falling into three parts, namely, Turkish, within the modern state of Turkey; Syrian, within the French mandated territory; and Iraqi, within the kingdom of Iraq. The section connecting Turkey and Iraq remains uncompleted.

The line starts at Konia and runs through Eregli to the Taurus mountains. Thence it crosses the Cilician plain as far as the Amanus mountains and through tunnel systems on to Nisibin. It is connected with the Syrian system at Muslemiye, north of Aleppo, and there is a branch from Kale Keui to Alexandretta. In Iraq the only true branch of the railway is from Baghdad to Shergat, the line from Baghdad to Basra being a metre gauge. Its economic importance naturally falls into sections. West of the Taurus the railway passes through an unproductive tableland, only tapping fertile lands at intervals. The irrigation work done by the Germans at Ronia served to benefit the Anatolian railway westwards to Constantinople rather than the Baghdad railway, which in this section seems to provide a connecting link between the Taurus and the Anatolian system rather than to form an independent system. East of the Taurus the line runs through the fertile Anatolian plain, which is especially rich in cereals, has access to the Mediterranean ports of Mersina and Alexandretta and is likely to develop considerably. The further extension eastwards taps an ancient trade route and so connects the foothill region with the Mediterranean. The Iraq section is unsatisfactory, and proposals have been mdde to pull up the line and prolong the existing railway on the other side of the Tigris through the populous and fertile foothill region to Mosul. This city, however, has connections rather with the south than with the west and the volume of trade, even if the connecting links of the projected railway were filled in. is more likely to flow through Baghdad than to the west, although a connection between Iraq and the Mediterranean is of the greatest importance, and its place is at present inadequately filled by the motor route across the desert. (For further details, *see* ASIA MINOR; MESOPOTAMIA and 'IRAQ.)

See British Colonial and Foreign Office annual reports, and E. M. Earle, *Turkey, the Great Powers and the Baghdad Railway* (1923).

BAGHELKHAND, a tract of country in central India, occupied by a collection of Indian States. The Baghelkhand agency is under the political superintendence of the governor-general's agent for Central India, and under the direct jurisdiction of a political agent who is also superintendent of the Rewa State, residing ordinarily at Sutna or Rewa. The agency consists of Rewa State and 11 minor States and estates, of which the more important are Maihar. Nagode and Sohawal. The country is geographically and historically akin to Bundelkhand (*q.v.*), and is very susceptible to drought and famine. Wilson's *Glossary of Indian Terms* says that the Baghelas are a branch of the Sisodhyia Rajputs who migrated eastward and once ruled in Gujarat.

BAGHERIA, city, province of Palermo, Sicily, 8 mi. by rail S.E. of Palermo. Pop. (1936) 23,809, town; 25,820, commune. It contains many villas of the 18th century aristocracy of Palermo. many in decay. The ruins of Soluntum (*q.v.*) are 2 mi. east.

BAGILLT, town, Flintshire, Wales, 14 mi. from Chester on the estuary of the Dee, in the ancient parish of Holywell. Pop. (1931) of Holywell Rural C.P. 3,423. Its situation on the Welsh border brought it into prominence in the middle ages. Near by is Mostyn Hall, dating from the time of Henry VI., the seat of one of the oldest Welsh families. With the development of the North Wales coal-field during the latter half of the 19th century and the proximity of the Lancashire industrial area, the town became the centre of zinc, lead, iron, alkali and chemical works. Trade depression after World War I affected the prosperity of this and other industrial towns of the area.

Bagillt has a station on the L.M.S. main coast route—Chester to Holyhead.

BAGIMOND'S ROLL. In 1274 the council of Lyons imposed a tax of a tenth part of all church revenues during the six following years for the relief of the Holy Land. In Scotland Pope Gregory X. entrusted the collection of this tax to Master Boiamund (better known as Bagimund) de Vitia, a canon of Asti, whose roll of valuation formed the basis of ecclesiastical taxation for some centuries. Boiamund proposed to assess the tax not according to the old conventional valuation but on the true value of the benefices at the time of assessment. The clergy of Scotland objected to this innovation, and in Aug. 1275 prevailed upon Boiamund to return to Rome for the purpose of persuading the pope to accept the older method of taxation. The pope insisted upon the tax being collected according to the true value, and Boiamund returned to Scotland to superintend its collection. A fragment of Bagimond's roll in something very like its original form has been printed by James Raine in his *Priory of Coldingham* (Surtees Society, vol. xii.). The actual taxation to which this fragment refers was not the tenth collected by Boiamund, but the tenth of all ecclesiastical property in England, Scotland, Wales and Ireland granted by Pope Nicholas IV. to Edward I. of England in 1288. The fragments should therefore be regarded as supplementary to the *Taxatio Ecclesiastica Angliae et Walliae* printed by the record commissioners in 1802.

See *Statuta Ecclesiae Scoticanae* (Bannatyne club, Edinburgh, 1866).

BAGIRMI, a country of north-central Africa, lying S.E. of Lake Chad and forming part of the Chad colony of French equatorial Africa. It extends some 240m. N. to S. and has a maximum breadth of 150m., with an area of 25,000sq m. Pop. (1926) 153,706. The surface, which lies about 1,000ft. above sea-level, is almost flat with a very slight inclination north to Lake Chad. It forms part of what seems to be the basin of an immense lake, of which Chad is the remnant. The soil is clay. The river Shari (*q.v.*) forms the western boundary. Numerous tributaries of the Shari flow through the country, but much of the water is absorbed by swamps and sand-obstructed channels, and seasons of drought are recurrent. The southern part of the country is the most fertile. Among the trees the acacia and the dum-palm are common. Various kinds of rubber vine are found. The fauna includes the elephant, hippopotamus, lion and several species of antelope. Of domestic animals there are large herds of cattle and flocks of sheep and goats. There are some ostrich farms; an "indigenous" breed of horses and a few camels. Bees are very numerous, and considerable quantities of honey are produced. Millet and sesame are the principal grains cultivated. Rice grows wild, and several kinds of Poa grass are used as food by the natives. Cotton is grown to a considerable extent, especially by Bornu immigrants. Fort Lamy, at the confluence of the Logone and Shari. originally a purely military post, was (1936) a town of 7,300 inhabitants. It is the administrative centre of the Chad colony. Trade is chiefly with British Nigeria, and with the Anglo-Egyptian Sudan *viâ* Wadai. The ancient caravan route, which ran through Kanem and across the Sahara to Tripoli. is now little used.

The population of Bagirmi is mixed. Negroid peoples predominate, but there are many pastoral Fula and Arabs. The Bagirmese proper are a vigorous, well-formed race of Negroid-Arab blood, who, according to their own traditions, came from the eastward several centuries ago, a tradition borne out by their language, which resembles those spoken on the White Nile. On their arrival they appear to have taken the place of the Bulala dynasty. They subdued the Fula and Arabs already settled in the district, and after being converted to Islam under Abdullah, their fourth king (about 1600), they extended their authority over a large number of pagan tribes living to the south and east, whom they raided for slaves The most important of these tribes are the Sara, Gulla and Nduka. The Sara are a widespread people, intelligent, tall and well made. Tree worship is prevalent among two small tribes, the Somrai and the Gaberi. In upper Bagirmi some traces of a patriarchal stage of society linger, one small State being called Beled-el-Mra, "Women's Land," because its ruler was always a queen.

Bagirmi was made known to Europe by the travels of Dixon

Denham (1823), Heinrich Barth (1852), who was imprisoned by the Bagirmese for some time, Gustav Nachtigal (1872), and P. Matteucci and A. M. Massari (1881). The country in 1871 had been conquered by the sultan of Wadai, and about 1890 was over-run by Rabah Zobeir (*q.v.*), who subsequently removed farther west to Bornu. By this time French interest in the country surrounding Lake Chad region had been aroused. The first expedition to the lake through Bagirmi met with disaster, its leader, Paul Crampel, being killed by order of Rabah. Subsequent missions were more fortunate, and in 1897 Emile Gentil, the French commissioner for the district, concluded a treaty with the sultan of Bagirmi, placing his country under French protection. A resident was left at the capital, Massenia, but on Gentil's withdrawal Rabah descended from Bornu and forced the sultan and resident to flee. It was not until after the death of Rabah in battle and the rout of his sons (1901) that French authority was firmly established. At the same time Kanem (pop., in 1926, 116,309), a country north of Bagirmi and subject in turn to it and to Wadai, was brought under French control. In a comparatively short time Bagirmi settled down under French rule and in 1914 Gen. Largeau was able to make it a base for operations against the Germans in northern Cameroons. Wars and slave-raiding had devastated both Bagirmi and Kanem; recovery was slow, but after 25 years of French rule the population had increased by 50%.

See H. Barth, *Travels and Discoveries in North and Central Africa* (1857–58); G. Nachtigal, *Sahara und Sudan* (1879–89); E. Gentil, *La Chute de l'Empire de Rabah* (1902); FRENCH EQUATORIAL AFRICA.

BAGNACAVALLO, BARTOLOMMEO (1484–1542), Italian painter. His real name was RAMENGHI, but he received the cognomen Bagnacavallo from the little village where he was born. He studied under Francia, and then in Rome as a pupil of Raphael for whom he worked, with others, at the decoration of the gallery in the Vatican. His work, considered to be inferior in point of design to some other productions of the school of Raphael, is distinguished by rich colouring and graceful drawing. The best specimens of it, the "Dispute of St. Augustine" and a "Madonna and Child," are at Bologna.

BAGNÈRES-DE-BIGORRE, town, S.W. France, capital of an arrondissement in the department of Hautes Pyrénées, 13m. S.S.E. of Tarbes on a branch of the Southern Railway. Pop. (1936) 7,545. It is situated on the left bank of the Adour, at a height of 1,825ft. Bagnkres (*Vicus Aquensis*) was much frequented by the Romans, but afterwards lost its renown. In the 12th century Centulle III., count of Bigorre, granted it a liberal charter. The baths rose into permanent importance in the 16th century, when they were visited by many distinguished persons. It remains one of the principal health resorts of France and is frequented as an excursion centre both in summer and in winter. The variety in the temperature and chemical composition of the waters attracts many patients in the season (July–September). The Promenade des Coustous is the centre of the life of Bagnkres. Close by stands the church of St. Vincent (14th and 15th centuries). The old quarter of the town has several old houses and an octagonal tower (15th century) the remains of a Dominican monastery. The Néothermes, occupying part of the casino, and the Thermes (1824), which has a good library, are the principal bathing establishments. Some cloister arches and a doorway remain of the old church of St. Jean Bagnères has tribunals of first instance and of commerce, and a communal college. *Barège,* a light fabric of silk and wool, and woollen goods are produced; wood-turning is practised, and there are important marble and slate quarries.

BAGNÈRES-DE-LUCHON, town, south France, in the department of Haute-Garonne, 87m. S.S.W. of Toulouse, on a branch line of the Southern railway from Montréjeau. Pop. (1936) 3,517. The town, perhaps the most fashionable of Pyrénéan resorts, is situated at the foot of the central Pyrénées at the confluence of the One and the Pique. In the Allées d'Etigny, an avenue planted with lime-trees, is the Thermes, or bathing-establishment. The thermal springs are chiefly impregnated with sulphate of sodium. and range widely in temperature. Numerous Roman remains attest the antiquity of the baths, probably the *Onesiorum* Thermae of Strabo; they were revived in the late 18th century.

BAGNUN, a mild-mannered, long-headed, Senegalese people who file their incisor teeth, occupying the territory between the Lower Kasamansa and Lower Cacheu rivers. The men shave their heads and the women net their hair. They have independent villages inhabited by the extended family group. The hereditary chieftainship descends in the paternal line from its founder. The insignia of authority consists of a red cap. Divorce is frequent. Payment of blood-money is enforced for manslaughter and ordeal by vegetable poison is common. They are good husbandmen. The body of the deceased is exposed for three days before burial. The religion is animistic.

See Brosselard-Faidherbe, *Casamance et Mellacorée* (1893); Lasnet, *Une mission au Sénégal* (1900).

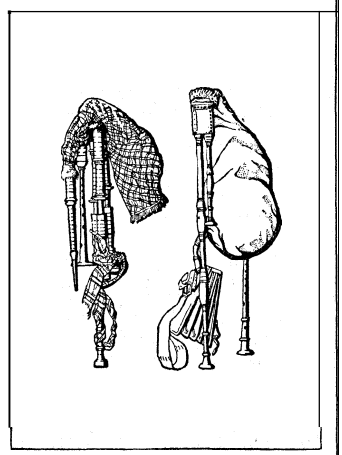
BAGOAS, a Persian name (Bagoi), a shortened form of names like Bagadāta, "given by God." often used for eunuchs. The best known of these ("Bagoses" in Josephus) became the confidential minister of Artaxerxes III. He threw in his lot with the Rhodian condottiere Mentor, and with his help succeeded in subjecting Egypt again to the Persian empire (probably 342 B.C.). Bagoas administered the upper satrapies and gained such power that he was the real master of the kingdom (Diod. xvi. 50; *cf.* Didymus, *Comm.* in Demosth. *Phil.,* vi. 5). He became very wealthy by confiscating the sacred writings of the Egyptian temples and giving them back to the priests for large bribes (Diod. xvi 51). When the high priest of Jerusalem. Jesus, murdered his brother Johannes in the temple, Bagoas (who had supported Johannes) put a new tax on the Jews and entered the temple, saying that he was purer than the murderer who performed the priestly office (Joseph., Ant, xi. 7. 1). In 338 Bagoas killed the king and all his sons but the youngest, Arses (*q.v.*), whom he raised to the throne; two years later he murdered Arses and made Darius III. king. When Darius attempted to become independent of the powerful vizier, Bagoas tried to poison him too; but Darius was warned and forced him to drink the poison himself (Diod. xvii. 5; Johann. Antioch, p. 38, 39 ed. Müller; Arrian ii. 14. 5; Curt. vi. 4. 10). Another eunuch, Bagoas, was a favourite of Alexander the Great (Dicaearchus in Athen. xiii. 603*b*; Plut., *Al.,* 67; Aelian, *Var. Hist.,* 3. 23; Curt. vi. 5. 23; x. 1. 25 et seq.).

BAGOBO, a Malayan tribe of Mindanao island in the Philippines with a Negrito strain, remarkable as horsemen and horse-breeders from remote times. Polygyny is practised; there seems to be no exogamous system, but marriage is barred to three degrees of blood-relationship. They believe in a Creator and subsidiary spirits, the war-god and his wife dwelling in a volcano. There are traces of head-hunting; human sacrifice is practised; portions of an enemy's liver are eaten, and graded insignia of red garments are worn by warriors. Clothing is made of hemp fibre; the spear and the dao are used as weapons, bows and blow-guns rather as toys, small bells for ornament are made by the *cire perdue* process. Fish are obtained by impregnating water with toxic plants.

See Colle, *Wild Tribes of Davao District* (1913).

BAG-PIPE, a complex reed instrument of great antiquity. The bag-pipe forms the link between the syrinx (*q.v.*) and the primitive organ, by furnishing the principle of a reservoir for the wind-supply, combined with a simple method of regulating this air pressure by means of the arm of the performer. The instrument consists of an air-tight leather bag having three to five apertures, each of which contains a fixed stock or short tube. The stocks act as sockets for the reception of the pipes, and as air-chambers for the accommodation and protection of the reeds. The pipes are of three kinds: (1) a simple valved insufflation tube or "blow-pipe," by means of which the performer fills the bag reservoir; (2) the "chaunter" (chanter) or the melody-pipe, having according to the variety of the bag-pipe a conical or a cylindrical bore, lateral holes, in some cases keys and a bell, and a double-reed; (3) the "drones," jointed pipes with cylindrical bore, generally terminating in a bell, but having no lateral holes and being capable, therefore, of producing but one fixed note.

The drone ground bass which sounds without intermission is the main characteristic of the bag-pipe whose numerous varieties fall into two classes according to the method of inflating the bag: (1) by the breath of the performer using the blow-pipe described above; (2) by means of a small bellows connected by a valved feed-pipe with the bag and worked by the other arm or elbow to which it is attached by a ribbon or strap. Class I comprises the Highland bag-pipe; the old Irish bag-pipe; the cornemuse; the Sackpfeife or Dudelsack; the bignou or biniou (Breton bag-pipe); the Calabrian bag-pipe; the ascaulus of the Greeks and Romans; the *tibia utricularis;* and the chorus. To class II. belong the musette; the Northumbrian or border bag-pipe; the Lowland bag-pipe; the union pipes of Ireland; and the surdelina of Naples.



BY COURTESY OF METROPOLITAN MUS. OF ART

THE TWO CLASSES OF BAGPIPES
The Scotch model on the left is inflated by the breath of the performer. The French model on the right is inflated by bellows operated by the arm

The origin of the bag-pipe must be sought in remote antiquity. It is true that no instrument in any degree similar to it is represented on any of the monuments of Egypt or Assyria known at the present day; but we are able nevertheless to trace it in ancient Persia and by inference in Egypt, in Chaldaea and in ancient Greece. The principle of the drone, *i.e.*, the beating-reed sunk some three inches down the pipe, was known to the ancient Egyptians, and the instrument was known in Greece in A.D. 100. The latter fact is supported by allusions in Aristophanes and in Plato's *Crito.*

We leave the realm of inference for that of certainty when we reach the reign of Nero, who had a passion for the Hydraulus *(see* ORGAN: *History)* and the *tibia utricularis.* That the bag-pipe was introduced by the Romans into the British Isles is a conclusion supported by the discovery in the foundations of the praetorian camp at Richborough of a small bronze figure of a Roman soldier playing the *tibia utricularis.*

From England the bag-pipe spread to Caledonia and Ireland, where it took root, identifying itself with the life of the people, and becoming a military instrument held in great esteem by the Celtic races. On the downfall of the Roman empire, the bag-pipe, sharing the fate of other instruments, probably lingered for a time among itinerant musicians, actors, jugglers, etc., reappearing later in primitive guise with the stamp of *naïveté* which characterizes the productions of the early middle ages, and with a new name, chorus (*q.v.*). From the 13th century, however, the bag-pipe became a court instrument played by minnesingers and troubadours as seen in literature and in the mss. and monuments.

As regards the musette it originated in France, among the courtiers and elegant world, turning from the pomps and luxuries of court life to an artificial admiration and cult of nature, idealized to harmonize with silks and satins. The cornemuse of shepherds and rustic swains became the fashionable instrument, but as inflating the bag by the breath was an ungraceful procedure the bellows were substituted, and the whole instrument was refined in appearance and tone-quality to fit it for its more exalted position. Lully introduced the musette into his operas, and in 1758 the iist of instruments forming the orchestra at the Opéra included one.

BAGRATION, PETER, PRINCE (1765–1812), Russian general descended from the noble Georgian family of the Bagratides, entered the Russian army in 1782, and served for some years in the Caucasus. He was engaged in the siege of Ochaltov (1788), and in the Polish campaign of 1794, being present at the taking of Praga and Warsaw. His merits were recognized by Suvarov, whom he accompanied in the Italian and Swiss campaign of 1799, winning distinction by the capture of Brescia. In the wars of 1805 his achievements were even more brilliant. With a small rearguard he successfully resisted the repeated attacks of forces five times his own numbers (Hollabrunn), and though half his men fell, the retreat of the main army under Kutusov was thereby secured. At Austerlitz he was engaged against the left wing of the French army, under Murat and Lannes, and at Eylau, Heilsberg and Friedland he fought with the most resolute and stubborn courage. In 1808 by a daring march across the frozen Gulf of Finland he captured the Åland Islands, and in 1809 he commanded against the Turks at the battles of Rassowa and Tataritza. In 1812 he commanded the II. Army of the West, and, though defeated at Mogilev (July 23), rejoined the main army under Barclay and led the left wing at Borodino (Sept. 7), where he received a mortal wound. A monument was erected in his honour by the Tsar Nicholas I. on the battlefield of Borodino. *(See* NAPOLEONIC CAMPAIGNS.)

BAGUIO, second Philippine municipality in order of incorporation (1909), situated in, and capital of, the subprovince of Benguet on the island of Luzon. Pop. (1939), 24,117, of whom 12,807 were males and 449 whites. The site was probably visited by Spaniards about 1829, and a small military contingent was stationed near there (La Trinidad); but the locality was little known and hardly at all developed until after the U.S. occupation. Governor Taft and the early U.S. officials intended it as a summer capital, but the idea was never carried out by the Filipinos. Meanwhile, however, it became a popular summer resort, not only for the Philippines but also for other parts of the far east, for it is in the mountains at an elevation of from 4,500 to 5,500 ft., with pine forests, picturesque rocks and hills and many attractive scenic features. It is about 160 mi. N. of Manila and is reached by railway to a point beyond Dagupan. Thence the traveller has the choice of two automobile routes—the famous Baguio zigzag road and the Naguilian. During the rainy season, from May or June till November, there is a heavy rainfall (annual mean, 181 in.), but the weather during the balance of the year is ideal. The native population (aboriginal) consists largely of Igorots (mountain people), and Episcopal missions in Baguio and elsewhere in the Mountain province have done much to improve the condition of these primitive folk. There is a school (the Brent) for young Americans and for a number of years, from 1908 on, the bureau of education conducted a teachers' encampment on one of the many hills. Camp John Hay, a U.S. military encampment, is located there, and one of its features is a natural stadium formed in one of the valleys. Baguio is an important mining centre. The United States high commissioner and the commonwealth president have maintained residences there, but the local administration is in the hands of a mayor and council. Many hotels, cottages and pretentious homes have been built and the locality attracts many from the lowlands during the hot season. Most modern improvements have been installed, including telephones, electric iights, waterworks, ice plant and sewage system. The *Manila Bulletin,* principal U.S.-edited newspaper in the Philippines, publishes a special Baguio edition. Baguio was occupied by the Japanese in Dec. 1941. (C. S. L.)

BAG-WORM or **BASKET-WORM,** the caterpillar of the moth *Thyridopteryx ephemeraeformis,* so called from its habit of spinning. as a protection, a bag of silk with which it moves about head downwards, and within which it ultimately pupates. Common in the northern United States, this destructive creature is particularly partial to shade-trees, which may be completely defoliated through its activities. The adult female is wingless and never leaves the puparium, within which she lays her eggs.

BAHADUR KHEL, a salt-mine in the Kohat district of the North-west Frontier Province of India, in the range of hills south of the village of Bahadur Khel between Kohat and Bannu. For a space of 4m. in length by ¼m. in breadth there exists an exposed mass of rock-salt with several large hillocks of salt on either side. The quarries extend over an area 1m. long by ½m. broad, and the salt is hewn out in large blocks with picks and wedges.

BAHADUR SHAH I. (bä-hah′dŏŏr), a Mogul emperor of Hindustan, 1707–12, the son and successor of Aurangzeb. At the time of the latter's death his eldest surviving son, Prince Muazim, was governor of Kabul, and in his absence the next brother, Azam Shah, assumed the throne. Muazim came down from Kabul, and offered to share the empire with his brother. Azam would not accept the proposal, and was slain on the plains of Agra. Muazim then ascended the throne under the title of Bahadur Shah.

BAHADUR SHAH II. (d. 1862), the last of the Mogul em-

perors of Hindustan, 1837–57. He was a titular emperor only. since from the time of the defeat of Shah Alam at Buxar in 1764 all real power had resided with the East India Company; but all proclamations were still worded under "The King's Realm and the Company's rule." His sole importance is due to the use made of his name during the Mutiny of 1857. At the time of the assault he fled to the Tomb of Humayun, 6m. from Delhi, where he was captured by Major Hodson. In Jan. 1858 he was brought to trial for rebellion and for complicity in the murder of Europeans. On March 29 he was found guilty and sentenced to imprisonment for life. He died at Rangoon on Nov. 7, 1862.

BAHÁ'Í FAITH, the religion founded by Bahá'u'lláh (b 1817, in Persia, d. 1892 at 'Akká, Palestine) who, after the martyrdom of his forerunner, the Báb (see BÁBÍISM), was imprisoned in Tihrbn and exiled successively to Baghdad, Constantinople, Adrianople and to 'Akkb. His fundamental teachings are: that God is unknowable except through His Manifestation, the Prophet; that divine revelation is continuous and progressive, man's spiritual and social evolution proceeding in cycles of approximately 1,000 years; that while outwardly different as to human personality the Manifestations are in essence one being and reveal one evolving truth; that the divine command for this age is to unify humanity within one faith and one order; and that religion, in its consummation, is not only a sacred law for the guidance of individual souls but also the supreme law for society and civilization.

Bahá'u'lláh left a testament appointing his eldest son, 'Abdu'l-Bahá, Interpreter and Exemplar of the religion. Before the outbreak of the World War, 'Abdu'l-Bahá journeyed to Egypt, Europe and America to promulgate the Bahá'í principles of universal peace, giving public warning of imminent social upheavals. Under 'Abdu'l-Bahb's testament (d. at Haifa, Palestine, 1921), Shoghi Effendi, Baha'u'llbh's great grandson, was constituted First Guardian of the faith and Head of the Future Universal House of Justice provided in Bahá'u'lláh's writings. Bahá'í communities exist today in forty countries of East and West, more than five hundred in Persia alone and some ninety in North America. A biennial volume (*The Bahá'í World*) records the activities and progress of the cause.

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BAHAMAS (Lucayos), an archipelago of the British West Indies, estimated to consist of 29 islands, 661 cays and 2,387 rocks, extending along a line from Florida on the north-west to Haiti on the south-east, between Cuba and the open Atlantic, over a distance of about 630m., from 80° 50′ to 72° 50′ W. and 22° 25' to 26° 40' N. Total estimated land area 5,450 sq.m., of which the main islands occupy 4,424 sq.m. Pop. (1933) 62,679, including about 12,000 whites. The main islands and groups, beginning from the north-west are: Little and Great Abaco, with Great Bahama to the west; Eleuthera (probably corrupted from Spanish *Isla* de *Tierra*) Cat, Watling or Guanahani, and Rum cay on the outer line towards the open ocean, with New Providence, the Exuma chain and Long Island forming an inner line to the west; still farther west Andros (a group of islands divided by narrow straits); and finally the Crooked islands, Mayaguana and Inagua. The Turks and Caicos islands continue the outer line, and belong geographically to the archipelago, but not politically. The surrounding seas are shallow for the most part, but there are three well-defined channels—the Florida or New Bahama channel, between the north-western islands and Florida, followed by the Gulf Stream, the Providence channels (north-east and north-west) from which a depression known as the Tongue of Ocean extends south along the east side of Andros, and the old Bahama channel, between the archipelago and Cuba. The Andros Islands are 9jm. long; area 1,600 sq.m. Great Abaco is ;om. long: area 680 sq m. Great Inagua, 34m. long. is 530 sq in. in area; and Grand Bahama 66m. with area 430 sq.m. The most important island, as containing the capital, Nassau, is New Providence, only 19⅜m. in length; area 85 sq.m. This island had a population in 1933 of 19,948 The next most important island is Eleuthera (6,048), followed by the Andros Islands (7,417), Long Island (4,684), Abaco (4,318), Cat Island (4,1jj), Grand Bahama (2,353), Exuma (3,925), Acklin's Island (1,808), Crooked Island (1,347).

Physical Geography.—The islands are of coral foundation and low-lying. Except in the considerable island of Andros there are no streams in the whole group. The inhabitants derive their water supply from wells. Owing to the porosity of the rock, many wells rise and fall with the tides of the sea. An artificial lake in New Providence, made for the use of turtle-catchers, is noted as exhibiting extraordinary phosphorescence. So called "banana holes," regular and up to 40ft. deep, frequently occur in the limestone and are caused (like the Jamaica "light holes") by the action of carbonic acid in rain-water The "Mermaid's Pool" in New Providence, which is deeper still, is partly filled with water. The rock also weathers into pinnacles, pillars and arches.

Geology.—The Bahamas consist almost entirely of aeolian deposits (see BERMUDAS) and coral reefs. The deposits which form the greater part of the island frequently rise in rounded hills to a height of 100 or 200ft., and in Cat Island to the highest elevation of nearly 400ft. The material is largely calcareous, derived from the disintegration of coral reefs and from the shells of animals living in the shallows. The rock on the surface is hard but underneath it gradually softens and furnishes an admirable stone for building, which can be sawn into blocks of any size, hardening on exposure to the atmosphere. On Andros there is a fine white marl almost resembling a chalky ooze. The coral reefs are of special interest in reference to the study of such formations.

Nassau.—The scenery of the islands is enchanting, gaining beauty from the splendid colouring of the sea and the rich vegetation. Nassau is a favoured winter health-resort for many visitors from the United States and Canada. It lies on a safe harbour on the north shore of New Providence, sheltered by the small Hog Island. There is a depth of 14ft. at low-water spring-tide on the bar. The town extends along the shore and up a slight ridge behind it. It contains the principal public buildings, and some old forts, from the 18th century, though the subterranean works below Fort Charlotte are earlier. From the same century dates an octagonal building formerly a gaol, now a good public library. The sea-bathing is excellent. February and March are the principal season for visitors. There is direct connection with New York by steamers, which make the journey in about four days; and also with Miami in Florida.

Climate, Flora, Fauna.—The climate is agreeable. Mean temperature of hottest months (June to September) 88° F., of coldest (Jan. to March) 60°. The prevalent winds are from the north-east or east. Hurricanes occur from July to October, and May to October are the rainy months. The average annual rainfall at Nassau is 18in. The soil is generally shallow but very fertile. A well-defined area in New Providence is known as the "pine barrens" (*Pinus cubensis*). Elsewhere three types of soil are distinguished—a black soil, of decayed vegetable matter, where the land is under forest, a reddish clay, and a white soil occurring along the shores. Andros Island and the Abaco Islands may be especially noted for their abundance of large timber, including mahogany, fustic, lignum vitae, iron and bullet woods. The want both of labour and of roads renders it impossible to turn this valuable timber to useful account, though attempts have been made to work it in Abaco. The produce includes tamarinds. olives, oranges, lemons, limes, citrons, pomegranates, pine-apples, figs, sapodillas, bananas, sour-sops, melons, yams, potatoes, gourds, cucumbers, pepper, cassava, prickly pears, sugar-cane, ginger, coffee, indigo, Guinea corn and pease. Tobacco and cascarilla bark also flourish; and cotton is indigenous and was woven into cloth by the aborigines. Sisal is grown in increasing quantity. The cultivation of tomatoes is making considerable progress. A fair

export trade in canned pine-apples has grown up. The extensive areas covered with pine forests are only partially exploited. The Board of Agriculture, which ceased to exist in 1910, was re-established in 1912 on broader lines. With the advice of the Marine Products Board the sponge industry is being pursued more scientifically.

There are many varieties of birds, including flamingoes, humming birds, wild geese, ducks, pigeons, hawks, green parrots and doves. The waters swarm with fish and the turtles caught here are particularly fine. There are good salt ponds, but their working has decreased. The portion of Nassau harbour known as the Sea Gardens has a beautiful development of marine organisms.

Government, Trade, **etc.**—The colony is under a British Governor, with an executive council of nine members, partly official, partly unofficial, and a legislative council of nine members nominated by the Crown. There is also a legislative assembly of 29 members, representing 15 electoral districts; the franchise being exercised by all white men of 21 years of age at least. The members' qualification is the possession of real or personal estate to the value of £200. Revenue rose from £84,386 in 1910–11 to the record figure of £852,573 in 1922–23. In 1926 it was £502,202. The expenditure in 1910–11 was £85,315; in 1924 £374,126. The reason for the increase in revenue is to be found in the expansion in the imports of spirits, resulting directly from the 18th Amendment to the Constitution of the United States in 1919. The public debt in 1926 was £170,000 of which £150,000 had been borrowed to finance a hotel company. The value of imports in 1926 was £2,159,000, of which £810,000 was for alcoholic liquors. The value of Island exports was £407,000, of which £261,709 was for local produce, almost one-half of it sponges. The Bahamas were represented at the Canada-West Indies Conference of 1925, and were signatories to the Trade Agreement of July 8 of that year, under which such produce of the Bahamas as is dutiable in Canada receives a preference of 50% of the duties, with a specific preference of one half cent per pound on canned pineapples, while Bahamas sponges of marine production are admitted free of duty, foreign sponges paying an ad valorem duty of 17½%. The Government of Canada undertook to provide, within 15 months after ratification, a fortnightly mail, passenger and freight service between St. Lawrence ports in summer and other Canadian ports in winter, calling at Bermuda, the Bahamas and Jamaica fortnightly. The Government of the Bahamas undertook to contribute £2,000 per annum towards such services when established.

The government supports elementary free schools, controlled by a nominated board of education, while committees, partly elected, exercise local supervision. There are higher schools and a Queen's college in Nassau. Nassau is the seat of a bishopric of the Church of England, created in 1861. The Bahamas are without railways, but there are good roads in New Providence and a few elsewhere. A cable connects Nassau with West Jupiter in Florida. (O.)

HISTORY

The Bahama Islands have a romantic place in history as the gateway by which Columbus entered the New World. He reached the group in Oct., 1492, and landed at "Guanahani," renamed by him San Salvador, the identity of which has been long disputed between advocates for Cat Island, Great Turk and others. In so far as the problem has any solution, it seems likely that Watling Island was the actual landfall; and this theory received the official sanction of the Bahamas Legislature in 1926. Columbus described the islands in enthusiastic terms: "This country," he wrote, "excels all others as far as the day surpasses the night in splendour; the natives love their neighbours as themselves; their conversation is the sweetest imaginable; their faces always smiling; and so gentle and so affectionate are they, that I s ear . . . there is not a better people in the world." Spain, however, had not long taken possession of the Bahamas.—under the Papal Bulls which divided the New World between Spain and Portugal—before these innocent and indolent natives were transported in large numbers to work in the mines and sugar mills of Hispaniola; and their islands were almost depopulated until English settlement began in the second quarter of the seventeenth century. Prior to this, the long silence was broken only by the visit of Juan Ponce de Leon, who stopped at several islands on his quest for the miraculous "Fountain of Youth," before making the valuable discovery of Florida.

The Spaniards made no settlements there, and in 1627 the Bahamas were included in the grant made by Charles I. of England to Sir Robert Heath; but the only result was an unimportant claim of title some generations later. By 1640 visitors were coming from Bermuda, and in 1647–49 the Company of Eleutherian Adventurers was formed in London for the systematic development of the islands, proprietary rights being granted with a charter providing for government with representative and elective elements. This grant led to the settlement of Eleuthera and, shortly after, of New Providence. The latter possessing the best harbour, soon became the island upon whose fortunes the history of the whole group turned. In spite of the success thus achieved Charles II. in 1670 granted the islands to the Duke of Albemarle and five other proprietors of Carolina. A year later John Wentworth who had already been elected governor by the settlers was appointed by the new proprietors; and a parliamentary system of government, centred on New Providence, was established, with the aim of being as near as conveniently possible to the constitution of England. The proprietary régime, although prolific in theoretical schemes for the development of the islands, did not save them from frequent depredations by Spaniards and French. The settlement was almost destroyed in 1684; and in 1703–04 the two powers joined to expel most of the inhabitants from the recently founded city of Nassau. At this time also the island became a favourite resort of pirates, chief among whom was the notorious Edward Teach, called Blackbeard, who was killed in 1718.

Throughout the proprietary period the career of the Bahamas was a stormy one. Little was done for their protection, although appeals to Jamaica brought considerable help from that island. The king himself had to order the proprietors to act against the pirates in 1684. Eleven years later a fort was begun. and the city named Nassau in honour of William III. The governors themselves were drawn into privateering enterprises; Parliament was far from docile; and in 1690 the governor trained his guns on their chamber. Conflicts between government and people increased after the sack of Nassau in 1703; and by 1708 official recommendations were being made for direct Crown control. English merchants petitioned; and after an uncertain period during which the proprietary governors received royal approval—usually with difficulty—the proprietors in 1717 surrendered the civil and military government to the King. An official preamble stated that "by reason of the great neglect of the proprietors of the Eahama islands, the Government of the said islands is fallen into great disorder and confusion"; and Capt. Woodes Rogers was appointed first royal governor, arriving in 1718. From this time there was a continuous line of royal governors under whom the constitution was revised, the population and resources increased, and the colony's motto made possible: *expulsis piratis comntercia restituta.* William Shirley, formerly governor of Massachusetts, was appointed to the office in 1760; and during the War of American Independence the Bahamas grew considerably in importance. The young American navy captured New Providence in 1776, but soon abandoned it. Five years later it was taken by the Spaniards, and cleverly recaptured in 1783, after the Peace of Versailles had already provided for its restoration to England. The emigration of American loyalists from the mainland brought many immigrants to the Bahamas, where estates were granted to them. Among the newcomers was Lord Dunmore, formerly governor of New York and of Virginia, who became governor from 1786–97. The constitution was again reformed, and in 1787 the proprietors surrendered their remaining rights for the sum of £12,000. The increase of population brought a corresponding increase of wealth, and also introduced large numbers of slaves to work on the cotton and other plantations. Cotton cultivation, however, was unlucky. Pests destroyed the crops in 1788 and in 1794, and cotton declined steadily in importance early in the

19th century. The abolition of slavery was accomplished in the Bahamas as easily as in any British colony. Free Negroes were given the vote in 1830, and after 1834–35 political careers were open to all. Many planters, however, emigrated as the abolitionist movement in England gained strength; and when, after the opposition of the assembly, the slaves were freed in 1838, at a cost of £128,296, paid in compensation, a decline in the agricultural industries followed. The great cotton plantations fell into decay, and the later sisal hemp and pineapple plantations often gave way to tomato-growing and—until pests again worked havoc—to orange groves and grapefruit orchards. Cultivation of the last-named was later stimulated by the growing tourist traffic, and an attempt was also made to revive the production of cotton.

In 1804 the authority of the Bahamas government was extended over the Turks and Caicos Islands, which, though discovered in the 16th century, had been used only for casual salt-raking visits prior to the American Revolutionary War. The Bermudans, who had the greatest interest in the salt ponds, made vigorous protest, and though this was overruled, the union of the islands was never harmonious. Their commercial products were entirely different; and the prosperous salt-producing communities had to pay a larger share to the treasury than seemed proportionate to what they received. The union was dissolved in 1848, although the Turks and Caicos Islands remained ecclesiastically, as they were geographically, part of the Bahamas group. Politically, they were now joined to Jamaica. The fertility of the islands had been a source of profit to the Bahamas, which suffered correspondingly after their removal.

During the American Civil War, the Bahama Islands enjoyed a wave of extraordinary prosperity, due to the closing of the southern ports, and the consequent blockade-running. Their trade increased between twenty and thirty-fold, and some of the wealth was used in the erection of public works. The greater part, however, brought little advantage to the colony as a whole, and a devastating hurricane in 1866 may be regarded as effectively closing the era of prosperity. Meanwhile arrangements had been made for better steamship communications with New York; and from the beginning of the 20th century great improvement was made in this way. The Bahamas became a popular tourist resort for the United States, with whose interests and tariff policy they are inevitably bound up. The War of 1914–18, to which the Bahamas made generous contribution, partly in conjunction with Jamaica, diverted trade still more to America; and after the United States carried its Prohibition amendment in 1920 a period of great prosperity came to the islands marked by the growth of investments and public works.

The Bahamans are justly proud of their long tradition of self-government on the English model.

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BAHAWALPUR or **BHAWALPUR,** an Indian state. within the Punjab, stretching more than 300 mi. along the left bank of the Sutlej, Punjnud and Indus, the chief Mohammedan state in the Punjab. Area 15,003 sq.mi.; population 781,000; estimated gross revenue £375,000. The chief, whose title is Nawab, is a Mohammedan of the Daudputra family from Sind, and claims descent from Abbas, uncle of the Prophet. The dynasty established its independence of the Afghans towards the end of the 18th century, and made a treaty with the British in 1838. The territory is traversed throughout its length by the North Western and Southern Punjab railways. The state gave valuable help during World War I, its Camel corps being especially useful.

The town of Bahawalpur lies near the left bank of the Sutlej. Pop. (1931) 20,943. Except along the banks of the river the whole area of the state is a wilderness. Part has been reclaimed by canals which run during the summer floods, and the completion of the Sutlej Valley Irrigation project further extended and improved cultivation in the vicinity of the tom.

BAHIA (state): *see* BAÍA.

BAHIA (city): *see* SALVADOR OR BAÍA.

BAHÍA BLANCA, a city and port of Argentina, on the Napostá river, 3 mi. from its outlet into a deep, well-sheltered bay of the same name. Pop. (1940 estimate) 115,000, with suburbs. It is situated in the extreme southern part of the province of Buenos Aires and is 398 mi. by rail S.W. of the national capital, with which it is also connected by air route and by highway. The settlement of the national territories of La Pampa and Neuquén contributed largely to the growth and importance of Bahia Blanca. It is the natural shipping-port for these territories and for the southern districts of the province of Buenos Aires, from which great quantities of wheat and wool are exported. The bay has long been recognized as one of the best on the Argentine coast, and since the channel has been dredged, will admit steamers of 30 ft. draught at low water.

Bahia Blanca dates from 1828, when a fort and trading post were located there, but its development as a commercial centre began only in 1885, when its first railway line mas opened. There are four main features of the port: the Puerto Militar, a government military and naval station with extensive docks, machine shops, slips and dry docks, capable of handling the largest battleships; Puerto Belgrano, developed by the Rosario-Puerto Belgrano railway to handle their exports; Puerto Ingeniero White. named after the man who built it as a terminal for the Southern railway, and equipped with modern electrical freight-handling devices, fireproof elevators, freight yards and warehouses; and the equally up-to-date Puerto Galván constructed by the Pacific railway for loading and unloading its great cargoes of wheat, oats, wools, cattle and varied merchandise.

Though situated near the mountainous section of southern Buenos Aires, the immediate vicinity of the city is low and swampy, its water is brackish, and it has been decidedly unhealthful; but a better water supply with better drainage and street paving greatly improved matters.

Bahia Blanca is a modern city in every respect and ranks close to Buenos Aires in commercial importance.

BAHR, HERMANN (1863–1934), Austrian author and playwright, member of the Prussian academy, was born at Linz. Upper Austria, July 19, 1863. After studying at the universities of Vienna, Graz, Czernowitz and Berlin and travelling extensively, Bahr settled in Vienna where he worked as feuilletonist on the staffs of various newspapers. His earlier works consisted mostly of collected volumes of light essays. *Studien zur Kritik der Moderne* (1890) and *Die Ueberwindung des Naturalismus* (1891) mark the first phase of his varied career: his initial enthusiasm for naturalism, and his attempt to reconcile it with romanticism. *Wien*, a more remarkable essay on the soul of Vienna, enjoyed the distinction of being prohibited under the monarchy. Under the influence of Maeterlinck, Bahr next became a champion of mysticism and symbolism. Turning to the theatre, Bahr fell under the influence of Schnitzler. His comedies, which include *Wienerinnen* (1900), *Der Krampus* (1902) and *Das Konzert* (1909), are superficial but amusing and hit off the Viennese type of the day admirably. In 1903 Bahr became director of the Deutsches theatre, Berlin, and in 1918 he was for a short time director of the Viennese Burgtheatre. During World War I, he fell under the influence of Catholicism, and from his Austrian country home, became the leading representative of the typically Austrian conservative and strongly Catholic school, as instanced in his *Himmelfahrt* (1916).

BAHR, JOHANN CHRISTIAN FELIX (1798–1872), German philologist and historian, was born at Darmstadt on June 13, 1798. He was educated at Heidelberg and later became a professor there. His most important work was *Geschichte der römischen Litteratur (History of Roman Literature)*, which he wrote

in 1828 and which has become a classic in its field. He is also well-known for his edition of the works of Herodotus. He died on Nov. 29, 1872, at Heidelberg.

BAHR or **BAHAR,** the Arabic for "sea," with the diminutive *bahira* or *boheira.* Bahr also signifies a river, especially one with a large body of water, *e.g.,* the Nile, and is occasionally used to designate the dry bed of a river.

BAHRAICH, a town and district of British India, situated in the Fyzabad division of the United Provinces. The town is on the river Sarju. It contains the most popular place of pilgrimage in Oudh, the tomb of Masaud, a champion of Islam, slain in battle by the confederate Rajputs in 1033, which is resorted to by Mohammedans and Hindus alike. There is also a Muslim monastery, and the ruined palace of a nawab of Oudh. Pop. (1931) 33,783.

The district of Bahraich contains an area of 2,639 sq.mi. It consists of three tracts: (1) a central elevated triangular south-easterly projection from the Himalayas for about 50 mi.; (2) the great Gogra plain on the west, about 40 ft. below the plateau; and (3) on the east, the lesser basin of the Rapti. Forest and marshy tracts of the south slopes of the Himalayas merge within the district into drier land, stream beds become deeper and more marked, marshes disappear, and the plain of the Ganges is entered. The Gogra skirts the district for 114 mi.; and the Rapti, with its branch, the Bhalka, drains the high grounds. In 1931 the population was 1,136,348. A considerable trade is conducted with Nepal, chiefly in timber. The district is purely agricultural in character, and is one of large estates, 78% being held by *taluqdars,* of whom the four chief are H.H. the maharajah of Kapurthala, the maharajah of Balrampur, the rajah of Nanpara and the rajah of Payagpur.

Little is known of the history of the district before the Muslim invasion in A.D. 1033. Masaud was defeated and slain by Bahraich nobles in 1033, and the Muslim did not establish their authority here till the middle of the 13th century. About 1450 the Raikwars, or Rajput adventurers, made themselves masters of the west of the district, which they retain to this day. In 1816, by the Treaty of Segauli, the Nepal *tarai* was ceded to the British but was given back in 1860.

BAHRĀM, the name of five Sassanid kings (*Varahrān,* in Gr. Οὐαραράνης or Οὐραράνης, the younger form of the old *Verethragna,* the name of a Persian god, "the killer of the dragon Verethra").

1. BAHRĀM I (A.D. 274–277). From a Pahlevi inscription we learn that he was the son (not, as the Greek authors and Tabari say, the grandson) of Shapur I, and succeeded his brother Hormizd (Ormizdas) I. Bahrām I is the king who, at the instigation of the magians, put to a cruel death the prophet Mani, the founder of Manichaeism.

2. BAHRĀM II (277–294), son of Bahrām I. Of his reign some theological inscriptions exist (F. Stolze and J. C. Andreas, *Persepolis* (1882) and *E.* W. West, "Pahlevi Literature" in *Grundriss d. iranischen Philologie,* ii pp. 75–129).

3. BAHRĀM III, son of Bahrām II, under whose rule he had been governing Seistan. reigned only four months (in 294).

4. BAHRĀM IV (389–399), son and successor of Shapur III, under whom he had been governor of Kirman. Under him or his predecessor, Armenia was divided between the Roman and the Persian empires.

5. BAHRĀM V (420–439), son of Yazdegerd I, after whose sudden death (or assassination) he gained the crown against the opposition of the grandees by the help of al-Mondhir, the Arabic dynast of Hira. He began a systematic persecution of the Christians, which led to a war with the Roman empire. But a treaty was soon concluded by which both empires promised toleration to the worshippers of the two rival religions, Christianity and Zoroastrianism. Bahrām deposed the vassal king of the Persian part of Armenia and made it a province. He is a great favourite in Persian tradition and is called Bahrām Gor, "the wild ass," on account of his strength and courage.

BAHRAM CHOBIN or COBIN, Persian general and king of Persia, A.D. 590–91. He first came to prominence during the reign of Hormizd IV, who had so alienated his subjects by cruelty and rnismanagement that rebellions were cropping up over the entire Persian kingdom. Persia's enemies, taking advantage of the situation, began to encroach on Persian territory. Bahram successfully repelled the Turks, who formed the most serious threat, but in his next campaign in the Caucasus was defeated by Roman troops. Hormizd, jealous of Bahram's success and popularity, took advantage of the defeat to dismiss him from the army. Bahram revolted with his troops and refused to be pacified even after Chosroes II, who succeeded Hormizd in 590, offered him second place in the kingdom. Chosroes therefore marched against Bahram, but the king's troops revolted and Chosroes was forced to flee to the Romans for assistance. Bahram proclaimed himself king. His throne, however, was never secure; and in 591 Chosroes, who had meanwhile obtained Roman support, had little difficulty in defeating Bahram's army and recapturing the throne. Bahram took refuge with the Turks but Chosroes, determined to remove the threat to his position forever, was soon able to arrange his assassination.

BAHRDT, KARL FRIEDRICH (1741–1792), German theologian and adventurer, was born on Aug. 25, 1741, at Bischofswerda and died at Halle on April 23, 1792. At the age of 16 young Bahrdt began to study theology at Leipzig under the orthodox mystic, Christian August Crusius (1715–75), who in 1757 had become first professor in the theological faculty. In 1766 he was appointed professor extraordinarius of biblical philology. Bahrdt was successively professor of theology at Giessen, master of the "Philanthropin," a famous school at Marschlins, general superintendent at Diirkheim, and a lecturer on other subjects than theology at Halle. From these posts he was expelled in each case on account of irregular living, and for the last ten years of his life he kept an inn on the Weinberg near Halle. He is remembered for his *Neueste Offenbarungen Gottes in Briefen und Erzählungen* (1773–75), which purported to be a "model version" of the New Testament and drew down on him the scorn of Goethe.

See life, with detailed bibliography, by Paul Tschakert in Herzog-Hauck, *Realencyklopädie;* a more favourable account is given in J. M. Robertson's *Short History of Freethought,* ii. 278.

BAHREIN, an archipelago named from its chief island, in the gulf of the same name occupying the angle formed by the Qatar peninsula and the Hasa coast of Arabia. Bahrein Island, 27 mi. long and 10 mi. wide, lying north and south is a low flat expanse of sand, with a number of luxuriant oases, and the rocky crater-like hill of Jebel Dukhan, 400 ft., is its central and most prominent feature.

Manama, the port and capital, generally referred to as "Bahrein," extends 3 mi. along the shore with a population of about 25,000. It is connected by road, suitable for motors, with Sukhair, 18 mi. and Budaia, 12 mi. distant and has a municipal council. Opposite Manama across a narrow strait lies Muharraq, with 25,000 inhabitants, capital of the island of the same name; it is semicircular in shape and 4 mi. long by ½ mi. broad. With the exception of Sitra on the east, 3 mi. by 1 mi., the other islands of the group are unimportant. Besides the towns mentioned there are about 100 villages distributed over the islands.

The archipelago is the headquarters of the Persian gulf pearl trade, in which over 1,000 sailing boats of various sizes are engaged, and employ some 20,000 men. Its average annual value is over £1,500,000. Dates form the chief agricultural product. The islands produce a fine breed of white donkey, which, however, is no longer exported. Shipbuilding and the making of sailcloth and reed-mats are the chief industries. The climate is humid but not unhealthful, a remarkable feature of the locality being an abundant supply of submarine fresh-water, which was formerly tapped by the insertion of reed pipes. Latterly, however, more modern methods have been employed to tap this water supply which probably originates in the highlands of the central Arabian plateau, 150 mi. to the west. The population consists mainly of Arabs with a good sprinkling of Negroes. There is also a considerable community of Persians and of Indian (Hindu) merchants. In the northern part of Bahrein Island is an extensive plain covered with

a vast number (probably running to six figures) of burial tumuli of various sizes, containing two-chambered sepulchres built of slabs of limestone. A number of these have been explored by Durand, Bent, Prideaux, Mackay and others, who have found numerous relics and specimens of pottery, but nothing sufficiently distinctive to indicate the age of the necropolis. It was considered by the earlier explorers that it was of Phoenician origin, but this is not accepted by archaeologists.

The Portuguese occupied the islands in 1507 but were dispossessed in 1602 by Arab subjects of Persia from the opposite shores of the gulf, during the reign of Shah Abbas. They mere in turn ejected in 1783 by Arab hordes from the Arabian mainland, mainly of the Ataiba tribe, who have remained in possession up to the present day. The ruling family, of the Al Khalifah section of that tribe, was represented during a reign of 60 years, up to 1922, by Shaikh Isa bin Ali. In that year, having regard to his extreme old age and the prevalence of intrigues among his sons, Shaikh Isa was persuaded by the British authorities to abdicate in favour of his son. In 1932 Shaikh Hamad bin Isa became ruler and on his death in 1942 he was succeeded by his son, Shaikh Sulman bin Hamad.

The principality is recognized as independent, but is in treaty relations with the government of India, who are represented by a political agent, working under an order in council. The territories are under the protection of Great Britain, which has been several times called upon to intervene in order to defeat the attempts of various powers to assert dominion over the islands; *e.g.,* the sultan of Oman, the Wahabis, the Turks and the Persians.

The latter power has periodically advanced a claim to sovereignty over Bahrein, one of the occasions being in Nov. 1927. In their reply to the Persian government, dispatched on Jan. 18, 1928, with copy to the League of Nations. the British government refused to consider the claim and declared the intention of Great Britain to protect the islanders as previously against any attempt to subject them to foreign domination.

See Bent, *Southern Arabia* (London, 1900); Prideaux, in *Report of Archaeological Survey of India* (1908–1909); Hogarth, in *Geographical Journal,* vol. lxix (1927).

BAHR-EL-GHAZAL, the chief western affluent of the river Nile, N.E. Africa, which it joins in 9° 30′ N., 30° 25′ E. The Bahr-el-Ghazal (Gazelle river) is a stream formed by the junction of many rivers, of which the Jur *(see* below) is the most important. The basin of the Ghazal is a large one, extending northwest to Darfur, and southwest to the Congo watershed. The main northern feeder of the Ghazal is a large river, whose headwaters are in the country west of 24" E. where the Nile, Congo and Shari watersheds meet. It is reinforced by intermittent streams from the hills of Darfur and by considerable rivers flowing north from Dar Fertit, among them being the Bahr el Homr, the Bahr el Arab and its tributary the Lol and the river Jur or Agur. The latter is the most important of the southern affluents and is known in its upper course as the Sueh. The upper courses of the Lol include the Boru, Banga, Sopo. The Lol receives the Cheu (with the Biri) and the Pongo. Deim Zubeir, formerly the chief station of Zobeir Rahama (*q.v.*), is near the Biri tributary of the Cheu.

The town of Wau (7" 42' N., 28° 3' E.), on the Jur, is the capital of the Bahr-el-Ghazal province of the Anglo-Egyptian Sudan. Meshra-er-Rek, the chief station and trading centre of the early explorers, is on a backwater south of the point where the Jur turns northwards to join the Bahr-el-Ghazal. Between the Jur and the Nile, parallel with these rivers, several streams, including the Tonj, Rohl and Deleb, run north from the Congo-Nile watershed and join the Bahr-el-Ghazal. Lake No is a depression near the junction of the Bahr-el-Jebel and the Ghazal. The lake is about 7 mi. long from west to east, and the Bahr-el-Jebel, after passing through its eastern corner, is known as the Bahr-el-Abiad or White Nile.

In their upper courses the southern affluents of the Ghazal cut deeply into the central African plateau. North of 7° 20′ N. (where rapids interrupt the currents) the valleys open out although their channels are often choked by sandbanks. This alluvial region, flooded in the rainy season, gives place about 9° N. to a wide area of marsh, forming part of the huge swamp region of the Nile (*q.v.*). Through these swamps it is almost impossible to trace the course of the various rivers. From the confluence of the Bahr-el-Arab with the Jur, above which point none of the rivers is called Bahr-el-Ghazal, to the junction with the Nile at Lake No, is a distance of about 100 mi. Just above the Bahr-el-Arab confluence the Jur broadens out and forms a lake (Ambadi) 10 mi. long and 1 mi. broad at low water and very much larger in flood time. This lake is the home of many sudd plants but the papyrus and ambach are absent. The whale-headed *Balaeniceps rex,* elsewhere rare, is found here in large numbers. At first the Ghazal flows north with lagoon-like expansions having great breadth and little depth—nowhere more than 13 ft. Turning northeast the channel becomes narrower and deeper, and is characterized by occasional reaches of papyrus. Finally, the Ghazal turns east and again becomes broader until Lake No is reached. As a rule the banks in this section are marked by anthills and scrub. The rise of the Ghazal river and the lower reaches of its main tributaries in flood time is barely 3 ft., but this is sufficient to flood an enormous area of country.

Exploration of **the** River.—Rumours of the existence of the Bahr-el-Ghazal led some of the Greek geographers to imagine that the source of the Nile was westward in the direction of Lake Chad. The first map on which the course of the Ghazal is indicated fairly accurately is that of the French cartographer, d'Anville, published in 1772. The exploration of the river followed the ascent of the White Nile by the Egyptian expeditions of 1839–42, and for a considerable portion of the period between 1853 and 186; John Petherick, a Welsh mining engineer, explored the Ghazal region, particularly the main stream and the Jur. In 1859 a Venetian, Giovanni Miani, penetrated the southern regions of the Ghazal basin and brought back reports of a great river (the Welle) flowing west beyond the Nile watershed. In 1862 a Frenchman, Lejean, surveyed the main river, and published a map. Considerable additions to the knowledge of the region were made by the ill-fated Tinné expedition of 1863. Georg Schweinfurth (*q.v.*), between 1869 and 1871 traversed the southern district and discovered the Welle. Further exploration of a military nature was undertaken in 1879–81 by Gessi Pasha, the Italian governor of Ghazal under Gordon. Wilhelm Junker (*q.v.*), about the same period, explored the southern tributaries of the Ghazal. These were carefully surveyed, and the Jur (Sueh) followed throughout its course by A. H. Dyé and other members of the French mission under J. B. Marchand, which crossing from the Congo (Oct. 1897) reached Fashoda on the White Nile in July 1898.

Like the Bahr-el-Jebel the Bahr-el-Ghazal is liable to be choked by sudd. The river became almost blocked in this manner during the rule of the Mahdists. Early in the 20th century the sudd was removed by British officers from the Bahr-el-GhazaI, the Jur and other rivers, and uninterrupted communication was thus established during the flood season between Khartoum and Wau, a distance of some 930 mi. In 1905–07 R. C. Bayldon, C. Percival and D. Comyri partly explored the northern and western affluents of the Ghazal. The whole area of the Bahr-el-Ghazal basin, some 200.000 sq.mi., contributes practically nothing to the volume of the White Nile. All the tributaries flow through a vast marsh area in which quantities of water are evaporated or transpired by vegetation. The maximum discharge of the Bahr-el-Ghazal is about 1,700 cu.ft. per second and often is nothing at all.

See NILE and the authorities there quoted, especially Sir William Garstin's *Report upon tlze Basin of the' Upper Nile, Egypt,* No. 2 (1904), and Capt. H. G. Lyons's *The Physiography of the River Nile and its Basin* (Cairo, 1906); *Geographical Journal,* vol. xxx (1907).

BAHUT (a French word of unknown origin), a portable coffer or chest, with a rounded lid covered in leather, garnished with nails, used for the transport of clothes or other personal luggage, —it was, in short, the original portmanteau. *(See* CHEST.)

BAHYA, IBN PAQUDA, a Jewish ethical writer (11th century) of Saragossa. In 1040 he wrote, in Arabic, a treatise, Duties *of the Heart,* which was one of the most significant and influential

Jewish works of the middle ages. Bahya felt that Jews were laying too much stress on the written law and giving too little attention to the real spirit of it. Duties of *the* Heart was his attempt to formulate an ethical system from Jewish teachings which would reconcile this discrepancy and give the proper importance to the duties of the heart or spirit as opposed to those of the body. The law, in the rabbinical sense, was reverenced by Bahya, who made it part and parcel of the Jew's inner life.

His book was written in ten sections, each one representing one of the duties of the heart. Some selections from it have been translated into English by E Collins.

BAI, TOMMASO (*c.* 1650–1714), Italian musician, was born at Crevalcuore, Italy. He sang in the Vatican chapel for some years and a year before his death was made maestro of the chapel. His best work was a *Miserere* which critics compared favourably with similar compositions by Palestrina. He died in Rome on Dec. 22, 1714.

BAÍA, an Atlantic state of Brazil, bounded on the north by the states of Piauí, Pernambuco and Sergipe, east by Sergipe and the Atlantic, south by Espirito Santo and Minas Gerais. and west by Minas Gerais and Goiaz. Its area is 204,393 sq.mi., a great part of which is an arid, barren chapada (plateau), traversed from south to north and northeast by the drainage basin of the São Francisco river, and having a general elevation of 1,000 ft. to 1,700 ft. above that river, or 2,300 ft. to 3,000 ft. above sea level. On the west the chapada, with an elevation of 2,300 ft. and a breadth of 60 mi., forms the western boundary of the state and the watershed between the São Francisco and the Tocantins. East of the São Francisco it may be divided into three distinct regions: a rough limestone plateau rising gradually to the culminating ridges of the Serra da Chapada; a gneissose plateau showing extensive exposures of bare rock dipping slightly toward the coast; and a narrower plateau covered with a compact sandy soil descending to the coastal plain. The first two have a breadth of about zoo mi. each, and are arid, barren and inhospitable, except at the dividing ridges where the clouds from the sea are deprived of some of their moisture. The third zone loses its arid character as it approaches the coast and is better covered uith vegetation. The coastal plain varies in width and character; in some places low and sandy, or swampy. filled with lagoons and intersecting canals; in others more elevated, rolling and very fertile. The climate corresponds closely to these surface features, being hot and dry throughout the interior, hot and humid, in places unhealthful along the coast. Cattle raising is the principal industry in the interior. In the agricultural regions cacáo, sugar, cotton, tobacco, coffee, mandioca and tropical fruits are produced. The exports include cacáo, sugar, cotton, hides, mangabeira rubber, piassava fibre, diamonds, cabinet woods and rum. The population, largely of a mixed Negro and white racial origin, numbered 2,117,956 in 1900 and 3,938,909 in 1940. There is little immigration. The capital, Salvador or Baia (*q.v.*), which is one of the principal cities and ports of Brazil, is the export town for the Reconcavo, as the fertile agricultural district surrounding the bay is called. The principal cities of the state are Alagoinhas and Bomfim (formerly Villa Nova da Rainha) on the main railway line running north to the São Francisco, Cachoeira and Santo Xmaro near the capital in the Reconcavo, Caravelas and Ilhéus on the southern coast, with tolerably good harbours, the former being the port for the Baia and Minas railway, Feira de Santana on the border of the *sertão* and long celebrated for its cattle fairs, and Jacobina, an inland town northwest of the capital, on the slopes of the Serra da Chapada, and noted for its mining industries, cotton and tobacco. The state of Baia includes four of the original captaincies granted by the Portuguese crown—Baia, Paraguassú, Ilhéus and Pôrto Seguro, all of which reverted to the direct control of that government in 1549. During the war with Holland several efforts were made to conquer this captaincy, but without success. In 1823 Baia became a province of the empire, and in 1889 a state in the republic. Its government consists of a governor elected for four years, and a general assembly of two chambers, the senators being elected for six years and the deputies for two years.

BAIAE, ancient city, Campania, Italy, 10 mi. W. of Neapolis, on the Sinus Baianus, a bay on the west coast of the gulf of Futeoli. The grave of Baios, helmsman of Ulysses, was shown there; it was originally, perhaps, the harbour of Cumae. Its warm sulphur springs are remarkable for their variety and curative properties (Pliny, *Hist. Nat.* xxxi 4); it has mild climate and luxuriant vegetation. In Strabo's day it was as large as Puteoli. Julius Caesar possessed a villa here, of which there are probably remains on the ridge above the 16th century castle. Nero built a huge villa probably on the castle site. Hadrian died in Caesar's villa in A.D. 138, and Alexander Severus erected large buildings for his mother. Baiae formed part of the territory of Cumae. Its luxury and immorality were often censured.

Near Baiae was the villa resort of Bauli, so called from the *βοαύλια* (stalls) in which the oxen of Geryon were concealed by Hercules. By some it is identified with the modern village of Bacoli (presumed similarity of name), 2 mi. S.S E. of Baiae; by others with the Punta dell'Epitaffio, 1 mi. N.E. of Baiae. At Bauli, Pompey and Hortensius possessed villas, the former on the hills, the latter on the shores of the Lacus Lucrinus, remarkable for its tame lampreys and as the scene of the dialogue in the second book of Cicero's *Academica Priora;* it afterwards became imperial property and was the scene of Agrippina's murder by Nero. It was from Bauli to Puteoli that Caligula built his bridge of boats. Baiae has three large and lofty domed buildings, two octagonal, one circular, and all circular in the interior, popularly called temples but really baths. Fine fragments of Flavian architecture and sculpture have been found in the bay near them. The Punta dell'Epitaffio also is covered with remains; to the north of Bacoli is a small theatre, called the tomb of Agrippina; under the village are the ruins of a large villa; to the east the remains of a large water reservoir, the so-called Cento Camerelle; to the south another with vaulted ceiling, the *piscina* mirabilis, measuring 230 by 8j ft. The villa of Marius, bought by Lucullus, and afterwards in the possession of the imperial house, was the scene of the death of Tiberius. It is sometimes spoken of as Baiana, sometimes as *Misenensis* and is perhaps to be sought at Bacoli. Baiae was devastated by the Saracens in the 8th century and entirely deserted on account of malaria in 1500.

BAIBURT, a town of Asiatic Turkey, on the direct carriage road from Trebizond to Erzerum, situated on both banks of the Churuk river, which here traverses an open cultivated plateau (altitude, 5,100 ft.), before turning east. It is the chief place of a kaza in the vilayet of Gümüṣane; the bazaar is poor, and there is no special industry in the town. The houses run up the hillsides on both banks of the river to a considerable height. On an isolated mass of rock, on the left bank, is the old castle, with extensive walls partly ruined, built originally by the Armenians and restored by the Seljuks. The principal gate with some Arabic inscriptions stands at the southwest corner. There are remains of a vaulted chamber, a Christian church, a mosque and two covered staircases to the river. A fine view is seen from the summit over the plain and the Pontic ranges to the north. Population 48,842.

BAIḌĀWĪ (ʿAbdallāh ibn ʿUmar al-Baiḍāwī) (died c. 1286), Mohammedan critic. His chief work is the commentary on the Koran entitled *The* Secrets of Revelation and *the* Secrets of *Interpretation* (*Asrār ut-tanzīl wa Asrār ut-ta'* wil). This work is in the main a digest of the great Mu'tazalite commentary (*al-Kashshāf*) of Zamakhshari, though it is not complete in its discussion of any branch of theological or linguistic knowledge of which it treats, and is not always accurate (cf. Th. Noldeke's Geschichte des Qorans, Göttingen, 1860, p. 29). It has been edited by H. O. Fleischer (Leipzig, 1846–48; indices ed. W. Fell, Leipzig, 1878). A selection with numerous notes mas edited by D. S. Margoliouth as *Chrestomathia Beidawiana* (London, 1894).

See C. Brockelmann's *Geschichte* der arabischen *Litteratur* (Weimar, 1898), vol. i, pp. 416-418.

BAÏF, JEAN ANTOINE DE (1532–1589), French poet and member of the Pléiade, was born at Venice, the natural son of the scholar Lazare de Baïf, at that time French ambassador there. He was taught Latin by Charles Estienne, and Greek by

Ange Vergèce, the Cretan scholar and calligraphist who designed Greek types for Francis I. When he was 11 years old he was put under the care of the famous Jean Daurat (*q.v.*). Ronsard, who was eight years his senior, now began to share his studies. Claude Binet tells how young Baif, bred on Latin and Greek, smoothed out the tiresome beginnings of the Greek language for Ronsard, who in return initiated his companion into the mysteries of French versification. Baif possessed an extraordinary facility, and the mass of his work has injured his reputation. Besides a number of volumes of short poems of an amorous or congratulatory kind, he translated or paraphrased various pieces from Bion, Moschus, Theocritus, Anacreon, Catullus and Martial. He resided in Paris and enjoyed the continued favour of the court. He founded in 1567 an *académie* de musique et de *poésie,* with the idea of establishing a closer union between music and poetry; his house became famous for the charming concerts which he gave, entertainments at which Charles IX. and Henry III. frequently flattered him with their presence. Baïf elaborated a system for regulating French versification by quantity. In this he was not a pioneer. Jacques de la Taille had written in 1562 the *Manière* de *faire* des *vers en français comme* en grec *et* en *latin* (printed 1573), and other poets had made experiments in the same direction. Baïf's innovations included a line of 15 syllables known as vers *baïfin.* He also meditated reforms in French spelling. His theories are exemplified in *Etrenes* de *poezie Franzoeze* an vers *mezures* (1514). His works were published in four volumes, entitled *Oeuvres en rime* (1573), consisting of *Amours,* Jeux, *Passetemps,* et *Poëmes,* containing, among much that is now hardly readable, some pieces of infinite grace and delicacy. Baif was the author of two comedies, *L'Eunuque* (1565, published 1573), a free translation of Terence, and Le Brave (1567), an imitation of the *Miles* Gloriosus, in which the characters of Plautus are turned into Frenchmen, the action taking place at Orleans. Baif published a collection of Latin verse in 1577, and in 1576 a popular volume of *Mimes, enseignemens* et *proverbes.*

His father, LAZARE DE BAÏF, published a translation of the Electra of Sophocles in 1537, and afterwards a version of the Hecuba; he was an elegant writer of Latin verse.

The *Oeuvres* en rime (1881–90) of J. A. de Baif form part of the Pldiade *française* of M. Ch. Marty-Laveaux. See also Becq de Fouquières, *Poésies choisies* de J. A. de Bazf (1874), with a valuable introduction; and F. Brunetière, *Hist.* de la *litt. française* classique (1904, bk. iii. pp. 398–422). For an account of Baïf's academy see Edouard Frémy, *Les Origines* de *l'Académie Française* (1887). See also L. Pinvert, Lazare de Baif, *1496?–1547* (1900).

BAIKAL, a lake of East Siberia (known to the Mongols as Dalai-nor, and to the Turkish tribes as *Bai-kul*), the sixth in size in the world and the largest fresh-water basin of Eurasia. It stretches from south-liest to north-east (52° and 56° N. and 104° to 110° E), lying in the Buriat-Mongol A S S R., except for the coastal area north and south of the outlet of the Angara river, which is in the Irkutsk province and has a length of 674km. and a width of from 25 to 74 kilometres. Its south end penetrates into the high plateau of Asia, and the lake lies entirely in the mountain zone north-west of that plateau. Its area is 33,000sq km, *i.e.,* nearly as great as Switzerland. The length of its coast-line is 2,200 kilometres. Its altitude is 462 metres above sea level and 40 metres above the level of the Angara at Irkutsk (*Zapiski,* Russ. Geog. Soc., xv., 1885). Its level changes regularly during the year, being lowest in April and highest in September. The amplitude of variation is about 80 centimetres. Its level is also subject to irregular oscillations, and after five weeks of heavy rain in 1869 it rose more than two metres and submerged a large area at the mouth of the Selenga. The drainage area is estimated at 650,000 sq.km., and the intake of fresh water at 162cu.km. per annum.

Drizhenko, working in 1897–1902, produced a map published in *Pilot* for *the* Lake Baikal. This shows that, as regards depth, the lake may be divided into three sections. The southern section stretches from the west end to the Selenga delta and is enclosed between spurs of the East Sayan mountains in the west and the Khamar-daban mountains in the east. Both these ranges have precipitous granitic slopes down to the lake and into its depths, with soundings in places of more than 1,400 metres. From the Selenga delta, with its large alluvial deposits, a rise of the lake floor stretches north-west and is covered by only 200 to 530 metres of water. The second section stretches from the mouth of the Selenga to Svyatoi Nos on the east coast, and is extremely deep, a sounding of 1,522 metres being taken quite close to Cape Ishimei on the island of Olkhon; the lake floor here lies 1,060 metres below sea-level, and is thus the deepest crypto-depression of the earth's surface. As the average depth of Baikal is 700 metres, it is the deepest lake in the world, and in proportion to its area it has the largest volume of water, estimated at 23,000 cu.km., or approximately the volume of the Baltic and the Kattegat, though the surfaces of these together have an area 12 times that of Baikal. The third section stretches from Svyatol Nos to the north end; here the depths gradually diminish, but soundings of more than 500 metres occur almost everywhere. The water is beautifully clear.

Temperature. — The surface-layers have summer temperatures of 55½° to 57°, both close to the shores and at some distance from the mouth of the Selenga, but these warmer layers are not deep, and a nearly uniform temperature of 39" is found from a depth of zoo metres right down to the bottom. At various places round the shores, *e.g.,* the mouth of the Barguzin, hot springs exist. The lake freezes usually at the end of December, or in the beginning of January, and it remains frozen till the second half of May. Evaporation exercises a certain influence on the climate of the surrounding country, while absorption of heat for thawing of ice has a notable cooling effect in early summer. In summer the climate is cooler, in winter warmer than that of the surrounding region, the range of air temperature on the lake being only 56° as against 79° away from the lake.

Rivers. — Lake Baikal receives over 300 streams, mostly short mountain torrents, besides the Upper Angara, which enters its north-east extremity, the Barguzin, on the east, and the Selenga on the south-east. Its only outflow is the lower Angara, which issues through a rocky cleft on the west shore. The Irkut no longer reaches Baikal, though it once did so. After approaching its south-west extremity it abandons the broad valley which leads to the lake, and makes its way northwards through a narrow gap in the mountains and joins the Angara at Irkutsk.

Mountains. — Save at the Selenga delta, Lake Baikal is surrounded by mountains. The Khānar-daban border-ridge (the summit of a mountain of the same name is 1,800 metres above the lake), falling, with steep cliffs, towards the lake, fringes it on the south; a massive, deeply-ravined highland occupies the space between the Irkut and the Angara; the Onot and Baikal ridges (also Primorskiy) run along its north-west shore, striking it diagonally; a complex of still unexplored mountains rises on its north-east shore; the Barguzin range impinges upon it obliquely in the east; and the Ulanburgasi mountains intrude into the delta of the Selenga.

Geology.—Baikal may already have existed in the Jurassic period. It has certainly existed since the Miocene. At times it has stretched westwards into what is now the valley of the Irkut, and northward and eastward up the lower valleys of the Upper Angara and the Barguzin, but it has never been in connection with the Arctic ocean. It is a very old relict-lake, a deep depression among great mountain lines, which is still progressing, and earthquakes are frequent along its shores.

Fauna.—Dybowski and Godlewski (1876) and Korotnev (1902) found the fauna much richer than was supposed, and highly peculiar. A few animals of marine affinities are found; *e.g.,* a seal (*Phoca* foetida *sibirica,* Gmelin) but these animals have wandered up the lower Angara and have thus reached the lake. There may also have been at various times seasonal expanses of water from melting ice in the Yenisei basin. On the whole the fauna, and especially the lower animals in it, are, as it were, a sort of fresh-water museum of ancient species, several of which are endemic and peculiar. Baikal has 188 species of Gammarus, more than half the species of this genus described for the world; of these 184 are found only here. The waters swarm with fish (sturgeons and *salmonidae*), and herring (Salmo *omul*) is the chief product of the fisheries, though notably fewer have been taken

within the last 50 years. The most interesting fish is *Comephorus baikalensis,* resembling fishes living at great depths of the ocean. Plankton is very abundant. The little Lake Frolikha, situated close to the northern extremity of Lake Baikal, and communicating with it by means of a river of the same name, contains a peculiar species of trout, *Salmo erythreas,* which is not known elsewhere.

Navigation.— The lake was discovered in 1643, since when boats have been in use on it; steamers having been introduced in 1844. Sudden storms and absence of good bays and ports, hinder navigation. The principal port on the western shore, Listvinichnoe, near the outflow of the Angara, is an open roadstead at the foot of steep mountains. Steamers ply from it to Misovaya (Posolskoe) on the opposite shore, a few times a year, to Verkhne-Angarsk, at the northern extremity of the lake, and frequently to the mouth of the Selenga, which they ascend to Bilyutai, near the Mongolian frontier. They bring back tea, imported by way of Kiakhta, while grain, cedar nuts, salt, soda, wool and timber are shipped on rafts down the Khilok, Chikoi and Uda (tributaries of the Selenga), and manufactured goods are taken up the river for export to China, but now (1928) there is only little traffic. Attempts are being made to render the Angara navigable below Irkutsk down to the Yenisei. In winter, when the lake is covered with ice 1 metre thick, it is crossed on sledges from Listvinichnoe to Misovaya. But a highway, available all the year round, was made in 1863–64 around its southern shore, partly by blasting the cliffs, and it is (since 1905) followed by the trans-Siberian railway.

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BAIKIE, WILLIAM BALF'OUR (1824–1864), Scottish explorer, naturalist, and philologist, eldest son of Captain John Baikie, R.N., was born at Kirkwall, Orkney. He studied medicine at Edinburgh, and, on obtaining his M.D. degree, joined the royal navy in 1848. He early attracted the notice of Sir Roderick Murchison, through whom he was appointed surgeon and naturalist to the Niger expedition sent out in 1854 by Macgregor Laird with government support. On the death of the senior officer (Consul Beecroft) at Fernando Po, Baikie succeeded to the command. Ascending the Benue about 250m. beyond the point reached by former explorers, the little steamer "Pleiad" returned and reached the mouth of the Niger, after a voyage of 118 days, without the loss of a single man. The expedition had been instructed to endeavour to afford assistance to Heinrich Barth (*q.v.*), who had in 1851 crossed the Benue in its upper course, but Baikie was unable to gain any trustworthy information concerning him. Returning to England, Baikie gave an account of his work in his *Narrative of an Exploring Voyage up the Rivers Kwora and Binue . . .* (1856). In March 1857 Baikie—with the rank of British consul—started on another expedition in the "Pleiad." After two years spent in exploring the Niger, the navigating vessel was wrecked in passing through some of the rapids of the river, and Baikie was unable longer to keep his party together. All returned home but himself; in no way daunted, he determined single-handed to carry out the purposes of the expedition. Landing from a small boat, with one or two native followers, at the confluence of the Niger and Benue, he chose Lokoja as the base of his future operations, it being the site of the model farm established by the expedition sent by the British government in 1841, and abandoned within a year on the death of most of the white settlers. *See* Capt. W. Allen, R.N., and T.R.H. Thomson, M.D., *A Narrative of the Expedition . . . to the River Niger in 1841* (1848). After purchasing the site, and concluding a treaty with the Fula amir of Nupe, he proceeded to clear the ground, build houses, form enclosures, and pave the way for a future city. Numbers flocked to him from all neighbouring districts, and in his settlement were representatives of almost all the tribes of west-central Africa. To the motley commonwealth thus formed he acted not merely as ruler, but also as physician, teacher, and priest. In less than five years he had opened up the navigation of the Niger, made roads, and established a market to which the native produce was brought for sale and barter. He had also collected vocabularies of nearly 50 African dialects, and translated portions of the Bible and prayer book into Hausa. Once only during his residence had he to employ armed force against the surrounding tribes. He died at Sierra Leone while on his way home, on leave of absence. After his death the British government abolished the consulate (1866), and it was through private enterprise that some 20 years later the district where Baikie had worked so successfully was finally secured for Great Britain *(see* **NIGERIA**).

Baikie's *Observations on the Hausa and Fulfulde* (*i.e.,* Fula) *Languages* was privately printed in 1861, and his translation of the Psalms into Hausa was published by the Bible Society in 1881.

BAIL, in English common law, the freeing or setting at liberty of one arrested or imprisoned upon any action, either civil or criminal, on surety taken for his appearance on a certain day and at a place named. The surety is termed bail, because the person arrested or imprisoned is placed in the custody of those who bind themselves or become bail for his due appearance when required. So he may be re-seized by them (if they suspect that he is about to escape) and surrendered to the court, when they are discharged from further liability. The sureties must be sufficient in the opinion of the court to answer for the sum for which they are bound, and, as a rule, only householders are accepted; an accomplice of the person to be bailed or an infant would not be accepted. Bail is obligatory in all summary cases. It is also obligatory in all misdemeanours, except such as have been placed on the level of felonies, viz., obtaining or attempting to obtain property on false pretences, receiving property so obtained or stolen, perjury or subornation of perjury, concealment of birth, wilful or indecent exposure of the person, riot, assault in pursuance of a conspiracy to raise wages, assault upon a peace officer in the execution of his duty or upon any one assisting him, neglect or breach of duty as a peace officer, any prosecution of which the costs are payable out of the county or borough rate or fund. In cases of treason, bail can only be granted by a secretary of State or the king's bench division. A person charged with felony is not entitled as of right to be released on bail. The power of admitting a prisoner to bail is judicial and not ministerial, and the exercise of the discretion must not be punitive, the chief consideration being the likelihood of the prisoner failing to appear at the trial—cf. *Reg. v. Rose* (17 Cox. C.C. 717). This must be gauged from the nature of, and the evidence in support of, the accusation, the position of the accused and the severity of the punishment which his conviction will entail, as well as the independence of the sureties. The Bail Act 1898 gives a magistrate power, where a person is charged with felony or certain misdemeanours, or where he is committed for trial for any indictable offence, to dispense with sureties, if in his opinion the so dispensing will not tend to defeat the ends of justice. A surety may be examined on oath as to his means, while the court may also require notice to be given to the plaintiff, prosecutor or police. A person who has been taken into custody for an offence, not apparently of a serious nature, without a warrant, and cannot be brought before a court of summary jurisdiction within 24 hours, may be admitted to bail by a police officer of superior rank or the officer in charge of the police station; and this can be done while inquiries are being made (Criminal Justice Acts, 1914 and 1925). An appeal against a refusal to grant bail lies to the king's bench division, and the court of trial has power to grant bail when necessary.

As to bail for an arrested ship, *see* ADMIRALTY JCRISDICTION.

(W. DE B. H)

United States.—I. In civil cases, the right of the person arrested on mesne process to be admitted to bail is absolute. The amount of the bail, unless otherwise fixed by statute, generally depends upon the amount of the civil liability claimed to be enforced, although the court has some discretion to reduce or increase it. The bond, undertaking or recognizance runs to the arresting officer, generally the sheriff, or to the plaintiff creditor, as required by the statute of the particular jurisdiction. Sureties, if individuals, may generally be either householder or freeholder, or may be a surety company.

2. In criminal cases the right to bail, and to that in an amount not to be excessive, is guaranteed by constitutional provisions except in capital cases. In capital cases, bail may be allowed in the discretion of the court, dependent on the circumstances of the case and nature and degree of proof of the offence available. The court having jurisdiction over the trial of the offence has jurisdiction to admit to bail. The form of the bail bond or recognizance is generally fixed by statute. The amount, except that it must not be excessive, is in the sound discretion of the court. The sureties must generally be freeholders or a surety company. The sureties may surrender the prisoner if they deem their risk doubtful. If the prisoner fails to appear upon the date set by the court, bail is forfeited and the State may enforce the collection of the amount of the bail against the property of the sureties. (B. RE.)

BAILÉN or **BAYLEN,** a town of southern Spain, in the province of Jaén. Population 8.998. Bailén is probably the ancient Baecula, where the Romans, under P. Cornelius Scipio the elder, signally defeated the Carthaginians in 209 and 206 B C In its neighbourhood, also, in 1212, was fought the great battle of Las Navas de Tolosa, in which, according to the ancient chroniclers, the Castilians under Alphonso VIII slew 200,000 Moors, and themselves lost only 25 men.

Bailén, Battle of, 1808.—Dupont, invading Andalusia with 20,000 men, found his communications with Madrid through the Sierra Morena threatened by guerrillas *(see* PENINSULAR WAR). Hearing that Castanos was approaching from Seville with 30,000, Dupont took post behind the Guadalquivir, his right on the Seville road at Andujar, his left 15 miles away at Mengibar. while the divisions of Vedel and Gobert lay at Bailén, five miles behind Mengibar. Castanos demonstrated in front at Andujar and sent the divisions of Reding and Coupigny to cross the river at Mengibar; this was easily stopped by Vedel moving up from Bailén. Dupont, who throughout regarded Andujar as the point of importance, both in defense, and as a bridge-head for future offensive operations, ordered Vedel to bring his main body thither; whereupon Reding crossed at Mengibar and defeated Gobert's weak division before Bailén. Gobert himself fell, his successor retired through Bailén along the Madrid road to Guarroman, while Reding withdrew behind the Guadalquivir. Hurrying back, Vedel found Bailén deserted and assumed tnat the Spaniards had followed Dupont northwards. He in turn followed, leaving an ever widening gap between himself and Dupont. Into this gap stepped Reding and Coupigny with 17,000 men. Dupont at last decided to abandon Andujar and fall back upon Bailén, where he hoped to join Vedel; instead he found Reding and Coupigny on the hills before Bailén. He at once attacked, July 19, 1808, but his column was badly organized and encumbered by a huge baggage train. After 11 unsuccessful attacks, lasting from dawn to noon. Dupont heard the signal guns of Castanos army following in his rear. He was trapped in a valley between two Spanish forces, his men exhausted and maddened by thirst. Had Vedel, who heard the firing hurried south again, he would equally have entrapped Reding and Coupigny between himself and Dupont, but Vedel unaccountably tarried and Dupont in despair surrendered, Vedel's forces being included in the capitulation. The capture of 18,000 French regulars (2,000 were killed) by a not greatly superior Spanish force consisting largely of peasants was a stunning blow to French prestige.

See Clerc, *Capitulation de Bailén, causes et conséquences* (1907).

BAILEY, FLORENCE MERRIAM (1863–), American ornithologist, sister of C. Hart Merriam (*q v*), was horn at Locust Grove, N. Y., on Aug. 8, 1863. She graduated at Smith college in 1886 and in 1899 married Vernon Bailey (*q.v.*). She became a devoted and able student of birds, especially those of western North America, and a prolific writer on ornithological subjects, publishing upwards of 100 papers, the most 'noteworthy of which were field studies contributed to the *Auk* and the *Condor,* together with several valuable larger works.

Her writings include: *Birds Through an Opera Glass* (1889); *My Summer in a Mormon Village* (1895); *A-Birding on a Broncho* (1896); *Birds of Village and Field* (1898); *Handbook of Birds of the Western United States* (1902), her most notable bock; *Wild Animals of Glacier National Park,* with Vernon Bailey (1918); *Birds Recorded from the Santa Rita Mountains of Southern Arizona* (1923); and *Birds of New Mexico* (1928).

BAILEY, LIBERTY HYDE (1858–), American botanist and horticulturist, was born at South Haven, Mich., on March 15, 1858. He spent his early years on a farm and in 1882 graduated from Michigan State Agricultural college. In 1882–83 he was a student assistant in botany under Asa Gray at Harvard, and in 1884–88 he was professor of horticulture and landscape gardening in Michigan State Agricultural College. From 1888 to 1903 he was professor of horticulture and from 1903 to 1913 he was dean of the college of agriculture and director of the agricultural experiment station, Cornell university. He rose to front rank among American botanical educators and by his achievements as a teacher, lecturer, writer and editor contributed substantially to the advancement of horticultural science. In systematic botany he made researches on North American sedges (especially *Carex*), on blackberries and raspberries (*Rubus*), and also on New World palms, collecting in the American Tropics much valuable material for their scientific study. In connection with his horticultural and taxonomic investigations he built up an extensive private herbarium. He also made important studies in rural economics, rural sociology and agricultural education. In 1908–09 he served as chairman of the Roosevelt commission on country life.

He was the editor of several series of books on agriculture and horticulture and also of the important *Cyclopaedia of American Horticulture* (1900–02); *The Cyclopaedia of American Agriculture* (1907). and *The Standard Cyclopedia of Horticulture* (1914–17, new ed. 1927).

Besides 'numerous articles in scientific journals and popular magazines and poems on country life, he was the author of *The Nursery Book* (1891); *Plant Breeding* (1897, rev. ed. 1915); *The Principles of Fruit Growing* (1897, 20th ed., 1921); *Sketch of the Evolution of Our Native Fruits* (1898); *Principles of Agriculture* (1898, 16th ed. 1910); *The Nature Study Idea* (1903); *The Training of Farmers* (1909); *Manual* of *Gardening* (1910); *The Outlook to Nature* (1911): *Country Life Movement in the United States* (1911); *Ground Levels in Democracy* (1911); *Tlze Practical Garden Book* (1913, rev. ed. 1925); *Universal Service* (1918); *The Nursery Manual* (1920); *The Apple Tree* (1922); *Manual of Cultivated Plants* (1924); and *The Garden Lover* (1928).

BAILEY, NATHAN or **NATHANIEL** (d. 1742), English philologist and lexicographer. He compiled a *Dictionarium Britannicum: a more compleat universal etymological English dictionary than any extant,* bearing the date 1730, but supposed to have been published in 1721. This formed the basis of Dr. Johnson's great work. Bailey, who was a Seventh-day Baptist (admitted 1691), had a school at Stepney, near London, and was the author of *Dictionarium Domesticum* and several other educational works.

BAILEY, PHILIP JAMES (1816–1902), English poet, author of *Festus,* was born at Nottingham and had a legal education though he never practised seriously. He is a man of one book, the voluminous and incoherent poem of *Festus,* which appeared anonymously in 1839, when the author was only 23. He wrote other volumes, none of which had any great success. *Festus* was reissued several times, and Bailey incorporated in it fragments from his other works, so that the original length of 20,000 lines was almost doubled in the end. The story is based on the Faust legend, treated in the most diffuse and rambling way. It had an enormous vogue in its day, and undoubtedly contains some fine passages.

BIBLIOGRAPHY.—The 50th anniversary edition of *Festus* was published in 1893. Other volumes by Bailey arc: *Tlze Angel World* (1850), *Tke Mystic* (1855), *The Age* (1858) and *The Universal Hymn* (1867). See J. Ward, *Philip James Bailey, author of Festus, Personal Recollections* (1905).

BAILEY, SAMUEL (1791–1870), philosopher and economist, born at Sheffield, England, and founder of a bank there. His published works range over a wide field, including pamphlets on parliamentary reform and on the right of primogeniture and two volumes containing some not very felicitous suggestions for the textual emendation of Shakespeare's plays. I-lis most important writings are: *Essays on the Formation and Publication of Opinions* (1821) in which it is held that man's opinions are independent of his will, and a sequel. *Essays on the Pursuit* of *Truth and on the Progress of Knowledge* (1829); *A Critical Dissertation on the Nature, Measure and Causes of Value* (1825), directed against the opinions of Ricardo and his school; *Review of Berkeley's Theory of Vision* (1842); *Letters on the Philosophy of the Human Mind* (1855–63).

Both in his philosophical and economic writings Bailey's work was characterized more by a clear logical and critical faculty than by creative thought. In psychology his chief theories are the superiority of the method of introspection; the reduction of the so-called faculties to mere phenomena of consciousness; the direct perception of external things; and the necessity of experience as the source of abstract ideas. Bailey was a strong utilitarian in ethics and in politics an adherent of philosophic radicalism. His "Dissertation" on the theory of value does not attempt to establish a new doctrine but attacks Ricardo for appearing to uphold the existence of absolute value, and also for not allowing for the influence of rates of remuneration of labour as well as quantities of labour on the value of commodities. He held that value can only be ascertained in terms of actual exchange ratios at a given moment and that there is no standard of value possible in terms of which values can be composed at different periods.

BAILEY, VERNON (1864–1942), American biologist, was born in Manchester, Mich.. on June 21, 1864 Early in life he became devoted to natural history. In 1887 he was appointed chief field naturalist of the biological survey, U.S. department of agriculture, and served in this position until July 31, 1933. He made extensive researches on the geographical distribution and life zones of mammals, birds and plants. and conducted many biological surveys, notably in Texas, New Mexico, North Dakota, Oregon and Montana. He died April 20, 1942.

His publications include: *Spermophiles of the Mississippi Valley* (1893); *Pocket Gophers of the Mississippi Valley* (1895); *Mammals of District of Columbia* (1900, 1923); *Biological Survey of Texas* (1905); *Life Zones and Crop Zones of New Mexico* (1913); *Revision of the Porket Gophers of the Genus Thomomvs* (1915); with F. A M. Bailey, *Wild Animals of Glacier National Park* (1918): *Beaver Habits and Beaver Farming* (1923); *Animal Life of the Carlsbad Cavern* (Baltimore, 1938); *Mammals of Oregon* (1936).

BAILEY, an open space enclosed by a fortification, sometimes known as the "ward" If more than one line of fortification is present there will be an inner and an outer bailey. The word persists chiefly in proper names, such as the Old Bailey in London whose name is derived from its situation in one of the baileys that was a part of the old city fortifications.

BAILIFF AND BAILIE, a legal officer to whom some degree of authority, care or jurisdiction is committed.

The term was first applied in England to the King's officers generally. such as sheriffs. mayors, etc., and more particularly to the chief officer of a hundred The county within which the sheriff exercises his jurisdiction is still called his bailiwick, while the term bailiff is retained as a title by the chief magistrates of various towns and the keepers of royal castles, as the high bailiff of Westminster, the bailiff of Dover Castle, etc. Under the manorial system, the bailiff, the steward and the reeve were important officers; the bailiff managed the property of the manor and superintended its cultivation *(see* Walter of Henley, Hus*bandry,* R. Hist. Soc. 1890).

The bailiff of a franchise or liberty is the officer who executes writs and processes, and impanels juries within the franchise. He is appointed by the lord of such franchise (who, in the Sheriffs Act 1887, § 34, is referred to as the bailiff of the franchise).

The bailiff of a sheriif is an under-officer employed by a sheriff within a county for the purpose of executing writs, processes, distraints and arrests. Special bailiffs are officers appointed by the sheriff at the request of a plaintiff for the purpose of executing a particular process. The appointment of a special bailiff relieves the sheriff from all responsibility until the party is arrested and delivered into the sheriff's actual custody.

By the County Courts Act 1888 provision is made for the appointment of one or more high-bailiffs by the judge; and is empowered to appoint a sufficient number of able and fit persons as bailiffs to assist him, whom he can dismiss at his pleasure and for whom he is responsible. The duty of the high-bailiff is to serve all summonses and orders, and execute all the warrants, precepts and writs issued out of the court. The Law of Distress Amendment Act 1888 enacts that no person may act as a bailiff to levy any distress for rent, unless he is authorized by a county-court judge to act as a bailiff.

In the Channel Islands the bailiff is the first civil officer in each island. He is appointed by the Crown, and generally holds office for life. He presides at the royal court, and takes the opinions of the jurats; he also presides over the states, and represents the Crown in all civil matters.

Bailie.—In Scotland the word bailiff denotes an inferior officer locally appointed to watch and ward; *e.g.,* a water-bailiff. *In* the form "bailie" the word signifies an official appointed to exercise a local delegated jurisdiction, civil or criminal. The feudal bailies, formerly appointed by the superiors of regality or of barony lands to exercise jurisdiction within these lands have disappeared in consequence of the abolition of feudal jurisdictions. The municipal bailies still subsist and are now elected from among the members of town councils, and each holds office from the date of such election until he fails to retire from the council in ordinary rotation. (Town Council [Scotland] Act 1900, 55, j6 and 57.) They are, along with the provost, the magistrates of the burgh and are invested with certain judicial and administrative powers within the burgh for which they are elected. They sit as police-court magistrates, being assisted usually by a paid legal adviser, called an "assessor," and, in the larger burghs, act as a licensing court.

Bailli.—In France the bailiff *(bailli),* or seneschal in feudal days, was the principal officer of any noble importance. He it was who held the feudal court of assizes when the lord was not present himself. A great noble often also had a *prévôté,* where small matters were settled, and the preparatory steps taken relative to the more important cases reserved for the assizes. Among the great officers of the Crown of France a grand-seneschal formerly figured until the reign of Philip Augustus, when the last holder of the office was not replaced by a successor. It is also under Philip Augustus that local bailiffs first make a definite appearance. In the ordinance of 1190, by which the king, about to set forth on the crusade, arranged for the administration of the kingdom during his absence, they figure as part of a general system. Their essential function was at first the surveillance of the royal provosts (*prévôts*), who until then had had the sole administration of the various parts of the domain. They concentrated in their own hands the produce of the provostships, and they organized and led the men who by feudal rules owed military service to the king. They had also judicial functions, which, at first narrowly restricted in application, became much enlarged as time went on, and they held periodical assizes in the principal centres of their districts. When the right of appeal mas instituted, it was they who heard the appeals from sentences pronounced by inferior royal judges and by the seigniorial justices. Royal cases, and cases in which a noble was defendant, were also reserved for them. The royal *bailli* or seneschal (no real difference existed between the two offices, the names merely changing according to the district), was for long the king's principal representative in the provinces, and the *bailliage* or the *sénéchaussée* was then as important administratively as judicially. But the political power of the bailiffs was greatly lessened when the provincial governors were created. They had already lost their financial powers, and their judicial functions now passed from them to their *lieutenants.*

By his origin the bailiff had a military character; he was an officer of the "short robe" and not of the "long robe," which in those days was no obstacle to his being well versed in precedents.

But when, under the influence of Roman and canon law, the legal procedure of the civil courts became *learned,* the bailiff often availed himself of a right granted him by ancient public law; that of delegating the exercise of his functions to whomsoever he thought fit. But as this delegation became habitual, the position of the lieutenants was strengthened; in the 16th century they became royal officers by title, and even dispossessed the bailiffs of their judiciary prerogatives. The tribunal of the *bailliage* or *sénéchaussée* underwent yet another transformation, becoming a stationary court of justice, the seat of which was fixed at the chief town. During the 15th and 16th centuries ambulatory assizes diminished in both frequency and importance. In the 17th and 18th centuries they were no more than a survival, the *lieutenant* of such a *bailliage* having preserved the right to hold one assize each year at a certain locality in his district. The ancient bailiff or *hailli d'épée* still existed, however; the judgments in the tribunal of the bailliage were delivered in his name, and he was responsible for their execution. So long as the military service of the *ban* and *arrière ban,* due to the king from all fief-holders, was maintained (and it was still in force at the end of the 17th century), it was the bailiffs who organized it. Finally the *bailliage* became in principle the electoral district for the states-general, the unit represented therein by its three estates. The justiciary nobles retained their judges, often called bailiffs, until the Revolution. These judges, who were competent to decide questions as to the payment of seigniorial dues, could not, legally at all events, themselves farm those revenues.

See Dupont Ferrier, *Les Officiers royaux des bailliagrs et sénéchaussées et les institutions monarchiques locales en France à la fin du moyen âge* (1902); Armand Brette, *Recueil de documents relatifs à la convocation des états-généraux de 1789* (1904) (vol. iii. gives the condition of the *bailliages* and *sénéchaussées* in 1789).

(J. P. E.; W. A. B.)

BAILLET, ADRIEN (1649–1706), French scholar and critic, was born on June 13 1649, at the village of Neuville near Beauvais, in Picardy, and died in Paris on Jan. 21 1706. He became in 1680 librarian to M. de Lamoignon, advocate-general to the *parlement* of Paris, of whose library he made a *catalogue raisonné* (35 vols.), all written with his own hand. The remainder of his life was spent in incessant, unremitting labour; he is said to have allowed himself only five hours a day for rest. Of his numerous works the most famous is *Jugements des savants sur les principaux ouvrages des auteurs* (1685–86). At the time of his death he was engaged on a *Dictionnaire universel ecclésiastique.* The praise bestowed on the Jansenists in the *Jugements des savants* brought down on Bnillet the hatred of the Jesuits, and his *Vie des saints* (1701), in which he brought his critical mind to bear on the question of miracles, caused some scandal. His *Vie de Descartes* is a mine of information on the philosopher and his work, derived from numerous unimpeachable authorities.

See the edition by M. la Monnoye of the *Jugemens des savans* (Amsterdam, 1725), which contains the *Anti-Baillet* of Gilles Ménage and an *Abrégé de la vie de M. Baillet.*

BAILLIE, LADY GRIZEL (1665–1746), Scottish song-writer, eldest daughter of Sir Patrick Hume or Home of Polwarth, afterwards earl of Marchmont, was born at Redbraes castle, Berwickshire. When she was 12 years old she carried letters from her father to the Scottish patriot, Robert Baillie of Jerviswood, who was then in prison. Home's friendship for Baillie made him a suspected man, and the king's troops occupied Redbraes castle. He remained in hiding for some time in a churchyard, where his daughter kept him supplied with food, but on hearing of the execution of Baillie (1684) he fled to Holland, where his family soon after joined him. They returned to Scotland at the Revolution. Lady Grizel married in 1692 George Baillie, son of the patriot. She had two daughters, Grizel, who married Sir Alexander Murray of Stanhope, and Rachel, Lady Binning. Lady Murray had in her possession a ms. of her mother's in prose and verse. Some of the songs had been printed in Allan Ramsay's *Tea-Table Miscellany.* "And werena my heart licht I wad dee," the most famous of Lady Grizel's songs, originally appeared in *Orpheus Caledonius* (1725).

Memoirs of the Lives and Characters of the Right Hon. George Baillie of Jerviswood and Lady Grisell Baillie, by their daughter, Lady Murray of Stanhope, were printed in 1822. *See* also her *Household Book* (Scot. Hist. Soc. 1912). George Baillie's *Correspondence* (1702–08) was edited by Lord Minto for the Bannatyne club in 1842. "The Legend of Lady Grizelda Baillie" forms one of Joanna Baillie's *Metrical Legends* of *Exalted Character.*

BAILLIE, JOANNA (1762–1851), Scottish poet and dramatist, was born at the manse of Bothwell, on the Clyde. She belonged to an old Scottish family, which claimed among its ancestors Sir William Wallace. At an early period she moved with her sister Agnes to London, the two sisters settling at Hampstead, where they passed the remainder of their lives. Joanna Baillie published anonymously in 1790 a volume called *Fugitive Verses,* and in 1798, also anonymously, the first volume of her "plays on the passions" under the title of *A Series of Plays,* in which, says the title-page, "it is attempted to delineate the strange passions of the mind, each passion being the subject of a tragedy and a comedy." The book was followed by a second volume, *Plays on the Passions,* in 1802, a third in 1812 and three volumes of *Dramas* in 1836. *Miscellaneous Plays* appeared in 1804, and the *Family Legend* in 1810. Miss Baillie herself intended her plays not for the closet but for the stage, and *Family Legend* (1810) had a brilliant though brief success in Edinburgh while *De Monfort* (1809), because of the acting of John Kemble and Mrs. Siddons, had a run in London. *Henriquez* and *The Separation* were coldly received. Joanna Baillie is best remembered by some charming Scottish songs, though some of them, like *Woo'd and Married an'a',* are adaptations. She lived to be 89, and died on Feb. 23, 1851. Her sweetness of disposition made her a universal favourite, and her little cottage at Hampstead was the centre of a brilliant literary society.

See Joanna Baillie's *Dramatic and Poetical Works* (1851); *G.* Gilfillan, *Galleries of Literary Portraits,* vol. i. (1856); M. S. Carhart, *The Life and Work of Joanna Baillie,* "Yale Studies in English Bibl" (1923).

BAILLIE, MATTHEW (1761–1823), Scottish physician, was born at Shotts, Lanarkshire, on Oct. 27, 1761. He was educated at Balliol college, Oxford, and after studying medicine under his uncle, William Hunter, was made physician at St. George's hospital, London, in 1787. Two years later he received the M D. and the F.R.C.P. In 1795 appeared his *Morbid Anatomy of Some of tlze Most Important Parts of the Body,* which was the first attempt to treat pathology as a subject in itself. His *Lectures and Observafions on Medicine* were published in 1825.

BAILLIE, ROBERT (1599–1662), Scottish divine, was born at Glasgow. He was a member of the famous Glasgow Assembly (1638), professor of divinity at Glasgow (1642), one of the five Scottish clergymen who were sent to the Westminster Assembly (1643), and one of the commissioners sent to Holland to invite Charles II. to Scotland (1649). In 1661 he was made principal of Glasgow university. His *Letters,* by which he is now chiefly remembered, are of first-rate historical importance, and give a very lively picture of the period.

See D. Laing's edition of the *Letters and Journals of Robert Baillie* (1637–62), Bannatyne club, 3 vols. (1841–42).

BAIELIE, ROBERT (d. 1684), Scottish conspirator, known as BAILLIE OF JERVISWOOD, was the son of George Baillie of St. John's Kirk, Lanarkshire. In despair over the state of his country he determined in 1683 to emigrate to South Carolina, but the plan came to nothing. The same year, with some of his friends, he went to London and entered into communication with Monmouth, Russell and their party, in order to work for civil and religious liberty in Scotland. On the discovery of the Rye House Plot he was arrested, and being questioned by the king himself repudiated any knowledge of the conspiracy, but would not deny that he had been consulted with the view of an insurrection in Scotland. He was sent back a prisoner to Scotland where, though there was no evidence whatever to support his connection with the plot, he was fined £6,000 and kept in close confinement. On Dec. 3, 1684 he was brought up again before the high court on the charge of treason, and being pronounced guilty on the following day was hanged the same afternoon at the market cross at Edinburgh.

BAILLON, GUILLAUME DE (1538–1616), French physician, studied in Paris, and became physician to the Dauphin,

son of Henry IV. He has a place in the history of epidemiology on account of two books posthumously published (1640) on epidemics, in which he revived the Hippocratic doctrine of "epidemic constitutions" which seems to have influenced Sydenham's work. Baillon first described whooping-cough (1578), and he differentiated between rheumatism and gout, as Hippocrates had done.

His works include: *Definitionum* medicinalium liber (1639), a glossary of Hippocratic terms; *Consilia* (1635–49); treatises on gynaecology (1643), gout and calculus (1643) and two books on epidemics and ephemeral diseases (1640). His name is also spelt Baillou.

BAILLOT, PIERRE MARIE FRANÇOIS DE SALES (1771–1842), French violinist, was born at Passy, Paris, on Oct. 1, 1771, and died there on Sept. 15, 1842. Baillot was the last of the great classical Paris school of violinists, and his Art *du Violon* (1834) is still a standard work. His tradition was further maintained by his share in the *Méthode* du *Violon* issued by the Paris conservatoire. Baillot studied first under an Italian named Polidori and then under Sainte-Marie, and then in Rome under Pollani. From 1802 onwards he became known as a violinist in all the principal music centres of Europe. He excelled in chamber music and in the rendering of the classics.

BAILLY, JEAN SYLVAIN (1736–1793), French astronomer and orator, was born at Paris on Sept. 1j, 1736. He calculated an orbit for the comet of 1759 (Halley's), reduced Lacaille's observations of 515 zodiacal stars, and was, in 1763, elected a member of the Academy of Sciences. His *Essai sur* la *théorie* des satellites de *Jupiter* (1766), was followed up in 1771 by a dissertation Sur les *inégalités* de la *lumière* des satellites de Jupiter and by a series of important works on the history of science.

The Revolution interrupted his studies. Elected deputy from Paris to the states-general, he was chosen president of the Third Estate (May 5, 1789), led the famous proceedings in the Tennis Court (June 20), and acted as mayor of Paris (July 15 1789, to Nov. 16 1791). The dispersal by the National Guard, under his orders, of the riotous assembly in the Champ de Mars (July 17 1791), rendered him obnoxious to the infuriated populace, and he retired to Nantes, where he composed his *Mémoires d'un témoin* (published by MM. Berville and Barrière, 1821–22), an incomplete narrative of the extraordinary events of his public life. Late in 1793, Bailly quitted Nantes to join his friend Pierre Simon Laplace at Melun; but was there recognized, arrested and brought (Nov. 10) before the Revolutionary Tribunal at Paris. On Nov. 12 he was guillotined.

Notices of his life are contained in the *Éloges* by Mérard de Saint Just, Delisle de Salles, Lalande and Lacretelle; in a memoir by Arago, read Feb. 26 1844, before the Académie des Sciences, and published in Notices biographiques, t. ii. (1852). See also Delambre, *Histoire* de *l'astronomie* au *18me siècle*, p. 735, and Lalande, *Bibliographie* astrononzique, p. 730.

BAILMENT, a delivery of specific goods by one person, called the bailor, to another person, called the bailee, upon an understanding, express or implied, that the identical goods shall be restored to the bailor, or in accordance with his direction, as soon as the time or purpose, for which they were bailed, has elapsed or has been performed. A request for the return of the goods is usually an antecedent condition to proceedings for their recovery. Where goods in the lawful possession of a bailee are damaged by the negligence of a stranger, such third party is liable to the bailee although the latter may not be responsible to his bailors (*Glenwood* Lumber Co. v. Phillips [1904] A C. 410).

Bailments are divisible into six classes (Coggs v. Bernard [1704] 2 Ld. Ray 909). These are:—

(1) *Depositum,* a simple bailment, without reward, of goods to be kept for the bailor by the bailee who has no right to use them. Such a bailee is liable only for gross negligence which is "want of that care which every man of common sense . . . takes of his own property" It has been stated that bankers taking charge of their customers' securities are in this class (*Giblin* v. *McMullen* [1868] L.R. 2 P.C. 317); but as such accommodation is confined to customers of the bank the accuracy of the classification is doubtful.

(2) *Commodatum,* a bailment in which goods (afterwards to be returned to the owner in specie) are lent gratis to a bailee for use by him. The borrower for whose advantage the chattel is loaned guarantees not only to exercise the strictest care in its custody, but also warrants reasonable skill in its user and conformity to the purpose for which it was lent, slight negligence rendering him liable to indemnify the lender (Jones on Bailments 65).

(3) Locatio rei, or lending for hire. The hirer of the chattel is bound to exercise such ordinary diligence and care over the thing hired by him as a man of common prudence would take in the management of his own concerns (*Beal* v. *South Devon* Ry. Co. [1864] 3 H. & C. 342).

(4) *Vadium* or pledge, a bailment of personal goods by a debtor to his creditors to be kept till the debt is discharged. The measure of responsibility of the pledgee is ordinary diligence in safeguarding the chattel pledges.

(5) Locatio operis faciendi, a delivery of goods to be carried or in order that something may be done to them. Apart from legislation a common carrier is an insurer of the goods carried. A bailee receiving goods for repair must exercise ordinary diligence in preserving them.

(6) *Mandatum,* a delivery of goods to be carried or in order that something may be done to them gratuitously. The bailee must act in good faith and is liable for negligence or incapacity. (See also BAXKS AND BANKING, CARRIERS, DILIGENCE, FACTOR, HIRING, INNS AND INNKEEPERS, LIEN, NEGLIGENCE, PLEDGE, PAWNBROKING, PRINCIPAL AND AGENT, etc.).

UNITED STATES

In the United States the division of bailments into the classes above specified has not met with favour because of its lack of practical utility, and bailments in this country are divided into three classes: (1) bailments which benefit the bailor alone; (2) bailments which benefit the bailee alone; and (3) bailments which benefit both bailor and bailee. In all bailments title to and ownership of the property remain in the bailor, and the bailee takes only the interest specified for the object of the bailment. Possession in the bailee gives him a qualified property interest as against a third person. A bailee cannot deny his bailor's title, so the burden of proving ownership in bailment is always with the bailee. However, delivery of the property to one having a paramount title to the bailor is a sufficient excuse for non-delivery by the bailee to the bailor; in such case the bailee assumes the risk of establishing the title so recognized in another.

BAILY, EDWARD HODGES (1788–1867), British sculptor, the son of a carver of ship's figureheads, was born at Bristol on May 10, 1788. At school and in the commercial office which he entered on leaving school he made wax models and busts of his fellows, and in 1807 began to study under Flaxman; in 1809 he entered the academy schools. In 1821 he became R.A. Baily executed the bas reliefs on the south side of Marble Arch in Hyde Park, and many statues in London, notably that of Nelson in Trafalgar square. He died at Holloway, London, on May 22, 1867.

BAILY, FRANCIS (1774–1844), English astronomer, was born at Newbury, Berkshire. He made a fortune on the Stock Exchange, and acquired a great reputation for his actuarial calculations. He retired from business in 1825. He had already, in 1820, taken a leading part in the foundation of the Royal Astronomical Society; and its gold medal was awarded him in 1827, for his preparation of the Astronomical Society's Catalogue of 2881 stars (Memoirs R. Astr. *Soc.* ii.). The reform of the Nautical *Almanac* in 1829 was set on foot by his protests; he recommended to the British Association in 1837, and in great part executed, the reduction of Joseph de Lalande's and Nicolas de Lacaille's catalogues containing about 57,000 stars; he superintended the compilation of the British Association's Catalogue of 8.377 stars (published 1845); and revised the catalogues of Tobias Mayer, Ptolemy, Ulugh Beg, Tycho Brahe, Edmund Halley and Hevelius (Memoirs R. Astr. *Soc.* iv., xiii.).

His notice of "Baily's Beads," during an annular eclipse of the sun on May 15, 1836, at Inch Bonney in Roxburghshire, started

the modern series of eclipse-expeditions. The phenomenon, which depends upon the inequalities of the moon's limb, was so vividly described by him as to attract an unprecedented amount of attention to the totality of July 8, 1842, observed by Baily himself at Pavia. He completed and discussed H. Foster's pendulum-experiments, deducing from them an ellipticity for the earth of $\frac{1}{289}$ *(Memoirs R. Astr. Soc.* vii.); corrected for the length of the seconds-pendulum by introducing a neglected element of reduction; and was entrusted, in 1843, with the reconstruction of the standards of length. His laborious operations for determining the mean density of the earth, carried on by Henry Cavendish's method (1838–42), yielded for it the authoritative value of 5.66. Baily's *Account of the Rev. John Flamsteed* (1835) is of fundamental importance to the scientific history of that time. It included a republication of the British Catalogue.

See J. Herschel's *Memoir of* F. *Baily, Esq.* (1845), also prefixed to Baily's *Journal of a Tour,* with *a* list of his writings; *Month. Not.* R. *Astr. Soc.* xiv. 1844.

BAILY'S BEADS, a phenomenon seen during a total eclipse of the sun. Just before the moon's disc completely covers the sun the narrow crescent of sunlight is broken in several places, giving an appearance roughly compared to a string of beads. This is due to irregularity (mountains and valleys) on the edge of the moon's disc. These "beads" were named after Francis Baily (*q.v.*).

BAIN, ALEXANDER (1818–1903), Scottish philosopher and educationist. was born in Aberdeen, where he began life as a weaver. In 1836 he entered Marischal College, and towards the end of his arts course became a contributor to the *Westminster Review* (first article "Electrotype and Daguerreotype," Sept. 1840). This was the beginning of his life-long friendship with John Stuart Mill. In 1841 he acted as substitute for Dr. Glennie, the professor of moral philosophy, and in 1842 helped Mill with the revision of the ms. of his *System of Logic.* In 1845 he was appointed professor of mathematics and natural philosophy in the Andersonian University of Glasgow but resigned in the following year. In 1848 he obtained a post in the London Board of Health, under Edwin Chadwick, and became a prominent member of the brilliant circle which included Grote and J. S. Mill. In 185j he published *The Senses and the Intellect,* followed in 1859 by *The Emotions and the Will.*

In 1860 he was appointed to the new chair of logic and English in the University of Aberdeen. Bain succeeded in raising the standard of education generally in the north of Scotland, and also in forming a school of philosophy and in widely influencing the teaching of English grammar and composition. In 1863, he published the *Higher English Grammar,* followed in 1866 by the *Manual of Rhetoric,* in 1872 by *A First English Grammar,* and in 1874 by the *Companion to the Higher Grammar.* In 1861, *The Study of Character,* including an *Estimate of Phrenology,* appeared; but all his philosophical writings were condensed and retouched in his *Manual of Mental and Moral Science* (1868). In 1870, Bain published his *Logic,* based partly on J. S. Mill, but distinguished by its treatment of the doctrine of the conservation of energy in connection with causation and the detailed application of the principles of logic to the various sciences. His services to education in Scotland were recognized by an honorary LL.D. from Edinburgh in 1871. Next came two publications in "The International Scientific Series," namely, *Mind and Body* (1872), and *Education as a Science* (1879).

In Jan., 1876, appeared the first number of *Mind,* which Bain had instituted, under the editorship of a former pupil, G. Croom Robertson, of University College, London. To this journal, he contributed many important articles. Bain resigned his professorship in 1880 and two years later published his *Biography* of *James Mill,* together with *John Stuart Mill: a Criticism, with Personal Recollections.* Next came (1884) a collection of articles and papers, most of which had appeared in magazines, under the title of *Practical Essays.* This was succeeded (1887, 1888) by a new edition of the *Rheforic,* and a book *On Teaching English,* being an exhaustive application of the principles of rhetoric to the criticism of style; and in 1894 he published a revised edition of *The Senses and the Intellect.* His remaining years were spent in privacy at Aberdeen, where he died.

Wide as Bain's influence has been as a logician, a grammarian and a writer on rhetoric, his reputation rests on his psychology. He was the first in Great Britain to stress the necessity of cleuring psychology of metaphysics, of applying the methods of the exact sciences to psychological phenomena and of referring these phenomena to their correlates in the nerves and brain. He made a profound study of the physical origin of feeling and emotion, of instincts in relation to mental life and of the laws of association *(see* PSYCHOLOGY). In ethics, Gain was a utilitarian.

His autobiography, published in 1904, contains a full list of his works, and also the history of the last 13 years of his life by W. L. Davidson, of Aberdeen university, who further contributed to *Mind* (April, 1904) a review of Bain's services to philosophy. *See* also J. Seth, *English Philosophers* (1912); Th. Ribot, *La Psychologie anglaise contemporaine* (1870); J. T. Merz, *Hist. of European Thought in the Nineteenth Century* (1912).

Works of Bain (besides those already mentioned) include an edition, with notes, of Paley's *Moral Philosophy* (1352); *Education as a Science* (1879); *Dissertations on leading philosophical topics* (1903, mainly reprints of papers in *Mind*); he collaborated with J. S. Mill and Grote in editing James Mill's *Analysis of the Phenomena of the Human Mind* (1869), and assisted in editing Grote's *Aristotle* and *Minor Works;* he also wrote a memoir prefixed to G. Croom Robertson's *Philosophical Remains* (1894).

BAIN, ANDREW GEDDES (1797–1864), British geologist, was a native of Scotland. In 1820 he emigrated to Cape Colony, carried on for some years the business of a saddler at Graaf Reinet, and served in the Kafir War of 1833–34. He discovered the remains of many reptilia, including the *Dicynodon,* which was obtained from the Karroo beds near Fort Beaufort and described by Owen. Bain prepared in 1852 the first comprehensive geological map of South Africa, which was published by the Geological Society (London) in 1856.

Obituary by Dr. R. N. Rubidge in *Geol. Mag.* (Jan., 1865), p. 47; also *Trans. Geol. Soc. S. Africa* (June, 1896) vol. ii. part v. (with portrait).

BAINBRIDGE, JOHN (1582–1643), English astronomer, was born at Ashby-de-la-Zouch, Leicestershire. He started as a physician and practised for some years. Sir Henry Savile appointed him in 1619 to the Savilian chair of astronomy just founded by him at Oxford; Bainbridge was incorporated of Merton college and became in 1631 and 1635 respectively, junior and senior reader of Linacre's lectures. He wrote *An Astronomical Description of the late Comet* (1619); *Canicularia* (1648); and translated Proclus's *De Sphaera,* and Ptolemy's *De Planetarum Hypothesibus* (1620). Several manuscript works by him exist in the library of Trinity college, Dublin.

See Munk's *College of Physicians,* i. 175 Wood's *Athenae* (Bliss), iii. 67; *Biographia Britannica,* i. 419.

BAINBRIDGE, WILLIAM (1774–1833), commodore in the United States Navy, was born on May 7, 1774, in Princeton (N.J.). At 14 he went to sea in the merchant service and was in command of a trading schooner at an early age. When the Cnited States Navy was organized in 1798 he was included in the corps of naval officers and appointed to the schooner "Retaliation." When the United States found that bribing the pirate Barbary States did not stop their capture of its merchant ships in the Mediterranean, and was constrained at last to use force, he served against Algiers and Tunis. His ship, the "Philadelphia," ran aground on the Tunisian coast and he was for a time imprisoned. On his release he returned to the merchant service in order to make good the pecuniary loss caused by his captivity. But when the war of 1812 broke out between Great Britain and the United States, Bainbridge was appointed to command the United States frigate "Constitution" (44), in succession to Captain Isaac Hull (*q.v.*), and sent to cruise in the South Atlantic. On Dec. 29, 1812, he fell in with H.M.S. "Java," a vessel of 1,073 tons, formerly the French frigate "Renommée" (40). She was on her way to the East Indies, carrying the newly appointed lieutenant-governor of Bombay. She had a very raw crew, includ-

ing few real seamen, and her men had only had one day's gunnery drill. The United States Navy paid great attention to its gunnery, but the British navy, misled by its easy victories over the French, had neglected its own. In those conditions the fate of the "Java" was soon sealed. She was cut to pieces and forced to surrender, after suffering heavy loss and inflicting very little on the "Constitution." At the conclusion of the war with Great Britain, Bainbridge served against the Barbary pirates once more. During his later years he served on the board of navy commissioners. He died on July 28, 1833. (D. H.)

BAINBRIDGE, a city near the south-western corner of Georgia, U.S.A., on the Flint river and Federal highway 84; the county seat of Decatur county. It is served by the Atlantic Coast Line and the Seaboard Air Line railways, and by river steamers. The population was 4,792 in 1920 (46% Negroes), 6,141 in 1930 (about 36% Negroes), and in 1940, 6,352 by federal census. Bainbridge is a shipping point for cotton, peanuts and naval stores. It was founded in 1822 and incorporated in 1828.

BAINDIR, a town in Turkey in the Smyrna vilayet, situated in the valley of the Kuchuk Menderes. Population 25.500. It is connected with Smyrna by a branch of the Aidin railway, and has a trade in cotton. figs. raisins and tobacco.

BAINES, EDWARD (1774–1848), English newspaper proprietor and politician, was born Feb. 5, 1774, at Walton-le-Dale, near Preston, Lancashire, and died Aug. 3, 1848. In 1801 the assistance of party friends enabled him to buy the *Leeds Mercury*. Provincial newspapers did not at that time possess much influence; it was no part of the editor's duty to supply what are now called "leading articles," and the system of reporting was defective. In both respects Baines made a complete change in the *Mercury*. His able political articles gradually made the paper the organ of Liberal opinion in Leeds, and the connection of the Baines family with the paper made thtir influence powerful for many years in this direction.

Baines was an ardent advocate of parliamentary reform, and it was mainly by his influence that hfacaulay was returned for Leeds in 1832; and in 1834 he succeeded Macaulay as member. I-Ie was re-elected in 1835 and 1837, but resigned in 1841. In Parliament he supported the Liberal Party, but with independent views. Like his son Edward after him, he strongly advocated the separation of Church and State, and opposed Government interference in national education. His letters to Lord John Russell on the latter question (1846) had a powerful influence in determining the action of the Government.

His *Life* (1861) was written by his son, Sir EDWARD BAINES (1800–go), who was editor and afterwards proprietor of the *Leeds Mercury,* M.P. for Leeds (1859–74), and was knighted in 1880; his *History of the Cotton Manufacture* (1835) was long a standard authority. An elder son, MATTHEW TALBOT BAINES (1799–1860), was president of the Poor Law Board in 1849, and again from 1852 to 1855. In 1856 he entered the Cabinet as chancellor of the duchy of Lancaster.

BAINI, GIUSEPPE (1775–1844), Italian priest, musical critic and composer of church music, was born at Rome on Oct. 21, 1775, and died there on May 21, 1844. He was instructed in composition by his uncle, Lorenzo Baini, and afterwards by G. Jannaconi. In 1814 he was appointed musical director to the choir of the pontifical chapel, of which he had been a member since 1802. His compositions, of which very few have been published, show a reversion to the severe ecclesiastical style of the 16th century; and one, a ten-part *Miserere,* composed for Holy Week in 1821 by order of Pope Pius VII., has taken a permanent place in the services of the Sistine chapel during Passion Week. Of still greater value is his *Life of Palestrina (Memorie storico-critiche della vita e delle opere di Giovanni Pierluigi da Palestrim,* 1828), which is justly regarded as a classic in musical literature.

BAINVILLE, JACQUES (1879–1936), French historian and journalist, was born at Vincennes, near Paris, Feb. 9, 1879. His first literary work was a life of Louis II. of Bavaria (1900) written while travelling in Germany. He came under the influence of Maurras, joined the Royalist party, and, at the time of the Dreyfus case, became in 1899 one of the original editors of the monthly review, *Action Française.* This review in 1906 became a daily paper, of which Jacques Bainville was appointed foreign editor. From that time he devoted his energies to his short daily articles, which were clear, well-written, intelligent and full of striking phrases that soon became proverbial, such as that on the Treaty of Versailles, *"trop doux pour ce qu'il a de dur, trop dur pour ce qu'il a de doux."*

Jacques Bainville was the first writer in France to deal with the political philosophy of the World War. This he did in *L'lzistoire de deux peuples* (1915), a work in which the influence of hfaurras is modified by that of Thiers and Albert Sorel. The struggle between France and Germany is traced back to the far-off racial antagonisms from which it sprang, and one seems to be reading the documents of an endless lawsuit between the two peoples. The book is breathless and a little superficial, but clearly and brilliantly written. After the conclusion of peace he published *Les conséquences politiques de la paix* (1920) a reply to the well-known work of Mr. Maynard Keynes. The title itself of this book reflects the spirit of the *Action Française,* with its motto of "Politics First," and is an indication of how widely Bainville's views differed from those of the Cambridge economist. gainville's most celebrated work is his *Histoire de France* in one volume (1923), which is a model of clearness, intelligence, and grace of style. The doctrines of the *Action Française* in favour of the monarchical system are prominent, but they are considerably modified, and the dominating theme of the book is the continuity of political tradition in France. Latterly, Bainville wrote, after the style of Voltaire, a number of political essays, and, in 1926, a curious novel, *Jaco et Lori,* in which two parrots survey the political life of France during the second half of the 19th century and the beginning of the twentieth. **(A. T.)**

BAIRAM, a Perso-Turkish word meaning "festival," applied in Turkish to the two principal festivals of Islam. The first of these, according to the calendar, is the "Lesser Festival," called by the Turks *Kiichiik Bairām* ("Lesser Bairam"), or *Sheker Bairdm* ("Sugar Bairam"), and by Arabic-speaking Muslims *'Īd al-Fiṭr* ("Festival of Fast-breaking"), or *Al-'id aṣ-ṣaghīr* ("Lesser Festival"); it follows immediately the ninth or the fasting-month Ramadan, occupying the first three days of the tenth month, Shawwāl. Official receptions are held on it, and private visits paid; friends congratulate one another, and presents are given; new clothes are put on, and the graves of relatives are visited. The second, or "Greater Festival," is called by the Turks *Qurbān Bairdm,* "Sacrifice Bairam," and by Arabic speakers *Al-'id al-kabir,* "Greater Festival," or *'Īḍ al-adhd,* "Festival of Sacrifice." It falls on the tenth, and two or three following days, of the last month, *Dhū-l-hijja,* when the pilgrims each slay a ram, a he-goat, a cow or a camel in the valley of Minā in commemoration of the ransom of Ishmael with a ram. Similarly throughout the Muslim world, all who can afford it sacrifice at this time a legal animal, and either consume the flesh themselves or give it to the poor. Otherwise it is celebrated like the "Lesser Festival," but with less ardour. Both festivals, of course, belong to a lunar calendar, and move through the solar year every 32 years.

See Lane's *Modern Egyptians,* chap. xxv.; Hughes, *Dictionary of Islam,* pp. 192 ff.; Sir R. Burton, *Pilgrinzage,* chaps. vii., xxx.

BAIRD, SIR DAVID (1757–1829), British general, born at Newbyth, East Lothian, Scotland, entered the army in 1773, and went out to India as a captain in the 73rd (afterwards 71st) Highlanders in 1779. In the defeat of Col. Baillie's force by Hyder Ali, Baird was taken prisoner, and remained a prisoner for four years. After a short interval at home he returned to India in 1791 and took part in the campaign against Tippoo. After serving at the Cape of Good Hope he returned to India, and took part in the last war against Tippoo. Maj.-Gen. Baird stormed Seringapatam and became master of the place where he had so long been a prisoner. He was bitterly disappointed when the command of the place was given to Sir A. Wellesley (afterwards duke of Wellington), and resigned his command. His next campaigns were at the Cape of Good Hope (1805–06), and Copenhagen (1807). He was second in command at the battle of

Corunna (1808), and became commander-in-chief when Moore fell, but was wounded and superseded by Sir John Hope. He received the thanks of parliament, a K.B. and a baronetcy for his services, but, because of various political and personal enmities, was repeatedly passed over, and received no further command in the field, though he was promoted full general in 1814. He was commander-in-chief in Ireland from 1820 to 1822, and died on Aug 18 1829.

See *Lives* by Theodore Hook (1832), and W. H. Wilkin (1914).

BAIRD, HENRY MARTYN (1832–1906), American historian and educator, was born in Philadelphia on Jan. 17, 1832. He spent eight years of his early youth with his father in Paris and Geneva, and in 1850 was graduated from New York university. He then lived for two years in Italy and Greece, was a student in the Union theological seminary in New York, and in 1856 graduated at the Princeton theological seminary. He was a tutor for four years in the College of New Jersey (now Princeton university), and from 1859 until his death was professor of Greek language and literature in New York university. He is best known, however, as a historian of the Huguenots. His work, which appeared in three parts, entitled respectively *History of the Rise of the Huguenots of France* (1879), *Tlze Huguenots and Henry of Naaarre* (1886), and *The Huguenots and the Revocation of the Edict of Nantes* (1895), is characterized by painstaking thoroughness, by a judicial temper, and by scholarship of a high order. He also published *Modern Greece* (1856); a biography of his father, *The Life of tlze Rev. Robert Baird, D. D.* (1866); and *Theodore Beza, the Counsellor of the French Reformation* (1899). He died in New York city on Nov. 11, 1906.

His brother, CHARLES WASHINGTON BAIRD (1828–1887), a graduate of New York university (1848) and of the Union theological seminary (1852), and a minister at Brooklyn and Rye, N.Y., also published a scholarly work, *History of tlze Huguenot Emigration to America* (2 vols., 1885), left unfinished at his death.

BAIRD, JAMES (1802–1876), Scottish iron-master, was born at Kirkwood, Lanarkshire, on Dec. 5, 1802, the son of a coalmaster. In 1826 his father, two brothers and himself leased coalfields at Gartsherrie and in the vicinity, and in 1828 iron mines near by, and in 1830 built blast furnaces. In this year the father retired, the firm of William Baird and Co. was organized, and James Baird assumed active control. His furnaces, in 1864, were producing 300.000 tons annually and had 10.000 employees. The brothers became great landowners, and James was M P. for the Falkirk burghs in 1851–52 and 1852–57. He died at his estate near Ayr on June 20, 1876. He had been during his life a great public benefactor. founding schools and, in 1873, the Baird Trust of £500,000 for the Established Church of Scotland

BAIRD, JOHN LOGIE (1888–), British inventor, was born Aug. 13, 1888, in Helensburgh, Scotland and was educated at Larchfield Academy and Glasgow University. He served apprenticeship as an electrical engineer but abandoned engineering for a business career. In 1922 owing to ill health he gave up active business and retired to Hastings where he took up the study of television, his researches finally enabling him to give in January, 1926, a demonstration of television which has been claimed to be the first demonstration of true television ever given.

BAIRD, SPENCER FULLERTON (1823–1887), American naturalist, in his time the best informed man on the vertebrate fauna of North America, was born at Reading (Pa.) Feb. 3, 1823. In 1838 a meeting with Audubon, who gave Baird part of his own collection of birds, turned the young man's interest to ornithology. A year after his graduation from Dickinson college (1840), he made an ornithological excursion through the mountains of Pennsylvania. After studying medicine for a time, Baird became professor of natural history in Dickinson college (1845).

From the time he began his studies in natural science, Baird saw the pressing need of raw materials. By the time he was 27 he had accumulated 3,500 skins of birds; and collections of reptiles. embryos, skeletons, and skulls of North American vertebrates This became the nucleus of the vast collection of North American fauna which he assembled after he became assistant secretary of the Smithsonian institution in 1850. The great labour of correspondence, examination, description, and editing of reports for the Smithsonian collection was accomplished by Baird, in connection with the publication of the 13 fat quarto volumes of reports. In addition, Baird worked nights on the preparation of the volumes on birds, mammals, and reptiles. His great monographs at once became classics of systematic zoology. With the appearance of his volume on birds began what Dr. Elliott Coues (*Popular Science Monthly,* vol xxxiii , p. 553) calls the Bairdian period of American ornithology, lasting nearly 30 years. This volume, says Coues, "marked an epoch in the history of American ornithology."

In 1878 Baird succeeded Joseph Henry as secretary of the Smithsonian institution. Through Baird's efforts, Congress created the commission of fish and fisheries in 1874, and placed Baird at its head, in which position he did work worth millions of dollars to the country and organized fish culture in the United States so well that it has been widely copied as a model by other countries. Baird's influence with the government and authorities also brought about excellent field work in connection with nearly all government surveys and the signal service bureau, from the beginning of the Pacific railway surveys. He prepared for them manuals of instruction and reports of great importance.

G. Browne Goode said of him, "There is no name which occupies a more honourable place in the annals of American science than that of Spencer F. Baird." Among the more notable honours which he received were: Knight of the Royal Order of St. Olaf, conferred by the King of Norway and Sweden; silver medal of the Acclimatization Society of Melbourne, Australia; gold medal, Société d'acclimatation de France; and an honour by the emperor of Germany. Baird died at Woods Hole (Mass.) Aug. 19, 1887.

His most important works were: *Birds* (1858); *Mammals of North America* (1859); *History of North American Birds* (1875–84). A complete bibliography of his work and a detailed biography are given in the *Biog, Memoirs of the Nat'l Acad. of Sciences,* vol. iii. *See* also, Wm. F. Dalls, *Spencer* F. *Baird* (1915); G. Browne Goode, "Memorial and Bibliog.," *Bulletin 20 of US. Nat'l Museum;* C. Hart Merriam, "Baird, the Naturalist," *Scientific Monthly,* vol. xviii., pp. 588–595 (1924).

BAIRNSDALE, a town of Tanjil county, Victoria, Australia, on the Mitchell river, 171 m. by rail E. of Melbourne. Pop. about 4,000. It lies near the head of a lagoon (Lake King), which is open to the sea, and affords regular communication by water with Melbourne. In the district, which is chiefly pastoral, there are several goldfields, with both alluvial and reef mining. The town has tanneries and cheese and butter factories.

BAITER, JOHANN GEORG (1801–1877), Swiss philologist and textual critic, was born at Ziirich and was *Oberlehrer* at the gymnasium there from 1833 to 1876. Baiter's strong point was textual criticism, applied chiefly to Cicero and the Attic orators; most of his works were produced in collaboration with other scholars, notably Orelli. He edited Isocrates, *Panegyricus* (1831); with Sauppe, Lycurgus, *Leocratea* (1834), and *Oratores Attici* (1838–50); with Orelli and Winckelmann, a critical edition of Plato (1839–42), which marked a distinct advance in the text, two new mss. being collated; with Orelli, Babrius, *Fabellae Iambicae nuper repertae* (1845); Isocrates, in the Didot collection of classics (1846). He assisted Orelli in his great work on Cicero, and assisted in *Ciceronis Scholiastae* (1833) and *Onomasticon Tullianum* (1836–38). For the *Fasti Consulares* and *Triumphales* he was alone responsible. With Orelli and (after his death) Halm, he assisted in the second edition of the Cicero, and, with Kayser, edited the same author for the Tauchnitz series (1860–69). New editions of Orelli's Tacitus and Horace were also due to him.

BAIUS or **DE BAY, MICHAEL** (1513–1589), Belgian theologian, was born at Melun in Hainault. Educated at Louvain, he studied philosophy and theology and held various chairs there; in 1552 Charles V. made him professor of scriptural interpretation. At Louvain he was a leader in the anti-scholastic reaction under the banner of St. Augustine and so came into conflict with Rome on the vexed questions of grace and free-will. In 1567 Pius V. condemned 79 of his propositions in the Bull *Ex omnibus afflictionibus* Baius submitted, but indiscreet utterances by himself and his supporters led to a new condemnation in 1579 by Gregory

XIII. Baius, however, kept his professorship, and became chancellor of Louvain in 1575; he died there on Sept. 15, 1589. Baius is interesting as a forerunner of Cornelius Jansen (see JANSEN). His writings are described by Harnack as a fusion of Catholic orthodoxy with elements of Protestantism which were not regarded as such by Baius himself. The chief note of his teaching was the importance of sin, original and actual.

His principal works were published in a collected form at Cologne (1696); some large treatises have not been published. See F. X. von Linsenmann, *Michael Baius, und dze Grundlegung des Jansenismus* (Tubingen, 1867).

BAIZE, a material probably named from its original colour, though a derivation is also suggested from the Fr. baie, as the cloth is said to have been originally dyed with Avignon berries. It is generally a coarse, woollen cloth with a long nap, and is commonly dyed green or red. It is now also made of cotton. The manufacture is said to have been introduced into England in the 16th century by refugees from France and the Netherlands. It is used chiefly for curtains, linings, etc., and sometimes, in the lighter makes, for clothing. Table baize is a kind of oilcloth used as a cheap and easily-cleaned covering for tables.

BAJOUR or **BAJAUR,** a small district peopled by Pathan races of Afghan origin, in the north-west frontier province of India. It is about 45m long by 20m. broad, and lies at a high level to the east of the Kunar valley, from which it is separated by a continuous line of rugged frontier hills, forming a barrier easily passable at one or two points. Across this barrier the old road from Kabul to India ran before the Khyber pass was adopted as the main route. Bajour is inhabited almost exclusively by Tarkani (Tarkilanri) Pathans, subdivided into Mamunds, Isazai and Ismailzai, numbering, together with a few Mohmands, Utmauzais, etc., about 100,000. To the south of Bajour is the wild mountain district of the Mohmands, a Pathan race. To the east, beyond the Panjkora river, are the hills of Swat, dominated by another Pathan race. To the north is an intervening watershed between Bajour and the small state of Dir; and it is over this watershed and through the valley of Dir that the new road from Malakand and the Punjab runs to Chitral. Nawagai is the chief town of Bajour, and the khan of Nawagai is under British protection for the safe-guarding of the Chitral road. It was the active hostility between the amir of Kabul (who claimed sovereignty of the same districts) and Umra Khan of Jandola that led, firstly, to the demarcation agreement of 1893, which fixed the boundary of Afghanistan in Kunar, and, secondly, to the invasion of Chitral by Umra Khan (who was no party to the boundary settlement) and the siege of the Chitral fort in 1895.

An interesting feature in Bajour topography is a mountain spur from the Kunar range, which, curving eastwards, culminates in the well-known peak of Koh-i-Nor, which is visible from the Peshawar valley. It was here, at the foot of the mountain, that Alexander found the ancient city of Nysa and the Nysaean colony, traditionally said to have been founded by Dionysus. The Koh-i-Nor has been identified as the Meros of Arrian's history—the three-peaked mountain from which the god issued. It is also interesting to find that a section of the Kafir community of Kamdesh still claim the same Greek origin as did the Nysaeans; still chant hymns to the god who sprang from Gir Nysa (the mountain of Nysa); whilst they maintain that they originally migrated from the Swat country to their present habitat in the lower Bashgol. Long after Buddhism had spread to Chitral, Gilgit, Dir and Swat, whilst Ningrahar was still full of monasteries and temples, and the Peshawar valley was recognized as the seat of Buddhist learning, the Kafirs or Nysaeans held their own in Bajour and in the lower Kunar valley, where Buddhism apparently never prevailed.

The gazetteers and reports of the Indian Government contain nearly all the modern information available about Bajour. The autobiography of Baber (by Leyden and Erskine) gives interesting details about the country in the 16th century. For the connection between the Kafirs and the ancient Nysaeans of Swat, see R.G.S. *Journal*, vol. vii. (1896).

BAJZA, JOSEPH (1804–1858), Hungarian poet and critic. His earliest contributions were made to Kisfaludy's *Aurora*, which he edited from 1830 until 1837, when he was made director of the newly established national theatre at Pest. In 1847 Bajza edited the journal of the Opposition, *Ellenör*, at Leipzig, and in March 1848 Rossuth made him editor of his paper, *Kossuth Hirlapja*.

BAKALAI, a Bantu negroid tribe inhabiting the French Congo. They appear to be immigrants from the south-east, and are perhaps connected racially with the Galoa, one of the Mpongwe tribes and the chief river-people of the Ogowé. Their women display considerable ingenuity in dressing their hair, often taking a whole day to arrange a coiffure; the hair is built up on a substructure of clay and a good deal of false hair incorporated; a coat of red, green or yellow pigment often completes the effect. The same colours are used to decorate the hut doors. Some villages are fortified with palisades. Chiefs and rich men own plantations at some distance from the village to which their womenfolk are sent in times of war. The Bakalai of Lake Isanga cremate their dead; those of the Upper Ogowé throw the bodies into the river, except those killed in war. The body of a chief is placed secretly in a hut erected in the depths of the forest, and the village is deserted for that night, in some cases altogether; the slaves of the deceased are (or were) sacrificed, and his wives scourged and secluded in huts for a week. "Natural" deaths are attributed to the machinations of a sorcerer, and the poison-ordeal is often practised. Nearly all individuals refrain from eating the flesh of some particular animal.

BAKELITE, a synthetic resin developed by Dr. L. H. Baekeland in America. It has many industrial applications, but chiefly as an electrical insulator. It is prepared by the chemical interaction of phenolic substances, such as phenol and cresol found in coal-tar, and aldehydes such as formaldehyde, a derivative of methyl alcohol obtained either synthetically or by the distillation of wood. (See BAEKELAND; RESINS: Synthetic.)

BARER, SIR BENJAMIN (1840–1907), English engineer, was born at Keyford, Frome, Somerset, on March 31, 1840, and, after receiving his early training in a South Wales ironworks, became associated with Sir John Fowler in London. He was Fowler's chief assistant in the construction of the Metropolitan and District railways (London). He designed the cylindrical vessel in which Cleopatra's Needle, now standing on the Thames embankment, London, was brought over from Egypt to England in 1877–78. He made a thorough study of bridge construction, on which he wrote a series of important papers from 1867 onwards, and he was associated with Fowler in the design and erection of the Forth bridge completed in 1890. Fowler and Baker were consulted by the Egyptian Government on many important engineering undertakings. He sat on the commission appointed by Lord Cromer to consider Sir William Willcocks's plan for the storage of Nile water for irrigation purposes, and was consulting engineer for the making of the Aswan dam, opened in 1902. Sir Benjamin Baker, who also had a large share in the introduction of the system widely adopted in London of constructing intra-urban railways in deep tubular tunnels built up of cast-iron segments, obtained an extremely large professional practice, ranging over almost every branch of civil engineering. He served on many government and municipal commissions, and was a member of many learned societies, rendering especially valuable services to the Institution of Civil Engineers, on the council of which he sat for many years. He received a K.C.M.G. in 1890, and a K.C.B. in 1902. He died at Pangbourne, Berks, on May 19, 1907.

BAKER, GEORGE FISHER (1840–1931), American financier, was born in Troy, N.Y., March 27, 1840. When he was eight years old his family removed to Brooklyn, N.Y., and later to Williamsburg, N.Y. Most of his boyhood was spent at Dedham, Mass. After a brief period of schooling at Williamsburg, N.Y., he entered Semard university, Florida, N.Y., at which he graduated at the age of 16. From 1858 to 1863 he was a clerk in the State banking department, his services being interrupted for six months at the outbreak of the Civil War, when he acted as secretary to Gov. E. D. Morgan of New York. When the national banking system was created in 1863, John Thompson and his sons, Samuel C. and Frederick F. Thompson, with Baker, estab-

lished the First National Bank of New York city. Baker received a position as teller and was offered on credit all the stock he wanted. Baker refused, however, to go into debt, and bought only 30 shares with his savings.

The bank at first grew slowly, dealing chiefly in Government bonds; but when, in 1865, Baker became cashier and active head it began to expand rapidly, being admitted to the Clearing House in 1868. Baker was frequently consulted by the secretary of the Treasury and in 1877 he became president of the bank, the policy of which he continued to direct with such success as to make it one of the strongest banking institutions in America. In 1882 he acquired the Richmond and Danville railroad, which was the nucleus of a group reorganized as the Southern railway. Later he obtained control of the Jersey Central and the Delaware, Lackawanna and Western railways, when these systems were in difficulty.

In addition to the presidencies and directorships of numerous powerful corporations, he was president of the Metropolitan Opera House Association. His benefactions included large gifts to the Metropolitan Museum of Art, to the Red Cross and to universities, including one of $6,000,000 for the Graduate School of Business Administration of Harvard.

BAKER, GEORGE PIERCE (1866–1935), American educator, was born at Providence (R.I.), on April 4, 1866. He graduated from Harvard in 1887, and from 1905 to 1924 was professor of English there. His courses dealing with the theory of the drama were highly successful, and his famous laboratory, known as the "47 Workshop," afforded practical training for his students. He gave a course at the Sorbonne in Paris (1907–08) on the development of the English drama. In 1925 he became head of the department of dramatic art, School of the Fine Arts, Yale university. His works include: *The Development of Shakespeare as a Dramatist* (1907); *Dramatic Technique* (1919); and *Modern American Plays,* collected and edited with introduction (1920). He died Jan. 6, 1935.

BAKER, HENRY (1698–1774), English naturalist, was born in London on May 8, 1698. His invention of a system of instructing the deaf and dumb brought him to the notice of Daniel Deioe, whose youngest daughter Sophia he married in 1729. A year before, under the name of Henry Stonecastle, he was associated with Defoe in starting the *Universal Spectator and Weekly Journal.* He contributed many memoirs to the *Transactions* of the Royal Society, and in 1744 received the Copley gold medal for microscopical observations on the crystallization of saline particles. He was one of the founders of the Society of Arts in 1754, and for some time acted as its secretary. He died in London on Nov. 25, 1774. His name is perpetuated by the Bakerian lecture of the Royal Society, for the foundation of which he left by will the sum of £100.

BAKER, NEWTON DPEHL (1871–1937), American lawyer, administrator, and party leader, was born at Martinsburg, W. Va., Dec. 3, 1871. He was educated at Johns Hopkins (B.A. 1892) and at Washington and Lee (LL.B., 1894). In 1897 he began the practice of law in his native town, removing later to Cleveland, Ohio. There he soon distinguished himself as a lieutenant of Mayor Johnson in the latter's long struggle for tax reform and three-cent fares. Appointed city solicitor by the mayor in 1902, he held that office by election from 1904 to 1912 and that of mayor from 1912 to 1916. On the floor of the Democratic national convention oi 1912 he fought successfully to release the Ohio delegation from the unit rule, thereby contributing 18 votes toward the nomination of Wilson. As President-elect the latter offered him in 1913 the secretaryship of the interior, which he declined in order to push forward municipal reforms in Cleveland. Upon the resignation of Garrison three years later, however, he was appointed secretary of war. Although an avowed pacifist, immediately after the organization of the 65th Congress in 1917 he submitted a plan for universal military conscription, and remained at the head of the department of war throughout the whole period of the World War and to the retirement of Wilson in 1921. Administration policies regarding preparedness, conduct of the War, and treatment of conscientious objectors, became the subjects of severe criticism, much of it for partisan ends. In reply to this, he maintained before the Chamberlain Senate committee early in 1918 that "no army of similar size in the history of the world has ever been raised, equipped, or trained so quickly." After 1921 he resumed the practice of law in Cleveland. In the Democratic convention of 1924 he made a strenuous but losing fight for a strong League of Nations plank. (R. C. B.)

BAKER, SIR RICHARD (1568–1645), author of the *Chronicle of the Kings of England* and other works, was born probably at Sissinghurst, in Kent. He was educated at Oxford, and sat in Parliament for East Grinstead (1597). In 1620 he was high sheriff of Oxfordshire, but in 1623 his property in the county was seized for debts contracted by his wife's family, for which he had made himself responsible. He died on Feb. 18, 1645, in the Fleet prison where he spent the last ten years of his life.

His *Chronicle of the Kings of England from the Time of the Romans' Government unto the Death of King James* (1643, and many subsequent editions), was translated into Dutch in 1649, and was continued down to 1658 by Edward Phillips, a nephew of John Milton. The *Chronicle* was extremely popular, but its historical value is very slight. Baker also wrote many controversial and religious works during his imprisonment. His *Meditations* upon the psalms were edited by A. B. Grosart (1882).

See J. Granger, *Biographical History of England to the Revolution* (1804); *Biographia Britannica,* corrected *by* A. Kippis (1778–93).

BAKER, SIR SAMUEL WHITE (1821–1893), English explorer, was born in London, June 8, 1821, the son of a West India merchant. He was educated partly in England and partly in Germany. He spent two years in Mauritius (1844–46) and then went to Ceylon, where he founded an agricultural settlement at Nuwara Eliya, a mountain health-resort. He introduced emigrants from England and imported choice breeds of cattle. During his residence in Ceylon he published *The Rifle and the Hound in Ceylon* (1853), and two years later *Eight Years' Wanderings in Ceylon* (1855). After a journey to Constantinople and the Crimea in 1856, he undertook the supervision of the construction of a railway across the Dobruja, connecting the Danube with the Black Sea. In March 1861 he started upon his first tour of exploration in central Africa, "to discover the sources of the Nile, with the hope of meeting the East African expedition under Captains Speke and Grant somewhere about the Victoria Lake." After a year spent on the Sudan-Abyssinian border, during which time he learnt Arabic, explored the Atbara and other Nile tributaries, and proved that the Nile sediment came from Abyssinia, he arrived at Khartum, leaving that city in Dec. 1862 to follow up the course of the White Nile. Two months later at Gondokoro he met Speke and Grant, who, after discovering the source of the Nile, were following the river to Egypt. Their success made him fear that there was nothing left for his own expedition to accomplish; but the two explorers generously gave him information which enabled him, after separating from them, to discover the Albert Nyanza, of the existence of which credible assurance had already been given to Speke and Grant. Baker first sighted the lake on March 14, 1864. After some time spent in the exploration of the neighbourhood, during which Baker demonstrated that the Nile flowed through the Albert Nyanza—of the size of which he had formed an exaggerated idea—he started upon his return journey, and reached Khartum after many checks in May 1865. In the following October he returned to England with his wife, a Hungarian lady *née* Florence von Sass, who had accompanied him throughout the whole of the perilous and arduous journey. On his return the Royal Geographical Society awarded him its gold medal, and a similar distinction was bestowed on him by the Paris Geographical Society. In Aug. 1866 he was knighted. In the same year he published *The Albert N'yanza, Great Basin of the Nile, and Explorations of the Nile Sources,* and in 1867 *The Nile Tributaries of Abyssinia,* both books quickly going through several editions. In 1868 he published a popular story called *Cast up by the Sea.* In 1869 he attended the prince of Wales, afterwards King Edward VII., in a tour through Egypt. In the same year, at the request of the khedive Ismail, Baker undertook the command of a military expedition to the equatorial regions of the Nile, with the object of suppressing the slave-trade there and opening the way to com-

merce and civilization. Before starting from Cairo with a force of 1,700 Egyptian troops—many of them discharged convicts—he was given the rank of pasha and major general in the Ottoman army. Lady Baker, as before, accompanied him The khedive appointed him governor-general of the new territory for four years at a salary of £10,000 a year, and at the expiration of that time Baker returned to Cairo, leaving his work to be carried on by the new governor, Colonel Charles George Gordon. He had to contend with innumerable difficulties—the blocking of the river by sudd, the bitter hostility of officials interested in the slave trade, the armed opposition of the natives—but he succeeded in planting in the new territory the foundations upon which others could build up an administration. He returned to England with his wife in 1874, and in the folloning year purchased the estate of Sandford Orleigh in south Devon, where he made his home for the rest of his life.

He published his narrative of the central African expedition under the title of *Ismailia* (1874). *Cyprus as I saw it in 1879* was the result of a visit to that island.

He spent several winters in Egypt, and travelled in India, the Rocky Mountains and Japan in search of big game, publishing in 1890 *Wild Beasts and their Ways*.

See, besides his own writings, *Sir Samuel Baker, a Memoir*, by *T*. Douglas Murray and **A.** Silva White (1895).

BAKER, THOMAS (1656–1740), English antiquary, was born at Lanchester, Durham, England, and died at Cambridge. His most important printed work was his *Reflections on Learning* (1709–10). He spent the greater part of his life as fellow, and then as commoner-master of St. John's college, Cambridge.

BAKER, VALENTINE (BAKER PASHA) (1827–1887), British soldier, was a younger brother of Sir Samuel Baker (*q.v.*). He was educated at Gloucester and in Ceylon, and in 1848 entered the Ceylon Rifles as an ensign. He distinguished himself in the Kafir War of 1852–53 and in the Crimean War, and was for 13 years colonel of the 10th Hussars. He went through the wars of 1866 and 1870 as a spectator with the German armies, and in 1873 he started upon a famous journey through Khorasan. Though he was unable to reach Khiva, the results of the journey afforded a great deal of political, geographical and military information, especially as to the advance of Russia in central Asia. In 1874 he was back in England and took up a staff appointment at Aldershot. Less than a year later Colonel Baker's career in the British army came to an untimely end. He was arrested on a charge of indecent assault upon a young woman in a railway carriage, and was sentenced to a year's imprisonment and a fine. Two years later he entered the service of Turkey in the war with Russia. In 1883 he accepted the command of the newly-formed Egyptian army. On his arrival at Cairo, however, the offer was withdrawn and he obtained only the command of the Egyptian police.

When the Sudan War broke out, Baker, hastening with 3,500 men to relieve Tokar, encountered the enemy under Osman Digna at El Teb. His men became panic-stricken at the first rush and allowed themselves to be slaughtered like sheep. Baker himself with a few of his officers succeeded by hard fighting in cutting a way out, but his force mas annihilated. British troops soon afterwards arrived at Suakin, and Sir Gerald Graham took the offensive. Baker Pasha accompanied the British force, and guided it in its march to the scene of his defeat, and at the desperately-fought second battle of El Teb he mas wounded. He remained in command of the Egyptian police until his death in 1887. Among his works are *Our National Defences* (1860); *War in Bulgaria, a Narrative of Personal Experience* (1879); *Clouds in the East* (1876).

BAKER, one who bakes bread, biscuits, cakes, rolls, etc., for the market. The term is often extended to include those who simply sell bread, cakes and pastry. The term is sometimes applied to a portable oven for baking food and less commonly to an artificial fly used for salmon fishing and to the oven-bird, so named because it builds an ovenlike nest of clay or mud. (*See* BREAD AND BREAD MANUFACTURE; PASTRY. HOME MADE.)

BAKER, the largest city of eastern Oregon, U S A., about 338 mi. E. by S. of Portland, on the Old Oregon trail and the main line of the Union Pacific Railroad; it is the county seat of Baker county.

The Sumpter Valley railway connects at Austin (60 mi. S.W.) with stage lines for Grant county points. The population was 7,858 in 1930 and 9,342 in 1940 by federal census.

Baker lies in the beautiful valley of the Powder river, between the Cornucopia and the Elkhorn mountains, about 3,440 ft. above sea level. It is the centre of important mining, lumber, farming, dairying and livestock interests and has a large wholesale trade. Its industries include creameries, sawmills, planing mills and a cement plant.

The town was laid out in 1865, became the county seat in 1868, and was chartered as a city in 1874. The county and the city were named after Edward Dickinson Baker (b. 1811 in London), who served in the Mexican War as colonel, was prominent in local politics and met his death at Ball's Bluff, Va., Oct. 21, 1861. while serving as colonel in the Federal army.

BAKER ISLAND, a little sandspit in the Pacific ocean, lat. 0° 13′ N., long. 176° 28′ W. With Howland (*q.v.*) and Jarvis islands (q. *v.*), it mas placed under the jurisdiction of the U.S. department of the interior, by executive order of President Franklin D. Roosevelt, on May 13, 1936. The island was discovered by Michael Baker, of New Bedford, Mass., who visited it in 1832 and 1839, in the whaling ship "Gideon Howland." Baker Island is less than a mile in diameter and is surrounded by a ridge, the interior being almost entirely flat. The western shore line may change several times in the course of a year under the influence of shifting tides. The climate is hot and dry, and the vegetation is restricted to scattered herbs, grass and shrubs. The ridge which encloses the island rises to a height of 20 ft. at the southwest corner, where a steep sandy beach slopes down to the water's edge. An occasional light is shown from a white cylindrical stone tower in the western part of the island. Ships are warned that no supplies are available at Baker. It is one of the few steppingstones between Hawaii and Pago Pago, in American Samoa, and can be useful as a refueling station on the supply route of the U.S. navy between Hawaii and New Zealand.

(W. H. CH.)

BAKERSFIELD, a city of California, U S.A., on the Kern river, 100 mi. N.W. of Los Angeles, in the southern part of the San Joaquin valley; the county seat of Kern county. It is on federal highway 99; is served by the Santa Fe and the Southern Pacific railways, and by auto-stage lines to Los Angeles and San Francisco. It is one of the principal commercial airports on the Pacific coast mail line between Seattle and Los Angeles. The population was 4,836 in 1900; 18,638 in 1920; and was 29,252 in 1940 by federal census.

The city's prosperity rests on the agricultural development of Kern county and its oil fields. Cotton is the leading crop (123,000 bales ginned in 1940), followed closely by early vegetables, alfalfa and fruits, including seedless grapes. Oil was struck in the Kern river field in 1899, and the county's production for the calendar year 1940 was 60,336,987 net barrels. Pipe lines carry the oil to the harbours of Los Angeles and San Francisco, and Los Angeles takes all the natural gas sent out of the county. There are large oil refineries, and compressor plants making gasoline out of natural gas.

About 50 or 55 oil companies have offices in the city. The Elk Hills naval reserve is 23 mi. W.

The assessed valuation of property in Bakersfield was $42,000,000 in 1939. Bank clearings in 1940 approximated $86,031,596. The city has a planning commission and a city-manager form of government. A wild flower festival is held every March.

Pioneers coming by stage through Tejon pass settled here as early as 1858. A post office was established in 1868. The city was laid out in 1869 by Col. Thomas Baker, after whom it was named. He was a civil engineer who came in 1862 to supervise a reclamation project. In 1870 it had a population of about 600. It was chosen as the county seat by a popular election in 1873, and incorporated soon after. The Southern Pacific reached it in 1874. In 1889 it was almost entirely destroyed by fire. Thirty-eight miles S. is Fort Tejon, an adobe house built in 1854, which guarded the pass until 1864.

BAKEWELL, ROBERT (1725–1795), English agriculturist, was born at Dishley, Leicestershire, in 1725; in 1760 he took over the management of the estate at Dishley. His main object was to improve the breed of sheep and oxen, and in this he was highly successful, his new Leicestershire breed of sheep attaining within little more than half a century an international reputation, while the Dishley cattle (also known as the new Leicestershire long-horn) became almost as famous. He extended his breeding experiments to horses, producing a new and particularly useful type of farm-horse. He was the first to establish the trade in ram-letting on a large scale, and founded the Dishley Society, the object of which was to ensure purity of breed. The value of his own stock was quickly recognized. and in one year he made 1,200 guineas from the letting of a single ram. Bakewell's agricultural experiments were not confined to stock-breeding. His reputation stood high in every detail of farm-management, and as an improver of grass land by systematic irrigation he had no rival. He died on Oct. 1, 1795.

BAHEWELL, ROBERT (1768–1843), English geologist, wrote an *Introduction* to *Geology* (1813) which reached a fifth edition in 1838. He died at Hampstead on Aug. 15, 1843.

BAKEWELL, urban district, Derbyshire, England, on the river Wye, 25 mi. N.N.W. of Derby on the L.M.S. Ry. Pop. (1938) 3,191. Area 4.8 sq.mi. On Castle hill, in the vicinity, are remains of earthworks said to have been raised by Edward the Elder in 924. There was a settlement at the time of Domesday, where the church of All Saints receives mention. The almshouses (St. John's hospital) were founded in 1602, and the free grammar school dates from 1637. The village was almost depopulated by the plague of 1665. Bakewell has chalybeate springs and baths. Zinc and marble are worked in the neighbourhood. Haddon Hall is 2 mi. from the town and the picturesque village of Eyam (pr. Eem) is 6 mi. north.

BAKHCHI-SARAI (Turkish for "Garden palace"), a town in the Autonomous Crimean Soviet Socialist Republic. Lat. 44° 47' N., Long. 33° 56' E., on the railway 20 mi. S.S.W. of Simferopol. Population 10,800, mainly Tatar, making morocco leather, sheepskin cloaks, and small metal goods. From the 15th century to 1783 it was the residence of the Tatar Khans of Crimea and is still oriental in appearance. The Khan Sarai, erected in 1519 by Abdul-Sahal-Ghirai, and destroyed 1736, was restored through Potemkin for Catherine II: it contains tombs of the khans. There are 36 mosques in Bakhchi-Sarai, and 2½ mi. east, on almost inaccessible cliffs, is Chufut-Raleh (Jews' City), formerly the chief seat of the Karaite Jews, now deserted. The Uspenskiy monastery, on the cliff face between Bakhchi-Sarai and Chufut-Kaleh, was the scene of a great annual pilgrimage on Aug. 15 (29).

BAKHMUT, now ARTEMOVSK (*q.v.*).

BAKHTIARI, one of the great nomad tribes of Persia, whose camping-grounds are in the hilly district, known as the Bakhtiári province. The Bakhtiári are divided into the two great divisions, Haft-lang and Chahar-lang, and a number of branches and clans, and were known until the 15th century as the "Great Lurs," the "Little Lurs" being the tribes settled in the district now known as Luristan, with Khorremábád as capital. According to tradition the Lurs originally came from Syria in the 10th century, but they were probably in Persia 15 centuries before. They speak the Lur language, a Persian dialect.

For accounts of the Bakhtiári *see* Mrs. Bishop (Isabella Bird), *Journeys in Persia and Kurdistan* (London, 1893); C. de Bode, *Travels in Luristan* (London, 1841); Lord Curzon, *Persia and the Persian Question,* vol. ii. 283–303 (London, 1892); Sir H. Layard, *Early Adventures in Persia* (London, 1894).

BAKING POWDER, a prepared mixture to replace yeast in baking, containing as active ingredients, customarily, sodium bicarbonate (baking soda), and either potassium acid tartrate (cream of tartar), tartaric acid, or potassium aluminum sulphate (alum) or other material which, when moistened, acts as an acid to liberate carbon dioxide from the baking soda. Baking powders frequently contain starch, flour or other inert powdery materials, which serve to prevent premature reaction between the other ingredients,

BAKKARA, a tribe of Sudan Arabs. The young men are described as great dandies, and, though dark skinned, well formed noses seem to predominate. Their women, or at least the younger, wear the *rahad* (a deeply fringed belt of cut leather) or a width of cloth round the loins, but do not wear the length of cotton which envelopes the whole body, as even the women of the camel nomads do. With the possible exception of the Shaikia the Bakkara—who formed the backbone of the army of the Khalifa, himself a Ta'aishi—are the most warlike of the Sudan Arabs, and, living on the northern edge of the negro country, were inveterate slave raiders and traders until brought under control. Among their more notable tribes are, in Kordofan the Awlad Hamayd, the Habbania, the Hawaznia and the Messiria, in Darfur the Rizaykat, the Ta'aisha and the Beni Helba. ***See*** ARABS (Bibliography).

BAKÓCZ, TAMAS (BOKOTS), CARDINAL (1442–1521), Hungarian ecclesiastic and statesman, was the son of a wagoner, adopted by his uncle, who trained him for the priesthood and whom he succeeded as rector of Tétel (1480). Shortly afterwards he became one of the secretaries of King Matthias I., who made him bishop of Gyor and a member of the royal council (1490). Under Wladislaus II. (1490–1516) he became successively bishop of Eger, archbishop of Esztergom (1497), cardinal (1500), and titular patriarch of Constantinople (1510). From 1490 to his death in 1521 he was the leading statesman of Hungary and mainly responsible for her foreign policy. It was solely through his efforts that Hungary did not accede to the league of Cambrai, was consistently friendly with Venice, and formed a family compact with the Habsburgs. He was the only Magyar prelate who aspired to the papal throne. In 1513, on the death of Julius II., he went to Rome and barely failed to secure his election as pope. He returned to Hungary as papal legate, bringing with him the bull of Leo X. proclaiming a fresh crusade against the Turks. But the crusade degenerated into a *jacquerie* which ravaged the whole kingdom, and much discredited Bakócz. He lost some of his influence at first after the death of Wladislaus, but continued to be the guiding spirit at court, till age and infirmity confined him almost entirely to his house in the last three years of his life.

Bakócz was *a* man of great ability but of no moral principle whatever. His whole life was a tissue of treachery. He was false to his benefactor Matthias, false to Matthias's son János Corvinus, whom he deprived of the throne by arts of chicane, and false to his accomplice in that transaction, Queen Beatrice. His attempt to incorporate the wealthy diocese of Transylvania with his own primatial province was one of the principal causes of the spread of the Reformation in Hungary. He left a fortune of many millions. His one redeeming feature was a love of art.

See Vilmos Fraknoi, *Tamás Bakdcz* (Hung.) (1889).

BAKRI, ABŪ 'UBAID 'ABDALLAH IBN 'ABD UL-'AZĪZ UL-BAKRĪ (1040–1094), Arabian geographer, was born at Cordova. He compiled a dictionary of geographical names occurring in the poets (edited by F. Wuestenfeld, Goettingen, 1876–77).

See C. Brockelmann, *Gesch. der Arab. Literatur* (Weimar, 1898), vol. I., p. 476.

BAKST, LÉON (1866–1924), Russian painter, passed his childhood in St. Petersburg (Leningrad). He attended the Imperial Academy of Arts, but left after painting a too realistic "Pietà." A member of the Society of Painters in Water Colours and a teacher to the children of the Grand Duke Vladimir, he succeeded both as a court painter and in the fashionable world. From 1900 he was scenic artist, first at the Hermitage Court theatre and afterwards at the Imperial theatres. He designed the scenery and accessories for the tragedies of Sophocles in the spirit of the Greek theatre and in the archaic style of the Aegina sculptures. He made a voyage to Greece and Crete of ,which he wrote an account, and his famous picture "Terror Antiquus" expresses his vision of mythic Greece.

In 1906 he exhibited in the Russian section of the Salon d'Automne in Paris. Two years afterwards he achieved considerable fame as the chief painter of scenery for the Russian ballets produced by Diaghilev. "Cleopatra," "Scheherazade" (1909) and "Daphnis and Chloe" were among his most notable

achievements. He returned to Russia and founded a liberal school of painting. Afterwards he settled in Paris, where he designed the setting of the tragedies of D'Annunzio and of a play of Verhaeren. He painted the scenery and designed the costumes for the "Sleeping Princess," the fairy ballet of Tchaikovski produced in London in 1921. He also produced several plays at the Paris Opera, among them the "Bewitched Night." Léon Bakst revolutionized the application of the decorative arts of the theatre and aimed at unity of impression. The influence of his genius may also be seen in the costumes of the time. He died in Paris.

See André Levinson, ***The*** *Story of Ldon Bakst's Life* (1921).

(A. LE.)

BAKU, chief city of the Azerbaijan S.S.R., on the west coast of the Caspian sea, south of the Apsheron peninsula, 40° 22' N., 49° 50' E. Av. rainfall 9·5 inches. Av. temp. Jan. 38·1° F, July 78·8° F. A violent north-north-west wind blows in winter. It is the centre of the Baku region, area 4,970sq.km. Pop. (1926) 520,936, only 73,564 rural, the remaining 446,832 being concentrated in Baku city, the number of men being much in excess of that of women. The town has a larger proportion of Russians than the rest of Azerbaijan. It is chiefly famous for its naphtha, the output 1926–27 being 6,400,000 tons, about $\frac{1}{13}$ of which was from natural fountains and the rest from drill-wells. A hydro-electric power plant to supply the oil refineries was completed in 1927. Recently constructed pipe lines completed in 1928 convey oil to Batum and Poti. Baku has a good harbour and is served by a fleet, mainly for oil, consisting in 1925 of 81 motor driven vessels (tonnage 112,049), 162 oil barges (tonnage 246,000), 75 dry cargo steamers and 63 line steamers and tugs. The oil transport facilities are good, but the dry cargo vessels (mainly for Persian and Trans-Caspian products, raw cotton, silk, rice, wine, fish, dried fruit and timber) are antiquated and inadequate. The silting up of the Volga delta seriously interferes with up-river transport to Moscow, and dredging would improve trade. Baku has good rail connections with the Black sea, in the north via Vladikavkaz, and in the south via Tiflis to Batum. The new town is creeping up the hill, and has petroleum refineries and factories for oil fuel, flour milling, sulphuric acid and tobacco. Near the harbour are engineering works, dry docks, barracks, stores, etc. A fair (May and June) serves for exchange between the Union of Socialist Soviet Republics and Persia, the latter providing cotton, wool, carpets, rice and dried fruits in exchange for Russian sugar. Transactions in 1926, when a special building for the fair was opened, amounted to 10,000,000 roubles. Baku has a university, a polytechnic institute, and other centres for education, drama, art and music.

The old town lies west and has ancient walls, with traces of 9th century and 10th century Arab architecture, the mosque of the Persian shahs built in 1078 (now an arsenal), the ruins of the 16th century palace of the native khans and, nearer the sea, the "Maiden's Tower," now a lighthouse. Baku was mentioned by the 10th century Arab geographer, Masudi. From 1509 to 1723 it was under Persian rule; it was then captured by the Russians but restored 173 j, and finally incorporated in the Russian empire in 1806. It suffered severely in the anarchy of 1904–05, when many oilworks were burned, and again in 1914–21. On the Apsheron peninsula, 30m. from Baku, is the village of Nardoron, with 13th century relics: a recent shifting of the sand has revealed an ancient mausoleum of Sheikh Said-Yusif-Caliph, 8th century.

BAKUNIN, MIKHAIL (1814–1876), Russian anarchist, was born at Torjok, Tver. He served as an officer of the imperial guard in Poland, but resigned in protest against Tsarist methods. He then travelled in Germany, France and Switzerland, where he fixed his residence, refusing a summons of the Russian Government to return, an act which cost him the confiscation of his estates. In 1849 he, like Wagner, took part in the vain defence of the Dresden revolutionary government. He was arrested and handed over to the Russian Government which sent him to eastern Siberia (1855), whence he escaped and returned to Europe (1861). From this time he took the place of Proudhon (*q.v.*) as the leading anarchist of Europe, till his death in Berne on June 13, 1876.

His chief principles, as enunciated in his God *and the State* (1882) and his letters, are three: (1) Atheism, and the propaganda of atheism—not agnosticism; (2) the destruction of the State; the State being an organ of oppression all that is needful is to break its power. A system of anarchist communism will then automatically appear. The anxiety of the socialists to put in the place of a capitalist State another, revolutionary, State is consequently idiotic; (3) political action must be rejected, because the destruction of the State cannot be achieved by political action but by insurrection. But while he demanded the complete abrogation of authority in society and in the organizations to which he belonged, he followed a reverse principle in organizations under his own control. These consisted of devoted revolutionaries who placed the revolution before everything else and yielded implicit obedience to their leader. He wrote in 1870 to his lieutenant Albert Richard, "Have you never thought what is the principal cause of the power and vitality of the Jesuit order? . . . it is the complete effacement of individuals and of private wills in collective organization and action." For this purpose he organized the "Alliance of Socialist Democracy" which operated first in a body called the League of Peace and Freedom and then in the International Association of working men. Within the Alliance, which was not secret, was an organization of secret "national brothers," and above them again a supreme organization of 100 "international brothers." After 1872, when this organization was dislocated, Bakunin formed another secret body which was called simply "Y." In the organization of all these he was chiefly aided by a Russian named Nechaieff, and he drew in 1870 a bitter picture of his methods: "For him, truth, mutual confidence, real and strict solidarity only exist between a dozen individuals who form the *sanctus sanctorum* of the Society. All the rest are to serve as blind instruments . . . they are conspiracy-fodder. . . . In the name of the cause it is his duty to gain possession of your whole person without your knowledge. . . . If your friend has a wife or a daughter, he will manage to seduce her and give her a baby in order to force her to break away from official morality and into a revolutionary protest against society." His views gained wide acceptance in the International (*q.v.* for further details) before it was split in 1872, especially in Spain, Italy, Belgium and French Switzerland. An anarchist insurrection, personally directed, at Lyons in 1870 was a fiasco, but the Bakuninists played a great part in the Spanish revolution of 1873, being in control or part control of several towns during the year. Their influence died away in Belgium, but in Italy and later in Russia, Bakuninism was for years exceedingly powerful.

Bakunin was the progenitor of Nihilism, but was no great theorist himself. What elaborations he made on his three main principles were, as he himself said, due to the "great master of us all, Proudhon." His influence in his lifetime was largely personal: his sincere and impulsive character profoundly impressed men much his superior in intellect. His philosophy struck deep roots only in countries such as Italy, Spain and Russia which were industrially backward and had a large oppressed peasant population. Historically, he was justified in his claim to be the successor of Stenka Razin and the leaders of the *jacquerie*.

See INTERNATIONAL, THE; ANARCHISM, and their attached bibliographies, also R. W. Postgate, *The Workers' International* (1920, bibl.), and G. M. Stekloff, *History of the First International (1928,* bibl.). M. Nettlau's (German) life of Bakunin has not been published; there is a duplicated copy in the British Museum.

(R. W. P.)

BAKWE, a vigorous, fair-complexioned folk of medium stature on the French Ivory Coast between the Sassandra and Kavally rivers. The sub-tribes Ne, Houane, Pia, Abri, Pla and Ba live on the coast and supply crews known as *Krumen* for European vessels. The Bakwe properly so-called, the Ba, and the Te, dwell inland. The extended family has its patrimony in common. Marriage is exogamous, polygamy is allowed, the first wife being the head. Descent is patrilineal. The family property is inherited by the surviving brother, then by the eldest son. They are animists, and have ordeals by boiling oil or redwood.

See Thomann, *Essai de Manuel de la Langue Neoulé* (1905).

BA-KWIRI, a Bantu people in southern Nigeria. According to tradition they are migrants from the eastward. The "Brush-

men," for that is the meaning of their name, are grouped in about 60 separate clans. Most of the women are much shorter and far lighter in colour than the men. The law of blood for blood is mercilessly fulfilled, even in cases of accidental homicide. Their religion is ancestor-worship blended with witchcraft and magic. They believe in good and evil spirits, those of the forests and seas being especially feared. The Ba-Kwiri possess a curious drum language. By drum-tapping news is conveyed from clan to clan. Slaves and women are not allowed to master this language, but all the initiated are bound to repeat it to pass on the messages. The Ba-Kwiri have a horn language peculiar to themselves.

See P. A. Talbot, *The Peoples of* Southern Nigeria *(1926).*

BALA, market town and urban district of Merionethshire, north Wales, near the end of Lake Bala, the largest natural lake in Wales, on the Tryweryn just above its confluence with the Dee. Population of the urban district (1931) 1,395. A mound known as Tomen-y-Bala is thought to be a Norman motte and bailey castle and was possibly an outpost in the upper Dee valley. As one of the most important northern foci of Welsh Wales it came into proininence during the 18th and 19th centuries, both as a woollen centre, manufacturing chiefly flannel and hosiery, and also as a centre ior the religious and educational movements of the period.

In the latter capacity it is associated with Thomas Charles (1755–1814), Howell Harris (1714–73) and Thomas Edward Ellis (1859–99). A grammar school was founded in 1712 and a Calvinistic Methodist college in 1837, and later an Independent college now transferred to Bangor. At Bala junction near the town a branch railway up the Tryweryn valley to Festiniog separates from the railway which skirts Bala lake and proceeds south-westwards via Dolgelly to the sea coast.

BALAAM, a prophet in the Bible. Balaam, the son of Beor, was a Gentile seer; he appears in the history of the Israelites during their sojourn in the plains of Moab, east of Jordan, at the close of the forty years' wandering. Balak, king of Moab, alarmed by their conquests, sent for Balaam to curse Israel; Balaam came after some hesitation, but when he sought to curse Israel Yahweh compelled him to bless them.

The main passage concerning Balaam (Num, xxii.–xxv.) consists of a narrative containing seven oracular poems of unequal length and is doubtless based on ancient traditions.

The narrative is held to be compiled with editorial additions from the two ancient sources commonly denoted by the symbols J and E (on which see BIBLE: Old Testament). The distribution of the material between the two documents is uncertain; but some such scheme as the following is not improbable. The references to portions the origin of which is especially uncertain are placed in parentheses () whilst restorations of supposed omissions are given in brackets [].

(i) J.—xxii. 3*b*–7 (omitting "to Pethor . . . river") 11, 17 fr.). Balak, king of Moab, alarmed at the Israelite conquests, sends elders of Moab and Midian to Balaam, son of Beor, to the land of *Ammon* (seq. versions) to induce him to come and curse Israel. He sends back word that he can only do what Yahweh commands.

xxii. 22–34*a,* 36a. Nevertheless Balaam sets out with two servants, but the angel of Yahweh meets him. At first the angel is seen only by the ass, which arouses Balaam's anger by its efforts to avoid the angel. The ass is miraculously enabled to speak to Balaam. Yahweh at last enables Balaam to see the angel, who tells him that he would have slain him but for the ass. Balaam offers to go back, but is told to go on.

Speaking animals are a common feature of folklore; the only other case in the Old Testament is the serpent in Eden. Some scholars regard the statements about the ass speaking as figurative; but the ordinary literal interpretation is more probable. It does not follow, however, that the authors of the Pentateuch intended the story to be taken as historical in its details.

xxii. 36, 39; xxiv. 1, 2, 10–14, 25. Balak meets Balaam and they go together (and offer sacrifices); Balaam, however, blesses Israel; Balak remonstrates, but Balaam reminds him of his message and again blesses Israel. Then Balaam goes home. (For the relation of the poems to J's narrative, *see* below)

(ii.) E.—xxii. 2, 3*a,* 5*b* "to Pethor, which is by the river," 8–10, 12–16, 19–21, 35, 36*b*–37*a,* 38. Balak, king of Moab, alarmed at the conquests of Israel, sends the princes of Moab to Balaam at Petlzor on the river, that he may come and curse Israel. Some scholars take "river" (nakar) as the *"river"* (better "ravine" *nahal*) of Egypt to the south of Judah. But "river" used absolutely means the Euphrates, and *Pethor* can be identified with *Pitru* near Carchemish, mentioned in an inscription of Shalmaneser III. Deut. xxiii. 4 places Pethor in Mesopotamia.

God appears in a dream and forbids him to go. The princes return and report to Balak, who sends them back to Balaam. God in another dream permits him to go, on condition that he speaks what God tells him. He goes with the princes of Moab. Balak meets them, and Balaam warns him that he can only speak what God tells him.

xxii. 40, 41; xxiii. 1–6, 11–17. Balak offers sacrifices, but Yahweh inspires Balaam with a blessing on Israel. Balak remonstrates and Balaam explains. They try to get a more favourable result by sacrificing on a different spot, but he is again compelled to bless Israel. After further remonstrances and explanations [Balaam goes home]. (For the relation of the poems to E's narrative, see below.)

Deut. xxiii. 3–6 summarizes E's account of this incident, adding, however, the feature that the Ammonites were associated with the Moabites. Joshua, in his farewell speech to the Israelites (Josh. xxxiv. 9, 10. E) also refers to this episode. The Priestly Code (Num. xxxi. 8, 16) has a different story of Balaam, in which he advises the *Midianites* how they may bring disaster on Israel by seducing the people from their loyalty to Yahweh. Later on he is slain in battle, fighting in the ranks of Midian.

The Poems fall into two groups: the first four, in xxiii. 1.–xxiv. 19, are by most critics regarded as ancient lyrics which J and E inserted in their narrative.

The first two are found in an E setting, and therefore, if ancient, formed part of E. The First, xxiii. 7–10, prophesies the unique exaltation of Israel, and its countless numbers. The Second, xxiii. 18–24, celebrates the moral virtue of Israel, the monarchy and its conquests.

The second couple are connected with J. The *Third,* xxiv. 3–9, also celebrates the glory and conquests of the monarchy. Agag, in verse 7, can hardly be the Amalekite king of 1 Sam. xv.; Amalek was too small and obscure. Og has been suggested, but does not seem a great improvement. The *Fourth,* xxiv. 14–19, announces the coming of a king, possibly David, who shall conquer Edom and Moab.

The remaining poems are usually regarded as later additions. The Fifth, xxiv. 20, deals with the ruin of Amalek. It is of uncertain date; if the historical Amalek is meant, it may be early; but Amalek may be symbolical. The *Sixth,* xxiv. 21 f., deals with the destruction of the Kenite state by Assyria; also of uncertain date, Assyria being according to some, the ancient realm of Nineveh, according to others the Seleucid kingdom of Syria. The Seventh, xxiv. 23 f.. speaks of the coming of ships from the West, to attack Assur and "Eber"; it may refer to the conquest of Persia by Alexander the Great.

In the New Testament Balaam is cited as a type of avarice (II. Pet. ii. 16, 17; Jude 11). In Rev. ii. 14 we read of false teachers at Pergamum who held the "teaching of Balaam, who taught Balak to cast a stumbling-block before the children of Israel, to eat things sacrificed to idols, and to commit fornication."

Balaam has attracted much interest, alike from Jews, Christians, and Mohammedans. Josephus paraphrases the story and speaks of Balaam as the best prophet of his time, but with a disposition ill adapted to resist temptation. Philo describes him in the Life of Moses as a great magician. The later Targums and the Talmud represent him as a typical sinner; and there are the usual worthless Rabbinical fables, e g, that he was blind of one eye. There are also similar fables in Mohammedan writers. It has been conjectured that the Arabic wise man, commonly called Luqmān (*q.v.*), is identical with Balaam. The names of their fathers are alike, and "Luqman" means *devourer, swallower,* a meaning which might he got out of Balaam by a popular etymology.

If we might accept the various theories mentioned above, Balaam would appear in one source of J as an Edomite, in another as an Ammonite; in E as an Aramaean; in the tradition followed by the Priestly Code probably as a Midianite. All these peoples either belong to the Hebrew stock or are closely connected with it. We may conclude that Balaam was an ancient figure in traditions originally common to all the Hebrews and their allies, and afterwards appropriated by individual tribes.

The chief significance of the Balaam narratives for the history of the religion of Israel is the recognition by J and E of the genuine inspiration of a non-Hebrew prophet. Yahweh is as much the God of Balaam as he is of Moses. Probably the original tradition goes back to a time when Yahweh was recognized as a deity of a circle of connected tribes of which the Israelite tribes formed a part. But the retention of the story without modification may imply a continuous recognition through some centuries of the idea that Yahweh revealed his will to nations other than Israel.

BIBLIOGRAPHY.—*See* Commentaries on Kumbers, Gray (I C.C.), Binns (Westminster Comm.); "Balaarn" in Hastings's *Bible Dict.* and *Encyclopaedia Biblica.* (W. H. BE.; L. E. B.)

BALACLAVA, a village in the Crimea, east of Sevastopol, famous for a battle in the Crimean War (*q.v.*). The action of Balaclava (Oct. 25, 1854) was brought about by the advance of a Russian field army under Gen. Liprandi to attack the allied English, French and Turkish forces besieging Sevastopol. The ground on which the engagement took place was the Vorontsov ridge and the valleys on either side of it. Liprandi's corps formed near Traktir bridge, and early cn Oct. 25 its advanced guard moved southwards to attack the ridge, which was weakly occupied by Turkish battalions behind slight entrenchments. The two nearest British divisions were put into motion as soon as the firing became serious, but were prevented by their orders from descending at once into the plain, and the Turks had to meet the assault of greatly superior numbers. They made a gallant resistance, but the Russians quickly cleared the ridge, capturing several guns, and their first line was followed by a heavy mass of cavalry which crossed the ridge and descended into the Balaclava plain. At this moment the British cavalry division under the earl of Lucan was in the plain, but their commander was prevented from engaging the Russians by the tenor of his orders. One of his brigades, the Heavy (4th and 5th Dragoon Guards, 1st, 2nd and 6th Dragoons) under Brig. gen. J. Y. Scarlett, was in the Balaclava plain; the other, the Light Brigade under Lord Cardigan (4th and 13th Light Dragoons, 8th and 11th Hussars and 17th Lancers) in the valley to the north of the Vorontsov ridge. All these regiments were very weak in numbers. The Russian cavalry mass, after crossing the ridge, moved towards Balaclava; a few shots were fired into it by a Turkish battery and a moment later the Heavy Brigade charged. The attack was impeded at first by obstacles of ground, but in the *mêlée* the weight of the British troopers gradually broke up the enemy, and the charge of the 4th Dragoon Guards, delivered against the flank of the Russian mass, was decisive. The whole of the Russian cavalry broke and fled to the ridge. This famous charge occupied less than five minutes from first to last, and at the same time some of the Russian squadrons, attempting to charge the 93rd Highlanders (who were near Balaclava) were met by the steady volleys of the "thin red line," and fled with the rest. The defeated troops retreated past the still inactive Light Brigade, on whose left a French cavalry brigade was now posted. The Russians were at this juncture reinforced by a mixed force on the Fedukhine heights; Liprandi's infantry occupied the captured ridge, and manned the guns taken from the Turks. The cavalry defeated by the Heavy Brigade was re-formed in the northern valley behind the field guns, and infantry, cavalry and artillery were on both the Fedukhine and the Vorontsov heights. Thus, in front of the Light Brigade was a valley over a mile long, at the end of which was the enemy's cavalry and 12 guns, and on the ridges on either side there were in all 22 guns, with cavalry and infantry. It was under these circumstances that an order was given by the British headquarters, which led to the charge for which above all Balaclava is remembered. It was carried to Lord Lucan by Capt. Nolan, 15th Hussars, and ran as follows:—"Lord Raglan wishes the cavalry to advance rapidly to the front and try to prevent the enemy carrying away the guns . . . French cavalry is on your left." Lucan, seeing no attempt on the part of the enemy to move guns, questioned Nolan, who is said to have pointed down the valley to the artillery on the plain; whereupon Lucan rode to Lord Cardigan, the commander of the Light Brigade, and repeated Lord Raglan's order and Nolan's explanation. The Light Brigade then advanced straight to its front, and soon came under fire from the guns on both flanks. Nolan mas killed as he rode across the front of the brigade, perhaps with the intention of changing its direction to the Vorontsov ridge. Five minutes later the guns in front began to fire with telling effect. The pace was increased, though the "charge" was not sounded, and Cardigan and those of his men who remained mounted, rode up to and through the Russian line of guns. Small parties even charged the Russian cavalry in rear and on either flank. The French 4th *Chasseurs d' Afrique* made a dashing charge which drove the Russians off the Fedukhine heights, though at considerable loss. Lucan had meanwhile called up the Heavy Brigade to support the Light, but it lost many men and horses and was quickly withdrawn. Only two formed bodies of the Light Brigade found their way back. The 13th Light Dragoons mustered but ten mounted men at the evening parade; the brigade as a whole had lost 247 men and 497 horses out of a total strength of 673 engaged in the charge, which lasted 20 min. from first to last. The two infantry divisions which now approached the field were again halted, and Liprandi was left undisturbed on the Vorontsov ridge and in possession of the captured guns. The result of the day was thus unfavourable to the allies, but the three chief incidents of the engagement—the two cavalry charges and the fight of the 93rd Highlanders—gave to it the glamour of a victory. The impression created by the conduct of the Light Brigade was expressed in Tennyson's well-known ballad, and the deeper truth contained in the equally celebrated remark of the French general Bosquet, *C'est magnifique mais ce n'est pas la guerre,* made iess impression on the British public, which has habitually cherished valorous stupidity above economical skill in its military annals—and thus helped to ensure a recurrence of such glamorous follies. (F. J. Hu.)

BALAENA, the genus of whales to which the Greenland right whale belongs. *See* CETACEA.

BALAENICIPITIDAE: *see* SHOE-BILL.

BALAENOPTERA, the generic name of the group of whales known as the rorquals, which form the main object of pursuit in modern whale-fisheries. *See* CETACEA.

BALAGHAT, a district of British India in the Nagpur division of the Central Provinces, with an area of 3.557 sq. m. The administrative headquarters are at the town of Burha. It forms the eastern portion of the central plateau which divides the province from east to west. These highlands, formerly known as the Raigarh Bichhia tract, remained desolate and neglected until 1366, when the district of Balaghat was formed. The district comprises: (1) The southern lowlands, a slightly undulating plain, comparatively well cultivated and drained by the Wainganga, Bagh, Deo, Ghisri and Son rivers. (2) The long narrow valley known as the Mau Taluka, lying between the hills and the Wainganga river, and comprising a long, narrow irregular-shaped lowland tract, intersected by hill ranges and peaks covered with dense jungle, and running generally from north to south. (3) The lofty plateau, in which is situated the Raigarh Bichhia tract, comprising irregular ranges of hills broken into numerous valleys, and generally running from east to west. The highest point is the Bhainsagat range, about 3,000 ft. The principal rivers in the district are the Wainganga and its tributaries, the Bagh, Nahra and Uskal; a few smaller streams, such as the Masmar, the Mahkara, etc.; and the Banjar, Halon and Jamunia, tributaries of the Nerbudda, which drain a portion of the upper plateau. A fine Buddhist temple of cut stone, belonging to some remote period, is suggestive of a civilization which had disappeared before historic times. The population in 1931 was 561.602. The Gondia-Jubbulpore line of the Bengal-Nagpur railway traverses the Wainganga valley in the west of the district.

BALAGUER, VICTOR (1824–1901), Spanish politician and author, was born at Barcelona and was educated at the university of his native town. His first dramatic essay *Pepin* el *jorobado,* was placed on the Barcelona stage when he was **14** years of age, and at **19** he was publicly "crowned" after the production of his second play *Don Enrique el Dndivoso.* From **1843** to **1868** he was the chief of the Liberal party in Barcelona, and as proprietor and editor of *El Conseller* promoted the growth of local patriotism in Catalonia. In **1857** he wrote his first poem in Catalan—a copy of verses to the Virgin of Montserrat. Henceforward he frequently adopted the pseudonym of "lo Trovador de Montserrat"; in 1859 he helped to restore the "Juegos Florales," and in **1861** was proclaimed *mestre de gay saber.* In **1867** he emigrated to Provence. On the expulsion of Queen Isabella, he returned to Spain, represented Manresa in the Cortes, and in 1871–72 was successively minister of the colonies and of finance. He resigned office at the restoration, but finally followed his party in rallying to the dynasty; he was appointed vice-president of congress, and was subsequently a senator. Long before his death he had become alienated from the advanced school of Catalan nationalists, and endeavoured to explain away the severe criticism of Castile in which his *Historia de Cataluña y de la Corona de Aragon* (1860–63) abounds. This work, like his *Historia politica* y *literaria de los trovadores* (1878–79) is inaccurate, partial and unscientific; but both books have done service to the cause of Catalonian nationalism.

BALAKIREV, MILY ALEXEIVICH (1 836–1910), was born at Nijni-Novgorod on Dec. **31, 1836** (O.S.), and died at St. Petersburg, May **16/29, 1910.** He began to study music with his mother, later received a few lessons from Dubuque and subsequently was taken in hand by Karl Eisrich, to whom he dedicated his early work for pianoforte and orchestra? a Fantasy on Russian Motives. In his youth he was fortunate also in living with Oulibichev, author of the well-known life of Mozart, who had a private band, from the performances of which Balakirev derived much benefit. At **18.** after a university course in mathematics, he went to St. Petersburg and there attracted attention as a pianist. He made the acquaintance of Glinka, and carried on that musician's influence as a member of the so-called "Nationalist" Russian School, which had sprung up in the 'fifties. Before he was **25** he found himself the acknowledged leader of an important group of his contemporaries, many of whom were destined to be heard of later, including as they did César Cui, Borodin, Mussorgsky and Rimsky-Korsakov. With Tschaikovsky also he was in close relations, although the latter was not actually to be reckoned as one of his disciples. Of his own compositions of this period many were never published, while others, such as the incidental music to *King Lear* and the tone-poem *Russia,* were only published many years after they were written. From the first, indeed, Balakirev appears to have displayed even more desire to promote the cause of Russian music generally than to advance his own individual claims. It mas to this end that he joined in **1862** with Lomakin and Stassov in founding the Free School of Music in St. Petersburg and with the same object that he organized many concerts at which representative works of the younger school were given a hearing unobtainable elsewhere. In **1869** he became director of the Imperial Chapel and conductor of the Imperial Russian Musical Society. He found, however, that official duties were quite incompatible with the development of his own creative powers, and in 1874, therefore, he retired into the country and devoted himself solely to composition, the most important product of his labours being revealed in due course in the shape of his finest work, the symphonic poem *Tanzara.* Although not to be reckoned among the greater masters, and one to be esteemed more for his inspiring influence on others than for his own individual achievements. Balakirev remains none the less a composer to be respected. His output is uneven, but such things as *Tamara,* the pianoforte fantasy *Islamy* and the tone-poem *Russia,* as well as some of his early songs, leave no room for doubt as to his creative powers.

BALALAIKA, a stringed instrument very popular in Russia among the peasants. It has a triangular sound-board to which is glued a vaulted back, forming a body having a triangular hase, enabling it to stand upright. To the body is added a fretted neck strung with two, three or four strings which are generally plucked but can also be swept by the hand to obtain glissando effects.

BALANCE, a generic term designating machines for comparing the weights of two bodies. This article deals chiefly with

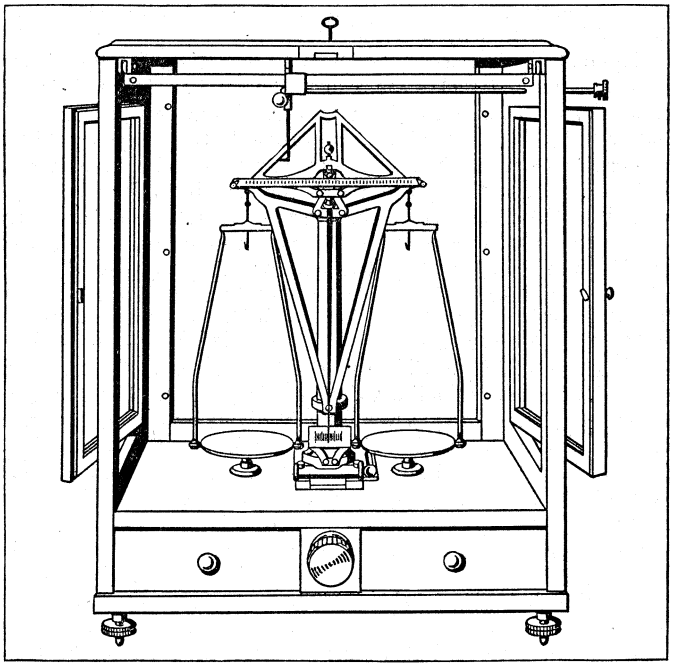
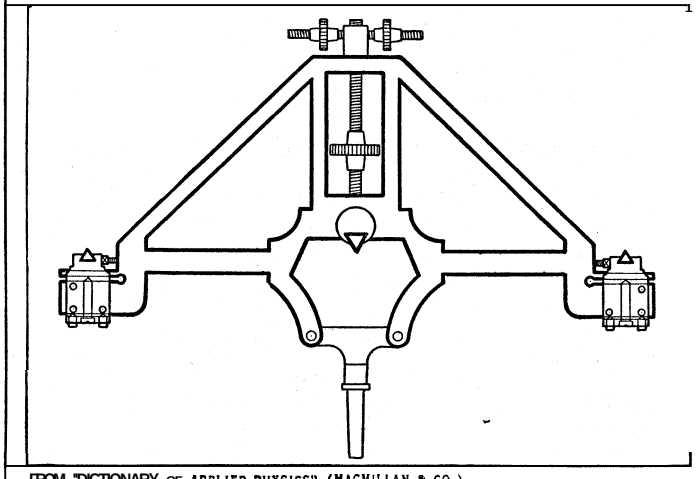


FIG. 1.—ONE OF THE MANY VARIETIES OF EQUI-ARM BALANCE
Essentially the balance is an equal armed beam which turns about a knife-edged fulcrum, while the weighing pans are suspended at the extremities of the beam, eauidistant from the fulcrum. Usually, when not in use. the beam and fulcrum are relieved of their loads by a convenient mechanism as here shown

the equi-arm type treated mainly as instruments of precision. (*See* also WEIGHING MACHINES.)

Of all the instruments used in making precise measurements, the familiar equi-arm balance is one of the most productive of high accuracy. The average type of balance is illustrated in fig. 1.



FROM "DICTIONARY OF APPLIED PHYSICS" (MACMILLAN & CO.)
FIG. 2.— TYPE OF BEAM OF A SENSITIVE ANALYTICAL BALANCE
Instead of the pans being suspended from hooks attached to the extreme ends of the beam, as in Fig. 1., many precision balances have the weighing pans suspended from terminal knife edges

Essentially the balance is an equi-arm lever consisting of a beam, usually of metal, which turns about a horizontal central knife-edge as fulcrum, while the objects weighed are supported on pans suspended at the extremities of the beam from terminal knife-edges which are equidistant from the fulcrum. Normally when the balance is not in use the three knife-edges are relieved of their loads. The balance reading is made by noting the angular swing of ihe beam about its fulcrum, and is ordinarily indicated

by the position, relative to a small fixed scale, of a metal pointer attached to the beam.

Design of Beam.—In order to obtain high sensitiveness of swing, the weight of the balance beam should be as small as possible, consistent with strength, relatively to the loads weighed from its extremities. Experience has shown that a beam about 7in. long is suitable for balances intended to take moderate loads; *e.g.*, up to 200 grams.

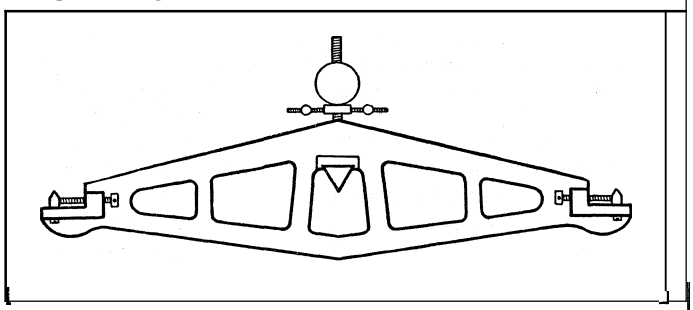


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FIG. 3.— TYPE OF BALANCE BEAM FOR WEIGHING HEAVY LOADS
The general principles under-lying the construction of instruments for weighing heavy loads are the same in most cases as the lighter balances, except that the working parts are heavier and more stoutly constructed

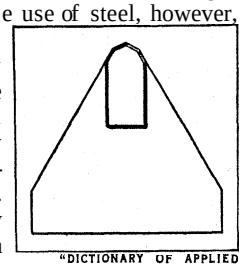
Some typical shapes of beams in general use are shown in figs. 2 and 3.

Balance beams are usually made of brass or bronze suitably covered with a protective coating, but in recent years aluminium alloy has also been employed on account of its low density while the use of invar steel has also been advocated owing to the low thermal expansibility of this material. The magnetic properties of invar however constitute a disadvantage.

In the working condition of the balance the centre of mass of the beam lies slightly below the fulcrum knife-edge. Instability will of course occur if the centre of mass lies above the fulcrum. The smaller the distance of the centre of mass below the fulcrum, the more sensitive is the balance, but the longer its period of swing. Adjustability of working conditions of sensitiveness and period of swing is obtainable by raising or lowering the "gravity bob" on the beam of the balance.

A separate adjustment for poise is also provided so as to enable the reading of the balance, when not loaded, to be brought to a convenient zero or reference mark on the scale.

Knife-edges.— The knife-edges should be straight, so that the load may be applied as nearly as possible along a straight line. They should also be hard and not tarnish. In spite of its tendency to rust, steel is very suitable for the construction of knife-edges owing to the great load it will support. The use of steel, however, for this purpose is exceptional, and apart from commercial balances is generally confined to cases where heavy loads are to be weighed. Agate is now in almost general use for the construction not only of the knife-edges but of the plane bearings which transmit the loads to the knives. Hard alloys, *e.g.*, stellite, are occasionally used for this purpose.



FROM "DICTIONARY OF APPLIED PHYSICS"

FIG. 4.—SECTIONAL VIEW OF AN AGATE KNIFE MOUNTED IN A BRASS TRIANGULAR BLOCK

Fig. 4 shows a sectional view of an agate knife mounted after the usual manner in a triangular brass block for convenient attachment to the beam. The knife-edge is formed by two facets inclined to each other at an obtuse angle. This type of knife-edge has been found to withstand many years' regular usage.

The precision obtainable from the balance depends especially on the accuracy with which the knives are mounted on the beam and adjusted to their correct relative positions. These fundamental adjustments demand much patience. As the central knife is usually first mounted square with the beam. the terminal knife-edges-have to be set parallel to, equidistant from and coplanar with the central one. These conditions are realized, to a moderate degree of accuracy in balances in general. In many balances made for low-precision work, all three knives are fixed to the beam without means of re-adjustment. In the more familiar types of balances used for chemical and technical purposes, the agate plane which bears on a terminal knife-edge is mounted in a metal stirrup which has at its lower end a hook, or an eye-hole, from which the balance pan hangs. This method of suspension has been found sufficiently good for most purposes. Improved methods of suspension have been used for special weighings of the highest precision.

Arrestment.—In general, three portions of the balance require means of arrestment for the purpose of loading or unloading. The central knife of the beam should be raised a short distance out of contact with its bearing plane, and it is desirable to be able to raise the suspension stirrups a little in order to remove the load on the terminal knives. Further, it is usual to provide an arrestment for the pans so as to facilitate loading and unloading, and to steady them, lest by swinging they should interfere with the oscillations of the beam when released. The arrestment should enable the beam and stirrups to be raised so that the respective knives are just clear of their bearing-planes, the margin of clearance being uniform throughout the length of a knife-edge. Clearances as small as one-thousandth of an inch are generally to be desired in all but large balances. It is important that the arrestment and release of the beam, and other parts, should be arranged to be made precisely and consistently each time. The beam, and preferably also the suspension stirrups, should be fixed definitely in position when arrested, and not allowed to have any rotational movement.

As to the mechanical gear for operating the arrestment, a cam controlled by a milled wheel outside the balance case raises or lowers a vertical frame which carries the arresting stops or points. The same motion raises or lowers the pan-supports, which are in good adjustment when they just touch the under surfaces of the pans as the arrestment is completed. It is preferable to design the arrestment so that, on releasing the balance for swinging, the load is transmitted to the terminal knives before the central knife is finally lowered on to its bearing plane. This is achieved in some makes of balance, but is by no means generally found.

Sensitiveness.— It is not possible, within the limits of this article, to give a detailed theoretical investigation showing the extent to which the performance of a balance is dependent on the relative positions of the three knives and the centre of mass of the beam. It can be shown, by considering the equilibrium of the beam under a given loading, that the sensitiveness of the balance, defined as the increase of angular deflection of the beam per unit increase in load on one pan is equal to

$$\frac{l}{Gs+2a(P+Q)}$$

where l = the length of each arm of the balance.
s = the distance of the centre of mass of the beam from the fulcrum.
a = the distance of the fulcrum above the horizontal plane through the terminal knife-edges.
G = the mass of the beam alone.
P = the mass of each pan with suspension stirrup (supposed the same for left and right pans).
Q = the load in each pan.

Further, if K is the radius of gyration of the beam alone about its fulcrum, and g is the value of gravity, a sufficiently good approximation to the complete period of swing of the balance can be shown to be

$$2\pi\sqrt{\frac{2(P+Q)(a^2+l^2)+GK^2}{g\{Gs+2a(P+Q)\}}}.$$

In this expression the small retarding forces due to friction, etc., have been neglected.

The square of the period of swing of the balance is therefore' proportional to

$$\frac{\text{The sensitiveness} \times \text{the moment of inertia of the whole moving system about the fulcrum.}}{\text{The length of beam.}}$$

The conditions of performance of a balance may now be summed up by an inspection of the above formulae:—

The ideal conditions of use of a balance are those in which the three knife-edges are coplanar for all loads placed on the balance pans, since the balance is then equally sensitive at all loads. This condition is not fully realized in practice. Even if the three knives were coplanar when relieved of their load, the slight bending of the beam under load would modify this relation at other loads. The period of swing of the balance will inevitably become slower as the load is increased.

Mode of Employment of the Balance.—It is desirable in choosing a site for a balance, to have a very rigid support (independent of the building foundation where possible) in a room with a pure atmosphere and a very steady temperature. For all accurate work the balance should be as far removed as possible from windows, and all sources of uneven heating. The disturbing effects of a variable temperature distribution inside the balance case are so much responsible for many of the difficulties encountered in accurate weighing, that the ideal conditions of use of the balance for the utmost precision would be to keep the balance case closed throughout the weighings, and to operate and read the balance from a distance. These precautions are practised in certain exceptional cases.

When the balance is first set up, if the component parts, including the arrestment, appear to be in good working order, the operator should test its performance thoroughly before putting it into general use. In some cases the method of weighing adopted will depend on the performance of the balance and its limitations. The sensitiveness and period of swing of the balance should be determined for a number of different loads and different positions of the gravity bob. The position finally chosen for the latter should be that which gives a sensitiveness compatible with the accuracy sought for, together with a suitably short period. Sometimes it may even be desirable to sacrifice sensitiveness in order to obtain a quicker swing. If facilities permit, an optical method of reading the balance may be used to obtain improved precision of observation while retaining a quick period of swing. The degree of equality of the arms of the balance should also be ascertained in order to decide to what extent the method of "single weighing" will suffice to give the required accuracy in certain operations in weighing.

The term "single weighing" implies that the body to be weighed is suspended only from one arin of the balance and poised against known weights operating on the other arm of the instrument, and clearly involves an assumption that the arms are equal. This assumption can always be tested easily by making a "double weighing"; *i.e.*, by seeing how the apparent weight of the body varies according to the arm from which it is weighed. It has been found that the effective lengths of the arms of a good analytical or chemical balance are usually equal to within 1 part in 100,000.

The constancy of the rest point of the balance should also be tested at several loads over a considerable period of time especially at the maximum load taken by the balance. Most balances exhibit small variations in rest point, even at no load, which may be caused by changes in temperature or by fatigue resulting from previous loading. Some observations should also be made on the use of a rider weight with the balance. Usually the graduated bar which holds the rider when in use is arranged to be in the plane through the terminal knives. This is not always the case, but unless it is so, the apparent weight of the rider when placed on the rider bar will depend on the inclination of the beam to the horizontal. The accuracy of graduation of the rider bar should also be tested, especially if it is intended to use relatively large rider weights. In work of the highest precision, it may be necessary to restrict the size of rider employed.

In all work with knife-edge balances, it will be found that the instrument is relatively slow to use. In general, the practice of weighing by the "null" method is followed; *i.e.*, the weights on one pan of the balance are arranged so as to obtain zero deflection of the beam, which is usually taken as corresponding to the position of the pointer opposite the central line of the scale. The realization of the equilibrium position is, of course, facilitated by a prior knowledge of the sensitiveness of the balance in terms of one division of the scale. Alternatively, and often preferably, if the operator has obtained balance with the pointer reading a few divisions away from the centre of the scale, he may calculate from the sensitiveness of the balance the extra loading on one pan necessary to make the pointer read zero.

In cases where the residual errors of inequality of the arms of the balance prohibit the use of the method of "single weighing." the choice lies between "counterpoise weighing" and "double weighing." In the former case, a constant mass is kept on one pan of the balance, and known weights are used on the other pan in addition to that which has to be determined. Weighing is thus made by substitution, and is independent of the length of the arm of the balance, provided that this length remains constant during the series of weighings. In "double weighing," the ordinary single weighing is repeated with the loads interchanged in the pans, the object being to minimize the combined errors due to inequality of the arms of the beam and unevenness of temperature distribution within the balance case. The double weighings may be repeated in the reverse order if for special reasons it is desired to eliminate errors due to changes in rest-point of the balance during the course of the weighings.

Performance of the Balance.—The following table indicates the main characteristics as regards the performance of a standard type of sensitive analytical balance:

Position of the gravity bob.	Load on each pan.	Mass to be added to one pan of the balance to change the rest point through one division.	Period of complete (to and fro) swing of balance.
	grm.	grm.	sec.
Low (most stable)	0	0·0008	13
	100	0·0008	21
	200	0·0008	28
Mean	0	0·0005	17
	100	0·0005	28
	200	0·0005	36
High (least stable)	0	0·0001	33
	100	0·0001	53
	200	0·0001	63

The above particulars refer to a balance in which the rest point is read by a pointer about 10in. long on a scale of which each division measures $\frac{1}{25}$ inch. One division thus corresponds to an angular deflection of the beam equal to about $\frac{1}{5}°$. For such a balance the distance of the centre of mass of the moving system would vary from 0·001 to 0·011in. according as the high or low position of the gravity bob were used.

The period of the balance should be regulated, in consideration of the above table, according to the nature of the weighings to be made, and the accuracy required. The least stable position is often not very useful as, owing to great sensitiveness, the balance cannot be poised unless the loads to be compared have very nearly the same weight.

It is somewhat difficult to give a fair impression of the accuracy attainable in the use of the balance, since in many cases the balance is not used under conditions suitable for maximum accuracy. Under ordinary conditions of use, it may be said that a 100grm. balance weighs to an accuracy of 0·0001 gram. Similarly larger balances will weigh to an accuracy representing one part in a million of the maximum load weighed. Small balances, of the type used in assay work, are capable of weighing to 0·00001grm. in general. These estimates, however, will not hold good unless the weights used in the process of weighing are accurate, and correct allowance is made for the buoyant force of the atmosphere on the objects weighed.

Allowance for Atmospheric Buoyancy.—The upward buoyant force on a body is equal to the weight of air displaced by it; *i.e.*, is equal to its volume × the atmospheric density. The precision to which it is necessary to determine the buoyancy corrections will naturally vary with the conditions of the work For

some purposes it is sufficient to assume an average value of the density of air, but where the atmospheric ,variations must be taken into account (and this is usually the case uhen objects of widely different densities are being weighed) the evaluation of the air density can be made from observed values of pressure, temperature and humidity of the air by use of tables of air density based on accepted average values of the chemical constitution of the atmosphere. In exceptional cases where extreme accuracy is required, it may be necessary to determine the air density experimentally since the chemical constitution of the atmosphere is known to vary slightly from day to day.

Weights.— The process of weighing generally involves the use of some standard in terms of which weight is measured. For this purpose a set of weights is used, though more strictly it should be regarded as a set of standards of mass. since the weight of a material object may vary with the conditions of weighing while the mass may ordinarily be regarded as unvaried, being independent of the conditions of weighing. Standards of mass are more frequently called "weights," and in scientific work generally they take the form of decimally constituted sets of weights, those from 1grm. upward usually being of brass, while the fractions of a gramme are made of platinum, gold alloy, nickel-silver or aluminium. Rider weights, for use on the beam of a balance, may be made of platinum, aluminium or some suitable alloy.

Brass weights are sometimes coated with a metal-plating or a lacquer in order to prevent tarnishing. Lacquered weights. however, absorb moisture from the atmosphere and consequently may vary to the extent of 0·0001grm. for the denominations ordinarily used by chemists. For metal-plated weights, platinizing should be preferred to gilding owing to the softer nature of the latter. The stability of a plated weight depends considerably

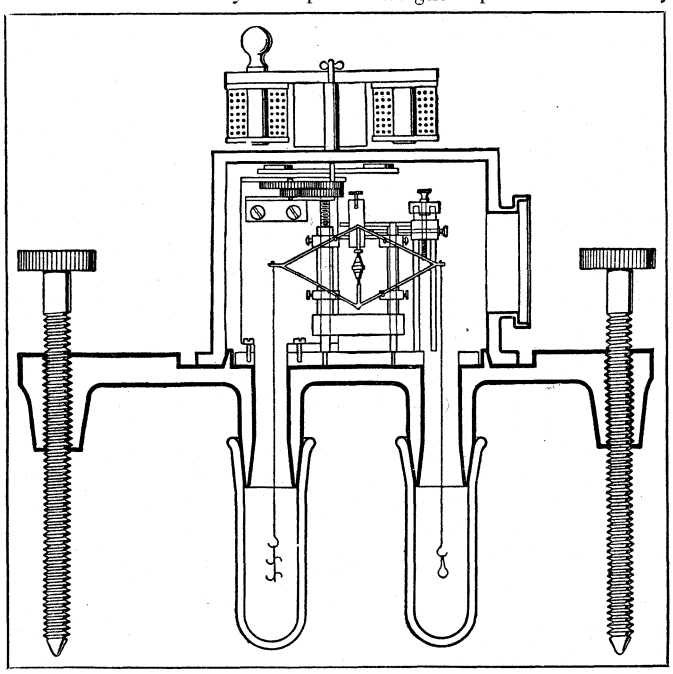


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FIG. 5.—PETTERSSON S TYPE OF QUARTZ MICROBALANCE

Microbalances are used chiefly to determine the density of gases. The balance is usually enclosed in a gas-tight chamber and a change of weight is measured by the chanae in the net buoyant force on the balance due to the gas in which it is suspended

on the method and care of plating. In general, however, platinized brass weights are preferable to non-coated polished ones, and are often used in work of a high accuracy. In some cases where special precision is required even platinized-brass weights may not be sufficiently reliable, and it may be necessary to consider other materials such as nickel-chromium (80% nickel, 20% chromium) which has been used with success for the construction of some laboratory reference standards of mass. Weights of this material are not ordinarily obtainable on the market. Platinum is still regarded as the most stable and suitable metal for use in the construction of the fundamental standards of mass, but its cost limits its use to the construction of relatively small weights.

Torsion Balance.— There is another class of balance, distinct from a knife-edge balance, in which the beam is suspended from a torsion thread so that it can rotate about the axis of the thread, which may be horizontal or vertical according to the purpose of the balance. The torsion method of balancing very small couples appears to have been invented by the Rev. John Michell towards the close of the 18th century. Some of the earlier forms of balances with vertical torsion suspension thread were devised with the object of determining experimentally the gravitation constant and the mean density of the earth. A great advance in the technique of torsion threads generally was made in 1889 by Boys, who developed the method of drawing out quartz fibres and so rendered serviceable a material whose elastic properties are exceptionally suitable for certain types of torsion balances. Balances with beams suspended from a horizontal torsion thread have also been used for weighing small loads.

Microbalances.—For more precise weighings conducted on a small scale, a considerable variety of types of quartz microbalance have been developed in recent years, most of which have been used to weigh to an accuracy very much finer than that generally associated with the most sensitive light assay balances working on the principle of a metal beam with three knife-edges. Microbalances have been used chiefly to determine the densities of gases, particularly of gases which are obtainable only in small quantities. Both the torsion and knife-edge types of quartz balance have been used with success. The balance usually operates in a gas-tight chamber and a change in weight is measured by the change in the net buoyant force on the balance due to the gas in which the balance is suspended, the pressure of the gas being adjustable, and measured by means of a mercury manometer connected with the balance case. In one successful design the beam was suspended from two vertical quartz fibres which take the place of the fulcrum knife-edge used in some of the earlier types. Pettersson has been able to detect differences in weight of only $0{\cdot}25\times10^{-6}$mg. in a load of 250mg

BIBLIOGRAPHY.—The literature concerning balances is somewhat scattered. Detailed articles on balances will be found in the *Dzctzonary of Applied Chemistry* (1921), vol. i. edited by Sir Edward Thorpe, and published by Longmans, Green & Co., London; also in the *Dictionary of Applied Physics* (1922–23) vol. iii., edited by Sir Richard Glazebrook and published by Macmillan, London. Many references are given in these articles. For further information relating to balance work of the highest precision, reference should be made to the various volumes of the *Travaux et Mémoires du Bureau International des Poids et Mesures* (Paris, Gauthier-Villars). *See* also articles on WEIGHING MACHINES, MEASURES AND WEIGHTS; MEASUREMENT.

(F. A. G.)

BALANCEMENT: see BEBUNG.

BALANCE OF POWER, in international relations, such a "just equilibrium" between nations as shall prevent any one of them being in a position to dominate the rest. The principle involved is as old as history, and was familiar to the ancients both as theorists and practical statesmen (see *e.g.,* Polybius, 1. i. cap. 83). In modern Europe it was first adopted as a fundamental maxim of statecraft in Italy, and later, as the conception of the sovereign state superseded feudal principles, everywhere else. Early in the 17th century, when international law began to take shape at the hands of Grotius and his successors, the theory of the balance of power was formulated as a fundamental principle. According to this, the European states formed a sort of federation based on the balance of power, and it was the right and duty of every state to interfere, if necessary by arms, when any of the conditions of the settlement were infringed by any other member of the community (*see* Vattel, *Le Droit des gens,* 1758). This principle was generally accepted. It was the justification of the coalitions against Louis XIV. and Napoleon and the occasion, or excuse, for most of the wars waged between the date of the Congress of Westphalia in 1648 and that of Vienna in 1814.

During the greater part of the 19th century the principle was obscured by the national upheavals which changed the map of Europe; but towards the end of the century it emerged again in the series of alliances and counter-alliances of which the osten-

sible object was to preserve peace. The outbreak of the World War is widely held to have discredited the whole principle of the balance of power. It would be truer to say, however, that the war broke out because Great Britain's attitude up to the last moment was uncertain, and that the balance had therefore not been kept conspicuously even. In any case, as the late Professor Oppenheim pointed out (*Internat. Law* i. 73), so long as there is no central authority capable of enforcing the rules of international law, the only sanction behind them, apart from the uncertain force of public opinion, is the capacity of the powers to hold each other in check. The League of Nations (*q.v.*) is a tentative effort to establish what H. H. Asquith called "a community of power" in place of "the balance of power." It has not been able to prevent, though it has done something to check and regularize, the system of separate alliances. In the United States, it may be added, the principle of the balance of power has always been denounced. This is easy to understand; for, in the expressive language of Secretary Olney, in the Americas "the fiat of the United States is law." The Latin Americans, equally naturally, dream of an ultimate balance.

See David *Hume, Essay on the Balance of Power* (1752); *Fr.* v. Gentz, *Fragments on the Balance of Power* (1806), and generally the standard works on International Law (*q.v.*). (W. A. P.)

BALANCE OF TRADE. This term in economics belonged originally to the period when the "mercantile theory" prevailed, and it is still in use, though not quite perhaps in the same way as at its origin, and the term "balance of payments" has largely taken its place. The "balance of trade" was of old identified with the sum of the precious metals which a country received in the course of its trading with other countries or with particular countries. There was no doubt an idea that somehow or other the amount of the precious metals received represented profit on the trading, and each country desired as much profit as possible. Princes and sovereigns, however, with political aims in view, were not close students of mercantile profits, and would probably have urged the acquisition of the precious metals as an object of trade even if they had realized that the country as a whole was exporting "money's worth" in order to buy the precious metals which were desired for political objects. The "mercantile theory" was exploded by Adam Smith's demonstration that gold and silver were only commodities like others with no special virtue in them, and that they would come into a country when there was a demand for them, according to the amount, in proportion to other demands, which the country could afford to pay; but the ideas in which the theory itself has originated have not died out, and the idea especially of a "balance of trade" to which the rulers of a country should give attention is to be found in popular discussions of business topics and in politics, the general notion being that a nation is prosperous when its statistics show a "trade balance" in its favour and unprosperous when the reverse is shown.

In modern times the excess of imports over exports or of exports over imports, shown in the statistics of foreign trade, has also come to be identified in popular speech with the "balance of trade," and many minds are no doubt imbued with the ideas (1) that an excess of imports over exports is bad, and (2) an excess of exports over imports is the reverse, because the former indicates an "unfavourable" and the latter a "favourable" trade balance. In the former case it is urged that a nation so circumstanced is living on its capital. Exact remedies are not suggested, although the idea of preventing or hampering foreign imports as a means of developing home trade and of thus altering the supposed disastrous trade balance is obviously the logical inference from the arguments. A consideration of these ideas, and of recent discussions about imports and exports, appears accordingly to be needed, although the "mercantile theory" is itself exploded.

TRADE BALANCE AND NATIONAL BALANCE

The phrase "balance of trade," then, appears to be an application of a trader's language in his own business to the larger affairs of nations or rather of the aggregate of individuals in a nation engaged in foreign trade. A trader in his own books sets his sales against his purchases, and the amount by which the former exceed the latter is his trade balance or profit. What is true of the individual, it is assumed, must be true of a nation or of the aggregate of individual traders in a nation engaged in the foreign trade. If their collective sales amount to more than their collective purchases the trade balance will be in their favour, and they will have money to receive. Contrariwise, if their purchases amount to more than their sales, they will have to pay money, and they will presumably be living on their capital. The argument fails, however, in many ways. Even as regards the experience of the individual trader, it is to be observed that he may or may not receive his profit, if any, in money. As a rule he does not do so. As the profit accrues he may invest it either by employing labour to add to his machinery or warehouses, or by increasing his stock-in-trade, or by adding to his book debts, or by a purchase of stocks or shares outside his regular business. At the end of a given period he may or may not have an increased cash balance to show as the result of his profitable trading. Even if he has an increased cash balance, according to the modern system of business, this might be a balance at his bankers', and they in turn may have invested the amount so that there is no stock of the precious metals, or "hard money," anywhere to represent it. And the argument fails still further when applied to the transactions between nations, or rather, to use the phrase already employed, between the aggregate of individuals in nations engaged in the foreign trade. It is quite clear that if a nation, or the individuals of a nation, do make profit in their foreign trading, the amount may be invested as it accrues—in machinery, in warehouses, in stock-in-trade, in book debts or in stocks and shares purchased abroad, so that there may be no corresponding "balance of trade" to bring home. There is no doubt also that what may be is in reality what largely happens.

In another particular the argument also fails. In the aggregate of individual trading with various countries, there may sometimes be purchases and sales as far as the individuals are concerned, but not purchases and sales as between the nations. For example, goods are exported from the United Kingdom, ammunition and stores and ships, which appear in the British returns as exports, and which have really been sold by individual British traders to individuals abroad; but these sales are not set off by any purchases on the other side which come into the international account, as the set-off is a loan by the people of one country to the people or government of another. The same with the export of railway and other material when goods are exported for the purpose of constructing railways or other works abroad. The sales are made by individuals in the United Kingdom to individuals abroad; but there is no set-off of purchases on the other side. *Mutatis mutandis* the same explanation applies to the remittance of goods by one country to another, or by individuals in one country to individuals in another to pay the interest or repay the capital of loans which have been received in former times. These are all cases of the movement of goods irrespective of international sales and purchases, though the movements themselves appear in the international records of imports and exports, and therefore it seems to be assumed, though without any warrant, in the international records of the balance of trade. There is yet another failure in the comparison, The individual trader would include in his sales and purchases services such as repairs performed by him for others, and similar services which others do for himself; but no similar accounts are kept of the corresponding portions of international trade such as the earning of freights and commissions, although in strictness, it is obvious, they belong as much to international trade as the imports and exports themselves, which cannot therefore show a complete "balance of trade."

The illusions which may result then from the confusion of ideas between a balance of trade or profit, and a balance of cash paid or received, and from the identification of an excess of imports over exports or of exports over imports with the balance of trade itself, though they are not the same thing, hardly need description. The believers in such illusions are not entitled to any hearing as economists, however much they may be accepted in the marketplace or among politicians.

The "balance of trade" and "the excess of imports over exports" are thus simply pitfalls for the amateur and the unwary.

On the statistical side, moreover, there is a good deal more to be urged in order to impress the student with care and attention. The records of imports and exports themselves may vary from the actual facts of international purchases and sales. The actual values of the goods imported and paid for by the nation may vary from the published returns of imports, which are, by the necessity of the case, only estimated values. And so with the exports. The actual purchases and sales may be something very different. A so-called sale may prove abortive through its not being paid for at all, the debtor failing altogether. In any case the purchases of a year may not be paid for by the sales of the year, and the "squaring" of the account may take a long time. Still more the estimates of value may be so taken as not to give even an approximately correct account as far as the records go.

MANY FACTORS OF THE BALANCE

The number of factors to be introduced into a "balance of trade" to make a complete account or "balance of payments" is considerable. Formerly, aiter accounting for all items of visible and invisible exports and imports, the net balance of the account was left to be regarded as settled by the import or export of gold, after allowing for any short term borrowing or "lag" in settlement of accounts. But the practice has now grown up of including all monetary items and attempting an exact balance, without any statistical residuum. This leads to an effort toward a new degree of precision.

For a long time international comparisons have been vitiated by differences in presentation and collection of statistics. A special sub-committee of the International Chamber of Commerce in April, 1927, drew up a uniform model to clear up the confusion, using as their basis the classification adopted by the economic and financial section of the League of Nations in their attempts to collect and publish balance of trade and balance of payment statistics from the various governments. This model in detail is as follows:—

I. Merchandise

1. (a) Merchandise, including silver bullion, exported (as per trade returns, including fish sold in foreign ports and analogous sales of commodities not already, included in statistics of exports).
   (b) Sale of ships.
   (c) Parcels post.
2. Adjustment for under or over-valuation of (1):
   (a) To arrive at f.o.b. value.
   (b) To convert "official" values which may relate to a prior date, to current "market" values.
   (c) To correct bias in traders' declarations, *e.g.*, where there is a tariff.
   (d) To include exports (or imports) of commodities under Government auspices (*e.g.*, reparation deliveries in kind) which do not appear in the regular trade returns.
   (e) To adjust the statistics to agree with the political territory (*e.g.*, mother-country, excluding colonies).
3. Contraband.

II. Bullion, Specie and Currency Notes

4. Gold bullion and gold specie exported (as per trade returns).
5. Specie (other than gold) exported (as per trade returns).
6. Currency notes not elsewhere indicated, exported.
7. Adjustment for under or over-valuation of (4) and (5) in order to arrive at the commercial value f.o.b.

III. Business Services to Foreign Countries

A. Transport Services:
8. Shipping freights, charter money, passage money and similar earnings, received by national ships on account of all foreign trade.
9. Port receipts from foreign shipping in national ports.
10. Transport and other charges received for foreign goods transshipped or in transit (if not included in Group 1., Nos. 1 to 3).
11. Post and telegraph and telephone earnings, not elsewhere indicated.

B. Trading Profits and Brokers' and Merchanting Commissions:
12. On exports and re-exports not included in f.o.b. price.
13. On commodities not entering into the country's imports or exports.

C. Banking and Financial Services:
14. Acceptance commissions.
15. Discount on foreign bills.
16. Commissions on issues of foreign loans.
17. Profits on exchange transactions.
18. Bank interest.

D. Insurance Services.
19. Insurance services.

IV. Interest

20. Interest received on foreign Government and municipal loans.
21. Other interest and dividends received from capital invested abroad.

V. Other Current Items on Private Account

A. Immigration and Emigration:
22. Funds brought in by immigrants and returned emigrants.
23. Remittances by emigrants.

B. Receipts from foreign tourists and travellers.

C. Charitable and educational donations from abroad.

D. Other current items.

VI. Government Transactions

A. Diplomatic consular and other expenditure.
24. By foreign governments.
25. By colonies.

B. Receipts in respect of loans paid direct to the home Government:
26. By foreign governments.
27. By colonies having the same monetary unit.
28. By colonies with monetary unit different from the Mother-Country.

C. Home Government receipts in respect of reparations.

D. Other receipts from abroad by the home Government.

VII. Capital Transactions

29. Receipt of payments on account of amortization of foreign Government and municipal loans:
   (a) Repayment of bonds at maturity.
   (b) Sinking fund operating for repayment of bonds.
30. Receipt of payments on account of amortization of other loans:
   (*a*) Same as 29.
   (*b*) „ „ 29.
31. Existing domestic securities sold to abroad (excluding if possible domestic securities purchased abroad by own nationals).
32. Foreign securities resold abroad.
33. Export of new domestic securities on account of new loans floated abroad.
34. Domestic real estate sold to foreigners.
35. Other foreign capital invested in . . .

VIII. Balancing *Items*

A. Increase of current short-period indebtedness.
36. Increased foreign deposits in home banks.
37. Increased foreign holdings of bills.
38. Increased commercial debts due to foreign nationals and outstanding not included in above.

B. Unexplained discrepancy between total credits and total debits.

A study of the above shows more clearly than any lengthy description the nature of the problem. The movements of gold are fairly well known, and the residual or balancing figure now tends to be the foreign investment items.

BRITISH AND AMERICAN STATISTICS

In spite of the practical differences which such estimates involve, the study of this question has received a remarkable amount of attention since the World War. Official estimates for the year 1923 or 1924 have been prepared by 1; governments, the most elaborate being those of the United States of America. For this country very detailed statements, official or non-official, have been compiled since 1919. These are summarized in the first table on p. 956.

The statement renders clear the manner in which the enormous net exports of the earlier years, largely to Europe, were covered by long-term loans and short-term credits, how the floating credits are being gradually liquidated, and how the export surplus itself sank from over $4,000,000,000 in 1919 to $389,000,000 in 1923. The increase of this surplus in 1924 was coincident with the revival of capital export to Germany in particular.

In 1926 very considerable revisions were made in the more recent estimates of the British balance of payments. The united figures for 1924 and 1925 and the preliminary estimate for 1926 appear in the second table on p. 956.

United States: Balance of Payments (Millions of Dollars)
(Credits+ Debits—)

	1919.	1920.	1923.	1924.	1925.	1926.
Exports of merchandise (net)	+4,016	+2,950	+389	+970	+666	+426
Exports+ and imports— of silver (net)	+152	+26	−2	+36	+168	+22
Exports+ and imports— of gold (net)	+160	−50	−294	−258	− 62	−138
Export of U.S. currency (net)	+91	+103	+50	−50		
Interest on foreign investments (net)	+50	+50	+417*	+464†	+515	+688
Ocean freight payments (net)	+93	+93	−8	+8	−8	−62
Miscellaneous invisible and current items	−2,375	−305	−19	−5	+70	+56
Immigrants' remittances, charity and tourist expenditure (net)	−650	−850	−760	−855	−920	−979
Foreign loans paid off	+515	+571	+23	+45	+140	+ 470
Sales of securities to foreigners	..	..	+412	+319	+411	+298
Repayment of principal of debts to U. S. government and miscellaneous current credits	..	..	+91	+23	+27	+67
Foreign investment of American capital	−970	−1,445	−417	−909	−1,010	−1,357
Excess of credits+ and debits— on all transactions	+1,082	+1,143	−118	− 212	−3	−509

*Includes interest received by U.S. Government from foreign governments.
†In 1921 and 1922 the balances were respectively —228 and —308.

In conclusion it may be useful to repeat the main propositions laid down as to the balance of trade. (1) A "balance of trade" to the individual trader, from whose experience the phrase comes, is not necessarily, as is supposed, a balance received or receivable in the precious metals. It may be invested as it accrues—in machinery, or warehouses, or stock-in-trade, or in book debts, or in stocks and shares or other property outside the trader's business, as well as in cash. (2) What is true of the individual trader is also true of the aggregate of individuals engaged in the foreign trade of a country. Cash is only one of the forms in which they may elect to be paid. (3) The imports and exports recorded in the statistical returns of a country do not correspond with the purchases and sales of individual traders, as the sales especially may be set off by loans, while the so-called imports may include remittances of interest and of capital repaid. (4) When capital is repaid the country receiving it need not be living on it, but may be investing it at home. (5) The foreign trading of countries may also comprise many transactions, such as the earning of freights and commissions, which ought to appear in a vroper account showing a balance of trade, as similar transactions appear in an individual trader's account, but which are not treated as imports or exports in the statistical returns of a nation's foreign trade. (6) Import and export returns themselves are not the same as accounts of purchases and sales; the values are only estimates, and must not be relied on literally without study of the actual facts. (7) The excess of imports or exports may vary indefinitely at different times according as a creditor country is receiving or lending at the time, or according as a debtor country is borrowing or paying off its debts at the time, but the permanent characteristics are always to be considered. (8) Governmental obligations for international loans (interest and repayment of capital) and reparations, are now an important addition to the account.

(R. GI.; J. S.)

United Kingdom: Balance of Payments (in Millions of Pounds)

	1924.	1925.	1926.	1913.
Excess of imports of merchandise and bullion	324	384	477	146
Excess of government payments made overseas	25	11	..	..
Total	349	395	477	146
Estimate:				
Set income from overseas investments	220	250	270	110
Net national shipping income	140	124	120	112
Short interest and commissions	60	60	60	
Otherservices	15	15	15	80
Total invisible exports on balance	43j	449	46j	302
Available for investment abroad	86	54	12	156
Sew overseas issues on London market in year	134	88	112	..

BALANCE SHEETS. A balance sheet is a summary of the balances remaining in the books of a business after those books have been closed by preparing and completing a proper revenue or profit and loss account. If the accounts have been properly prepared, the vital distinction between revenue items and balance sheet items will have been made; but if any balances have been wrongly excluded from the revenue account on either side, they will necessarily come into the balance sheet, and conversely any balances wrongly included in the revenue account will necessarily have been omitted from the balance sheet. Hence, it is difficult to criticize a balance sheet intelligently in the absence of the revenue account, and vice versa.

Not a Valued Statement.— If the balance sheet is properly compiled, those ledger balances included are in the nature of assets or liabilities. But a balance sheet does not profess to be a valuation of all the outstanding possessions of an undertaking on the one hand, set off against the liabilities and various kinds of obligations on the other. If one were to attempt year by year to revalue all the assets of a concern, the result would be to introduce into the balance sheet a number of alterations in value which, as a matter of book-keeping, would have to be treated as profits or losses, but which would have nothing whatever to do with the actual business of the undertaking. For example, an increase or decrease in the value of the premises in which a business is being carried on has no bearing on the earning capacity of the business. In fact, although it may be exceedingly difficult, if not impossible, to arrive at exact figures, the value of all kinds of property is subject to more or less continuous fluctuations. To include these fluctuations in the revenue account would be to render that account useless as a means of measuring the earning capacity of the business. An accurately compiled revenue account is essential for the information of those responsible for management. Hence, it becomes necessary in practical accounting to ignore these extraneous fluctuations, and in consequence to present a balance sheet which is not a valuation statement of assets and liabilities, but something very much more conventional.

It is usual for balance sheets to be prepared annually, and save in the case of quite unimportant concerns owned by private individuals or partnerships, it is usual for the accounts to be audited, and for the auditor to report upon the balance sheet submitted. In the case of public utility concerns, the law usually requires the accounts to be submitted in a prescribed statutory form, but there is no statutory form for the accounts of ordinary commercial concerns. Opinion is divided as to whether so much latitude is altogether desirable.

Balance Sheet a Summary.— A balance sheet is never a complete list of all the ledger balances that constitute it, but always a summary of those balances. Hence it follows that its value must depend to a large extent upon the way in which that summarization has been performed. Little or nothing is lost by grouping together similar items under a common heading, but a great deal is lost if wholly dissimilar items are grouped together under one heading without any indication of their relative importance. A very large

number of balance sheets of public companies are open to criticism upon this ground; in particular, a balance sheet must be unsatisfactory if it fails to distinguish quite clearly between what are called *fixed* and *floating* items.

"Fixed" and "Floating" Items.—What are technically known as fixed items are those which, in the ordinary course of events, are not continually changing, while floating items are those which, in the ordinary course of events, are continually in a state of flux. Fixed liabilities comprise the capital of the undertaking, any debenture debt that there may be, and any undivided profits which it is not intended to divide in the near future, *i.e.*, those liabilities, the payment of which has not to be provided for, at least for the time being. Floating liabilities, on the other hand, are those which in the ordinary course of business will fall due for payment at more or less fixed dates in the near future, the due payment of which has to be provided for if the undertaking is to continue in business. As regards assets, fixed assets are those which, in a broad sense, represent the equipment of the undertakings: the possessions which it owns with the object of continuing to hold them in their existing form, and to use them as a means, directly or indirectly, of making profits. They are held for use. The floating assets, on the other hand (apart from cash balances) are those which in the ordinary course of business it is the aim of the undertaking to convert into money with all convenient speed, making a profit in the process. Normally, the due payment of floating liabilities as they fall due can only be provided for by the liquidation of the floating assets; hence the ability of the undertaking to convert its floating assets into money sufficiently quickly to enable it to meet its floating liabilities as they fall due, is of vital importance. Thus no balance sheet can be regarded as satisfactory which fails to disclose quite clearly the full extent of the floating assets and liabilities.

Depreciation.—But because the fixed assets of an undertaking are not intended for sale, but rather for use, their precise realizable value at any given moment is comparatively unimportant, so long as there is always a sufficiency of floating assets to meet the floating liabilities as they fall due. Accordingly it is quite legitimate to treat fixed assets as outlays which affect current profits only in the sense that probably they will not for ever continue to be equally useful as equipment and will, therefore, from time to time, require to be replaced by others. The usual—and by far the most convenient—way of regarding fixed assets is to treat them as outlay to secure the temporary purpose of providing the necessary equipment, the cost of which must accordingly be treated as a working expense chargeable against the profits of the undertaking during the time they are in use. If the whole of the outlay on the original equipment had been exhausted before the balance sheet were prepared, the whole of such outlay would, of course, be charged against current profits. If only a part of the outlay has been exhausted, it follows that a corresponding part should be charged against the profits, to the earning of which it has contributed. When due provision is made for the depreciation of equipment it has this effect, and from year to year that portion of the original outlay not as yet charged against profits is carried forward in the balance sheet to be dealt with in future years. In this way the whole outlay is equitably apportioned over the series of years during which the equipment is in use, but the amount included in successive balance sheets does not profess to be the then realizable value of the equipment then in existence. For obvious reasons it is important to arrive at the most accurate statement of profits year by year, but it is by no means equally important year by year to arrive at an accurate realizable valuation of property which there is no intention of realizing.

BALANCE SHEET, 31ST DECEMBER 1927

Liabilities	£		*Assets*	£
Share Capital (100,000 shares of £1 each)		100,000	Goodwill	20,000
Reserve Fund		25,000	Business Premises, Plant, Machinery, etc.	44,000
Sundry Creditors		24,750	Stock-in-Trade and Work in Progress	28,750
Profit & Loss Account:			Sundry Debtors	35,000
Balance from 1926	£18,750		Investments	25,000
Dividends paid	12,500		Bank	22,250
	6,250			
Net profit for 1927	19,000			
		25,250		
		£175,000		£175,000

Extent of Information Supplied.—The *pro forma* balance sheet here shown is not supposed to represent a "model" balance sheet, but rather one typical of the practice at present usual among public companies. It will be observed that, without stating why, it suggests that there are assets worth a total of £175,000. No indication is given of how these figures are arrived at. For reasons already stated it is not reasonable in all cases to assume that the figures attached to the various items of a balance sheet represent in the view of the accounting parties their respective current realizable values; but it is submitted that, if the published balance sheet is to serve any useful purpose, the basis of valuation should be stated in each case. It is further suggested that as regards floating assets, and particularly stock in trade and work in progress, it would be an advantage if the identity of the individuals respectively responsible for the figures were to be stated. If that were done, it is possible that the responsible parties might take their duties somewhat more seriously. Certainly, it could do no harm. Similarly, as regards the sundry debtors, those responsible for making provision for bad and doubtful debts might very well be mentioned by name; and in the case of investments, it would always be advantageous to know whether these are included in the balance sheet at cost price, at current market price, or at what other figure.

Reserves.—On the truth of the figures attached to the various items on the assets side of the balance sheet must inevitably depend the truth of the figures put against the items reserve fund and profit and loss account. The true significance of the former is not always understood. A reserve fund is merely profits which have been set aside, or reserved, from immediate distribution by way of dividend. It is impossible for a company to protect its reserve fund from all possibility of subsequent loss. If anything happens to impoverish the concern the first thing to go is, of course, the balance of undivided profits as appearing on the profit and loss account. When this has been exhausted, if further losses occur the reserve fund must necessarily be reduced. It is normally a good practice for companies to acquire investments to an amount equal to their reserved profits; but this practice does nothing to protect the reserve fund itself against loss if anything happens to reduce the aggregate value of the assets as a whole. All that it does is to keep a corresponding amount of the company's resources in liquid form, available to be turned into money at short notice to meet any urgent need. Conversely, if the true value of the assets of the concern in question exceeds £175,000, the true extent of its undivided profits is to a corresponding amount in excess of that stated on the face of the balance sheet, and such excess is sometimes called an *internal reserve* or *secret reserve*. Similarly, if the actual amount of the liability to creditors is less than the balance sheet shows, there is a secret reserve in existence of a corresponding amount. Most successful companies have fixed assets actually worth more than the figures set against them in the balance sheet, and the provision for outstanding liabilities is commonly upon the generous side. Usually, therefore, a successful concern has in fact a secret reserve.

Foreign Balance Sheets.—In Latin, Teutonic and Scandinavian countries it is usual to present balance sheets showing assets upon the left-hand side and liabilities upon the right-hand side, and the items are often shown in considerably greater detail than is usually the case in Great Britain and its dependencies.

The British practice is based upon the form that a balance sheet would naturally take if one were to open a new set of books in connection with an established business, whereas the Continental and South American practice is based upon the form that a balance sheet would take if at the end of the financial period the balances remaining after the completion of the revenue account were to be transferred to another account, called *closing balance* or *balance de sortir*. If, however, the books be literally

"closed" in this way at the end of the financial period, they must necessarily be reopened at the commencement of the ensuing period, thus giving rise to a second "opening" balance sheet, which would take the form of the balance sheet customary in this country. It is submitted that inasmuch as books must be "opened" before they can be "closed," if the duplication of balance sheets is to be dispensed with, the form of the opening balance sheet is the more reasonable form to retain in current use.

See F. W Pixley, *How to Read a Balance Sheet* (1937 ed.); L. R. **Dicksee,** *Published Balance Sheets and Window Dressing* (1927); P. Tovey, *Balance Sheets* (1937). *See* also BOOKKEEPING. (L. R. D.)

UNITED STATES

There are some differences in the balance-sheet, in regard both to principles and to practice in the United States, as compared with that in Great Britain. These will be commented on under the three heads: (1) form; (2) content; and (3) interpretation.

Form. — In the United States the usual introduction to the study of accounting and to the principles of debit and credit, on which it rests, is through the medium of the proprietorship equation. This equation is used as a concrete definition of the balance-sheet element, net worth or proprietorship. The equation is usually stated in the following form: Assets—Liabilities=Proprietorship. Very frequently, particularly for internal use within the business. the manner in which the formal balance-sheet is drawn up follows the order and the mathematical relationship indicated by this equation. This is known as the report form of balance-sheet. Under this form, following the full title and date, the assets are shown first in accordance with whatever classification is adopted; then, beneath the assets are shown the liabilities, similarly grouped, the two group totals for assets and liabilities being extended into a free money column to the right. The third group or element of the balance-sheet, proprietorship, is then shown underneath the liability group and the total of the net worth is extended into the same column with the totals of assets and liabilities, the total net worth being the difference between the total assets and total liabilities. In this way the mathematics of the balance-sheet is shown by means of a vertical set-up of the elements on the page.

The other form of balance-sheet known as the account form as distinguished from the report form, is built up in accordance with the same basic equation; it is expressed, however, in the following form: Assets=Liabilities+Proprietorship. In the United States, as is generally true elsewhere, most balance-sheets issued for the purpose of publication are drafted in the account form. Under this form the right-hand elements, namely, liabilities and net worth, are frequently intermingled. The tendency at the present time is, however, to segregate the group of liabilities from the net worth group and secure totals for these separate groups just as is done in the case of the report form. It is customary here to show the assets on the left-hand side and liabilities and net worth on the right-hand side. Within these main groups practice varies as to the showing of the classified sections. If there is any prevailing practice it can be said to rest on the probable use to be made of the balance-sheet. In those concerns where the balance-sheet is used mostly for presentation to the banker as a basis for the granting of short term credit, it is customary to show the classified section containing the current assets first. This will then be follo ed by the fixed assets, and a similar arrangement as between current and fixed will be followed in the set-up of the liabilities. In other concerns, such, for example, as railroads and large manufacturing enterprises where the investment in fixed assets is very large compared with that in current assets, the fixed assets are frequently shown first on the balance-sheet, followed by the current. In such cases on the other side of the balance-sheet, when set up in account form, the capital stock item may be shown first, along with the bonds and other fixed liability items, in an effort to show the sources of the investment in exact juxtaposition with the properties acquired by that investment. When this is done, the final item of the proprietorship element, namely, surplus, appears as the last item on the right-hand side of the balance-sheet, and is thus separated from the other proprietorship element, capital stock. However, there is a rather decided trend to show in all balance-sheets, regardless of the purpose for which they are drawn up or the character of the company, the current assets and liabilities first, followed by the fixed assets and liabilities, and an entirely separate group for the showing of the proprietorship element.

Accounting in the United States has had a development which has been remarkably free from legal requirements. The Interstate Commerce Commission, a body of the Federal Government having general supervision over the interstate railways and other agencies of interstate commerce, has been given authority to prescribe accounting methods and forms. Accordingly there is an established form of balance-sheet for common carriers in accordance with which all reports to the Interstate Commerce Commission must be set up. This requirement does not prevent a railroad company from publishing its balance-sheet for other purposes in whatever form it sees fit, although such practice is becoming more and more rare. Similarly, the Public Utilities Commissions of the various States have similar forms in accordance with which reports must be made to them by the various public utility companies under their jurisdiction. There is also a very decided trend toward uniformity in connection with various trade associations. Some 150 of such associations have developed, or are undertaking to develop, uniform methods of accounting applicable to the entire industry. Such developments have resulted in the adoption of uniform balance-sheets and operating statements, the purpose of which is to provide for the building up of statistical data on a truly comparable basis. It should be noted that such uniformity is wholly voluntary on the part of the members of the associations or other users of the uniform statements. (See COST ACCOUNTING.)

Content. — In connection with the content of the balance-sheet, two basic problems are involved. One relates to the items which shall be admitted to the balance-sheet, the other to the valuation basis on which they shall be admitted. It may be said briefly with regard to the first that all properties owned and all liabilities incurred relative to a particular business entity should be shown in its balance-sheet. In a great many instances even what are known as contingent assets and contingent liabilities are shown by incorporation in the content of the balance-sheet, although these are frequently appended as foot-notes. Such items are typified by forward sales orders, that is, sales orders received for future delivery of goods, and purchase commitments covering goods bought but not yet received.

As to the valuation basis of the items admitted to the balance-sheet, this rests largely on the uses to which the average balance-sheet is to be put. At present time the chief use made of balance-sheets is as a basis for the granting of short term credit, or for the determination of the degree of solvency of the concern. By solvency is meant the ability of a business to pay its debts as they come due. For this purpose the current assets and liabilities are chiefly used, little attention or value being given to the fixed assets and liabilities. Accordingly, the principles of valuation applied to the current assets rest upon the assumption that these assets are to be used chiefly for the payment of the current debts falling due within, say, the next twelvemonth. This requires the valuation of the current assets on an extremely liquid basis. It may be said, therefore, that such assets are, with certain limitations, to be valued in accordance with their cash realizable value. That is, they should be stated at such values as represent, on the part of those best qualified to judge, the estimated amount of cash which will be realized when they are converted into cash. Accordingly, the accounts and notes receivable are stated, not at book value, but at such value less the estimated amount of loss through inability to collect. Similarly, current investments are usually to he valued on the basis of their cash realizable value on the date of the balance-sheet. Merchandise is usually valued on the basis of cost, or replacement cost, whichever is the lower, although that basis is not looked upon as entirely satisfactory in a great many cases. The fixed assets, because little regard is paid to them in the ordinary uses of the balance-sheet, are valued on the basis of cost less accrued depreciation to date. Seldom is any effort made to have the fixed assets reflect their true present value in accordance with the price trend at a given time. Thus, the standard practice results in a balance-sheet statement which does not reflect the

present worth of a business, as distinct from its net worth, which is determined on the valuation basis referred to above. A physical appraisal of the properties becomes necessary to determine the present value of a business.

Interpretation. — There is a decided trend at the present time, on the part of accountants, towards paying much more attention to the interpretation of balance-sheets than has been paid in the past. Very few business executives know how to read a balance-sheet intelligently. The accountant, who realizes better than any one else the way in which the items on the balance-sheet have been built up, is in a position to interpret them more readily than any one else. Accordingly, a great many accountants to-day are not satisfied merely with drawing up a balance-sheet and letting it speak for itself, but insist upon indicating in their reports the significant facts which an intelligent reading of the balance-sheet brings to light. Such items as the sufficiency of valuation reserves, the reserve for doubtful accounts and the reserve for depreciation; the sufficiency of the working capital employed in the business; the relationship between borrowed capital or funds and the owner's investment in the business; the relation of current assets to current liabilities — these are some of the more patent things about which the balance-sheet gives information and which certainly should be called to the attention of the owners. More and more there is a tendency to relate the interpretation of the balance-sheet to the position in the business cycle, and also to the price trend, as evidenced by price index numbers. All of this requires, on the part of the accountant, a grasp of the broad underlying economic condition of the country and also a knowledge of the basic conditions in the particular industry. Without such knowledge a really sound and discerning interpretation of the balance-sheet is not possible. Some accountants even go so far as to insist that the balance-sheet should reflect present valuations in both the current and fixed assets. Because of the relatively rapid turnover of merchandise and accounts and notes receivable, those items are for the most part valued on a basis which is fairly close to the current price level. The value of the fixed assets, particularly those with long lives, may be very far removed from a present valuation basis. Accounting methods have been devised whereby both the present value and the original cost value may be shown on the same balance-sheet and these present values incorporated in the books of account without disturbing the statement of operations of the business. While a good deal of research has been conducted in this direction, the matter is an extremely controversial one.

As to the frequency with which balance-sheets are prepared, there is an increasing trend toward the monthly balance-sheet. A great many concerns. particularly manufacturing and large retail establishments, use monthly balance-sheets for internal guidance.

See H G Stockwell, *How to Read a Financial Statement (1926);* C. B. Couchman, The *Balance Sheet* (1924); R. B. Kester, *Accounting Theory and Practice,* vol ii. (1933). (R. B. K.)

BALANOGLOSSUS, the name given by the Neapolitan naturalist, Delle Chiaje, to certain fragmentary specimens of a marine creature brought to him by a fisherman about 1820. The creature would be termed by any ordinary person a "worm" as it is soft bodied, without legs or other appendages and burrows in sand or mud at the bottom of comparatively shallow sea. The body is somewhat flattened and produced into a lobe or flap on each side and hence Delle Chiaje thought it looked like a tongue; but in front there is a pointed salient portion issuing from a collar-like ring, and this reminded Delle Chiaje of a barnacle (*q.v.*), hence the name, which literally means "barnacle-tongue."

Subsequently researchers into antiquarian zoology discovered that four years previous to the publication of Delle Chiaje's work in 1829 a Russian naturalist, Eschscholtz, had described a similar "worm" from one of the Pacific islands and had called it Ptychodera. Eschscholtz had mistaken the "worm" for a sea cucumber and his discovery attracted no notice at the time and was forgotten. Delle Chiaje's description however awakened interest and drew the attention of many other observers; the "worm" proved to have many startling features in its anatomy. The name Balanoglossus had thus become firmly embedded in zoological literature when it was stated Ptychodera must be used instead,

In time "worms" like these were found all over the world in the warm and temperate zones, wherever suitable conditions of muddy sand existed; they differed in the proportions of the various parts of the body. Delle Chiaje's old genus eventually became an order. The difficulty created by the historiographers was then partially got over by using both the names Balanoglossus and Ptychodera for two of the genera into which the old genus was divided. The name Balanoglossus has been retained also as a popular appellation for the whole group and in that sense it will be used in this article.

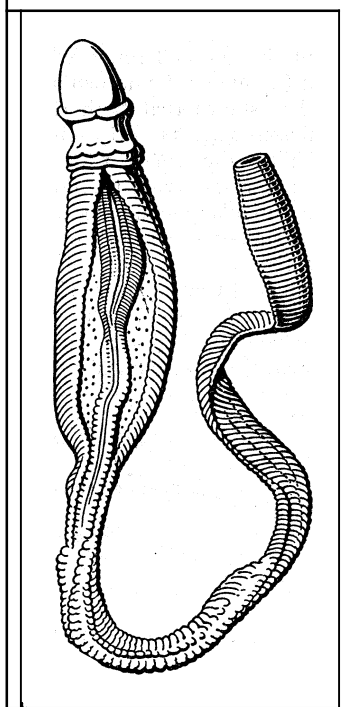


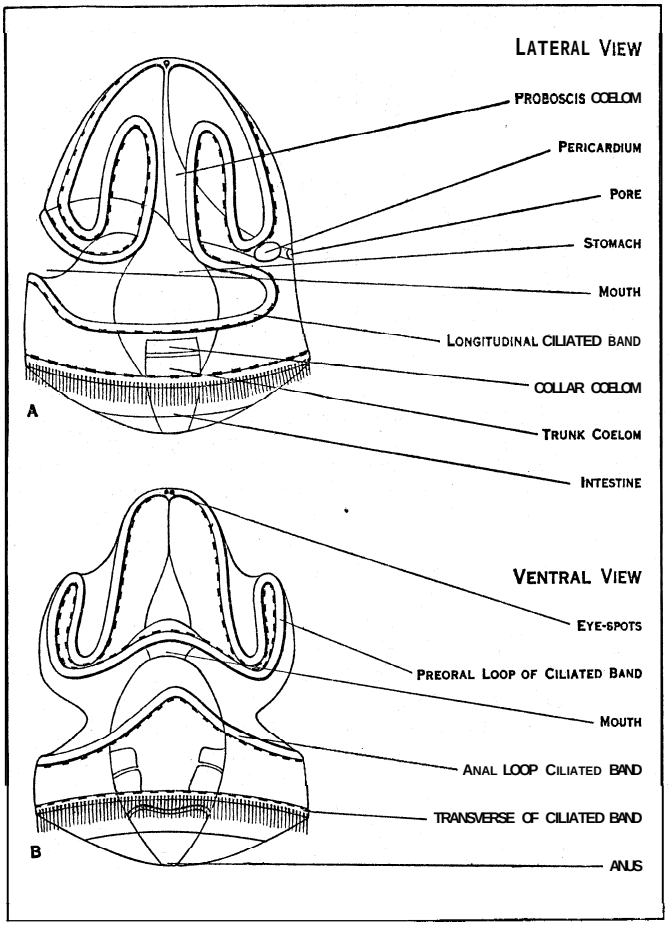
FIG. 1 — THE BALANOGLOSSUS IS A MARINE BURROWING WORM RELATED TO THE VERTEBRATES

The body of these worms is divided into three regions, as shown in fig. 1, which represents Eschscholtz's Ptychodera. In front is the conical projection now termed the proboscis and which was Delle Chiaje's barnacle. Behind it comes the "collar" region and behind this the long trunk In the genus Ptychodera this is produced at the sides into two great flaps, but in Balanoglossus (*sensu stricto*) these are absent. In every species however along the upper surface of the trunk in front there are found two long rows of pores which penetrate right through the alimentary canal. Nothing like these is known anywhere else in the animal kingdom except the gill-slits of fish and other aquatic vertebrates.

Balanoglossus resembles in its food and mode of life many burrowing creatures of widely dissimilar structure, amongst others the common lugworm and earthworm. Feeding and movement are essentially the same operation. As it burrows, it swallows the muddy sand and extracts the organic matter. Its mode of motion, however, is peculiar; the proboscis possesses a single pore and the collar a pair of ciliated pores. By these water is sucked in and the cavities of these regions distended. The muscles of these stiffened parts then wriggle and drag the passive trunk after them.

The reproductive organs are mere groups of cells situated in the sides of the trunk — in the flaps when these are present. The cell masses when ripe burst to the exterior, making their own openings — just as boils do in the human body. The sexual cells are discharged into the sea, their union being left to chance. From the fertilized egg there is developed an extraordinary larva, the tornaria, which strikingly resembles the larva of an Echinoderm (*q.v.*) and indeed was mistaken for such by its discoverer (Johannes Müller). This larva (fig. 2) is of glassy clearness. It possesses a gut consisting of gullet, stomach and intestine. The anus is at the posterior end of the body but the mouth lies on the under surface far behind the front end. Its movement is made by a peculiar folded ridge of skin which carries long cilia. This ridge is shaped roughly like an H, the sides of which run from anterior to posterior ends of the larva; whilst on the central surface deeply enfolded cross-pieces run backwards on the lobe in front of the mouth and forwards in front of the anus. In addition there is an independent ring of cilia round the hinder end. In front of the mouth there is a thin walled cellular vesicle which communicates with the exterior by a pore on the dorsal surface. This vesicle is of similar character and origin to the peritoneal vesicle of the Echinoderm larva (see INVERTEBRATE EMBRYOLOGY) and it becomes the cavity of the proboscis of the adult, still communicating with the exterior by a pore. Behind it lies a pulsating vesicle or "heart" and a similar vesicle is found in the Echinoderm. A pair of peritoneal vesicles is developed, as the larva grows older, in the collar regios between the gut and the skin, and

another such pair in the trunk. The pulsating vesicle persists as the pericardium and heart in the base of the proboscis. There seems to be no escape from the conclusion that Balanoglossus and the Echinodermata are widely divergent offshoots from the same stock. But is Balanoglossus really related to the Vertebrata and does it therefore form a link between these two great groups? Now in all Vertebrata besides the gill-slits, which even in land animals appear during embryonic life, there are two other distinguishing features, viz., (1) the notochord, a gelatinous rod developed from the mid-dorsal cells of the gut-wall round which the "vertebrae" are later built up; and (2) above the notochord a hollow tubular nerve cord. Bateson has shown that both these structures are represented in Balanoglossus (fig. 3), although restricted to the collar and neck, joining the collar with the proboscis. The notochord is a hollow outgrowth from the dorsal wall of the gut, surrounded by a tough cuticular membrane, especially underneath; it projects into and supports the neck of the proboscis. The nervous system over the whole surface of the proboscis and along the mid-dorsal and mid-ventral lines of the trunk is a mere plexus or nerve net lying at the base of the skin, but in the collar it is a deeply embedded tube opening to the exterior in front and behind. Subsequently it was shown by the



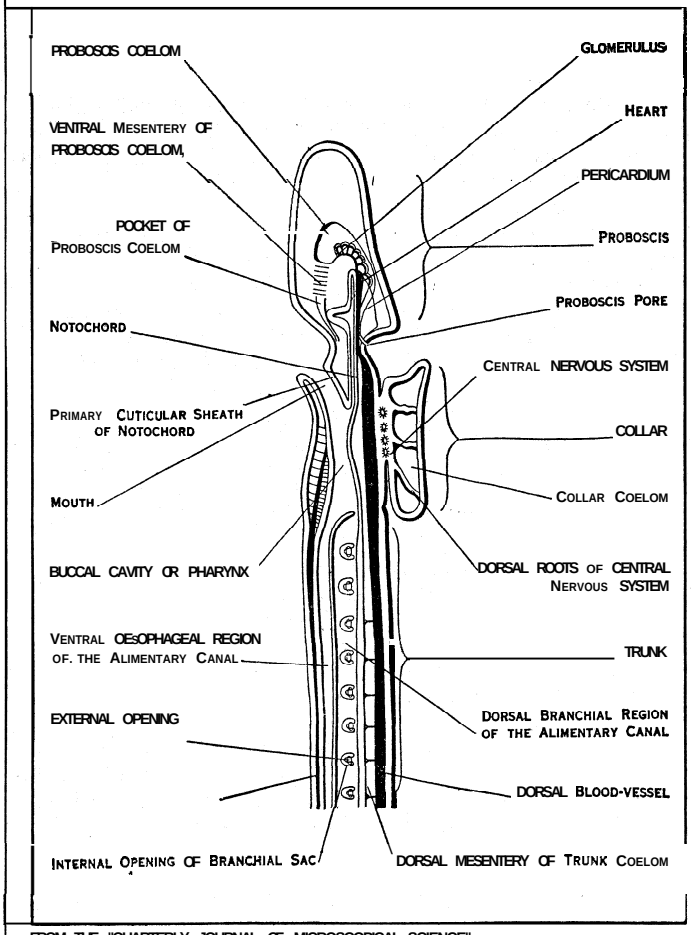
FROM SPENGEL "DIE ENTEROPNEUSTEN"

FIG. 2.—A LATERAL AND A VENTRAL VIEW OF THE FREE-SWIMMING, IMMATURE FORM OF THE BALANOGLOSSUS WHICH PASSES THROUGH A METAMORPHOSIS BEFORE ASSUMING THE ADULT CHARACTERISTICS

present author and others that the proboscis and collar cavities of Balanoglossus are represented in the simplest fish-like animal Amphioxus and in the higher Vertebrata by the pre-mandibular and mandibular head-cavities which lie in front of, and at the sides of, the mouth. The principal advance made by the higher Vertebrata over the condition found in Balanoglossus is the breaking up of the long trunk body cavities of Balanoglossus into a series of hollow muscular segments or *myotomes;* and this change was correlated with and no doubt caused by an advance to a more vigorous form of locomotion expressed in lateral wrigglings of the body. Whilst in the condition represented by the *tornaria* larva, the ancestral stock glided through the waters by means of cilia; in Balanoglossus which is perhaps a degenerate offshoot, the powers of locomotion are concentrated in the proboscis and collar.

(E. W. MACB.)

BALANTE, a long-headed. prognathous patrilineal people who file their incisor teeth, living in French Senegal and Portuguese Guinea between the Kasamansa and the Geba rivers. Their



FROM THE "QUARTERLY JOURNAL OF MICROSCOPICAL SCIENCE"

FIG. 3.—A LENGTH-WISE SECTION OF AN ADULT BALANOGLOSSUS
This diagrammatic representation shows the arrangement of the gut, body-cavities, notochord, central nervous system and the gill-slits

language is related to Bagnun and Mandjak. They have age groups. There are no special marriage rules. They are mainly hunting people, engaging in cultivation, and are turbulent raiders. The dead are exposed for two or three days and then buried under their houses. The Balante practise ordeal by vegetable poison (tali).

See Dr. Lasnet, *Une mission* au *Sénégal* (1900); Capitaine Brosselard-Faidherbe, *Casamance* et *Mellacorée* (1893).

BALARD, ANTOINE JÉRÔME (1802–1876), French chemist, was born at Montpelier. In 1826 he discovered in sea-water a substance which he recognized as a previously unknown element and named *bromine.* He then succeeded L. J. Thénard in the chair of chemistry at the faculty of sciences in Paris, and in 1851 was appointed professor of chemistry at the Collège de France, where he had M. P. E. Berthelot first as pupil, then as assistant, and finally as colleague. The discovery of bromine and the preparation of many of its compounds was perhaps his most conspicuous piece of work. In his researches on the bleaching compounds of chlorine he was the first to advance the view that bleaching-powder is a double compound of calcium chloride and hypochlorite; and he studied the problem of economically obtaining soda and potash from sea-water, though here his efforts were nullified by the discovery of the much richer sources of supply afforded by the Stassfurt deposits. In organic chemistry

he published papers on the decomposition of ammonium oxalate, with formation of oxamic acid, on amyl alcohol, on the cyanides, and on the difference in constitution between nitric and sulphuric ether.

BALASH, Sassanian king in A.D. 484–488, was the brother and successor of Pērōz, who had died in a battle against the Hephthalites (White Huns), who invaded Persia from the east. He put down the rebellion of his brother Zareh. After a reign of four years he was deposed and blinded, and his nephew, Ravadh I., raised to the throne.

BALASORE, a town and district of British India, in the Orissa division of Behar and Orissa. The town is the administrative headquarters of the district, and is situated on the right bank of the river Burabalang, about 7m. from the sea-coast as the crow flies and 16m. by the river. Pop. (1931) 17,843. The British first settled here in 1633, and established a factory in 1642; they were followed by the Dutch, Danes and French. The French still retain a plot of land called a *loge* in the town. After the outbreak of hostilities with the Moghul government Balasore was captured by Job Charnock in 1687 and again next year by Capt. Heath. In the 18th century Ralasore rapidly declined in importance, on account of the silting-up of the river mouth.

The district forms a strip of alluvial land between the hills and the sea, varying from about 9 to 34m. in breadth. Area, 2,055 square miles. Population (1931) 990,600. The district naturally divides itself into three well defined tracts — (I) The salt tract, along the coast; (2) The arable tract, or rice country; and (3) The submontane tract, or jungle lands. The salt tract which is only a few miles broad, rises towards the beach into sandy ridges, from 50 to 80ft. high. Inland, it spreads out into prairies of coarse long grass and scrub jungle, with patches of rice cultivation. Salt used to be manufactured here by evaporation, but the industry is now extinct. The arable tract lies beyond the salt lands and embraces the chief part of the district. It is a long dead-level of rice fields, with depressions near the river-banks. The submontane tract is an undulating country with a red soil, broken up into ravines along the foot of the hills. Large tracts are covered with *sal* jungle, which nowhere, however, attains to any great height.

Balasore district is watered by six distinct river systems: those of the Subarnarekha, the Panchpora, the Burabalang, the Jamka, the Kansbans and the Dhamra. The main crop is rice, which is grown on nine-tenths of the cultivated area. The district is traversed throughout its entire length by the Bengal-Nagpur and High Level Coast canals, and also by the railway from Calcutta to Madras. The only port is Chandbali, over 20m. up the river Dhamra, which is visited regularly by small coasting steamers.

BALASSA, BALINT, Baron of Kékkö and Gyarmat (1551–1594), Magyar lyric poet, was born at Kékkö, and educated by the reformer, Péter Bornemissza, and by his mother, the highly gifted Protestant zealot, Anna Sulyok. He died of wounds at the siege of Esztergom. Balassa's poems fall into four divisions: religious hymns, patriotic and martial songs, original love poems, and adaptations from the Latin and German. They are all most original, exceedingly objective and so excellent in point of style that it is difficult even to imagine him a contemporary of Sebastian Tinodi and Peter Ilosvay. But his erotics are his best productions. They circulated in manuscript for generations and were never printed till 1874, when Farkas Deák discovered a perfect copy of them in the Radvanyi library. For beauty, feeling and transporting passion there is nothing like them in Magyar literature till we come to the age of Mihaly Csokonai and Alexander Petofi. Balassa was also the inventor of the strophe which goes by his name. It consists of nine lines—a a b c c b d d b—or three rhyming pairs alternating with the rhyming third, sixth and ninth lines.

See Áron Szilády, *Bdlint Balassa's Poems* (Hung., 1879).

BALATA, a valuable raw material, resembling gutta percha and used as a substitute for it, derived from the latex of the bullet tree (*Mimusops balata*), a near relative of the gutta percha tree. The bullet tree is native in the West Indies and South America and is abundant in Guiana. It is really an inferior gutta percha, the latex containing about 50% of that substance. It is used in machine-belting. (*See* Gutta Percha)

BALATON, the largest lake of central and western Europe, situated in Western Hungary. About 50m. in length it lies in a narrow north-east to south-west tectonic rift whose origin is associated with the Alpine uplift. The depth averages 6ft. and attains a maximum of about 38ft. near the Tihany peninsula. The northern shore is flanked by the vine-covered slopes of the Bakony mouniains whose thermal springs have led to the growth of several popular spas, while the southern shore is flat and dotted with watering places. Apart from these resorts, settlements are small and devoted to fishing the richly stocked lake and to the preparation of wines, though the growing popularity of the lake as a summer bathing resort for the population of Budapest is overshadowing these original activities.

See "Resultate der wissenschaftlichen Erforschung des Balatonsees," *Herausg. v. d. Ungar. Geographischen Gesellsclzaft* (Budapest, 1891–1916).

BALAYAN, a municipality in the province of Batangas (formerly called Balayan), on the island of Luzon, in the Philippine Islands at the head of Balayan bay, about 55 mi. by land S. by W. of Manila and 79 mi. by water. Pop. (1939), 15,224, of whom 7,453 were males; no whites. The municipality was formerly the provincial capital, but in 1732 the capital was moved to Taal, and later to Batangas. It has an administrative centre and 23 barrios (wards). The climate is healthful and its fertile, volcanic- soil produces abundant crops of rice, sugar, corn and various fruits. Horses and cattle are raised and marketed in considerable numbers, and fishing is an important industry. The number of parcels of land declared for taxation in 1938 was 3,327, and the owners numbered 2,149. The total land area of the municipality in 1939 was 9,660 hectares. (C. S. L.)

BALBI, ADRIAN (1782–1848), Italian geographer, was born in Venice. He was professor of geography at Murano, then of physics at Fermo, and for some years a customs officer in Venice. The years 1821–32 were spent in Portugal. His most important works were *Atlas ethnographique du globe . . .* (1826), and *Abrégé de Géographie* (1832). His son, Eugenio Balbi (1812–1884), professor of geography at Pavia, edited his father's *Scritti geografici* (Turin, 1841).

BALBO, CESARE, Count (1789–1853), Italian writer and statesman, was born at Turin of a noble Piedmontese family. From 1808 to 1814 he served in various capacities under the Napoleonic empire at Florence, Rome, Paris, and in Illyria. On the fall of Napoleon he entered the service of his native country. While his father, Prospero Balbo, was appointed minister of the interior, he entered the army and undertook political missions to Paris and London. On the outbreak of the revolution of 1821, of which he disapproved, although he was suspected of sympathizing with it, he was forced into exile; and though later he was allowed to return to Piedmont, all public service was denied him, and he turned to the literary expression of his political ideas. He sought the independence of Italy from foreign control but was not a partisan of revolution. Of true Italian unity he had no expectation and no desire; but he was devoted to the house of Savoy, which he foresaw was destined to change the fate of Italy. In his book *Speranze* (or *Hopes of Italy*), he suggests that Austria should seek compensation in the Balkans for the inevitable loss of her Italian provinces. He became the leader of a moderate party, and the steady opponent, not only of despotism, but of democracy. At last, in 1848, his hopes were to some extent satisfied by the constitution granted by the king. He was appointed a member of the commission on the electoral law, and became first constitutional prime minister of Piedmont, but only held office a few months. With the ministry of d'Azeglio he was on friendly terms. The most important of his writings are historico-political, and derive at once their majesty and their weakness from his theocratic conception of Christianity. He published *Quattro Novelle* (1829); *Storia d'Italia sotto i Barbari* (1830); *Vita di Dante* (1839); *Meditazioni Storiche* (1842–45); *Le Speranze d'Italia* (1844), *Pensieri sulla Storia d'Italia* (1858), *Della Monarchia ruppresentativa in Italia* (Florence, 1857).

See E. Kicotti, *Della Vita e degli Scritti di Cesare Balbo* (1856); A. Vismara, *Bibliografia di Cesare Balbo* (Milan, 1882).

BALBOA, VASCO NUÑEZ DE (*c.* 1475–1517), Spanish explorer and conquistador, the discoverer of the Pacific, was born at Jerez de los Caballeros, in Estremadura, about 1475, of gentle parentage. In 1501 he followed Rodrigo de Bastidas in his voyage of discovery to the western seas. He appears to have settled in Hispaniola and taken to cultivating land in the neighbourhood of Salvatierra. In 1509 the famous Ojeda (Hojeda) sailed from San Domingo with an expedition and founded the settlement of San Sebastian. He had left orders with Enciso, an adventurous lawyer of the town, to fit out two ships and convey provisions to the new settlement. Enciso set sail in 1510, and Balboa, whose debts made the town unpleasant to him, managed to accompany him by concealing himself, it is said, in a cask of "victuals for the voyage," which was conveyed from his farm to the ship. The expedition reached San Sebastian to find Ojeda gone and the settlement in ruins. While Enciso was undecided how to act, Balboa proposed that they should sail for Darien, on the Gulf of Uraba, where he had touched when with Bastidas. His proposal was accepted and a new town was founded, named Sta. Maria de la Antigua del Darien; but quarrels soon broke out among the adventurers, and Enciso was deposed, thrown into prison, and finally sent off to Spain with Balboa's ally, the alcalde Zamudio. Being thus left in authority, Balboa began to conquer the surrounding country, and by his bravery, courtesy, kindness of heart, and just dealing gained the friendship of several native chiefs. On one of these excursions he heard for the first time, frcm the cacique Cornogre, of the ocean on the other side of the mountains and of the gold of Peru. Soon after his return to Darien he received letters from Zamudio, informing him that Enciso had complained to the king and had obtained a sentence condemning Balboa and summoning him to Spain. In his despair at this message Vasco Nufiez resolved to attempt some great enterprise, the success of which he trusted would conciliate his sovereign. On Sept. 1, 1513, he set out with 190 Spaniards (Francisco Pizarro among them) and 1,000 natives; on Sept. 25 or 26 he reached the summit of the range and sighted the Pacific. Pizarro and two others were sent on to reconnoitre; one of these scouts, Alonzo Martin, was the first European actually to embark upon the new-found ocean, in St. Michael's Gulf. On Sept. 29 Balboa himself arrived upon the shore, and formally took possession of the "Great South Sea" in the name of the Spanish monarch. He remained on the coast for some time, heard again of Peru, visited the Pearl Islands, and thence returned to Darien, which he entered in triumph with great booty on Jan. 18, 1514. He at once sent messengers to Spain bearing presents, to give an account of his discoveries; and the king. Ferdinand the Catholic, partly reconciled to his daring subject, named him *Adelantado* of *the* South Sea, or admiral of the Pacific, and governor of Panama and Coyba. None the less an expedition sailed from Spain under Don Pedro Arias de Avila (generally called Pedrarias Dávila) to replace Balboa in the government of the Darien colony itself. Meanwhile the latter had crossed the isthmus and revisited the Pacific several (some say more than 20) times; plans of the conquest of Peru and of the exploration of the western ocean began to shape themselves in his mind; and, with a view to realizing these projects, two light brigantines were built, launched, and armed. With these Vasco Nuñez took possession of the Pearl Islands, and, had it not been for the weather, would have reached the coast of Peru. His career was stopped by the jealousy of Pedrarias, who enticed him to Acla, near Darien, by a crafty message. As soon as he had him in his power he threw him into prison, had him tried for treason, and forced the judge to condemn him to death. The sentence was carried out on the public square of Acla in 1517.

See G. F. de Oviedo, *Historia general . . . de las Indias* (1526, *bk.* xxxix. chs. 2, 3); D. M. T. Quintana, *Vidas de Españoles celebres;* M. *F.* de Navarrete, *Coleccion de los Viajes y Descubrimientos* (1825–37); *J.* Acosta, *Compendio historico de la Nueva Granada* (1848); O. Pesche!, *Geschichte der Erdkunde* (1865, p. 237) and *Zeitalter der Entdeckungen,* pp. 442–3 etc.; Washington Irving, *Voyages and Discoveries of the Companions of Columbus* (1831); *J.* T. Medina, *El Descubrimiento del Oceano Pacifico* (Santiago de Chile, 1914); A. de Altolaguirre y Duvale, *Vasco Nuñez* de *Balboa* (Madrid, 1914).

BALBOA, a town, Panama Canal zone, the port adjoining the city of Panama. The port is about 3m. distant from Panama city, and contains all the wharves and docks, Panama itself not being a seaport. (See PANAMA CANAL and PANAMA.)

BALBRIGGAN, town, Co. Dublin. Eire, 21¾ mi. N.N.E. of Dublin by the Great Northern railway. Pop. (1936) 2,434. The harbour affords a good refuge from the east or south-east gales. The town has considerable manufactures of cottons and hosiery, "Balbriggan hose" being well known. The industry was founded by Baron Hamilton in 1761. There is some coast trade in grain, etc., and also sea-fishery. Balbriggan is much frequented as a watering-place in summer.

BALBUS, literally "stammerer," the name of several Roman families. Of the Acilii Balbi, one, Manius Acilius, was consul in 150 B.C., another in 114. To another family belonged T. Ampius Balbus, a supporter of Pompey; afterwards pardoned by Julius Caesar (cf. Cic. ad *Fam.* vi. 12 and xiii. 70). We know also of Q. Antonius Balbus, praetor in Sicily in 82 B.C., and Marcus Atius Balbus, who married Julia, a sister of Caesar, and had a daughter Atia, mother of Augustus. The most important of the name were the two Cornelii Balbi, natives of Gades (Cadiz).

1. LUCIUS CORNELIUS BALBUS (called *Major*), was born early in the last century B.C. Pompey conferred Roman citizenship on him and his family for his services against Sertorius in Spain. Becoming friendly with all parties, he had much to do with the formation of the First Triumvirate, and was one of the chief financiers in Rome. He won the favour of Caesar, and went with him as *praefactus fabrum* (chief engineer) to Spain (61) and Gaul (58). His position as a naturalized foreigner, his influence and his wealth naturally made Balbus many enemies, who in 56 put up a native of Gades to prosecute him for illegally assuming the rights of a Roman citizen, a charge directed against the triumvirs equally with himself. Cicero, Pompey and Crassus all spoke on his behalf, and he was acquitted. During the civil war he tried to get Cicero to mediate between Caesar and Pompey. Balbus became Caesar's private secretary, and after Caesar's murder attached himself to Octavian; in 43 or 42 he was praetor, and in 40 consul—an honour then for the first time conferred on an alien. The year of his death is not known. Balbus kept a diary of the chief events in his own and Caesar's life (Suetonius, Caesar, 81). The 8th book of the Bell. Gall., which was probably written by his friend Hirtius at his instigation, was dedicated to him.

See Cicero, *Letters* (Ed. Tyrrell and Purser, iv. introd. p. 62) and *Pro Balbo* (ed. *J. S.* Reid, 1878, with introduction); *see* also *E.* Jullien, *De* L. *Cornelzo Balbo Maiore* (1886).

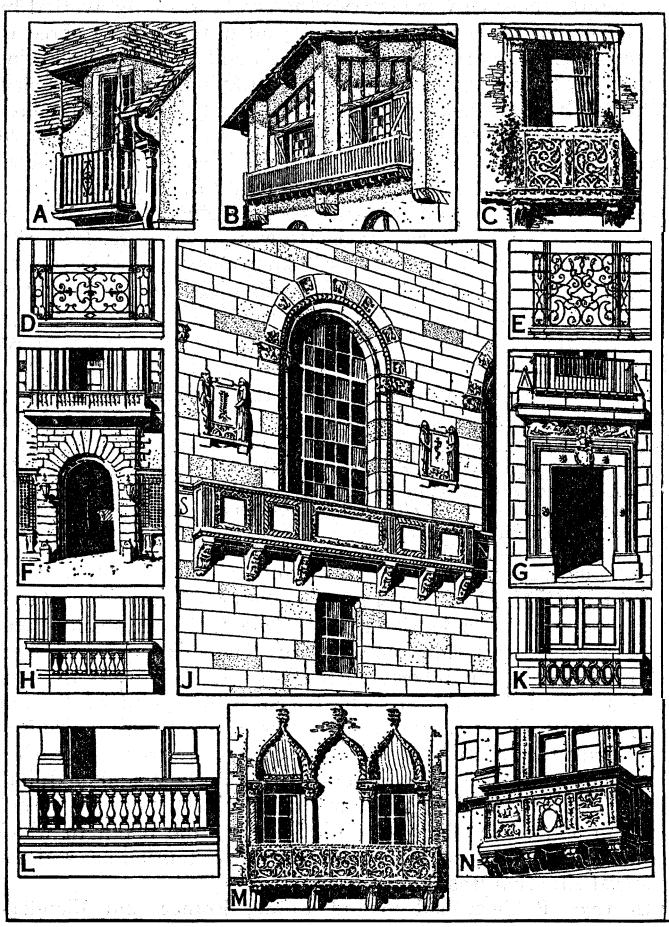
2. LUCIUS CORNELIUS BALBCS (called *Minor*), nephew of the above, received the Roman citizenship at the same time as his uncle. During the civil war, he served under Caesar. He also took part in the Alexandrian and Spanish wars. He was rewarded by being admitted into the college of pontiffs. In 43 he was quaestor in Further Spain, where he made a fortune by plundering the inhabitants. In the same year he crossed over to Bogud, king of Mauretania, and is not heard of again until 21, when he was proconsul of Africa. In 19 Balbus defeated the Garamantes, and on March 27 in that year celebrated a triumph, which was then for the first time granted to one who was not a Roman citizen by birth, and for the last time to a private individual. He built a theatre, which was dedicated at Rome in 13 (Dio Cassius liv. 25; Pliny, *Nat. Hist.* xxxvi. 12. 60). Balbus wrote a play on his visit to Lentulus in the camp of Pompey at Dyrrhachium, and, according to Macrobius (Saturnalia, iii. 6), a work called Ezegetica, dealing with the gods and their worship.

See Velleius Paterculus ii. 51; Cicero, ad Att. viii. 9; and on both the above the exhaustive articles in Pauly-Wissowa, *Realencyclopadie,* iv. pt. i. (1900).

BALCONY, a platform enclosed by a railing, and projecting from the wall of a bullding. In theatres the balcony, originally a stage box, is now one of the upper levels of the auditorium.

BALDACHINO, also known as a ciborium in architecture, the canopy over an altar or tomb, supported on columns, especially when free standing and disconnected from any enclosing wall. Early examples of the baldachino are found in the

basilicae of Kavenna and Rome. The usual form consists of four columns supporting entablatures which carry miniature colonnades topped by a pyramidal or gabled roof. In Romanesque work arches generally replaced the entablatures, and gables frequently topped the four sides as in San Ambrogio in Milan. Few baldachinos of the Gothic period remain, and their use, outside of Italy, seems to have been spasmodic; there is, however, a rich



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A. Modern American balcony. B. Modern Swedish. C, M. Venetian Gothic: Contarini Palace, Venice. D, H, K. French Renaissance: Petit Trianon, Versailles. F, E, L, N. Italian Renaissance: F, Farnese Palace, Rome; L, from Vicenza; N, Cancelleria, Rome. J. Modern American

Gothic example in the Ste. Chapelle at Paris (1247–1250) reconstructed by Viollet-le-Duc in the 19th century, which shows great richness of carving, gilding, jewelling and the use of coloured enamels. In the Renaissance the use of the baldachino became more common, probably owing to the influence of the enormous bronze baldachino which Bernini designed for the altar of St. Peter's in Rome. These late Renaissance examples make frequent use of the spiral column supporting canopies of extremely fantastic design. See also ALTAR and CANOPY. (T. F. H.)

BALDE, JAKOB (1604–1668), German Latinist, was born at Ensisheim, in Alsace. In 1624 he entered the Society of Jesus. and in 1633 was ordained priest. His lectures and poems had now made him famous; in 1638 he became court chaplain to the elector, Maximilian I. at Munich, where he remained till 1650. In 1654 he was transferred to Neuberg on the Danube, as court preacher to the count palatine. There he died on Aug. g, 1668. Balde ranks high among modern Latin verse writers.

A collected edition of Balde's works was published at Cologne (1650); a more complete edition at Munich (1729); also a good selection by L. Spach (Paris and Strasbourg, 1871). An edition of his Latin lyrics appeared at Regensburg (1884). There are translations into German of his finer odes, by J. Schrott and M. Schleich (Munich, 1870). *See* G. Westermayer, *Jacobus Balde, sein Leben und seine Werke* (1868); J. Bach, *Jakob Balde* (Freiburg, 1904).

BALDER, a Scandinavian god, the son of Odin. The story of his death is given in two widely different forms, by Saxo in his Gesta *Danorum* (ed. Holder), and in the prose Edda (*Gylfaginning*).

See F. Kauffmann, *Balder: Mythus und Sage* (Strassburg, 1902).

BALDERIC, the name given to the author of a chronicle of the bishops of Cambrai, written in the 11th century. This Gesta *episcoporum Cambracensium* (first printed in 1615) was for some time attributed to Balderic, archbishop of Noyon, but it now seems tolerably certain that the author was an anonymous canon of Cambrai.

The best edition is in the *Monumenta Germaniae historica. Scriptores.* Bd. vii. (1826–92) which contains an introduction by L. C. Bethmann. See *Histoire littéraire de la France,* tome viii. (1865–69).

BALDI, BERNARDINO (1533–1617), Italian mathematician and miscellaneous writer, was born at Urbino and was abbot of Guastalla for 25 years. He is said to have written 100 different works, the chief part of which have remained unpublished. He was a theologian, mathematician, geographer, antiquary, historian and poet. The Cronica dei Matematici (published at Urbino in 1707) is an abridgement of a larger work, on which he had bestowed 12 years of labour, and which was intended to contain the lives of more than 200 mathematicians. His life has been written by Affò, Mazzuchelli and others.

BALDINUCCI, FILIPPO (1624–1696), Italian writer on the history of the arts, was born at Florence. His chief work is entitled *Notizie de'Professori del Disegno* da *Cimabue* . . . (dal 1250 *sino al 1670)* (1681–1728). The capital defect of this work is the attempt to derive all Italian art from the schools of Florence. A good edition is that by Ranalli (Florence, 1845–47). Baldinucci's whole works were published at Milan (1808–12).

BALDNESS (technically alopecia), the result of loss of hair, particularly on the human scalp. Two forms may be distinguished: one the premature baldness common in young men, due to alopecia seborrhoica, the other alopecia areata, now regarded as an epidemic disease.

Alopecia seborrhoica is always due to the underlying disease seborrhoea, and, though it progresses steadily if neglected, is yet very amenable to treatment by sulphur and salicylic acid, 18 grains of each added to an ounce of vaseline making a good application. This should be rubbed well into the scalp daily for a prolonged period. The head must be frequently cleansed, and in very mild cases a daily washing with soap spirit will at times effect a cure unaided.

Alopecia areata is characterized by the development of round patches more or less completely denuded of hair. It is most commonly observed on the scalp, though it may occur on any part of the body where hair is naturally present. At the margin of the patches short, broken hairs are usually to be seen. Clinical evidence is steadily accumulating to show that this disease may be transmitted. The disease must be distinguished from ringworm (*q.v.*).

The loss of hair following acute fevers must be treated by keeping the hair short, applying stimulating lotions to the scalp, and attending to the general hygiene of the patient.

BALDOVINETTI, ALESSIO (1427–1499), Florentine painter and restorer of the disused art of mosaic, was born on Oct. 14, 1427, and died on Aug. 29, 1499. He belonged to the group of scientific realists and naturalists in art which included Andrea del Castagno, Paolo Uccello and Domenico Veneziano, the influence of the last-named master being particularly evident in his work. Tradition says that he assisted in the decorations of the chapel of S. Egidio in Santa Maria Kuova. That he was commissioned to complete the series at a later date (1460) is certain. In 1462 Alessio was employed to paint the great fresco of the Annunciation in the cloister of the Annunziata, which still exists in ruined condition. His favourite method in mall-painting was to lay in his compositions in fresco and finish them a secco with a mixture of yolk of egg and liquid varnish. This, says Vasari, was with the

view of protecting the painting from damp; but in course of time the parts executed with this vehicle scaled away, so that the great secret he hoped to have discovered turned out a failure. In 1463 he furnished a cartoon of the Nativity, which was executed in tarsia by Giuliano de Maiano in the sacristy of the Duomo, and still exists. From 1466 date the groups of four Evangelists and four Fathers of the Church in fresco, together with the Annunciation on an oblong panel, which still decorate the Portuguese chapel in the church of S. Miniato, and are given in error by Vasari to Pietro Pollaiuolo. A fresco of the risen Christ between angels inside a holy sepulchre in the chapel of the Rucellai family, also still existing, belongs to 1467. In 1471 Alessio undertook important works for the church of Sta. Trinità on the commission of Bongianni Gianfigliazzi. First, to paint an altar-piece of the Virgin and Child with six saints; this was finished in 1472 and is now in the Academy at Florence; next, a series of frescoes from the Old Testament which was to be completed according to contract within five years, but actually remained on hand for fully 16. Only some defaced fragments of it now remain.

Meanwhile Alessio had been much occupied with other technical pursuits and researches apart from painting. He was regarded by his contemporaries as the one craftsman who had rediscovered and fully understood the long disused art of mosaic, and was employed accordingly between 1481 and 1483 to repair the mosaics over the door of the church of S. Miniato, as well as several of those both within and without the baptistery of the cathedral.

See Vasari, ed. Milanesi, vol. ii.; Crowe-Cavalcaselle, *Hist. of Painting in Italy,* vol. ii.; Bernhard Berenson, *Study and Criticism of Italian Art,* 2nd series.

BALD PATE, the common name for a North American duck (*Anas,* or *Mareca, americana*), allied to the European widgeon (*q.v.*).

BALDRIC, a belt worn over one shoulder, passing diagonally across the body and under the other arm, either as an ornament or a support for a sword, bugle, etc.

BALDUINUS, JACOBUS, Italian jurist of the 13th century, a Bolognese and reputed to be of a noble family, was a pupil of Azo, and the master of Odofredus, Hostiensis and Jacobus de Ravanis (who first applied dialectical forms to legal science). His great fame as a professor of civil law at Bologna caused Balduinus to be elected *podesta* of the city of Genoa, where he was entrusted with the reform of its laws. He died at Bologna in 1225. His treatises on procedure were the earliest of their kind.

BALDUNG, HANS: *see* GRÜN.

BALDUS DE UBALDPS, PETRUS (1327–1406), Italian jurist of the noble family of the Ubaldi, studied civil law at Perugia under Bartolus, gaining the doctorate at the age of 17. Federicus Petrucius of Siena was his master in the canon law. Upon his promotion to the doctorate he went to Bologna, where he taught for three years; and then became a professor at Perugia, where he stayed 33 years. Afterwards he taught at Pisa, Florence, Padua and Pavia, when the schools of law in those universities disputed the palm with Bologna. The extant *Treatises* of Baldus hardly account for the reputation which he had in his own day, due partly to his public career, and partly to the fame of his consultations, of which there are five volumes (Frankfurt, 1589). Baldus was the master of Pierre Roger de Beaufort (Pope Gregory XI.), whose successor, Urban VI., called Baldus to Rome to assist him in 1380 against the anti-pope Clement VII. Cardinal de Zabarella and Paulus Castrensis mere his pupils. His *Commentary on the Liber Feudorum* is one of his best works, most of which he left unfinished. His brothers Angelus (1328–1407) and Petrus (1335–1400) were also eminent as jurists.

BALDWIN I. (1172–1205), emperor of Rumania, count of Flanders and Hainaut, was one of the most prominent leaders of the fourth crusade. On the capture of Constantinople he was elected first emperor of Rumania (May 9, 1204) and crowned a week later, after the imperial crown had first been refused by Doge Dandolo. Besides being feudal superior of the princes invested with portions of the conquered territory, Baldwin received as his own portion Constantinople, the adjacent regions both on the European and the Asiatic side, along with some outlying districts, and several islands, including Lemnos, Lesbos, Chios and Tenos He at once marched into Thrace to conquer the allotted territory, with the intention of occupying Thessslonica. He was immediately involved in a conflict with Boniface of Montferrat, who had been his rival candidate for the empire, and had been invested, in compensation, with a large territory in Macedonia and the title of king of Salonika. Boniface aimed at complete independence of the empire, and civil war between the rivals was only averted by the mediation of Dandolo, who persuaded Baldwin to agree to the establishment of the kingdom of Salonika. In the following winter the Franks made conquests in Bithynia, in which Henry, Baldwin's brother, took part; but in Feb. 1205 the Greeks revolted in Thrace, relying on the assistance of John (Kaloyan), tsar of Bulgaria, whose overtures of alliance had been unwisely rejected by the emperor. In a desperate battle under the walls of Adrianople (April 1j, 1205) the crusaders were defeated, the count of Blois slain and Baldwin captured. He was taken to the Bulgarian capital Trnovo, where a tower is still known as "Baldwin's tower," and held hostage; but he was afterwards killed by the Bulgarian tsar. The manner of his death is obscure. Kaloyan wrote to Pope Innocent III. that he had died in prison; but one contemporary writer says that his hands and feet were cut off and he was thrown into a valley, where he died on the third day. His brother Henry, who had acted as regent since his capture, succeeded him as Emperor in 1206, when his death was definitely known.

See Ducange, *Histoire de l'empire de Constantinople sous les empereurs français* (1657); G. Finlay, *History of Greece,* vol. iv. (1877); Pears, *The Fall of Constantinople* (1885); Gerland, *Geschichte des lateinischen Kaiserreiches von Konstantinopel,* pt. i. (Homburg v. d. Hohe, 1905); W. Miller, *The Latins in the Levant* (1908); Gibbon, *Decline and Fall,* vol. vi. (ed. Bury, 1912). (J. B. B.)

BALDWIN II. (1217–1273), emperor of Rumania, was a younger son of Yolande, sister of Baldwin I. Her husband, Peter of Courtenay, was third emperor of Rumania, and had been followed by his son Robert, upon whose death in 1228 the succession passed to Baldwin. The barons chose John of Brienne (titular king of Jerusalem) as emperor-regent for life; Baldwin was to rule the Asiatic possessions of the empire when he reached the age of 20, was to marry John's daughter Mary, and on John's death enjoy the full imperial sovereignty. The marriage took place in 1234, but when John died (1237) the realm to which Baldwin succeeded was little more than Constantinople, and the financial situation was desperate.

In 1236 Baldwin had visited Rome, France and Flanders, trying to raise money and men to recover the lost territory of his realm, and in 1240 he was able to bring a considerable army back to Constantinople. But he could accomplish nothing with this help and in 1245 travelled again to Italy and then to France, where he spent two years. The Empress Maria and Philip of Toucy governed during his absence. Louis IX. bought some relics from him, and redeemed his son Philip whom he had been obliged to give to some merchants as security for loans; but Baldwin spent most of his reign in inglorious mendicant tours.

In 1261 Constantinople was captured by Michael Palaeologus, Baldwin escaped in a Venetian galley to Negropont, and then proceeded to Athens, whence he passed to Apulia and finally to France, still in quest of help from the western powers. He went to Italy in 1267, and in May induced Charles of Anjou to sign a treaty for the reconquest of Constantinople and to pension himself and his son Philip. In Oct. 1273 Philip married Beatrice, daughter of Charles, at Foggia. A few days later Baldwin died.

See bibliography for BALDWIN I. above; also Norden, *Das Papsttum und Byzanz* (1903).

BALDWIN I. (1058–1118), prince of Edessa, and first king of Jerusalem (1100–18), was the brother of Godfrey of Bouillon (*q.v.*). He was originally a clerk in orders, and held several prebends; but in 1096 he joined the first crusade, and accompanied his brother Godfrey as far as Heraclea in Asia Minor. When Tancred left the main body of the crusaders at Heraclea, and marched into Cilicia, Baldwin followed, partly in jealousy, partly from the same political motives which animated Tancred. He wrested Tarsus from Tancred's grip (Sept. 1097), and left there a garrison of his own. After rejoining the main army at

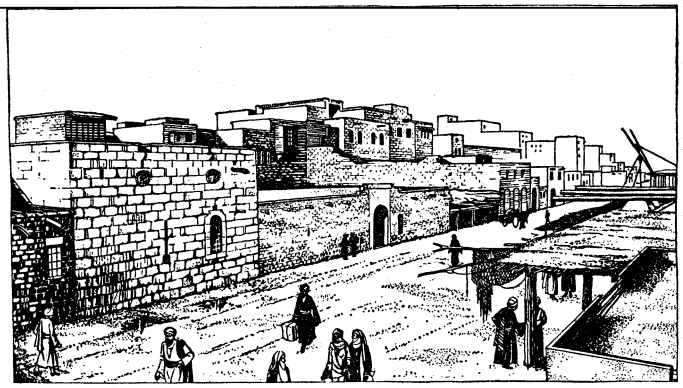
Marash, he received an invitation from an Armenian named Pakrad, and moved eastwards towards the Euphrates, where he occupied Tell-bashir. Another invitation followed from Thoros of Edessa; and to Edessa Baldwin came, first as protector, and then, when Thoros was assassinated, as his successor (March 1098). For two years he ruled in Edessa (1098–1100), marrying an Armenian wife, and acting generally as the intermediary between the crusaders and the Armenians. During these two years he was successful in maintaining his ground, both against the Mohammedan powers by which he was surrounded, and from which he won Sainosata and Seruj (Sarorgia), and against a conspiracy of his own subjects in 1098. At the end of 1099 he visited Jerusalem along with Bohemund I.; but he returned to Edessa in January 1100. On the death of Godfrey he was summoned by a party in Jerusalem to succeed to his brother. A lay reaction against the theocratic pretensions of Dagobert, who was counting on Norman support, was responsible for the summons; and in the strength of that reaction Baldwin was able to become the first king of Jerusalem. He was crowned on Christmas Day, 1100, by the patriarch himself; but the struggle of church and state was not yet over, and in the spring of 1101 Baldwin had Dagobert suspended by a papal legate, while later in the year the two disagreed on the question of the contribution to be made by the patriarch towards the defense of the Holy Land. The struggle ended in the deposition of Dagobert and the triumph of Baldwin (1102).

As Baldwin had secured the supremacy of the lay power in Jerusalem, so he extended into a compact kingdom the poor and straggling territories to which he had succeeded. This he did by an alliance with the Italian trading towns, especially Genoa, which supplied, in return for the concession of a quarter in the conquered towns, the instruments and the skill for a war of sieges, in which the coast towns of Palestine were successively reduced. Arsuf and Caesarea were captured in 1101; Acre in 1104; Beirut and Sidon in 1110 (the latter with the aid of the Venetians and Norwegians). Meanwhile Baldwin repelled in successive years the attacks of the Egyptians (1102, 1103, 1105), and in the latter years of his reign (1111–18) he even pushed southward at the expense of Egypt, penetrating as far as the Red Sea, and planting an outpost at Monreal. In the north he had to compose the dissensions of the Christian princes in Tripoli, Antioch and Edessa (1109–10), and to help them to maintain their ground against the Mohammedan princes of north-east Syria, especially Maudud and Aksunkur, amirs of Mosul. In this way Baldwin was able to make himself the practical suzerain of the three Christian principalities of the north, though the suzerainty was, and always continued to be, somewhat nominal. In 1118 he died, after an expedition to Egypt, during which he captured Farama, and, as old Fulcher says, "caught many fish, and his death in eating them."

Baldwin was one of the "adventurer princes" of the first crusade, and as such he stands alongside of Bohemund. Tancred and Raymund. On the whole he was the most successful of his class. By his defense of the lay power against a nascent theocracy, and by his alliance with the Italian towns, he was the real founder of the Latin kingdom of Jerusalem. Events worked for him: he might never have come to the throne, unless Bohemund had fallen into the hands of Danishmend; and the dissensions among the Mohammedans alone made possible the subsequent consolidation of his kingdom. But he had *virtù* as well as *fortuna;* and on his tombstone it was written that he was "a second Judas Maccabaeus, whom Kedar and Egypt, Dan and Damascus dreaded." As king, he still retained something of the clerk in the habit of his dress; but he was at the same time a warrior so impetuous as to be sometimes foolhardy, and his policy was on the whole anti-clerical. He may be accused of greed; his life was not chaste; and the two defects met in his rejection of his Armenian wife and his marriage to the rich Sicilian widow Adelaide (1113). But "on the holiest soil of history, he gave his people a fatherland"; and Fulcher of Chartres, his chaplain, who paints at the beginning of Baldwin's reign the terrors of the lonely band of Christians in the midst of their foes, can celebrate at the end the formation of a new nation in the East (*qui fuimus* occidentales, *nunc* facti *sumus* orientates)—an achievement which, so far as it was the work of any one man, was the work of Baldwin I.

BIBLIOGRAPHY.—The *Historia* Hierosolymitana of Fulcher, who had accompanied Baldwin as chaplain to Edessa, and had lived in Jerusalem during his reign, is the primary authority for Baldwin's career. There is a monograph on Baldwin by Wolff (Konig *Baldwin* I. *von Jerusalem*), and his reign is sketched in R. Rohricht's Geschichte des *Königreichs Jerusalem* (1897), C. i.–iv. (E. B.)

BALDWIN II., count of Edessa (died 1131), king of Jerusalem (1118–31), originally known as Baldwin de Burg, was a son of Count Hugh of Rethel, and a nephew of Godfrey of Bouillon and Baldwin I. He appears on the first crusade at Constantinople as one of Godfrey's men; and he helped Tancred to occupy Bethlehem in June 1099. After the capture of Jerusalem he served for a time with Bohemund at Antioch; but when Baldwin of Edessa became king of Jerusalem, he summoned Baldwin de Burg, and left him as count in Edessa. From Edessa Baldwin conducted continual forays against the Mohammedan princes; and in the great foray of 1104, in which he was joined by Bohemund, he was defeated and captured at Balich. Tancred became guardian of Edessa during Baldwin's captivity, and did not trouble himself greatly to procure his release. Baldwin, however, recovered his liberty at the beginning of 1108, and at once entered upon a struggle with Tancred for the recovery of Edessa. In September 1108 he regained his principality; but the struggle with Tancred continued, until it was composed by Baldwin in 1109. For the next ten years Baldwin ruled his principality with success, if not without severity. Planted in the farthest Christian outpost in northern Syria, he had to meet many attacks, especially from Mardin and Mosul, in revenge for the provocation offered by his own forays and those of the restless Tancred. In 1110 he was besieged in Edessa, and relieved by Baldwin I.; in 1114 he repelled an attack by Aksunkur of Mosul; in 1115 he helped to defeat Aksunkur at Danith. At the same time, if Matthew of Edessa may be trusted, he also carried his arms against the Armenians, and plundered in his avarice every Armenian of wealth and position. In 1118 he was on his way to spend Easter at Jerusalem, when he received the news of the death of Baldwin I.; and when he arrived at Jerusalem, he was made king, chiefly by the influence of the patriarch Arnulf. In a reign of 13 years, Baldwin II. extended the kingdom of Jerusalem to its widest limits. His reign is marked by almost incessant fighting in northern Syria. In 1119, after the defeat and death of Roger of Antioch, he defeated the amirs of Mardin and Damascus



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

THE WALLS OF THE MOHAMMEDAN CITY OF ALEPPO IN SYRIA. WHICH CHECKED THE VICTORIOUS ADVANCE OF BALDWIN II.

at Danith; in subsequent years he extended his sway to the very gates of Aleppo. In 1123 he was captured by Balak of Mardin, and confined in Kharput with Joscelin, his successor in the county of Edessa, who had been captured in the previous year. During his captivity Eustace Graverius became regent of Jerusalem, and succeeded, with the aid of the Venetians, in repelling an Egyptian attack, and even in capturing Tyre, 1124. In that year Baldwin II. succeeded in securing his liberty, under conditions which he instantly broke; and he at once embarked on strenuous and not unsuccessful hostilities against Aleppo and Damascus (1124–27),

exacting tribute from both. During his reign he twice acted as regent in Antioch (1119–30), and in 1126 he married his daughter Alice to Bohemund II. In 1128 he offered the hand of his eldest daughter, Melisinda, to Fulk of Anjou, who had been recommended to him by Honorius II. In 1129 Fulk came and married Melisinda, and in 1131, on the death of Baldwin, he succeeded to the crown.

Baldwin II. had much of the churchmanship of Godfrey and Baldwin I.; but he appears most decidedly as an incessant warrior, under whom the Latin domination in the East stretched, as Ibn al-Athir writes, in a long line from Mardin in the North to el-Arish on the Red Sea—a line only broken by the Mohammedan powers of Aleppo, Hamah, Homs and Damascus. The Franks controlled the great routes of trade, and took tolls of the traders; and in 1130 their power had reached its height.

BIBLIOGRAPHY.—Fulcher of Chartres narrates the reign of Baldwin II. down to 1127; for the rest of the reign the authority is William of Tyre. R. Rohricht, *Geschichte des Königreichs Jerusalem* (Innsbruck, 1898), C. vii.–x., is the chief modern authority. (E. B.)

BALDWIN III., king of Jerusalem (1143–1162), was the eldest son of Fulk of Jerusalem by his wife Melisinda. He was born in 1130, and became king in 1143, under the regency of his mother, which lasted till 1152. He came to the throne at a time when the attacks of the Greeks in Cilicia, and of Zengi on Edessa were fatally weakening the position of the Franks in northern Syria; and from the beginning of his reign the power of the Latin Kingdom of Jerusalem may be said to be slowly declining. Edessa was lost, however, in the year after Baldwin's accession, and the conquest by Zengi of this farthest and most important outpost in northern Syria was already a serious blow to the kingdom. Upon it in 1147, there followed the second crusade; and in that crusade Baldwin III., now some 18 years of age, played his part by the side of Conrad III., and Louis VII. He received them in Jerusalem in 1148; with them he planned the attack on Damascus and with them he signally failed in the attack. In 1149, after the failure of the crusade, Baldwin III. appeared in Antioch, where the fall of Raymund, the husband of the princess Constance, made his presence necessary. He regulated affairs in Antioch, and tried to strengthen the north of Palestine generally against the arm of Zengi's successor, Nureddin, by renewing the old and politic alliance with Damascus interrupted since 1147, and by ceding Tell-bashir, the one remnant of the county of Edessa, to Manuel of Constantinople. In 1152 came the inevitable struggle between the young king and his mother, who had ruled with wisdom and vigour during the regency and was unwilling to lay down the reins of power. Baldwin originally planned a solemn coronation, as the signal of his emancipation. Dissuaded from that course, he nevertheless wore his crown publicly in the church of the Sepulchre. A struggle followed: in the issue, Baldwin agreed to leave his mother in possession of Jerusalem and Nablus, while he retained Acre and Tyre for himself. But he repented of the bargain; and a new struggle began,, in which Baldwin recovered, after some fighting, the possession of his capital. From these internal dissensions Baldwin was now summoned to the north, to regulate anew the affairs of Antioch and also those of Tripoli, where the death of Count Ravmund had thrown on his shoulders the cares of a second regency. On his return to Jerusalem he was successful in repelling an attack by an army of Turcomans; and his success encouraged him to attempt the siege of Ascalon in the spring of 1153. He was successful: the "bride of Syria," which had all but become the property of the crusaders in 1099, but had since defied the arms of the Franks for half a century, became part of the kingdom of Jerusalem. From 1156 to 1158 Baldwin was occupied in hostilities with Nureddin. In 1j6 he had to submit to a treaty which cut short his territories; in the winter of 1157–58 he besieged and captured Harim, in the territory once belonging to Antioch: in 1158 he defeated Nureddin himself. In the same year Baldwin married Theodora, a near relative of the East Roman emperor Manuel; while in 1159 he received a visit from Manuel himself at Antioch. The Latin king rode behind the Greek emperor, without any of the insignia of his dignity, at the entry into Antioch; but their relations were of the friendliest, and Manuel—as great a physician as he was a hunter—personally attended to Baldwin when the king was thrown from his horse in attempting to equal the emperor's feats of horsemanship. In the same year Baldwin had to undertake the regency in Antioch once more, Raynald of Chatillon, the second husband of Constance, being captured in battle. Three years later he died (1162), without male issue, and was succeeded by his brother Amalric I.

Baldwin III. was the first of the kings of Jerusalem who was a native of the soil of Palestine. His three predecessors had all been emigrants from the West. His reign also marks a new departure from another point of view. His predecessors had been men of a type half military, half clerical—at once hard fighters and sound churchmen. Baldwin was a man of a subtler type—a man capable of dealing with the intrigues of a court and with problems of law, and, as such, suited for guiding the middle age of the kingdom, which the different qualities of his predecessors had been equally suited to found. Like his brother, Amalric I., he was a clerkly and studious king versed in law, and ready to discuss points of dogma. In an excellent sketch of Baldwin's character (xvi. cii.), William of Tyre tells us that he spent his spare time in reading and had a particular affection for history; that he was well skilled in the *jus consuetudinarium* of the kingdom (afterwards recorded by lawyers like John of Ibelin and Philip of Novara as "the assizes of Jerusalem"); and that he had the royal faculty for remembering faces, and could generally be trusted to address by name anybody whom he had once met, so that he was more popular with high and low than any of his predecessors. He had, William also reports, a gift of impromptu eloquence, and a faculty both for saying witty things pleasantly at other people's expense and for listening placidly to witticisms directed against himself; while he was generous to excess without needing to make exactions in order to support his generosity, and always respected the Church. If in his youth he had been prone to gambling, and before his marriage with Theodora had been somewhat lax in his morals, when he became a man he put away childish things; his married life was a shining example to his people and he was abstemious both in food and drink, holding that "excess in *either* was an incentive to the worst of crimes." Even his enemy, Nureddin, said of him, when he died—"the Franks have lost such a prince that the world has not now his like."

BIBLIOGRAPHY.—William of Tyre is the great primary authority for his reign; Cinnamus and Ibn-al-athir (see *Bibliography* to the article CRUSADES) give the Byzantine and Mohammedan point of view. His reign is described by R. Rohricht, *Geschichte des Königreichs Jerusalem* (Innsbruck, 1898), *C.* xiii.–xvi. (E. B.)

BALDWIN IV., the son of Amalric I. by his first wife Agnes, ruled in Jerusalem from 1174 to 1183, when he had his nephew Baldwin crowned in his stead. Educated by William of Tyre, Baldwin IV. came to the throne at the early age of 13; and thus the kingdom came under the regency of Raymund II. of Tripoli. The problems of the reign of Baldwin IV. may be said to have been two—his sister Sibylla and the fiery Raynald of Chatillon, once prince of Antioch, then a captive for many years in the hands of the Mohammedans, and since 1176 lord of Krak (Kerak), to the east of the Dead Sea. Sibylla was the heiress of the kingdom; the problem of her marriage was important. Married first to William of hfontferrat, to whom she bore a son, Baldwin, she was again married in 1180 to Guy of Lusignan; and dissensions between Sibylla and her husband on the one side, and Baldwin IV. on the other, troubled the latter years of his reign. Meanwhile, Raynald of Krak took advantage of the position of his fortress which lay on the great route of trade from Damascus and Egypt, to plunder the caravans (1182), and thus helped to precipitate the inevitable attack by Saladin. When the attack came, Guy of Lusignan was made regent by Baldwin IV., but he declined battle and was deposed both from his regency and from his right of succession, while Sibylla's son by her first husband was crowned king as Baldwin V. in 1183. For a time Baldwin IV. still continued to be active; but in 1184 he handed over the regency to Raymund of Tripoli, and in 1185 he died.

BIBLIOGRAPHY.—The narrative of William of Tyre concludes with Baldwin IV's. transfer of the regency to Raymund of Tripoli. R. Röhricht describes the reign of Baldwin IV. *Geschichte des Königreichs Jerusalem* (Innsbruck, 1898), *C.* xix., xxi.

BALDWIN V., the son of Sibylla (daughter of Amalric I.) by her first husband, William of Montferrat, was the nominal king of Jerusalem from 1183 to 1186, under the regency of Raymund of Tripoli. His reign is marked by the advance of Saladin and by dissensions between the government and Guy of Lusignan.

BALDWIN, JAMES MARK (1861–1934), American philosopher, was born at Columbia (S.C.), Jan. 12, 1861, and educated at Princeton and several German universities. He was professor of philosophy in the University of Toronto (1889–93), of psychology at Princeton (1893–1903), of philosophy and psychology in Johns Hopkins university (1903–09) and in the National University of Mexico until 1913. After lecturing at Oxford and the French provincial universities, he became professor at the École des Hautes Études Sociales, Paris, in 1919. Prominent among experimental psychologists, he received many honours from learned societies in America and Europe. His works include.

Handbook of Psychology (1889–1891); *Elements of Psychology* (1893); *Story of the Mind* (1898); *Mental Development in the Child and the Race* (1896); *Hirtory of Psychology* (1913); *Between Two Wars* (1926); and contributions to the *Dict. of Philosophy and Psyclzology* (1901–05) and the *Psychological Review,* both of which he edited.

BALDWIN, MATTHIAS WILLIAM (1795–1866), American inventor and manufacturer, was born in Elizabethtown, N.J., on Dec. 10, 1795. He was trained as a jeweller but, being encouraged to engage in the manufacture of locomotives, eventually founded the Baldwin Locomotive Works (q v.). He died in Philadelphia on Sept. 7, 1866.

See W. Calkins, *Memorial of Matthias William Baldwin* (Phil., 1867) and *anon., History of the Baldwin Locomotive Works* (1924).

BALDWIN, ROBERT (1804–1858), Canadian statesman, was born at York (now Toronto) on May 12 1804. His father, William Warren Baldwin (d. 1844), went to Canada from Ireland in 1798. He opposed the religious and political oligarchy which was then at the head of Canadian affairs, and brought up his son in the same principles. Robert Baldwin was called to the Bar in 182j, and entered into partnership with his father. In 1829–30 he sat in the parliament of Upper Canada for the town of York. During the next six years, he constantly advocated a responsible executive as the one cure for the political and economic evils of the time. In 1836 he was nominated to the executive council, but resigned within a month. Though a reformer, he strongly disapproved of the rebellion of 1837–38. On the union of the two Canadas he became (1841) a member of the executive council under Lord Sydenham, but soon resigned on the question of responsible government. In 1842 he formed the first Liberal administration, in connection with Mr. (afterwards Sir) L. H. Lafontaine, but resigned the next year, after a quarrel with the governor-general, Sir Charles Metcalfe, on a question of patronage, in which he felt that of responsible government to be involved. At the general election which followed, the governor-general was sustained by a narrow majority, but in 1848 the Liberals were again returned to power, and he and Mr. Lafontaine formed their second administration under Lord Elgin and carried numerous important reforms, including the freeing from sectarian control of the Provincial university and the introduction into Upper Canada of an important municipal system.

Internal dissensions soon began to appear in the Liberal party, and in 1851 Mr. Baldwin resigned. The special struggle leading to his resignation was an attempt to abolish the court of Chancery of Upper Canada, whose constitution was due to a measure introduced by Baldwin in 1849. The attempt, though defeated, had been supported by a majority of the representatives from Upper Canada, and Baldwin's fastidious conscience took it as a vote of want of confidence. A deeper reason was his inability to approve of the advanced views of the Radicals, or "Clear Grits," as they came to be called. On seeking re-election in York, he declined to give any pledge on the burning question of the Clergy Reserves and was defeated. In 1858 the Liberal-Conservative party, formed in 1854 by a coalition, attempted to bring him out as a candidate for the upper house, which was at this date elective, but though he had broken with the advanced reformers, he could not approve of the tactics of their opponents, and refused to stand. He died on Dec. 9 1858. After the concession of responsible government, he devoted himself to bringing about a good understanding between the English and French-speaking inhabitants of Canada, and his memory is held as dear among the French Canadians as in his native province of Ontario.

See J. C. Dent, *Canadian Portrait Gallery* (1880). His life, by the Hon. Geo. W. Ross, is included in "The Makers of Canada" series (Toronto).

BALDWIN, STANLEY BALDWIN, 1ST EARL, OF BEWDLEY (1867–), British statesman, was born at Bewdley Aug. 3, 1867, the only son of Alfred Baldwin, Chairman of the Great Western Railway and for 16 years M.P. for Bewdley. Descended from a family, which had long been small landowners in Shropshire, Baldwin's great-grandfather, toward the end of the 18th century, migrated into Worcestershire and established at Bewdley an iron foundry which expanded with the passage of time into the great combination of iron and steel manufactories and collieries known as Baldwin's, Ltd. Stanley Baldwin is thus, on one hand, a son of the soil, on the other, a son of the forge and the factory, and his economic and social outlook was the result of close personal experience of the evolution of modern industry.

Besides the territorial and the industrial there was a third strain in Baldwin's character which came to him from his father's and his mother's people. It was that of Puritanism. Both his parents were of Puritan stock; both, indeed, were brought up as Wesleyan Methodists. His mother, who lived to see her son twice prime minister, was Louise, one of the five remarkable daughters of the Rev. G. B. Macdonald, a Wesleyan minister. Of Mrs. Baldwin's sisters, one became the wife of Sir Edward Burne-Jones; a second of Sir Edward Poynter, P.R.A., and a third of J. L. Kipling. Stanley Baldwin is thus a first cousin of Rudyard Kipling. His mother was a great favourite with Rossetti and William Morris, and it was in this circle and from his close and constant association with his gifted relations that Baldwin derived an abiding taste for the best things in art and literature. In 1881 he went to Harrow and in 1885 to Trinity college, Cambridge, where he took his B.A. in 1888.

After leaving Cambridge Baldwin went into his father's business; and when his father entered parliament in 1892 Stanley Baldwin became virtually the head of the concern. For nearly 20 years the business was the central interest of his life. He became a county magistrate and a county councillor, and lived the life of a country gentleman, with scholarly tastes and large business interests. In 1892 he had married Lucy, the eldest daughter of E. L. J. Risdale of Rottingdean, by whom he had two sons and four daughters. In 1906 he served his apprenticeship to politics by unsuccessfully contesting Kidderminster in the Conservative interest. Two years later his father died, and Stanley Baldwin succeeded to the chairmanship of the business, now converted into a joint stock company, to a seat on the board of the Great Western Railway and to the representation of the Bewdley division of Worcestershire.

On March 3, 1908, the future prime minister took his seat in the House of Commons, and on June 22 made his maiden speech. It was a characteristically modest and sensible contribution to a debate on a subject of which he had intimate knowledge. He spoke in opposition to the Coal Mines (Eight Hours) bill from the point of view of the class which he and his family had represented for four or five generations. In the session of 1909 he had the chance of making a private member's motion. He chose as his theme the investment of British capital abroad, and in the course of his speech revealed himself as an ardent Protectionist. But, although the House listened to him respectfully on the several occasions on which he spoke, he gave no special promise of future distinction. For nine years he did his work as a private member, quietly, effectively and modestly.

Official Career.—Lord Edmund Talbot, later Viscount Fitzalan and then chief whip, noted Baldwin's ability and advised Bonar Law to make him his parliamentary private secretary. This was done in Dec. 1916, and from that moment Baldwin's advancement mas astonishingly rapid. In Jan. 1917, he becdme a junior lord of the Treasury, but instead of going into the whip's

office, he was kept busy "on the bench," deputizing for the financial secretary who had no seat in the House. In June he became joint financial secretary to the Treasury and in that capacity gave valuable assistance in debate to Bonar Law and Austen Chamberlain — successively chancellors of the exchequer. Accustomed to control the policy of a great business concern, Baldwin was not perhaps well fitted for a subordinate place in the official hierarchy, but his efficient work in parliament was rewarded by admission to the Privy Council in 1920 and to the cabinet when, in 1921, he became president of the board of trade. It was there that he first gave proof of the stuff that was in him; but in party politics he was still almost an unknown factor.

His chance, however, came in 1922. The Coalition formed by Lloyd George in Dec. 1916, and cemented by the general election of 1918, was by that time manifestly breaking. Many Liberals, and still more Conservatives, found that the Coalition imposed too great a strain on their political consciences. Lloyd George and his personal followers were anxious to appeal again to the electors as a coalition. The majority of the Conservatives were opposed to them. The crisis came in Oct. 1922, when, in fear of a *coup d'état* by the Coalition ministers, a meeting of the Conservative M P.'s was called at the Carlton club on Oct. 19. Austen Chamberlain presided, and his weight, with that of almost all his colleagues in the cabinet, was thrown into the scale of the Coalition. But they did not prevail with the rank and file of the party, who decided, there and then, by 187 votes to 87 to cut themselves adrift from Lloyd George and the Liberal wing of the Coalition, and to appeal to the country as Conservatives *sans phrase*. That meeting was the turning-point in the history of modern Conservatism, and in the career of Stanley Baldwin.

The result was due, apart from the determination of the rank and file, pre-eminently to two men: Bonar Law and Baldwin. The former emerged from retirement, to rescue his party from the Coalition. His action was heroic; the hand of death was already on him, and nothing but a high sense of duty induced him to essay a task manifestly beyond his strength. But Baldwin's was the greater courage. Only recently admitted to cabinet rank, yet plainly destined to a high place in politics; just approaching the zenith of his powers, physical and intellectual; with everything to lose politically by a false step, he took his courage in both hands and did simply what he believed to be right. His speech was characteristically brief and direct. He went at once to the "root of the whole difficulty — the position of the prime minister," and expressed his conviction that if the "present association" were continued, the disintegrating process in the Conservative ranks, already far advanced, would "go on inevitably until the old Conservative Party was smashed to atoms and lost in ruins." Accordingly he declared himself "prepared to go into the wilderness if he should be compelled" by the dynamic force of Lloyd George to "stay with him."

The die was cast. The meeting voted with Bonar Law and Baldwin; Austen Chamberlain and other Unionist leaders went into the wilderness — temporarily — with Lloyd George; Bonar Law became prime minister — the first Conservative to hold the office in 16 years; Baldwin became chancellor of the exchequer and principal lieutenant in the Commons; Lord Curzon remained foreign secretary and leader in the House of Lords.

The electors endorsed the verdict of the Carlton club meeting; 344 Conservatives were returned, a clear though small majority over all other parties; but the premier was a stricken man and after a few months in office resigned. Length and distinction of service, no less than intellectual pre-eminence, pointed to Lord Curzon as his successor; but the King was persuaded that, since the Labour Party had become the official Opposition, a peer-premier was no longer practicable. Accordingly Baldwin was invited to form a ministry, and, assured of the loyal support of his colleagues, consented. The Ministry was easily reformed under the new premier, but some of the ablest and most experienced Conservatives still remained outside the Ministry and the loss of Bonar Law was severely felt.

Baldwin's first Ministry was short-lived. In Nov. 1923, despite the fact that his parliamentary majority was intact, he decided to ask the electors for a vote of confidence in himself and in the policy which he believed could alone cure trade depression and relieve unemployment — protection for native industries. The country refused its assent. Out of the three parties none commanded an absolute majority in the new parliament. Consequently the Baldwin Ministry, with 259 supporters, met parliament. The Liberals, however, coalesced with the Socialists and turned out the Conservatives. Ramsay MacDonald, thereupon, became the head of a Socialist Government and remained for nine months in office, until a hostile vote in the House of Commons compelled him to appeal to the country, with the result that Baldwin found himself at the head of a solid phalanx of 414 Conservatives. Commissioned to form a ministry he not only invited Austen Chamberlain and other Conservative exiles to rejoin the cabinet, but entrusted the chancellorship of the exchequer to Winston Churchill. Growing steadily in political stature, having won an electoral victory almost without parallel in recent history, he refused to exploit a party triumph, and made a heroic effort to secure, by conciliation and consent, the peace which industry so sorely needed. He failed. His pacific overtures were misinterpreted by the Socialists, who responded to them by proclaiming a general strike. This conspiracy failed ignominiously but parliament could not ignore the danger so narrowly averted, nor neglect precautions against its recurrence. Consequently, an important amendment of the law relating to trade disputes was enacted in 1927 *(see* STRIKES AND LOCKOUTS).

Personality and Character. — The career thus outlined is one of the most remarkable in English political history. Fortune has undoubtedly been kind to him, though in politics fortune rarely smiles except on those whom she suspects to be worthy of her favours. Baldwin has still to win a place in the select company of great statesmen, but fate has given him an opportunity and he himself has given promise that he can take advantage of it. He starts with several initial advantages. The first, and not the least, is that his countrymen know him to be, like Pitt, pecuniarily disinterested. Pitt was a poor man, but his refusal of the Clerkship of the Pells proved that he counted money as dross compared with the public interest. Baldwin, a rich man, proved his public spirit when in June 1919 he presented to the exchequer for cancellation £150,000 of the new War Loan, a sum representing approximately 20% of his total fortune. He hoped, in this way, to set an example of personal sacrifice. He clearly perceived that the country was in grave danger of "being submerged in a wave of luxury and materialism," and he believed that "a fool's paradise is only the ante-room to a fool's hell."

With the ideals of a patriot, Baldwin combines the instincts of a Puritan. He appeals, therefore, if not like Gladstone to the Non-conformist conscience, to the best feelings of all good men, whatever their creed. "I stick all through to what I believe to be right." So Baldwin said at the Carlton club meeting, and his countrymen instinctively recognized that he spoke with sincerity and simplicity. There is no pose about Baldwin, though his briar pipe comes (thanks to the photographers) perilously near one. Simple, sincere, disinterested, he is also shrewd. Keen of intellect, and many sided in interests (as is proved by a volume of non-political addresses On *England* published in 1926), he disdains ostentation and advertisement. He is slow of speech and a curious working of the face and puckering of the brows gives the impression that his thoughts are, like his speech, laboured. "My mind moves slowly," he wrote of himself.

His speeches reveal a fund of dry and rather caustic humour, but in verbal wit he does not excel, though his judgments on men and things are expressed, especially in private, with pungent force and directness. Rhetoric he profoundly mistrusts; oratory he regards with Froude as "the harlot of the arts." Yet he has a keen appreciation of style in literature, and though he is impatient of the intrusion of the intellectual into politics or industry, few men have a higher sense of the value of real education. Less of the scholar, in the narrower sense, than Gladstone or Peel, he belongs like them to the aristocracy of commerce. He loves good art and good literature, but above all he loves nature, and his joy in the sights and sounds and smells of the English

countryside is drawn from that quiet worship which is the basis of all true poetry. No one who was not at once patriot and poet could have made the speech which he delivered on St. George's day, 1924, reprinted in *On England*. (J. A. R. M.)

Apart from the general strike of 1926 and its consequences, the main features of the Baldwin administration of 1924–29 were the passing of the Representation of the People (Equal Franchise) Act (1928), which brought universal adult parliamentary suffrage: and the Local Government Act (1929), by which the Boards of Poor-Law Guardians were replaced by Public Assistance Committees *(see* POOR LAW). In May 1929 the Labour Party returned to office. On the formation of the National Government, 1931, Baldwin became Lord President of the Council and, June 1935 to May 1937, Prime Minister. On his retirement in May 1937 he was created an earl and K.G *See* ENGLISH HISTORY.

BALDWIN LOCOMOTIVE WORKS, THE, situated at Eddystone, Pa., were founded by Matthias W. Baldwin, who completed his first locomotive, the "Old Ironsides," in 1832. It proved a success, and other orders followed. By the time of Baldwin's death, in 1866, the works had a capacity of 125 locomotives *per annum,* and a total of 1,500 had been built. Baldwin, from time to time, had partners associated with him. After his death a new partnership was organized, and this form of management was continued until 1909, when the works were finally incorporated. The plant was concentrated in Philadelphia until 1906, when a large tract was purchased at Eddystone, Pa , about 12 m. from the city. The removal of the works to Eddystone was completed in 1928. The Eddystone tract contains about 500 ac., of which 110 ac. are under roof. To 1940 over 62,200 Baldwin locomotives have been built, the maximum annual production being 3,580 in 1918. The company's products now include besides locomotives of all types (steam, electric, Diesel and gasoline), marine boilers, forgings and steel castings, ferrous and non-ferrous castings, hydraulic press machinery, tensile and compression testing machines, water power equipment, Diesel engines, etc. (M. K. W.)

BALDWINS LIMITED. This British joint-stock company amalgamated, in 1902, a number of old-established undertakings, including colliery owners, steel manufacturers, and makers of tinned, galvanized, leadcoated and black sheets; it has since enlarged its operations by further amalgamations.

The company has many famous associations. The Rt. Hon. Earl Baldwin of Bewdley, a former prime minister, was a director until he resigned to join the Government in 1917; it was near the Pontypool works of the company that Major Capel Hanbury first produced iron sheets by rolling instead of hammering; it was at the company's Landore steel works that Dr. Siemens carried on the greater part of the research that ultimately led to the invention of the open-hearth method of producing steel; while at the Worcestershire village, Cookley, the first tinplate coated through rolls was made in the '60s. The Cookley tinpot was almost as great an advance in tinning over the old method as Hanbury's invention of rolling in the production of iron sheets. (L. C. M.)

BALE, JOHN (1495–1563), bishop of Ossory, English author, was born at Cove, near Dunwich in Suifolk, on Nov. 21, 1495. At the age of 12 he entered the Carmelite monastery at Norwich, removing later to the house of "Holme," probably the abbey of the Whitefriars at Hulne near Alnwick. Later he entered Jesus college, Cambridge, graduating B.D. in 1529. At Cambridge he came under the influence of Cranmer and of Thomas Wentworth, 1st Baron Wentworth, and became an ardent partisan of the Reformers. He obtained the living of Thornden, Suffolk, in spite of being married. He enjoyed the powerful protection of Thomas Cromwell, whose notice he is said to have attracted by his miracle plays. He was an unscrupulous controversialist, and in these plays he allows no considerations of decency to stand in the way of his denunciations of the monastic system and its supporters. The prayer of Infidelitas which opens the second act of his *Thre Laws* is an example of the lengths to which he went in profane parody. These violent productions were well calculated to impress popular feeling, and no doubt Cromwell found in him an invaluable instrument. But on his patron's fall in 1540 Bale fled with his wife and children to Germany. He returned on the accession of Edward VI. He received the living of Bishopstoke, Hampshire, being promoted in 1552 to the Irish see of Ossory. He refused to be consecrated by the Roman rite which still obtained in the Irish Church, and won his point, though the dean of Dublin entered a protest against the revised office during the ceremony *(see* his *Vocacyon of John Bale to the Bishopperycke of Ossorie, Harl. Misc.,* vol. vi.). Bale pushed his Protestant propaganda in Ireland with no regard to expediency, and on the accession of Mary, it was with difficulty that he was got safely out of the country. He eventually made his way to Holland and thence to Frankfurt and Basle. After his return, on the accession of Elizabeth, he received (1560) a prebendal stall at Canterbury. He died in Nov. 1563 and was buried in the cathedral. Of Bale's mysteries and miracle plays only five have been preserved. The *Thre Laws of Nature, Moses and Christ, corrupted by the Sodomytes, Pharisses and Papystes most wicked* (pr. 1538 and again in 1562) was a morality play. The direction for the dressing of the parts is instructive: "Let Idolatry be decked like an old witch, Sodomy like a monk of all sects, Ambition like a bishop, Covetousness like a Pharisee or spiritual lawyer, False Doctrine like a popish doctor, and Hypocrisy like a gray friar." *A Tragedye; or enterlude manyfesting the chief promyses of God unto Man . . .* (1538, printed in Dodsley's Old Plays, vol. i.), *The Temptacyon of our Lorde* (ed. A. B. Grosart in *Miscellanies of the Fuller Worthies Library,* vol. i., 1870), and *A brefe Comedy or Enterlude of Johan Baptystes preachynge in the Wyldernesse, etc.* (*Harl. Misc.* vol. i.) were all written in 1538. His plays are doggerel, but his *Kynge Johan (c.* 1548) has some historical importance, since it marks the transition between the old morality play and the English historical dramas.

But Bale's most important work is *Illustrium majoris Britanniae scriptorum, hoc est, Angliae, Cambriae, ac Scotiae, Summarium . . .* (Ipswich and Wesel, for John Overton, 1548, 1549). This contained five centuries, but another edition, almost entirely rewritten and containing 14 centuries, was printed at Basle with the title *Scriptorum illustrium majoris Britanniae . . . Catalogus* (1557–59). The chronological catalogue of British authors and their works was partly founded on the *Collectanea* and *Commentarii* of John Leland.

A list of Bale's works is to be found in *Athenae Cantabrigienses* (vol. i. pp. 227 *seq.*). Beside the reprints already mentioned, *The Examinations of Lord Cobham, William Thorpe and Anne Askewe, etc.* were edited by the Rev. H. Christmas for the Parker Society in 1849. Bale's autograph note-book is preserved in the Selden collection of the Bodleian library, Oxford. It contains the materials he collected for his two published catalogues arranged alphabetically, with no attempt at ornament of any kind, and without the personalities which deface his completed work. He also gives in most cases the sources from which his information was derived. This book was prepared for publication with notes by Dr. R. Lane Poole, with the help of Miss Mary Bateson, as *Index Britanniae Scriptorum quos . . . collegit Ioannes Baleus* (1902), forming part ix. of *Anecdota Oxeniensia.*

BALE. (1) Evil, suffering, a word obsolete except in poetry, and more common in the adjectival form "baleful." In early poetry, used in antithesis to "bliss"; (2) a bonfire, a northern English use more common in "bale-fire"; (3) in industry, a bundle or package of material, bound in canvas with bands of metal or other hoops. The size and weight of a bale varies with the custom of different trades. A bale of American cotton weighs 500 lbs.; of Egyptian cotton 700 lbs. (4) More correctly "bail," to empty water out of a boat by means of a bail or bucket.

BALEARIC ISLANDS (BALEARES), an archipelago of four islands, with a number of islets, in the Mediterranean, off the east coast of Spain, of which it forms a province. Pop. (1930) 365,512; (est. 1939) 389,760; area 1,935 square miles. The archipelago, which lies between 38° 40′ and 40° 5′ N., and 1° and 5° E., comprises two distinct groups. In the eastern and larger group, the ancient Gymnesiae Insulae and Insulae Baliares, are the two principal members, Majorca (Span., Mallorca) and Minorca (Span., Menorca), with the islet of Cabrera and others. The

western group, the ancient Pityusae or Isles of Figs, comprises two relatively large islands, Iviza (Span. Ibiza), the ancient Ebusus, and Formentera, the ancient Ophiusa, with a number of islets. Majorca, Minorca and Iviza are described in separate articles, and Formentera with the last named.

Geology and Topography. — The Balearic Islands are the emergent portions of two submarine plateaux rising from the sill by which, at a depth of some 3,000ft., the mountain chains of the province of Alicante are continued for over 150m. beyond the triple headland of Cape de la Nao. Both plateaux lie near the surface, so that a fall of only 150ft. in the level of the Mediterranean would make the western group into one large island, while a fall of about 300ft. would unite Majorca with the adjoining islets and leave it joined to Minorca by a narrow ridge. Formentera, an island in which two low tablelands (the higher, La Mola, 630ft.) are connected by a narrow isthmus of alluvium, continues the horizontal formations, mostly of Pleistocene date, of the south of Iviza; these reappear in the chain of islets dotting the intervening channel, and similar formations penetrate to the heart of Iviza from other parts of the coast. The older formations of Iviza, mainly Cretaceous but with upper Trias and upper Jurassic appearing in the north-east, have been violently folded by pressure from the south-east and rise to 1,560ft. in La Atalayasa; the island, like Majorca, is elongated in the direction of the submarine sill and at right angles to the direction of this pressure; the threefold imbricated structure of these formations corresponds to that of the mountain chain of north-west Majorca, and the post-Burdigalian date of folding to the date of the later folding movements in Alicante and south-east Majorca. In Majorca the horizontal formations, among which the fertile marls and mollasses of the Vindobonian levels of the Miocene are more important than in Iviza, lie in a broad belt of lowland, scarred by the courses of torrents descending mostly from the rugged sierras on the north-west (Puig Mayor, 4,736ft.) or from the zone of highland, less elevated (nowhere reaching 2,000ft.) and less rugged in profile, on the south-east; they also partly envelop the southern end of this highland zone. Between the structure of the highland zone and that of the high sierra zone no correlations have been established; the former is more obviously a zone of *charriages*, and bears clear evidence of folding movements of early Oligocene date besides the post-Burdigalian movements already mentioned. The older formations are brought up also as inliers, rising in hills above the central lowlands at Randa and Petra, by posthumous movements which are believed, to have continued into Pleistocene time. Like the structure, the geological history of Majorca is more complex than that of Iviza; the gaps in the stratigraphical sequence are fewer, for the Trias is complete, and the Lias and Lower Oolite appear here, though wanting in the Iviza group. Structural resemblances and the great similarity of facies of the strata which belong to the same horizon in the two islands indicate that Iviza and Majorca belong to the same tectonic unit and have had, broadly speaking, the same geological history.

The case of Minorca is quite different. The island stands on the edge of the subtnarine sill, overlooking deeps of 8,000ft. to the north-east and at a distance of only 25m. from Majorca. But its principal axis, roughly the line Mahon-Ciudadela, lies obliquely to the direction of the sill; the! older formations, which make up the zone to the north of this axis, have been subjected to pressure chiefly from the east; there are no Alpine characters in the structure of this zone, and Monte Toro, the highest of the small and usually arid hills which stand out from its somewhat worn relief, reaches only to 1,175ft. The direction and the pre-Burdigalian date of the pressure, the wide extension of palaeozoic formations (Devonian), unknown elsewhere in the Balearics, the dissimilarity of facies between the Trias and Neocomian of Minorca and contemporaneous strata in the other islands, and the general "Catalan," rather than Balearic, character of Minorca suggest that the island is to be regarded as a piece of débris from the Continental massif which formerly united Sardinia with Catalonia, rather than as an integral portion of the Alpides with which it is now accidentally associated. In the south of Minorca, separated by a well marked depression from the northern zone, the Vindobonian beds form a low tableland of gently rolling surface, not infertile in itself, and cut by broad ravines with highly fertile alluvial bottoms.

Climate. — The mildness and humidity of the climate and the differences of exposure between places at sea-level are indicated by the following meteorological data for Palma and Port Mahon: —

Particulars of climate	Palma	Port Mahon
Mean annual variation	60° F (max. 95°, min. 35°)	59° F (max. 93°, min. 34°)
,, daily variation	15° F (max. 71°, min. 56°)	11° F (max. 67°, min. 56°)
,, annual rainfall	484 mm.	628 mm.
Days of rainfall per ann.	73	80
,, ,, gales per ann.	1·4	27
Humidity	73%	70%

The summer months are almost rainless throughout the islands.

Industry and Trade. — Arboriculture is the traditional industry of Majorca and Iviza, and the cereals and legumes which are grown are usually intercalated in the orchards or olive groves; large numbers of swine are raised on the figs and other orchard refuse.

In Minorca, where shelter from the north-west wind is wanting, agriculture and stock-raising go hand in hand. Of the trees cultivated the most important are the olive and almond, which have largely replaced the vine in Majorca, the almond now gradually taking the place of the olive also. Next in importance to the almond among the fruits come the nopal, carob and apricot. The absence of permanent watercourses and the permeability of the soils make irrigation difficult outside the zone of the Albufera, into which the unhealthful marshlands of the Bay of Alcudia have been drained.

Stock-raising is handicapped by the lack of water for irrigation of pastures, but the number of artificial meadows, favoured by the humid climate and the heavy dews, is increasing. Greater security of land tenure in Minorca, where the *aparceria* (similar to the French *métayage*) for indefinite periods prevails, seems to assist progress. Sheep are numerous on the two larger islands and supply milk; they are shorn twice yearly, but the wool is of poor quality. The mineral productions include lignite and sea salt, and superphosphates, cement and coke are manufactured. Barcelona is the *entrepôt* for the chief imports of the Balearics. With Barcelona and Valencia there is a fair export trade in swine and occasionally in sheep. The direct export trade in fruits is vigorous; of these the almond is most widely distributed, ordinarily to Britain, France, Algeria, Puerto Rico and Cuba.

Inhabitants. — The islanders are closely akin to the Catalans; but the long period of Moorish rule has left its mark on their physical type and customs. Crime is rare. There are secondary and normal schools in Palma, but the standard of primary education is below the Spanish average and much below the Catalonian. Castilian is spoken by the upper and commercial classes; the lower and agricultural speak a dialect of Catalan; there is a French-speaking colony at Soller in Majorca.

History. — Of the origin of the early inhabitants of the Balearic Islands nothing is certainly known, though Greek and Roman writers refer to the Boeotian and Rhodian settlements. According to general tradition the natives, from whatever quarter derived, were a strange and savage people till they received some tincture of civilization from the Carthaginians, who built Mago (Port Mahon) and Jama (Ciudadela). About 23 years after the destruction of Carthage the island was conquered for the Romans by Q. Caecilius Metellus, who founded the cities of Palma and Pollentia, near the modern Alcudia, and introduced the cultivation of the olive. Besides valuable contingents of the celebrated Balearic slingers, the Romans derived from their new conquest mules (from Minorca), edible snails, sinope and pitch. In A.D. 465 the islands were seized by the Vandals and in 534 by Belisarius for the Byzantine empire. Though raided frequently by the Muslims as well as by the Normans, the islands were not permanently

conquered for the Omayyads of Córdova until 903. After the fall of the Omayyads and until their conquest by James I. of Aragon in 1232, they experienced the same alternations between independence and subjection to the Almoravids and Almohads as the small Muslim States of the Peninsula; an independent Almoravid dynasty maintained itself here until as late as 1203. The islands formed an independent kingdom until 1349, from which time their history merges with that of Aragon. In 1521 a peasant insurrection wiped out many of the nobility of Majorca, and the rebellion was suppressed only with difficulty. In the War of the Spanish Succession all the islands declared for Charles; Count Villars reduced Minorca in 1707 but it was not until 1715 that Majorca was subjected. Meanwhile the British under General Stanhope captured Port Mahon in 1708. The island was ceded to Great Britain in 1713, but in 1756 a French force defeated the British Admiral Byng and captured Port Mahon. The island was restored to England in 1763 and remained in Britain's possession until seized by Spain in 1782. Once more the British captured it in 1788, but by the peace of Amiens in 1802 it was finally ceded to Spain. In the nationalist revolution of July 1936, points in the islands were seized by insurgent troops. Loyalist forces recaptured Iviza and Formentera in Aug. 1936, but these were again lost to the rebels in September. Minorca remained longest in loyalist possession. For a time it was expected that the islands would be ceded to Italy in return for aid extended to General Franco during the rebellion.

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ARCHAEOLOGY

No finds that can with certainty be attributed to the Stone Age have been made in the Balearic Islands, and it seems likely that the earliest population was not established here until the beginning of the metal era. To the aeneolithic period, then, must be attributed the few flint implements hitherto discovered, that are on this view the contemporaries of some simple arrowheads and a beaker sherd. To this period also are assigned certain cave-dwellings and artificial grotto-graves, and even the more complicated rock-hewn tombs of San Vincente in Majorca that are clearly related to the grottoes of south France. On the other hand, various natural and artificial grottoes in the same island, recently excavated, contained pottery assigned to the El Argar stage of the Spanish Bronze Age, so that it is probable that the continental Bronze Age was well established at the time of the development of the earliest civilization in the islands. At any rate, it seems certain that the most remarkable of the prehistoric remains in the Balearic group are not earlier than perhaps about 1,000 B.C., and represent a culture that persisted with little change until Roman times.

The Talayots and the Navetas are the best-known monuments of this culture. The Talayots (Catalan, watch-towers) are exceedingly numerous; they are conical towers about 20ft. in height with either a round or a square plan, and they enclose a chamber about 15 to 20ft. in width; this room was roofed, generally with the aid of supporting pillars, and there was an upper story, but in no instance has this survived in its complete original state. The masonry of the round towers, doubtless the oldest structures in the islands, is very rough, the walls being composed of immense rugged blocks of stone; but the four-cornered talayots, that are presumably later, show more careful workmanship. As a class they are obviously akin to the *nuraghi* of Sardinia, and it seems probable that, like the nuraghi, they served as fortified dwelling-places. It is true that there is clear evidence of the deposition of cremation-burials (and even signs of cremation-fires) in the talayots of Majorca, and that there is also proof of occasional burial in the talayots of Minorca, but the position and character of the structures, in particular as regards the entrance, the presence of occasional out-buildings, and the fact that they are often collected in settlements surrounded by a wall, prove that the talayots were built primarily as dwelling-places. Indeed, the *poblats* or villages, as at Lluchmajor in Majorca, are only more complicated forms of the same talayot architecture.

The *Naus* or *Navetas* (Catalan, ships), on the other hand, were graves. These are found chiefly in Minorca, and are elongated pyramidal structures, likewise built of immense blocks of stone, with a rounded end and a squared or slightly concave front; in this front face is a tiny door giving access through a passage to a long rectangular chamber that was roofed in a manner now unknown. In the famous Nau d'Es Tudons the total length of the structure was 45ft., and the height 12ft. The plan of the navetas is almost the same as that of the larger burial-grottoes of which they are probably copies. Many small artificial grottoes (coves) must also be counted among the remains of the talayot-culture; and while some of these have been found to contain both burnt and unburnt burials, many of them may have been used as habitations. Among the pottery from these sites is much Roman ware, and there have also been found a red figure crater, a Campanian vase, and sherds of painted Iberian ware. Furthermore, the native conical hollow-footed cups and lead plaques of the talayot-culture have been found in a Roman context. Bronze double-axes, bronze and iron bird-headed sceptres, and bronze figures of oxen, seem also to date from a late phase of this culture; thus, the important group of three bronze heads of oxen (two life-size) from Costig in Minorca cannot well be an immediate product of Cretan or Aegean influence, for though the type may perhaps be traced into the Early Iron Age cultures of Central Europe, it seems clear that in the islands these figures are not older than the second to first centuries B.C.

The "temples," such as the building at Costig, may, of course, have been used as ordinary habitations, though there is good reason to suspect their religious nature. They are squarish enclosures with one rounded side, and within the area stands a *taula* (table), a pillar 6ft. to 12ft. in height supporting a horizontal slab. These T-shaped taulas are probably central supports for roofing, an explanation warranted by the fact that there are often supplementary pillars between the taula and the outer wall and also by the fact that the taula-method of roofing is actually employed in the artificial grottoes. This, at any rate, was the view of E. Cartailhac and A. Bezzenberger, but the suggestion of A. Mayr that the taulas were a variety of baetyl in a hypaethral temple deserves consideration.

There is no doubt of the general relationship between the architecture of the talayot-culture and the megalithic architecture of the western Mediterranean, and there is philological proof of an intimate bond at an early period between the Balearics and Sardinia. Indeed: if the first population of the Balearics was an aeneolithic or Early Bronze Age folk derived from Spain, it may be that the talayot-culture represents a later Bronze Age immigration from Sardinia, a movement that possibly originated in north Africa. At any rate, it seems that for some time after the establishment of the talayot-culture Spanish influence was of little account, and was not asserted again until an advanced period in the Early Iron Age.

There is little evidence of direct Greek influence in the Balearics, though visits from merchants on their way to Ampurias are likely enough. A few fragments of pottery and some archaic bronze figures are, however, the only relics of the period; nor

is there any considerable sign of Carthaginian dominion. On the other hand, the Roman occupation in the second century B.C. seriously modified the talayot-culture, and in addition to the remains of the mixed civilization already described there are several notable Roman structures such as the aqueduct at Pollensa.

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BALEN, HENRY VAN (1560–1632), Flemish painter, was born in Antwerp in 1560, and died there on July 17, 1632. He was a pupil of Adam von Noort, and after travelling for a time in Italy, he joined the Gild of St. Lucas at Antwerp in 1593. Balen was the first master of Van Dyck; he collaborated with various painters, including J. Breughel and F. Snyders. His subjects are chiefly religious and mythological. His painting of the Holy Family is in the chapel of Notre Dame, Antwerp. Other pictures at Antwerp are: "The Trinity" and "The Adoration of the kings"; the Musée de Paris has two—the "Holy Family in the desert, attended by angels," and "Abraham sending away Agar and her son Ismael."

BALES (BALESIUS), PETER (1547–1610?), English calligraphist, one of the inventors of shorthand writing, was born in London in 1547, and is described by Anthony à Wood as a "most dexterous person in his profession. . . ." John Evelyn speaks of him as having written, in the year 1575, "the Lord's Prayer, the Creed, Decalogue, with two short prayers in Latin, his own name, motto, day of the month, year of the Lord, and reign of the queen, to whom he presented it at Hampton Court, all of it written within the circle of a single penny, inchased in a ring and borders of gold, and covered with a crystal, so accurately wrought as to be very plainly legible; to the great admiration of her majesty, the whole privy council, and several ambassadors then at court." Bales was very dexterous in imitating handwritings, and between 1576 and 1590 was employed by Secretary Walsingham in certain political manoeuvres. He was at the head of a school near the Old Bailey, London, in 1590, in which year he published his *Writing Schoolemaster, in three Parts.* This book included an *Arte of Brachygraphie,* which is one of the earliest attempts to construct a system of shorthand. He died about the year 1610.

BALFE, MICHAEL WILLIAM (1808–1870), Irish music composer, was born on May 15, 1808, at Dublin, the son of a dancing master. At the age of seven he composed a polacca and two years later appeared in public as a violinist. On the death of his father in 1823 he was engaged as a violinist in the orchestra of Drury lane, and then made an unsuccessful début as a barytone at Norwich in *Der Freischütz.* In 1825 he was taken to Rome by Count Mazzara, being introduced to Cherubini on the way. In Italy he wrote his first dramatic work, a ballet, *La Pérouse.* At the close of 1827 he appeared as Figaro in Rossini's *Il Barbiere* at the Italian opera in Paris. Returning to Italy, he remained there some nine years, singing at various theatres and composing a number of operas. During this time he married Mlle. Luisa Roser, a Hungarian singer whom he had met at Bergamo. Fétis says that the public indignation roused by an attempt at "improving" Meyerbeer's opera *Il Crociato* by interpolated music of his own compelled Balfe to throw up his engagement at the theatre La Fenice in Venice. By this time he had produced his first complete opera, *I Rivali di se stessi,* at Palermo in the carnival season of 1829–30; the opera *Un Avvertimento ai gelosi* at Pavia; and *Enrico Quarto* at Milan, where he had been engaged to sing with Malibran at the Scala. He returned to England in the spring of 1833, and on Oct. 29, 1835 his *Siege of Rochelle* was rapturously received at Drury lane. *The Maid of Artois* followed on May 27, 1836—the success of the opera being confirmed by the exquisite singing of Malibran. In 1838 he sang the part of Papageno in the first performance of *The Magic Flute* in English. Balfe was a prolific composer. His English operas alone include: *Siege of Rochelle* (1835); *The Maid of Artois* (1836); *Catherine Grey* (1837); *Joan of Arc* (1837); *Falstaff* (1838, Lablache in title-rôle); *Amelia, or the Love Test* (1838); *Keolanthe* (1841); *The Bohemian Girl* (Nov. 27, 1843); *The Daughter of St. Mark* (1844); *The Enchantress* (1845); *The Bondman* (1846); *The Devil's in it* (1847); *The Maid of Honour* (1847); *The Sicilian Bride* (1852); *The Rose of Castile* (1857); *Satanella* (1858); *Bianca* (1860); *The Puritan's Daughter* (1861); *The Armourer of Nantes* (1863); *Blanche de Nevers* (1863). Of all these works the most famous and successful was, of course, *The Bohemian Girl,* which was given all over Europe, and which even to-day keeps its place in the active repertory. Balfe also wrote several operas for the Opéra Comique and Grand Opéra in Paris, where MM. Scribe and St. George provided him with the libretti for his *Le Puits d'amour* (1843) and his *Les Quatre Fils Aymon* (1844). His *L'Étoile de Seville* was written in 1845 for the Académie Royale. In 1864 he retired to Rowney Abbey, Hertfordshire, and amused himself with farming. The briefest account of Balfe would be incomplete which did not mention that he was the composer of "When other Lips" and "I dreamt that I dwelt in marble halls." He died on Oct. 20, 1870.

BALFOUR, ARTHUR JAMES BALFOUR, 1ST EARL OF (1848–1930), British statesman, eldest son of James Maitland Balfour of Whittingehame, Haddingtonshire, and of Lady Blanche Gascoyne Cecil, a sister of the 3rd marquess of Salisbury, was born on July 25, 1848. Educated at Eton and Trinity college, Cambridge, in 1874 he became M.P. in the Conservative interest for Hertford and represented that constituency until 1885. When, in the spring of 1878, Lord Salisbury became foreign minister on the resignation of the 15th Lord Derby, Balfour became his private secretary, and accompanied him to the Berlin Congress. At this time also he became known in the world of letters, the intellectual subtlety and literary capacity of his *Defence of Philosophic Doubt* (1879) suggesting that he might make a reputation as a speculative thinker. Released from his duties as private secretary to Lord Salisbury, his uncle, by the general election of 1880, he began to take a rather more active part in parliamentary affairs. He was for a time politically associated with Lord Randolph Churchill, Sir Henry Drummond Wolff, and Sir John (then Mr.) Gorst, the quartette becoming known as the "Fourth Party" and gaining notoriety by the freedom of the criticisms directed by its leader, Lord Randolph Churchill, against Sir Stafford Northcote, Lord Cross, and other prominent members of the "old gang." In these sallies, however, Balfour had no direct share. He was thought to be merely amusing himself with politics. It was regarded as doubtful whether he had the bodily strength or the energy of character requisite for a big political career. The House did not take him quite seriously. Members did not suspect the reserve of strength and ability beneath what seemed to them to be the pose of a parliamentary *flaneur.* As a member of the very select social coterie known as the "Souls" he was, so to speak, "caviare to the general." Indolence was supposed to be the key-note of his character—a refined indolence, with cleverness of a somewhat sceptical and superior order.

These views were not shared by Lord Salisbury. In his first administration (June 1885–Jan. 1886) he made Balfour president of the Local Government Board, and in forming his second administration (July 1886) secretary for Scotland with a seat in the cabinet. Sir Michael Hicks-Beach resigned the chief secretaryship for Ireland in 1887, and in his stead Lord Salisbury appointed his nephew. By the Irish Nationalists the appointment was received with contemptuous ridicule, for none suspected Balfour's serene fearlessness, his tenacity with finesse, his debating power, his ability in attack, and his still greater capacity to disregard criticism. The debates on the Crimes bill and the Irish land bill quickly undeceived them, and the steady and even remorseless vigour with which the government of Ireland was conducted speedily convinced the House of Commons and the country that Balfour was in his right place as chief secretary. His policy was that of "coercion"—the fearless administration of the Crimes Act—coupled with remedial legislation; and he enforced the one while he proceeded with the other, regardless of the risk of outrage outside the House and of insult within. Balfour's work in this office covered one of the most turbulent and most exciting periods in modern parliamentary history and Irish administration. With

a courage that never faltered he broke down the Plan of Campaign in Ireland, and in parliament he not only withstood the assaults of the Irish Nationalists, but waged successful warfare with the Home Rule party. Events, it is true, were in his favour. The disclosures before the Parnell Commission, the O'Shea divorce proceedings, the downfall of Parnell, and the disruption of the Irish party assisted him in his task; but the fact remains that by persistent courage and undeviating thoroughness he reduced crime in Ireland to a vanishing point. His work was also constructive, for he broadened the basis of material prosperity and social progress by creating the Congested Districts Board in 1890. During this period, from 1886–92, moreover, he developed gifts which made him one of the most effective of public speakers. Impressive in matter rather than in manner of delivery and seldom rising to the level of eloquence in the sense in which that quality was understood in a House which had listened to Bright and Gladstone, his speeches were logical and convincing and their attractive literary form delighted a wider audience than that which listens to the mere politician.

On the death of W. H. Smith in 1891 he became first lord of the Treasury and leader of the House of Commons, and in that capacity introduced in 1892 a Local Government bill for Ireland. The Conservative government was then at the end of its tether, and the project fell through. For the next three years Balfour led the opposition in the House of Commons with great skill and address. On the return of the Unionists to power in 1895 he resumed the leadership of the House, but not at first with the success expected of him, his management of the abortive education proposals of '96 being thought, even by his own supporters, to show a disinclination for the continuous drudgery of parliamentary management. But after the opening session matters proceeded more smoothly. His successful conduct of an Irish Local Government bill, his championship of the voluntary schools, his adroit parliamentary handling of the problems opened up by the movement against ritualistic practices in the Church of England, and his pronouncement in favour of a Roman Catholic university for Ireland—for which he outlined a scheme that met with much adverse criticism both from his colleagues and his party—were the most important aspects of Balfour's activity during the years 1895–1900. During the illness of Lord Salisbury in 1898, and again in Lord Salisbury's absence abroad, he was in charge of the foreign office, and conducted the very critical negotiations with Russia on the important question of railways in north China. At the general election of 1900 he was returned for East Manchester (which he had represented since 1885) by a majority of 2,453, and continued in office as first lord of the Treasury.

On Lord Salisbury's resignation on July 11, 1902, his nephew succeeded him as prime minister, with the cordial approval of all sections of the Unionist party. Balfour reconstituted the cabinet. He himself became first lord of the Treasury and lord privy seal, with the duke of Devonshire (remaining lord president of the council) as leader of the House of Lords; Lord Lansdowne remained foreign secretary, Mr. (afterwards Lord) Ritchie took the place of Sir Michael Hicks-Beach (afterwards Lord St. Aldwyn) as chancellor of the exchequer, Mr. Chamberlain remained colonial secretary, his son Austen being postmaster-general with a seat in the cabinet. The task of clearing up after the war, both in South Africa and at home, lay before the government; but the prime minister's cordial relations with Chamberlain and the enthusiastic support of a large parliamentary majority made the prospects fair. Chamberlain went to South Africa in the late autumn, with the hope that his personality would influence the settlement there; and the Venezuela crisis was met by tactful handling and by an ultimate recourse to arbitration. The extension of the new Education Act to London and Wyndham's Irish Land Purchase Act were well received. But Ritchie's remission of the shilling import-duty on corn led to Chamberlain's crusade in favour of tariff reform and colonial preference, and as the session proceeded the rift widened in the Unionist ranks.

Balfour had always admitted the onesidedness of the English free-trade system, and had supported the desirability of retaliating against unfair competition and "dumping" by foreign countries. But Mr. Chamberlain's new programme for a general tariff, with new taxes on food arranged so as to give a preference to colonial products, involved a radical alteration of the established fiscal system, and such out-and-out Unionist free-traders in the cabinet as Ritchie and Lord George Hamilton, and outside it, like Lord Hugh Cecil and Arthur Elliot (secretary to the Treasury), were entirely opposed to this. Balfour was anxious to avoid a rupture, doubtful of the feeling of the country, uncertain of the details by which Chamberlain's scheme could be worked out. As leader of the party and responsible for the maintenance of so great a political engine, he was anxious not to be precipitate. He was neither for nor against the new movement and professed to hold "no settled convictions" on the subject. From the middle of May, when Chamberlain began to press the matter, Balfour had a difficult hand to play, so long as it was uncertain how the party would follow the new lead. Another opportunity for making political capital was provided by the publication of the report of the royal commission on the Boer War under Lord Elgin's chairmanship, which horrified the country by its disclosures (Aug. 26) of political and military muddling and the want of any efficient system of organization.

On Sept. 16 Balfour published a pamphlet on "Insular Free Trade," and on the 18th it was announced that Lord George Hamilton and Ritchie had resigned, Lord Balfour of Burleigh and Arthur Elliot following a day or two later. These were the strait free-traders, but at the same time Chamberlain resigned also. The correspondence between Chamberlain and Balfour (Sept. 9 and 16) was published, and presented the latter in the light of a sympathizer with some form of fiscal union with the colonies, if practicable, and in favour of retaliatory duties, but unable to believe that the country was yet ready to agree to the taxation of food required for a preferential tariff, and therefore unwilling to support that scheme. At the same time he encouraged Chamberlain to test the feeling of the public and to convert them by his missionary efforts outside the government. Chamberlain on his side emphasized his own parliamentary loyalty to Balfour. In his pamphlet on "Insular Free Trade" the prime minister reviewed the economic history since Cobden's time, pointed to the falsification of the promises of the early free-traders, and to the fact that England was still the only free-importing country, and insisted that he was "in harmony with the true spirit of free-trade" when he pleaded for "freedom to negotiate that freedom of exchange may be increased." This manifesto was at first taken, not only as the platform of the government, but also as that from which its resigning free-trade members had dissented; and the country was puzzled by a statement from Lord George Hamilton that Balfour had circulated among his colleagues a second and different document in fuller agreement with Chamberlain. The situation was confused by personal suspicion and distrust as well as by economic difficulties. But the public noted that the duke of Devonshire, whose orthodoxy was considered typical, remained in the cabinet.

On Oct. 1 Balfour spoke at Sheffield, reiterating his views as to free-trade and retaliation, insisting that he "intended to lead," and declaring that he was prepared to reverse the traditional fiscal policy by doing away with the axiom that import duties should only be levied for revenue purposes. The speech was not enthusiastically received by the National Union of Conservative Associations, known to be predominantly in sympathy with Chamberlain. The free-traders also did not like Balfour's formula as to reversing the traditional fiscal policy of irnport taxes for revenue only. Next day the duke of Devonshire resigned, a step somewhat bitterly resented by Balfour, who clearly thought that his sacrifices in order to conciliate the duke had now been made in vain. During this critical fortnight the duke had apparently acquiesced in Balfour's compromise and had co-operated in reconstituting the ministry.

During the remainder of 1903 the struggle within the Unionist party continued. Chamberlain spoke all over the country, advocating a definite scheme for reorganizing the budget, so as to have more taxes on imports, including food, but proposing to adjust the tsxation so as to improve the position of the working-classes and

to stimulate employment. The free-trade Unionists, with the duke of Devonshire, Lord Goschen, Lord James, and Lord Hugh Cecil as their chief representatives, started a Free Food League in opposition to Chamberlain's Tariff Reform league. They criticized Balfour's attitude and repudiated his assumption that retaliation would be desirable. Finally in December came the appointment of Chamberlain's Tariff Commission. There was no doubt about the obstinacy and persistency of both sections, and both were fighting, not only to persuade the public, but for the capture of the party and of its prime minister. Both sides were inclined to claim him; neither could do so without qualification. Balfour insisted that in any case no definite action could be taken till the next parliament; and while he declined to go the "whole hog"—as the phrase went—with Chamberlain, he did nothing to discourage Chamberlain's campaign. Minor changes were made in the ministry in 1903, the government held together, and in 1904 the Licensing bill was successfully carried. Though a few Unionists transferred their allegiance, notably Winston Churchill, and by-elections went badly, Balfour still commanded a considerable though a dwindling majority. On Oct. 3 Balfour spoke at Edinburgh on the fiscal question. The more aggressive protectionists among Chamberlain's supporters had lately become very confident. Mr. Balfour plainly repudiated "protection" in so far as it meant a policy aiming at supporting or creating home industries by raising home prices; but he introduced a new point by declaring that an Imperial Conference would be called to discuss with the colonies the question of preferential tariffs if the Unionist government obtained a majority at the next general election.

It was plain indeed that the fiscal question itself was ripe for the polls; Board of Trade statistics had been issued in profusion, and the whole case was before the country. But, though Chamberlain declared his desire for an early appeal to the electors, he maintained his parliamentary loyalty to Balfour. There were, moreover, public reasons why a change of government was undesirable. While foreign affairs were being admirably conducted by Lord Lansdowne, they were critical enough to make it dangerous to contemplate a "swopping of horses." The Russo-Japanese War might at any moment lead to complications. The exercise by Russian warships of the right of search over British ships was causing great irritation in English commercial circles during 1904; on Oct. 23 the outrageous firing by the Russian Baltic fleet on the English fishing-fleet off the Dogger Bank in the North sea was within an ace of causing war. There were also important negotiations on foot for a renewal or revision of the treaty with Japan; and it was felt that on these grounds it would be a mistake for the government to allow itself to be driven into a premature dissolution, unless it found itself unable to maintain a majority in parliament. The end came in Nov. 1905, precipitated by a speech made by Balfour at Newcastle on the 14th, appealing for unity in the party and the sinking of differences, an appeal plainly addressed to Chamberlain, whose supporters were clamouring for a fighting policy. But Chamberlain was no longer prepared to wait. On Nov. 21 at Bristol he insisted on his programme being adopted, and Balfour was compelled to abandon the position he had held with so much tactical dexterity for two years past. Amid Liberal protests in favour of immediate dissolution, he resigned on Dec. 4; and Sir Henry Campbell-Bannerman was entrusted by the King with the formation of a government. The Unionists went to the polls with divided counsels and sustained a crushing defeat, Balfour himself being defeated by a large majority in Manchester.

Negotiations took place, between Balfour and Chamberlain which resulted in the patching up of an agreement (expressed in a correspondence dated Feb. 14), and its confirmation at a meeting of the party at Lansdowne House a few days later. The new compact was indicated in Mr. Balfour's letter, in which he declared that "fiscal reform is, and must remain, the first constructive work of the Unionist party; its objects are to secure more equal terms of competition for British trade and closer commercial union with the colonies; and while it is at present unnecessary to prescribe the exact methods by which these objects are to be attained, and inexpedient to permit differences of opinion as to these methods to divide the party, though other means are possible, the establishment of a moderate general tariff on manufactured goods, not imposed for the purpose of raising prices or giving artificial protection against legitimate competition, and the imposition of a small duty on foreign corn are not in principle objectionable and should be adopted if shown to be necessary for the attainment of the ends in view or for purposes of revenue." Mr. Balfour's leadership of the whole party was now confirmed; and a seat was found for him in the City of London by the retirement of Mr. Gibbs.

The downfall of Mr. Balfour's administration, and the necessity of reorganizing the Unionist forces on the basis of the common platform now adopted, naturally represented a fresh departure under his leadership, the conditions of which to some extent depended on the opportunities given to the new opposition by the proceedings of the Radical government. His own administration had been wrecked, through no initiative of his, by the dissensions over the fiscal question. But his wide range of knowledge and interests, his intellectual *finesse*, his personal hold over his supporters, his statesmanlike grasp upon imperial problems, and his oratorical ability had been proved to a remarkable degree; and in foreign affairs his tenure of power had been conspicuously successful. He left his country, indeed, in a position of strength abroad which it had not held since the Crimean War. His institution of the permanent Committee of Imperial Defence and of the new Army Council (1904) were reforms of the highest importance, resulting from the report of a "triumvirate" consisting of Lord Esher, Sir John Fisher, and Sir George Clarke, appointed in Nov. 1903. The Unionist régime as a whole, however, had collapsed. Its ministers had become "stale." The heavy taxation of the war years was still retained, to the disgust especially of the income-tax payers; and new issues arose over the Education Act, labour questions, and the introduction of Chinese labour into South Africa (in 1904), which were successfully used against the government in the constituencies. The result was the electoral defeat which indicated, no doubt, a pronounced weakening of Mr. Balfour's position in public confidence. This verdict, however, was one based mainly on temporary reasons, which were soon to be over-shadowed by the new issues involved in the change of ministry. As a matter of fact, a year of opposition had not passed before his power in the House of Commons, even with so small a party behind him, was once more realized. The immense Radical majority started with a feeling of contempt for the leader who had been rejected at Manchester, but by 1907 he had completely reasserted his individual pre-eminence among parliamentarians. Mr. Balfour had never spoken more brilliantly, nor shone more as a debater, than in these years when he had to confront a House of Commons three-fourths of which was hostile. His speech at Birmingham (Nov. 14, 1907), fully accepting the principles of Mr. Chamberlain's fiscal policy, proved epoch-making in consolidating the Unionist party—except for a small number of free-traders, like Lord Robert Cecil, who continued to hold out—in favour of tariff reform; and during 1908 the process of recuperation went on, the by-elections showing to a marked degree the increased popular support given to the Unionist candidates. The rejection of this budget in Dec. 1909 by the House of Lords led to a desperate struggle at the polls in Jan. 1910. The Unionists won back over 100 seats, returning 273 strong, but were still in a minority, the Liberals numbering 275, Labour members 40, and Irish Nationalists 82. Mr. Balfour himself was elected for the City of London by an enormous majority.

Balfour's other publications, not yet mentioned, include *Essays and Addresses* (1893) and *The Foundations of Belief, being Notes introductory to the Study of Theology* (1895). He was president of the British Association in 1904, and became a fellow of the Royal Society in 1888. He was known from early life as a cultured musician, and became an enthusiastic golf player, having been captain of the Royal and Ancient Golf Club at St. Andrews in 1894–95. (H C.)

As Conservative leader, after the general election of Jan 1910, Balfour was confronted with an embarrassing situation While endeavouring to save the effective authority of a second chamber

and to avert Irish Home Rule, with his supporters still sore over the Tariff Reform controversy, he was faced by a Liberal ministry dominated once more by a body of 80 Irish Nationalists, who held the balance of power in the House of Commons and insisted on a forward policy. He advocated the reform of the House of Lords as an alternative to the Ministerial Veto resolutions, which he denounced as irrational.

In the lull in the party fight which followed the death of King Edward he welcomed the suggestion of a conference between the parties to endeavour to arrange a compromise, and was one of the eight leaders who met on 21 occasions between June and November without coming to an agreement. When the conferences failed and ministers announced another dissolution he did his best to rouse the country to the dangers which, in his opinion, threatened it. When the second general election of 1910 confirmed the verdict of the first, dissatisfaction with his leadership, which had been long entertained by a considerable section of the Unionists, began to spread. It was pointed out that he had now led the party to three electoral defeats in succession: in 1906, Jan. 1910, and Dec. 1910.

The course of the session of 1911 intensified this dissatisfaction. Balfour did indeed fight the Parliament bill, in its passage through the House of Commons, with courage, persistency, acuteness, and passion. In committee he strove hard, but in vain, to get fundamental laws exempted from its operation. But he shrank from encouraging the House of Lords to persist in opposition when ministers announced that they had obtained the King's consent to the creation of sufficient peers to make its passage certain. He did indeed move a vote of censure imputing to ministers a gross abuse of the constitution in the advice they had given to the Crown; but he declared that he would stand or fall with Lord Lansdowne in that statesman's recommendation to the Unionist peers to abstain from further resistance as being no longer free agents.

This attitude was passionately resented by a large group of "Diehards," who organized themselves under Lord Halsbury. Mr. Balfour's counsel prevailed, and the bill was allowed to pass; but his authority as leader had been seriously shaken, and in November he decided that the time had come for him to resign. In announcing his decision to a meeting of the Conservative Association of the City of London on Nov. 8 he said that he desired to abandon his heavy responsibility before he could be suspected of suffering from a sort of petrifaction in old courses and inability to deal with new problems; and that he felt he had not the vigour, at his time of life, again to conduct a ministry. The announcement, in spite of the signs of discontent, came as a great shock to the party and the country.

Mr. Balfour was then only 63, and his powers as a parliamentarian were really at their height. Although he proceeded to devote more time to his manifold other interests in life—philosophy, science, literature, and the fine arts—he still took at intervals a prominent part in debate, giving throughout a loyal support to his successor in the House of Commons, Mr. Bonar Law. The renewed controversy on Home Rule afforded him a great opportunity; and the powerful series of speeches which he delivered, at Westminster and elsewhere, in the course of the next three years, did much to awaken Great Britain to the imminent danger of civil war in Ireland, and to force ministers into the policy of excluding Ulster, in some form or other, from the operation of their bill.

When the World War broke out he cordially accepted the policy of the Unionist leaders to sink all political differences in support of the national Government. Speaking at the Guildhall, London, on Nov. 11, 1914, he said that the Allies were fighting for civilization and the cause of small States, and, whether the War was short or long, they would triumph. In this spirit he joined the first Coalition ministry in May 1915, becoming First Lord of the Admiralty under Mr. Asquith. He speedily restored the harmony of the Board of Admiralty which had been distracted by a quarrel between Churchill and Lord Fisher. He also reversed Churchill's policy of differentiating between prisonets from submarines as compared with other German prisoners. Perhaps the best work which he did at the Admiralty was the issue, at intervals, of some cogent papers, mainly for the benefit of the Americans, indicating the great work of the British Navy in the War.

The chief naval battle of the conflict, the battle of Jutland, was fought during his term of office, and he incurred widespread criticism by the manner in which the news was officially communicated to the public, the great losses in ships being dwelt on to such an extent as to suggest that, instead of being a victory, if an imperfect one, the action was a defeat. In Nov. 1916 Balfour brought Sir John Jellicoe into the Admiralty as First Sea Lord, Sir David Beatty becoming naval commander-in-chief. On the King's birthday, June 3, 1916, Mr. Balfour's eminence and his patriotic readiness to resume in wartime, in spite of advancing years, official labours in a secondary position were suitably recognised by the grant of the Order of Merit. When Mr. Lloyd George formed his Coalition ministry in Dec. 1916 the Foreign Office, on the retirement of Lord Grey of Fallodon, was pressed upon Mr. Balfour, as it was essential to have there a man of experience and weight. He took up his new duties only a few weeks before Germany instituted the unrestricted submarine warfare which brought the United States into the War; and in April 1917 he headed a British mission which visited America in order to arrange for regular co-operation between the two countries.

His attractive personality greatly impressed his hosts and he received the compliment of being invited to address the House of Representatives on May 5. He proceeded subsequently to Canada and there addressed the two houses of parliament. The concentration of power in the hands of the War cabinet and the great personal ascendancy which Lloyd George, as Prime minister, rapidly acquired tended to reduce the importance of the foreign secretary during Balfour's tenure of the post. It was, however, he, as foreign secretary, who in Nov. 1917 gave a promise on behalf of the British Government to provide a "national home" for the Jtws in Palestine after the War. He went to the Paris Conference in 1919 as the second British plenipotentiary and appended his signature to the Treaty of Versailles and to the abortive treaty of guarantee to France against German aggression

When the conference was over, Balfour relinquished the secretary of state's seals to Lord Curzon, but remained in Lloyd George's cabinet as lord president of the council. He was appointed chief representative of the British Government at the first Assembly of the League of Nations in 1920 and also at the International Conference at Washington, D.C., in the winter of 1921–22. At Washington he was, after Secretary of State Hughes, the leading figure of the conference; and his prompt and cordial acceptance of Hughes's proposals for the scrapping of capital ships and their future strict limitation greatly impressed the American public. The conference not only secured the limitation of navies, but also merged the Anglo-Japanese Alliance into the Four-Power Pacific Treaty, the other two Powers being the United States and France. On his return in 1922 from this mission Balfour was created, in March, a Knight of the Garter, though still a commoner, and in May, an earl.

During this year the question of Inter-Allied debts was pressingly raised by America, a purely creditor state; and Lord Balfour addressed the so-called Balfour note, on behalf of the British Government, to the French Ambassador and the representatives of other European Powers. He pointed out that, while Great Britain, though more a lender than a borrower, was in favour of a general cancellation of Inter-Allied debts, she could not agree to the cancellation of European debts due to her independently of the question of the British debt to the United States.

Lord Balfour had no sympathy with the feeling of hostility which was growing in the Conservative party throughout 1921–22 toward the continuance of a Coalition ministry, and spoke in that sense at the Carlton club meeting on Oct. 19, 1922, which broke up the Coalition. He resigned office along with the other Unionist Coalition ministers and did not join either Bonar Law's or Baldwin's Conservative ministry in 1922–23. But he maintained a friendly attitude, and. after the fall of the Government, he moved, in a party meeting on Feb. 11, 1924, a vote of confidence in the ex-premier which was carried by acclamation.

Lord Balfour was elected in 1919 chancellor of his old uni-

versity, Cambridge. In 1923 he published a further philosophical work, Theism and *Thought*, a *Study in Familiar* Beliefs. He became president of the British academy and was constant in his attendance at its meetings. He became president also of the National Institute of Industrial Psychology. Early in 1925 he paid a visit to Palestine and was received with enthusiasm by the Jewish population, which had accepted his invitation of 1917 to establish there a national home. No open Arab hostility was shown to him in Palestine; but in Syria, which he proceeded to visit, it flamed out in immediate menace and the French administration had to escort him hurriedly out of the country. On his return to England he accepted an invitation from Stanley Baldwin, on Lord Curzon's death, to join the Government as lord president of the council; and he was immediately detailed for the congenial task of presiding over a civil research committee instituted by the cabinet.

He survived the fall of Baldwin's second ministry by nine months, and died at Woking March 19, 1930. He was universally mourned as one of the last representatives of the old aristocratic type of political leaders. (See CONSERVATIVE PARTY; ENGLISH HISTORY.) (G. E. B.)

BALFOUR, FRANCIS MAITLAMD (1851–1882), British biologist, younger brother of A. J. Balfour (first earl), was born at Edinburgh Nov. 10, 1851. At Harrow school he showed but little interest in the ordinary routine, but in one of the masters, George Griffith, he fortunately found a man who encouraged and aided him in the pursuit of natural science, a taste for which, and especially for geology, had been cultivated in him by his mother from an early age. Going into residence at Trinity college, Cambridge in 1870, he was elected a natural science scholar of his college in the folloning year, and although his reading was not ordered on the lines usual for the schools, he obtained the second place in the natural science tripos of Dec. 1873. A course of lectures on embryology, delivered by Sir Michael Foster in 1871 definitely turned his attention to animal morphology and, after his tripos, he was selected to occupy one of the two seats allocated to the University of Cambridge at the Naples zoological station. The research work which he began there contributed in an important degree to his election as a fellow of Trinity in 1874, and also afforded him material for a series of papers (published as a monograph in 1878) on the elasmobranch fishes, which threw new light on the development of several organs in the vertebrates, in particular of the urogenital and nervous systems. His next work was to write a large treatise, Comparative *Embryology,* in two volumes; the first, published in 1880, dealing with the invertebrates, and the second (1881) with the vertebrates. This book displayed a vigorous scientific imagination, always controlled by a logical sense that rigidly distinguished between proved fact and mere hypothesis, and it at once won wide recognition, not only as an admirable digest of the numberless observations made with regard to the development of animals during the quarter of a century preceding its publication, but also on account of the large amount of original research incorporated in its pages. Balfour's reputation was now such that other universities became anxious to secure his services, and he was invited to succeed Professor George Rolleston at Oxford and Sir Wyville Thomson at Edinburgh. But although he was only a college lecturer, holding no official post in his university, he declined to leave Cambridge, and in the spring of 1882 the university recognized his merits by instituting a special professorship of animal morphology for his benefit. Unhappily he did not deliver a single professorial lecture. During the first term after his appointment he was incapacitated from work by an attack of typhoid fever. Going to the Alps to recruit his health, he died, probably on July 19. 1882, in attempting the ascent of the Aiguille Blanche, Mont Blanc, at that time unscaled. Besides being a brilliant morphologist, Balfour was an accomplished naturalist.

BALFOUR, SIR JAMES (of Pittendreich) (d. 1583 or 1584), Scottish judge and politician, son of Sir Michael Balfour of Montquhanny, was educated for the legal branch of the Church of Scotland. In June 1547 he was imprisoned, with John Knox and others, but was released in 1549. He then abjured the reformers, entered the service of Mary of Guise, and was renarded with some considerable legal appointments. Subsequently he went over to the lords of the congregation and then betrayed their plans. After Mary's arrival in Scotland he became one of her secretaries, in 1565 being reported as her greatest favourite after Rizzio. He obtained the parsonage of Flisk in Fife in 1561, was nominated a lord of session, and in 1563, one of the commissaries of the court which now took the place of the former ecclesiastical tribunal; in 1565 he was made a privy councillor, and in 1566 lord-clerk-register. and was knighted. According to Mary, his murder was intended together with Rizzio's in 1566. An adherent of Bothwell, he was deeply implicated in Darnley's murder, though not present at the commission of the crime. By his means Darnley was lodged at Kirk o' Field, his brother's house. He was supposed to have drawn up the bond at Craigmillar for the murder; he signed it, was made under Bothwell deputy governor of Edinburgh castle, and is said to have drawn up the marriage contract between Bothwell and Mary. When, however, the fall of Bothwell was seen to be impending, he rapidly changed sides and surrendered the castle to Murray, stipulating for his pardon for Darnley's murder, the retention of the priory of Pittenweem, and pecuniary rewards.

He was appointed president of the court of session on resigning the office of lord-clerk-register. He was present at the battle of Langside with the regent in 1568, and was accused of having advised Mary to leave Dunbar to her ruin. and of having betrayed to her enemies the casket letters. The same year, however, in consequence of renewed intrigues with Mary's faction, he was dismissed, and next year was imprisoned on the charge of complicity in Darnley's murder. He succeeded in effecting his escape by means of bribery, the expenses of which he is said to have paid by intercepting the money sent from France to Mary's aid. In Aug. 1571, during the regency of Lennox, an act of forfeiture was passed against him, but next year he was again playing traitor and revealing the secrets of his party to Morton, and he obtained a pardon from the latter in 1573 and negotiated the pacification of Perth the same year. Distrusted by all parties, he fled to France, where he seems to have remained till 1580. In 1579 his forfeiture was renewed by act of parliament. In Jan. 1580 he wrote to Mary offering her his services, and in June protested his desire to be useful to Elizabeth, lamented the influence of the Jesuits, and intended a journey to Dieppe to hear some good Protestant preaching. On Dec. 27 of the same year he returned to Scotland and effected the downfall and execution of Morton by producing a bond, probably that in defense of Bothwell and to promote his marriage with Mary, and giving evidence of the latter's knowledge of Bothwell's intention to murder Darnley.

In July 1581 his cause was reheard; he was acquitted of murder by assize, and shortly afterwards in 1581 or 1582 he was restored to his estates and received at court. His career, one of the blackest in the annals of political perfidy and crime, closed shortly before Jan 24, 1584. He was the greatest lawyer of his day, and part-author at least of Balfour's Practicks, the earliest textbook of Scottish law, not published, however, till 1754. He married Margaret, daughter and heir of Michael Balfour of Burleigh, by whom, besides three daughters, he had six sons, the eldest of whom was created Baron Balfour of Burleigh in 1607.

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BALFOUR, SIR JAMES, BART. (of Denmylne and Kinnaird) (c. 1600–1657), Scottish annalist and antiquary, was acquainted with Sir William Segar and with Dugdale, to whose Monasticon he contributed. He was made Lyon king-at-arms in 1630. Some of his numerous works are preserved in the Advocates' library (now National Library of Scotland) at Edinburgh, together with his correspondence—from which rich collection

Haig published *Balfour's Annales of Scotland from Malcolm III to Charles II* (1824–25).

See Sibbald, *Memoria Balfouriana* (1699).

BALFOUR, ROBERT (BALFOREUS) (1550?–1625?), Scottish philosopher, was educated at St. Andrews and at Paris. He was for many years principal of Guienne college, Bordeaux His great work is his *Commentarii in Organum Logicum Aristotelis* (Bordeaux, 1618); the copy in the British Museum contains a number of highly eulogistic poems in his honour. Balfour was one of the scholars who contributed toward spreading over Europe the fame of the *praefervidum ingenium Scotorum*. His contemporary, Dempster, called him the "phoenix of his age, a philosopher profoundly skilled in the Greek and Latin languages, and a mathematician worthy of being compared with the ancients." His *Cleomedis meteora*, with notes and Latin translation, was reprinted at Leiden as late as 1820.

See T. Dempster, *Historia Ecclesiastica Gentis Scotorum* (Bonn, 1627); D. Irving, *Lives of Scottish Writers* (Edinburgh, 1839); W. Anderson, *The Scottish Nation*, i 217 (Edinburgh, 1863).

BALFOUR-BROWNE, WILLIAM ALEX. FRANCIS (1874–), British entomologist, was born Dec. 27, 1874, at London and was educated at St. Paul's school and at Magdalen college, Oxford. He was called to the bar in 1898 but returned to Oxford the following year to study zoology. After serving on the staff of the Marine Biological association's laboratory, Plymouth, he became director of the Sutton Broad laboratory at Norfolk in 1902. He later lectured at Queen's university, Belfast, and at the University of Cambridge. During World War I he was attached to the royal army medical corps. From 1925 to 1930 he was professor of entomology at the Imperial College of Science and Technology and in 1934–35 he was president of the Royal Microscopical society. He wrote several volumes and many papers on entomology, including *Keys to the Orders of Insects* and *Concerning the Habits of Insects*.

BALFOURIER, MAURICE (1852–1933), French soldier, was born at Paris and entered the military college at Saint Cyr in 1870, shortly before the beginning of the Franco-German war. In 1871 he was assigned to an infantry regiment, with which he remained until the end of the war. He then returned to Saint Cyr and was commissioned second lieutenant in 1872. He specialized in military transport, particularly railroads, and served with distinction on a number of military technical committees in the French army, soon advancing to the rank of colonel and to brigadier general in 1908. He was commander of the 11th infantry division at Nancy at the outbreak of World War I in 1914, and on Aug. 29 of that year succeeded Foch as commander of the 20th army corps, which took part in the battles of Grand Couronné, Picardy and Artois. In 1916 he was at Verdun, where he fought with great gallantry, particularly at Malancourt and Béthincourt. He was also present during the first stages of the battles of the Somme in July 1916. In September of that year he took command of the 36th army corps in Belgium, where he remained until March 1917, when he was placed on the reserve list. He died at Paris.

BALGUY, JOHN (1686–1748), English theologian, was born at Sheffield Aug. 12, 1686. He was educated at the Sheffield grammar school and at St. John's college, Cambridge, graduated B.A in 1706, was ordained in 1710, and in 1711 obtained the small living of Lamesley and Tanfield in Durham. He married in 1715. It was the year in which Bishop Hoadley preached the famous sermon on "The Kingdom of Christ," which gave rise to the "Bangorian controversy"; and Balguy, under the nom de plume of Silvius, began his career of authorship by taking the side of Hoadley in this controversy against some of his High Church opponents. In 1726 he published *A letter to a Deist concerning the Beauty and Excellency of Moral Virtue, and the Support and Improvement Which it Receives from the Christian Religion*, chiefly designed to show that, while a love of virtue for its own sake is the highest principle of morality, religious rewards and punishments are most valuable, and in some cases absolutely indispensable, as sanctions of conduct. In 1727 he was made a prebendary of Salisbury by his friend Hoadley. He published in the same year the first part of a tractate entitled *The Foundation of Moral Goodness*, and in the following year a second part, *Illustrating and Enforcing the Principles Contained in the Former*. The aim of the work was twofold—to refute the theory of Hutcheson regarding the basis of rectitude, and to establish the theory of Cudworth and Clarke. that virtue is conformity to reason—the acting according to fitnesses which arise out of the eternal and immutable relations of agents to objects. In 1729 he became vicar of Northallerton, in the county of York. His next work was an essay on *Divine Rectitude: or, a Brief Inquiry Concerning the Moral Perfections of the Deity, Particularly in Respect of Creation and Providence*. It was an attempt to show that the same moral principle which ought to direct human life may be perceived to underlie the works and ways of God: goodness in the Deity not being a mere disposition to benevolence, but a regard to an order, beauty and harmony, which are not merely relative to our faculties and capacities, but real and absolute; claiming for their own sakes the reverence of all intelligent beings, and alone answering to the perfection of the divine ideas. Balguy wrote several other terse and readable tracts of the same nature, which he collected and published in a single volume in 1734. In 1741 he published an *Essay on Redemption*, containing somewhat advanced views. He died at Warrogate Sept. 21, 1748.

BALI, an island, east of Java across the shallow Bali strait, only a mile wide at its narrowest; length 93 mi., extreme width 50 mi., area 2,095 sq.mi. With Lombok, it forms a residency with two divisions: Singaradja and South Bali Mountainous, with deep ravines southward, it has a large alluvial plain in the south. The chief range runs from Lombok strait to Bali strait. and is divided into (1) the eastern mountains, Mt. Agung, or Bali peak, a regular volcano reaching 10,499 ft.. rising sheer up from the crater lake of that name; Mt. Batur, in this section. is the only active volcano in the island; (2) the hills of the central division, of recent volcanic formation, with the crater lakes Bratan, Bujan, and Tamblingan; (3) the barren, uninhabited Jembrana mountains. fill the western division and extend right to the narrow part of Bali strait. A small plateau of chalk, 200 ft. above sea level connects with the mainland by the narrow and low Tafelhuk isthmus, which, with a spur projecting northwards on the eastern side, gives Bali—apart from the little-used Temuku, in the east—its only safe anchorage, Benua, the port for Den Pasar, though the entrance between coral reefs is tortuous. The coast is mostly steep and little indented, and on the north is exposed to the full force of the west monsoon, so the roadstead of Buleleng, the port of Singaradja, is often unsafe, whilst a heavy sea runs off the south coast during the southeast monsoon. Nine miles off the southeast coast lies the hilly island of Musa Penida, an old convict settlement. The rivers flow mostly steeply south from the central mountains and are quite unsuitable for navigation. Practically dry at one season. they become choked and liable to flood during the period of heavy rainfall. Bali belongs to Java in climate, flora and fauna. Tigers are known in the west, but not the rhinoceros or wild buffalo; deer exist, and mild pig, in considerable numbers. and they damage crops. hfammals, birds and insects of Asiatic origin found in Bali, but not east of the island, led Wallace to draw a line between Bali and Lombok—extending between Borneo and Celebes—marking the limit of the fauna of the oriental, or Indian region, and since termed "Wallace's line"; but later authorities are inclined to treat all the Lesser Sunda Islands as a transitional region. With extremely fertile soil, abundant rainfall, and very equable climate, ranging to subtropical in the mountains, Bali has luxuriant vegetation, with smaller trees than Java. Teak, coco-nut,

BY COURTESY OF THE ROYAL PACKET NAVIGATION CO.
IN BALI, DUTCH EAST INDIES, DANCING GIRLS ARE TRAINED IN THE ART FROM CHILDHOOD

lontar and other palms are plentiful; sugar cane, coffee, cocoa, tobacco, indigo, ground nuts and all Malayan fruits are grown to perfection, with excellent European vegetables on the highlands. The Balinese are easily the most expert rice growers in the archipelago, irrigating admirably in native style. From a distance, the green terraced hillsides resemble hanging gardens. Coffee is grown for export, water buffalo, cattle, horses, dogs, goats and many pigs are kept—the last for export to Java and Malaya, for the Chinese there. Pop. (1930) 1,101,393, composed of 403 Europeans and Eurasians, 1,092,037 natives, and 8,953 foreign Asiatics, including Chinese. Agriculture and fishing are the chief activities.

The Balinese are expert craftsmen in gold, silver and other metals. They are clever in the manufacture of arms, in woodcarving, as stonemasons, and in designing in colour, and building good temples and houses of stone. Fine pottery is manufactured and the women weave beautiful garments in cotton and silk. and textures of gold and silver thread, of rich colouring and artistic pattern. The people are of Hindu-Javanese extraction, with an original strain of Papuan blood, probably mixed with Polynesian. Colonized from India direct, and from Java, by Hindu-Javanese immigrants. in the days when Hindu influence there was at its highest, and again later, when Arab invasion in Java threatened those Javanese who wished to retain their Hindu faith, the aboriginal element in Bali was well-nigh submerged, save among the Bali Aga in a few isolated places, who follow a Polynesian cult and keep to themselves in their own villages. A few Mohammedans live more or less secluded along the coast, but nearly everyone is Hindu in religion, though offerings to household deities, at little home shrines, show Polynesian religious influence. Brahma, Vishnu, and Krishna are known, but it is to Siva that the temples are dedicated. In temple sculpture, the form of Ganesh is sometimes seen, together with a repulsive form, the upper part human—the face, that of a man, having tusks—the lower, animal, known as Lorong, and the phallic symbol is seen. The temple, or *pura,* with three walled-in courts, contains small buildings, or sheds, for the priests and their various ceremonies. The third, or inner court, encloses the actual temples, small wooden buildings on stone foundations. Worship in the open is attended with feasting, flowers and music; there are female as well as male priests, and women, particularly young maidens, play a leading part. Caste is observed as in the four degrees of India—Brahman, Kshatriya, Vaisya, and Sudra; suttee was practised before Dutch rule came; the cow is revered, and cremation occurs on a scale unparalleled in any part of India.

The Balinese resemble better-class Javanese, with a lighter skin where the Hindu strain is pronounced. Their long dark hair is fastened by both sexes up on the head, but princes and nobles cut it short. They seem stronger than the Javanese, are observant, lively, hospitable, eager to learn, careful and zealous in religion. They are very fond of feasts, games, dancing (watching professional dancers) and dramatic performances with music. The spoken language belongs to the same class as Javanese, Sundanese, etc., and is akin to the Sasak spoken in Lombok. The literary tongue borrows from Old Javanese in the three modes of address, and in the alphabet. Balinese sacred literature is written in the ancient *Kawi* language of Java, and is well understood. The name of the country is held to derive from the Sanskrit word *balin*, strong, and Hindu influence is predominant in the art of the island, the form of agriculture and the representation of the drama, whether in the form of *dalang,* or "shadow-show," or *wayang,* in which there is a stage with actors, the female parts being taken by men. In both forms events taken from the Mahabharata and the Ramayana are presented. Rights and duties of the village are enshrined in written laws and enforced by a sort of village council. Practically all cultivable land is cultivated, and tenure and irrigation are regulated by local agricultural associations. Land descends from father to son, and it is very difficult for any outsider to obtain a landed interest in Bali; nor is outside influence in any way encouraged by the Dutch, who gave financial support to such of the peasantry as needed it, through a state bank, in the form of advances against crops. The landscape of Bali is very beautiful, full of contrasts, with profusion of vegetation and wonderful distant views from the mountains. There is the additional charm of its fine old temples—those of Tampak Siring—the oldest, the mysterious "drum of Pedjing," and the double-coned volcano of Batur. Many roads were made before the Dutch arrived; but they greatly improved them, and motoring is safe and enjoyable. No hotels existed, but the *pasangrahans,* or resthouses, built for government officials on tour, were available at a fixed charge in every important centre.

Singaradja, in the north, is the capital of Bali and the seat of the resident. It has attractive buildings of Dutch colonial type, government offices, business premises, etc., and a neat native quarter on the side of hills which slope gradually from Euleleng on the coast, a couple of miles or so below Singaradja, to the northern spurs of the central mountains. It has a population of 12,345 (188 Europeans and Eurasians), and is a market for native produce and imported goods. Such also are Den Pasar (Badung), with 16,639 inhabitants and an assistant resident, Karang Asem, where the semi-independent descendant of the old Balinese princes acts as stadtholder for the Dutch government, Klungkung (also the chief centre for native arts and crafts), Gianjar and Tabanan, all in the south, which holds the greater part of the population, and Negara, in the extreme west. The Royal Mail Packet company in normal times has a biweekly service between Bali and Java, calling at both Benua and Buleleng, and the island has telephone and telegraphic communication, but no railways or tramways.

From the language on brass tablets found in Bali in the 10th century it is known that a Hinduized culture existed there then which had come direct from India. Later it was probably under the suzerainty of Majapahit, in Java, becoming independent when that dynasty fell before Arab invasion. Several of the Majapahit princes fled to Bali, and their descendants undoubtedly shared in the partition of Bali (end of 17th century) into nine separate principalities—Klungkung, Karang Asem, Mengwi, Badung, Bangli, Tabanan, Gianjar, Buleleng, and Jembrana. Houtman had visited Bali in 1597, and in 1743 the susuhanan of Surakarta ceded his "rights" over Bali to the Dutch. who took no steps to claim them, but later a slave recruiting post was established in Badung. The Balinese princes recognized Dutch supremacy but retained local autonomy. They agreed to forgo their ancient right of confiscating the cargoes of wrecked ships. In 1844, however, the rajas of Buleleng and Karang Asem asserted this right, and the Dutch sent an expedition (1846) which brought them to terms. Later they recanted and the princes of Bangli and Lombok helped the Dutch against them. The prince of Bangli was given Buleleng as a reward, Karang Asem became a fief of the Lombok raja, and all the Balinese princes signed a new treaty recognizing Dutch supremacy, and prohibiting piracy, slavery, the exercise of shore rights and settlements of any other European power. Native misrule in Buleleng and Jembrana led to indirect Dutch government there in 1854–56 and direct government in 1882. Wars between the other Balinese states led Gianjar to seek Dutch protection in 1900, to avoid extinction, while before this, Mengwi had been divided among Badung, Tabanan, Klungkung and Gianjar. Karang Asem had not supported its overlord, the raja of Mataram, in Lombok in 1894 against the Dutch, and the regent in 1895 was made stadtholder. Klungkung then refused to give up criminals, Badung reasserted the right of looting wrecked ships, and Tabanan and Bangli joined this state. A Dutch expedition in 1906 resulted in the death of the raja of Badung, the submission and suicide of the raja of Tabanan, and Dutch control over south Bali. Insurrection in Klungkung in 1908 led to another Dutch expedition, the death of the Dewa-agong of Klungkung, and direct Dutch government over the whole island, the raja of Bangli being recognized as stadtholder. His successors ruled under the Dutch in Bangli and Gianjar as regents, and Karang Asem had its stadtholder. This was the only Balinese rule which survived.

Before World War II, the island enjoyed a remarkable popularity among tourists and was a stopping point for many

travellers' cruises each year. The small island became known throughout the world for its climate and its tropical splendour.

After the Japanese began their southward march through the Malay archipelago in Dec. 1941, the strategic importance of Bali as an approach to the eastern part of Java and the great Dutch naval base at Surabaya was emphasized again. The Dutch and their allies—British and Americans—made every effort to fortify the island's land defenses, and to protect it from attack by sea or air. The Japanese, however, penetrated the defending screen of United Nations' warships and effected a preliminary landing on Bali Feb. 20, 1942. A series of naval engagements followed during the next few days, but despite losses of numerous ships the invaders were able to retain and extend their beachheads, and by Feb. 22, when they captured the aerodrome at Den Pasar, in southeastern Bali, they had definite air superiority over the United Nations. The Japanese soon controlled the whole island, and only the narrow Bali strait, hardly a mile wide near the city of Banjoewangi on the opposite shore, separated them from Java. The strait proved to be no obstacle, and within a week the Japanese were landing at several points on Java, which was itself overrun in a few more days.

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(E. E. L.)

BALIKISRI or **BALIXESIR,** a town of Turkey, capital of the vilayet of the same name; on rising ground above a fertile plain which drains to the Sea of Marmora. Pop. (1935) 26.699. It is a centre of trade in opium, silk and cereals, communicating by carriage roads with Panderma. The neighbourhood is rich in mineral wealth; silver mines are worked at Balia and boracite mines at Susurlu. At or near Balikisri the Roman town of Hadrianutherae was founded, as its name commemorates, by the emneror Hadrian.

BALINE, ISRAEL: *see* BERLIN, IRVING.

BALIOE, the name of a family which played an important part in the history of Scotland. The founder of the family in England was a Norman baron, Guy or Guido de Baliol, who held the fiefs of Bailleul, Dampierre, Harcourt and Vinoy in Normandy. Coming to England with William the Conqueror. he received lands in-the north of England from William II, and his son, Bernard, built a fortress in Durham called Castle Barnard. Bernard fought for King Stephen during the civil war, was present at the battle of the Standard (1138), and was taken prisoner at the battle of Lincoln (1141). The date of his death is uncertain. Dugdale believes in the existence of only one Bernard de Baliol. but it seems more probable that the Bernard de Baliol referred to after 1167 was a son of the elder Bernard, and not the same individual. If so, the younger Bernard was one of the northern barons who raised the siege of Alnwick and took William the Lion, king of Scotland, prisoner in 1174. Practically nothing is known of his sons, Eustace and Hugh. who succeeded about 121 **j.** Hugh's son and successor, John de Baliol. who married Devorguila (d. 1290), daughter of Alan, earl of Galloway, was one of the regents of Scotland during the minority of Alexander III, but in 1255 was deprived of this office and his lands forfeited for treason. He then appeared in England fighting for Henry III against Simon de Montfort, and was taken prisoner at the battle of Lewes in 1264. About 1263 he established several scholarships at Oxford, and after his death in 1269 his widow founded the college which bears the name of the family. He left three sons, two of whom died without issue, and in 1278 his lands came to his son, John de Baliol (*q.v.*), who was king of Scotland (1292–96) and died in Normandy in 1315. John's eldest son by his marriage with Isabel, daughter of John de Warenne, earl of Surrey, was Edward de Baliol, who shared his father's captivity in England in 1296. He appears to have lived mainly on his lands in Normandy until 1324, when he was invited to England by King Edward II, who hoped to bring him forward as a candidate for the Scottish crown. **A** favourable opportunity, however, did not arise until after the death of King Robert the Bruce in 1329, when Edward III had succeeded his father on the English throne. Although Edward did not give Baliol any active assistance, the claimant placed himself at the head of some disinherited Scottish nobles, raised a small army, and sailed from Ravenspur. Landing at Kinghorn in Fifeshire in Aug. 1332, Baliol gained a complete victory over the Scots under Donald, earl of Mar, at Dupplin Moor, took Perth and on Sept. 24 was crowned king of Scotland at Scone. He then acknowledged Edward III as his superior, but soon afterwards was defeated at Annan (where his brother, Henry de Baliol, was slain) and compelled to fly to England. Regaining his kingdom after the defeat of the Scots at Halidon hill in 1333, Baliol surrendered the whole of the district formerly known as Lothian to Edward, and did homage for Scotland to the English king. His party, however, was weakened by disunion, and he won no serious support in Scotland. Entirely dependent on Edward, he again sought refuge in England, and took a very slight part in the war waged on his behalf. He returned to Scotland after the defeat of King David II at Neville's cross in 1346. After making an absolute surrender of Scotland to Edward III in 1356 at Roxburgh in return for a pension, Edward de Baliol died at Wheatley near Doncaster in 1367.

A cadet branch of the Baliol family was descended from Ingelram, or Engelram, a son of the younger Bernard de Baliol. Ingelram's wife was the daughter and heiress of William de Berkeley, lord of Reidcastle in Forfarshire, and chamberlain of Scotland, and by her he had a son Henry, who became chamberlain about 1223. Henry married Lora or Lauretta, a daughter of Philip de Valoines (Valsques), lord of Panmure, and in 1234 inherited part of the rich English fiefs of the Valoines family. He died in 1246. It is probable that Henry's son was Alexander de Baliol, lord of Cavers in Teviotdale, first mentioned in 1287 as chamberlain of Scotland. He shared in the negotiations between the Scottish nobles and Edward I of England, which culminated in the treaty of Salisbury in 1289 and the treaty of Brigham in 1290. Probably deprived of his office as chamberlain about 1296 he may have shared the imprisonment of his kinsman, John de Baliol the king. He then fought in Scotland for Edward, and was summoned to several English parliaments. He died about 1309, and his grandson, Thomas, is the last of the Baliols mentioned in the Scottish records.

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BALIOL, JOHN DE (1249–1315), king of Scotland, was a son of John de Baliol (d. 1269) of Barnard Castle, Durham, by his wife Devorguila, daughter of Alan, earl of Galloway, and became head of the Baliol family (see above) and lord of extensive lands in England, France and Scotland on his elder brother's death in 1278. When the Scottish throne became vacant in 1290 owing to the death of Margaret, the "maid of Norway," he was one of the three candidates for the crown, claiming through his maternal grandmother. Margaret, great granddaughter of King David I. Baliol's principal rival was Robert Bruce, earl of Annandale, and the dispute was the somewhat familiar one of the eldest by descent against the nearest of kin. The English king, Edward I, was invited to settle this dispute; and when he met the Scottish nobles at Norham in May 1291, he demanded a formal recognition of his position as overlord of Scotland. After some delay this was acknowledged by Baliol and the other competitors, who all agreed to abide by his decision. A court of 80 Scotsmen and 24 Englishmen was then appointed to try the question. and on the advice of the court Edward decided in his favour. Having sworn fealty to the English king, Baliol was crowned king of Scotland at Scone on Nov. 30, 1292; in his new capacity he did homage to Edward at Newcastle. These amicable relations were soon disturbed. **A** Scottish vassal carried his case to Edward as Baliol's

overlord, and Baliol himself was summoned to the English court to answer a suit brought against him by Macduff, earl of Fife. After a short struggle he admitted Edward's right, and in May 1294 attended a parliament in London. He soon quarrelled with his overlord, the exact point at issue being doubtful, and returned to Scotland. Baliol and the Scots barons refused to support Edward in his war with France, and a council of 12 was appointed to assist Baliol. Englishmen were dismissed from the Scottish court, their fiefs were confiscated, and an alliance was concluded with Philip IV, king of France. War broke out, but Baliol did not take the field in person. Invading Scotland, Edward met with a feeble resistance. and at Brechin in July 1296, Baliol surrendered his kingdom to Antony Bek, bishop of Durham, as the representative of the English king. He also renounced his alliance with Philip IV and about the same time appeared before Edward at Montrose and delivered to him a white rod, the feudal token of resignation. With his son, Edward, he was taken prisoner to England and remained in captivity until July 1299, when he was released at the request of Pope Boniface VIII. He was then placed in the keeping of the papal delegate who had been sent by Boniface to negotiate peace between England and France. Baliol agreed to live wheresoever the pope directed him. He left England for his French estates arid did not return, though he apparently continued to be regarded by many Scotsmen, including Wallace, as the sovereign of Scotland. He died at Castle Galliard in Normandy, in 131j.

See authorities quoted under BALIOL above. Also SCOTLAND: ***History.***

BALIBARA, a frontier station and tract of British India to the north of the Darrang district in Assam. The creation of the Balipara frontier tract followed murders by Abors and administration was remodelled. An eastern section was formed at Sadiya and a western section at Balipara, to which a portion of the Darrang district was transferred. This frontier tract constitutes a charge under a political officer and consists of the area in contact with various tribes; viz., the Bhotias, Daflas, Akas and Apa Tanangs. Balipara is connected with Tezpur by a light railway and a trade route leads from it to Lhasa in Tibet over the Udalguri-Amratula pass.

BALIUAG, a municipality with administrative centre and 17 barrios (wards) of the province of Bulacan, Luzon, Philippine Islands, on the Quiñgua river, 29 mi. (by rail) N.N.W of Manila. Pop. (1939), 22,972, and none was white. Baliuag is on an extension of the Manila and Dagupan railway, owned by the government. The town is noted for its manufacture of hats and other products of native fibre and silk. It is the trade centre of a fertile agricultural district and also for various lines of industry, such as furniture making, sugar and rice mills, distillation of alcohol, tanning and fish breeding. The gain in population since 1918 was 4,718. Of those between the ages of 6 and 19, 36.2% attended school and of those over 10, 68.7% was literate. Tagalog is the vernacular. (C. S. L.)

BALKAN ENTENTE, THE. The Balkan Entente was a political organization formally created by four Balkan countries: Yugoslavia, Rumania. Greece and Turkey on Feb. 9. 1934, for the purposes of mutual defense and other common interests.

The Background **of** the Balkan Entente. — The idea of Balkan confederation or unity, of one sort or another, is a very old one, to be traced on the one hand to the mediaeval backgrounds of Balkan history, and on the other, to the period since the French Revolution. With the birth of nationalism among the nations of southeastern Europe there developed a feeling that through unity the small nations might free themselves from the Ottoman or Habsburg yoke. Among the south Slavic peoples of the peninsula, the basic ethnic elements involved, a sentiment of kinship added a positive cement to the historic and geographic bonds. By the end of the 19th century and the opening of the 20th, it seemed clear that neither Habsburg nor Ottoman imperialism could bring any solution to the manifold problems of this vital highway astride the intercontinental crossroads of Europe and Asia.

Early in the 19th century men like the Serbian Dositej Obradovich and Vuk Stefanovich Karajich, following in the footsteps of the Greek Rigas de Féréo, and later the Croatian Ljudevit Gaj and Bishop Joseph George Strossmayer, worked in the direction of Balkan, and especially, south Slavic unity. For a time, with Napoleon's creation of the Illyrian provinces, it was thought that the Illyrian movement would lead toward some kind of federation. The Serbian statesman, Ilya Garashanin, in 1844, developed his Nachertanija, which was designed to draw Serbs, Croats and Bulgarians together. Under Prince Michael Obrenović III, Garashanin continued to work toward the end of Balkan union. and ideas of a Serb-Bulgarian-Greek-Rumanian group were developed through a series of agreements in 1867–68. The assassination of King Michael in 1868, however. put an end, for a time, to these ideas. From that period until the formation of the Balkan alliances of 1911–13, few practical steps were taken toward the development of the idea of confederation, though there were many projects formulated in the minds of Balkan and other thinkers. The alliances of Serbia and Bulgaria, Greece and Serbia, and Greece and Bulgaria, to which both Montenegro and Rumania were later to be added, did not finally develop beyond that stage. Austria-Hungary was opposed to any strong state or federation in the Balkans, as was also Italy. Moreover, Bulgaria, under the influence of Austria-Hungary and later Germany, not only broke from its alliances with Greece and Serbia in 1913 and attacked these countries, but joined the Central Powers in Sept.–Oct. 1915. All idea of Balkan or south Slavic unity seemed broken for years to come.

In the period following World War I, nevertheless, the idea of Balkan unity was revived. Radical groups, sometimes inspired by the communist ideology or that of social democracy, favoured a form of unity, generally centring around the concept of the class struggle. The agrarian groups, the basic element in the Balkan social structure, led by men like the Croatian leader Stjepan Radić, the Bulgarian Alexander Stambolisky and the Rumanian Julius Maniu looked toward close co-operation among the Balkan peoples. In the end, some form of unity was their aim.

The factors which worked against the fruition of these ideas, however, were very strong. World War I had stimulated a powerful and particularistic nationalism in the Balkans as elsewhere. The highly centralized Balkan governments which emerged from the war pursued policies of political and economic nationalism which further weakened the already weak economic ties between the nations of southeastern Europe. Moreover, Bulgaria, embittered by its defeats and losses in both the Balkan and the World nars, was not at all favourable to any project of collaboration or federation which would not restore what Bulgaria had lost or had hoped to gain in 1913 and 1915—Macedonia and the Dobruja in particular. Finally, while Austria-Hungary had been eliminated as a political factor operating against Balkan union, fascist Italy systematically opposed any uell-developed plan for co-operation in the Balkans, and directed its policy toward disunity in general and the destruction of Yugoslavia in particular. Soon a revived Germany under Adolf Hitler returned to the Balkan scene, and there were, once more, questions concerning the aims and intentions of Russian policy.

The Balkan Conferences, 1930–33.—By 1930, however, the movement toward some form of union was to continue in another form. From 1930 to 1933, four Balkan conferences, with representatives from Albania, Bulgaria, Greece, Rumania, Turkey and Yugoslavia, were held in Athens, Istanbul, Bucharest and Salonica While these meetings were unofficial in character, all the Balkan governments were represented, and the Greek and Turkish governments especially took a lead in directing the work of the Balkan conferences.

Essentially the Balkan conferences were interrupted by the development of the European crisis, the trend toward dictatorship in Greece and toaard authoritarianism in the Balkan region generally. Whatever their disagreements as to method and procedure, the delegates to the conferences were in accord as to the aim of federation. They also realized that their work must be one of long duration. By 1933 substantial achievements had been made toward the desired goal A political pact had been drafted by the Third conference in Bucharest in 1932, based on the ideas

of outlawry of war, arbitration and mutual assistance, and it provided machinery for the settlement of the troublesome problem of minorities, within the framework of existing treaties. The adoption of a draft convention on the right of Balkan citizens to live, work and travel throughout the Balkans was another worthy accomplishment, for it looked toward those social, economic and cultural contacts which would give a broad social basis for political understanding. Quite significant was the project adopted at Salonica in 1933 for a partial Balkan customs union. One should also mention the projects for intellectual co-operation and for broad collaboration in the field of social legislation. The conferences promoted a thorough system of sanitary and veterinary treaties as well as projects for a Balkan system of agricultural co-operatives, a program of agricultural credit and a Balkan chamber of agriculture. If many of these ideas remained on paper, others were actually carried into operation. A Balkan chamber of commerce and industry was established in Istanbul (1931), an oriental tobacco office was created in 1933 by Bulgaria, Greece and Turkey, and a Balkan medical union began to function in 1933. A commission of Balkan jurists performed pioneer service in the direction of future legal unification. Groundwork was done looking toward a Balkan postal union. The death of M. Alexander Papanastasiou, the former Greek premier and the outstanding leader of the Balkan conferences, in the fall of 1936, however, was a crippling blow to the conferences.

The Creation of the Balkan Entente. — But even before the Balkan conferences had practically ceased, a Four-Power Balkan pact was signed at Athens on Feb. 9, 1934, by Greece, Rumania, Turkey and Yugoslavia. Rumania and Yugoslavia were already members of the Little Entente with Czechoslovakia, while Greece and Turkey had long since settled their outstanding difficulties and had only on Sept. 14, 1933, signed a remarkable treaty of friendship. The Four-Power pact mas purely a political treaty of mutual guarantee of inter-Balkan frontiers. This was at once its strength and its fatal weakness. Albania was not invited to become a signatory because of the fear of antagonizing fascist Italy, and Bulgaria refused to become a member since it would not renounce its idea of territorial revision, under article xix of the covenant of the League of Nations.

Some months later, at Ankara, Turkey (Oct 20–Nov. 2, 1934), the four states which had signed the Balkan pact organized the Balkan Entente, with a permanent council and an advisory economic council as its controlling organs. The permanent council, composed of the ministers of foreign affairs of the member states, was to meet at least twice a year, and all decisions were to be made in unanimity. The advisory economic council, which was to function as an auxiliary organ of the permanent council and was to be composed of specialists and experts in economic, commercial and financial problems, was to work toward the progressive co-ordination of the economic interests of the four members of the Balkan Entente.

If the Balkan Entente were designed to preserve the *status* quo in the Balkans — and it was — it was none the less true that, as in the case of the Little Entente, its purpose was to give some kind of unity to the Balkans to prevent that region from becoming a pawn in the hands of the great powers. That u-as also one of the ideals of the Balkan conferences — and the program of the Balkan economic council indicated that the influence of the conferences was felt in other directions. For a program of wide economic collaboration was prepared in the Jan. 1935 meeting of the advisory economic council.

The Development of the Balkan Entente. — Meanwhile, the Balkan Entente demonstrated its usefulness in the fall of 1934 when, together with the Little Entente, it stood by Yugoslavia following the assassination of King Alexander, who had done so much to promote the fortunes of that organization, and again in the spring of 1935, when it served as a stabilizing influence during the abortive Venizelos revolt in Greece. Regular meetings of the council enabled the Balkan Entente to solve problems as they arose. And while in 1936 Greece indicated that the obligations of the members should not be construed against Italy, there were some signs of growing strength. Moreover, the Balkan Entente, like the Little Entente (*q.v.*), acted formally as a unit during the Ethiopian crisis, co-operating with Great Britain, the leader of the league sanctionist powers, in upholding the principle of collective security, despite the possible political dangers and the obvious economic losses involved. Another significant achievement of the Balkan Entente was the revision of the Convention of the Straits in behalf of Turkey at the Montreux conference of June 22 to July 20, 1936.

Meanwhile, the economic council of the Balkan Entente was attempting to prepare the ground for fruitful economic collaboration. On Jan. 24, 1936, for example, a Balkan Entente air convention was signed by Greece, Rumania, Turkey and Yugoslavia, greatly facilitating inter-Balkan air communications. Moreover the economic council, meeting at Bled, Yugos., in July, recommended collaboration with the Little Entente, in the establishment of a limited postal, telephone and telegraph union. A convention for this purpose was actually signed by the members of the two ententes on Oct. 12, and went into effect on March 1, 1937. Not only were facilities to be improved, but rates were generally reduced and provision was made for the introduction of common stamps in the future. In July 1936 Rumania and Yugoslavia, and Czechoslovakia and Rumania reached agreements relative to tourist traffic which looked toward the elimination of the passport visa. The latter part of November witnessed a long delayed agreement between Rumania and Yugoslavia providing for the construction of a bridge across the Danube between Turnu Severin, Rum., and Kladovo, Yugos., the bridge to be constructed within about three years. It was noteworthy too, that in the summer of 1937 suggestions were being made by both Turkey and Greece that a Danubian bridge be built between Rumania and Bulgaria. In the latter part of 1936 Turkey and Yugoslavia arrived at a new commercial accord.

The meeting of the advisory economic council of the Balkan Entente at Bucharest in Jan. 1936 provided for the calling of a conference of maritime experts at Istanbul (May–June 1936), and a permanent maritime committee was organized at Peiraeeus, Gr., in October. The conference of the central (national) banks of issue of the Balkan Entente held its first session at Athens on Dec. 17–20, 1936. The meeting was attended by the governors of all the central banks, and the conference studied the manifold financial and economic problems confronting the states of the Balkan Entente. The group urged that a more liberal and natural system of inter-Ealkan exchanges be achieved, following, if necessary, international action. In view of their fundamental interest in effective collaboration among Balkan central banks, and in order to give that collaboration a more permanent character, it was decided to organize in each central bank, sections especially charged with the study of the economic and financial situation of the countries of the Balkan Entente. It is interesting to note also that the governors of the central banks declared their desire that the Balkan Entente be represented on the Council of the Administration of the Bank of International Settlements at Basle.

Rumania and Yugoslavia signed a series of important agreements in the spring of 1937. There was, for example, the new accord of March 13 and the significant Treaty of Commerce and Navigation of May 13, as well as the Sanitary Veterinary Accord of the same date. The Treaty of Commerce and Navigation may well be compared with the similar project for the entire Balkan region which was drafted by the Balkan conferences.

In view of the progress attained, the economic council of the Balkan Entente, meeting at Athens in March 1937, could well report some substantial achievement both in economic matters and in the realm of communication. The meeting indicated continued study of the problem of a common policy for the sale of certain products on extra-Balkan markets, announced the calling of a congress of Balkan chambers of commerce, and reported progress in the matter of inter-Balkan communications. It was recognized that progress would be made only step by step, and that the relatively similar economic character of the Balkan countries limited the possibilities of co-operation, but the economic council was determined, within the limits of the possible and the practical, to pursue its aims toward closer economic collaboration and freer economic activity and commercial interchange in the Balkans.

Other steps were also taken. During the course of 1936 and the early part of 1937, Yugoslavia and Rumania on the one hand, and Turkey on the other, prepared to establish exchanges of professors in their universities. A Balkan press entente was organized in June 1936, but important though such an organization was, its functioning under authoritarian regimes was seriously limited in usefulness.

The Balkan Entente and the European Crisis. — The years 1936–38 witnessed intense diplomatic activity in central and Balkan Europe. Events on the larger European and world stage were bound to have a determining influence in southeastern Europe. The Ethiopian campaign had thrown fascist Italy and nazi Germany together against the League of Nations and against Great Britain and France in the west and soviet. Russia in the east. Moreover the Spanish revolt, which might hare remained within the confines of the republic, became the prelude to a great European struggle as a consequence of the aggressive action of Germany and Italy especially. In central and Balkan Europe both fascist Italy and nazi Germany sought to break the unity of the Little and Balkan Ententes and to sever their con-

nections with France and western Europe. Pierre Laval, as foreign minister of France after the assassination of M. Jean Louis Barthou in Oct. 1934, played his role in weakening French ties not only with Czechoslovakia, hut with Yugoslavia and Rumania. Despite his efforts to strengthen the ties with central and Balkan Europe, M. Leon Blum was unable to do so effectively. The fact was that the rise of national socialist Germany had created a new situation in Europe, and the nations of southeastern Europe were to take account of it. The German and Italian successes made serious impressions in that region. It was apparent that the system of collective security under the League of Nations was on the verge of collapse. Germany was intent on isolating and destroying Czechoslovakia, and on winning Rumania, Greece, Turkey and Yugoslavia, as well as Bulgaria, already under Italian and German influence, with a new series of economic and financial clearing agreements.

In spite of internal differences and external pressures, the Balkan Entente was not yet to be broken. Moves for co-operation between the Little Entente and the Balkan Entente with the so-called Rome bloc of Italy, Austria and Hungary were even initiated, but on Nov. 1, 1936, Mussolini revealed his real intentions when he simultaneously offered "friendship" to Yugoslavia and urged "justice" for the "4,000,000 Hungarians" torn from their country by the treaty of Trianon. The protest from Czechoslovakia and Rumania was unmistakable, both Prague and Bucharest interpreting the manoeuvre as an attempt to wreck the two ententes. The belief was strengthened that Italy and Germany already had reached an agreement not only to continue their mutual support of Gen. Francisco Franco in Spain, but to divide central and Balkan Europe into spheres of influence—a project the Little Entente and the Balkan Entente were designed to prevent any great power from carrying into execution.

By this time, however, a number of developments were progressively weakening the Balkan Entente as they were the Little Entente. The establishment of the dictatorship of Gen. John Metaxas in Greece and the complete destruction of parliamentary institutions raised many doubts about the position of Greece within the Balkan Entente, especially since Metaxas was thought to be pro-Italian and pro-German, though Greek fidelity to the Balkan Entente was at once proclaimed.

Moreover Bulgaria was not a member of the Balkan Entente at all, though the Bulgarian attitude toward the new organization was, for a time, diplomatically correct, if not friendly. King Alexander of Yugoslavia had done much to promote a better feeling between Yugoslavia and Bulgaria before his death in Oct. 1934. On Jan. 24, 1937, however, under the leadership of Dr. Milan Stoyadinovich, the Yugoslav premier, a Bulgaro-Yugoslav treaty of "sincere and perpetual friendship" was signed, pledging that the two countries would never again go to war against each other. The signing of this treaty, without proper notice to or the consent of either the Little or the Balkan Entente, raised many questions as to Yugoslav policy. The Greek and Rumanian governments were much concerned. Greece was fearful lest there be danger of an upset in the Balkan balance of power against its interests and uneasy about a possible Yugoslav-Bulgar pressure in the direction of Salonica. Rumania did not approve the bilateral procedure and feared for the unity of the Balkan Entente. Professor Nicolas Jorga, the distinguished historian and former premier of Rumania, openly declared that the treaty had been made without prior consultation on the part of Yugoslavia with either the Little Entente or the Balkan Entente. The Italians, who appear to have had much to do with the making of the treaty, and whose unfriendly sentiments toward both the ententes was well known, considered the Bulgaro-Yugoslav treaty a blow to the unity of the Balkan Entente.

When the Balkan Entente met in Athens on Feb. 15–18, 1937, it discussed the new situation created in the eastern Mediterranean by the Anglo-Italian understanding and the report of the Turkish foreign minister, Dr. Tevfik Rüstü Aras, on his conversations with the Italian foreign minister concerning Balkan problems and the Convention of the Straits signed at Montreux. The other problem was the Bulgaro-Yugoslav agreement. While the council "took note with satisfaction" of the Bulgaro-Yugoslav agreement, after an explanation of its innocent character, fears of its consequences were by no means allayed.

The independent action of Yugoslavia with respect to Bulgaria was followed by a similar action with respect to fascist Italy when on March 25, 1937, a Yugoslav-Italian agreement was signed. This agreement stipulated respect for common frontiers on land and sea, and in case of unprovoked aggression against one of the parties, the other was pledged to abstain from any action which might accrue to the benefit of the aggressor. If both were threatened, Yugoslavia and Italy were obligated to reach an understanding as to common measures to be taken. A commercial agreement between the two countries followed. Despite subsequent formal approval, there is no doubt that the Yugoslav-Italian treaty struck a serious blow against the unity of both the Little and the Balkan Ententes. Dr. Stoyadinovich appeared to be leading his country away from its traditional moorings and into collaboration with fascist Italy and national socialist Germany.

In fact, the pressure put upon the Balkan states by the two fascist powers was of such a nature that it had brought about a weakening of the forces of unity and produced a strengthening of the trend toward authoritarian regimes in individual Balkan states, with all that that implied in political and economic nationalism. Again, by that time national socialist Germany was able to obtain a progressively dominant position over the economic life of all the Balkan countries, taking about 50% of the average imports and supplying a similar percentage of the exports of the region as a whole. When the Balkan countries perceived the weakness and the wavering position of Great Britain and France, and their own failure to preserve an essential unity of action against the forces of aggression, it was not unnatural that the smaller states of southeastern Europe should have failed as well.

The Balkan Entente and the Munich Crisis.—The so-called "pact of Munich," of Sept. 30, 1938, which laid the foundations for the destruction of the independent existence of the republic of Czechoslovakia, naturally destroyed the Little Entente, of which Czechoslovakia was the keystone. The last meeting of that organization took place on Aug. 21, 1938, while the Balkan Entente, in anticipation of the crisis, met on July 31 and moved toward an understanding with Bulgaria by removing the military restrictions of that country. In return, Bulgaria pledged to pursue a pacific policy toward the members of the Balkan Entente.

While the Balkan Entente was not wrecked by the Munich agreement, the lessons were not lost on the members, and realism not sentiment was now to sway Balkan judgments. Indeed, one Balkan statesman, a later foreign minister of Rumania, Grigore Gafencu, exclaimed: "Germany has her plans: have other countries their plans? If the other powers have no plans, we must perforce go with Germany." A. Neville Chamberlain seemed to speak clearly in the British house of commons when he declared a few weeks after the Munich agreement: "Geographically Germany must occupy a dominating position in central and southeastern Europe. I do not see any reason why we should expect a fundamental change to take place in these regions." Germany, in fact, was then to proceed to the organization of a *Grossraumwirtschaft*, a German *Lebensraunz*, in the Balkans. The members of the Balkan Entente were but a negligible force, apparently, against the forces which were then to be brought against them.

The Balkan Entente and World War II.—As the world moved toward war in the period after the Munich agreement, national socialist Germany moved toward the peaceful conquest of the Balkan region, and the forces of disintegration within the increasingly weakened Balkan Entente aided in that task. Rumania was subjugated economically to Germany through the commercial agreement of March 23, 1939, while Bulgaria, Yugoslavia and Greece, as well as Turkey seemed already in Germany's economic orbit. Each Balkan power now seemed determined to pursue its own course, though formal unity within the Balkan Entente still apparently prevailed.

The council of the Balkan Entente met in Bucharest, Rum., Feb. 20–22, 1939, and unanimously affirmed the identical attitude of the four member states toward the progressive developments in Europe, stressed their profound attachment to the ideal of peace, and re-emphasized the complete solidarity which united the members of the Balkan Entente and their unanimous determination "to continue their efforts in the same spirit." But there was little evidence that these words were anything more than an empty formula, for a united policy was not to be pursued. Nor was the situation perceptibly improved when Great Britain and France, after their guarantee to Poland on March 31, 1939, namely on April 13, offered guarantees to Greece and Rumania if they became the victims of aggression and communicated that declaration to Turkey. Yugoslavia was not covered by the guarantee, probably because the Yugoslavs, already surrounded on three sides by the Berlin-Rome axis, were too afraid to accept such assurances.

When the advisory economic council of the Balkan Entente met in Bucharest May 17–27, 1939, it noted the increase in inter-Balkan commerce and noted with satisfaction the efforts of the Balkan governments to insert a special Balkan clause in commercial conventions with other states. But the economic council was especially pleased at the measures which were being outlined for the improvement of inter-Balkan communications, railway and air, the postal services and tourist traffic.

When the war finally came, with the German attack on Poland Sept. 1, 1939, the Balkan Entente once more was to affirm the solidarity of the views of all the member states, though each state, in fact, was to pursue its own independent course. The last meeting of the council of the Balkan Entente took place Feb. 2–4, 1940, in the city of Belgrade, Yugos. As the war was now drawing somewhat more closely to the Balkan region, and as all the members of the Balkan Entente seemed clearly endangered in one way or another by German aggression, there was a possibility that at last the members of the Balkan Entente would assert a genuine unity of thought and action. Proper note was taken that war was going on all around the members of the Balkan Entente. The Yugoslav minister of foreign affairs, M. Aleksandar Ancar Markovitch, however, sounded a strange keynote when he declared: "We are happy today to state that our peaceful efforts have given good results. We consider the future with the same optimism. The Balkans are not menaced from any quarter. The loyal and correct attitude of the Balkan peoples has been justly appreciated and respected by all." Particular satisfaction mas expressed over the pacific sentiments of Hungary, Bul-

garia and fascist Italy. M. Gafencu, the Rumanian foreign minister, stressed the resolutely peaceful attitude of the Balkan Entente, though it was known that the Rumanian government was extremely fearful of German aggression at the moment, and was anxious for a declaration of complete solidarity on the part of the Balkan Entente at the time. The final communiqué of the council of the Balkan Entente Feb. 4, 1940, was especially innocuous. It noted the common interest of the four states in the maintenance of peace, order and security in southeastern Europe. It expressed "their firm decision to pursue their resolutely pacific policy, while maintaining strictly their positions concerning the present conflict in order to preserve this part of Europe from the experiences of war." It reaffirmed their "firm will to remain united" within the Balkan Entente, which was directed against no state, and to guard in common the right of each to its independence and its national territory. It emphasized the desire to enter into and to develop friendly relations with the neighbour states —Hungary and Bulgaria. Finally, it stressed the necessity of perfecting economic relations and communications between the members of the Balkan Entente. The four ministers of foreign affairs, as was customary, were to keep in direct contact with each other until the next meeting of the council of the Balkan Entente, which was to be held in Athens, in Feb. 1941.

The last communiqui of the Balkan Entente, however, was symbolic of the unreality of the meeting for there was no evidence that real unity had prevailed at all, or that the states were prepared to take any effective measures in common against the aggression which actually threatened the independence of them all. The meeting of Feb. 1941 was never held. In the summer of 1940 Rumania was partitioned, with the soviet union taking Bessarabia and Bukovina, and Hungary marching into a portion of Transylvania, while German troops took over the very heart of the country. In the summer of 1941 Rumanian troops were to move into the soviet union along with those from Germany. On Oct. 28, 1940, fascist Italy attacked Greece, which was finally subdued when the forces of Germany and Italy destroyed the independence both of Greece and of Yugoslavia. Turkey became, for a time at least, completely immobilized. Despite the professions of unity on the part of the members of the Balkan Entente when danger seemed somewhat afar, one by one and one after another, the Balkan states became the victims of the aggression which they had sought to avoid through the unity of action which they did not, in fact, follow. (H. N. H.)

BALKAN PENINSULA. Since the early 19th century this name has been given to the most easterly of the three southern prolongations of the European continent. Balkan is a Turkish word meaning mountain, and though in modern usage it is applied only to a particular mountain belt lying south of the Lower Danube, it was formerly regarded as a general name for a chain supposed to run from east to west across the peninsula. This hypothetical range was thought to be the boundary between the early maritime civilizations of the south and the bleaker, more difficult lands of the interior, with their barbarian peoples. The actual relief conditions are not so simple as was believed, but the fact that the conception of a Balkan peninsula, comparable to the Iberian and Italian ones, is of so recent a date is of great interest. The conception owes its origin and spread to two sets of facts. It has been shown by modern geographical research that the area possesses certain basal resemblances to the two more familiar peninsulas, particularly in its relations to the folded mountain chains of southern Europe and in its structural elements. But these resemblances depend upon fairly detailed points, mainly of interest to the physical geographer, and coexist with well-marked and obvious differences. The term Balkan peninsula would not have acquired its present familiarity to the general public, if it had connoted only certain structural features. During the 19th century, when geographers and geologists were acquiring new knowledge of the interior of the region, and coming to regard it as an entity, not as merely a background to Greece and Byzantium, great political changes were taking place within it. The peoples submerged by the Turkish advance began to organize themselves into national states and, as the Turkish empire contracted, new names appeared on the map. The growth of the new states was accompanied by much turmoil, which had reflex effects outside the limits of the peninsula however these be drawn; but the essential point is that it drew general attention to the region. It became increasingly clear that all the older European states, if in varying degree, were interested in the delimiting of boundaries within it, and that thus the facts disclosed by detailed geographical study had more than purely technical importance.

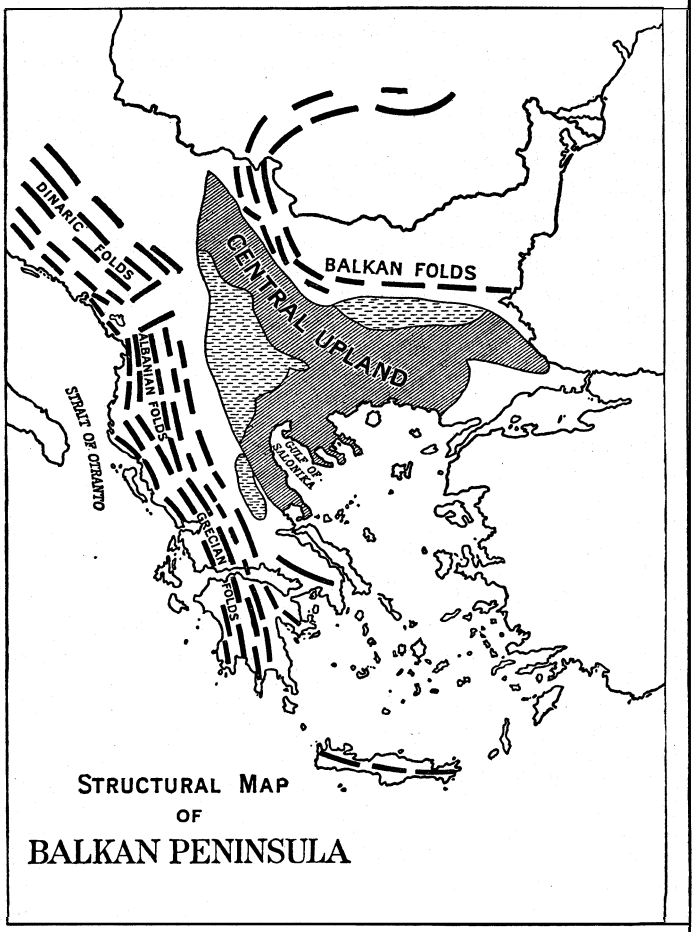
One of the reasons why the notion of the entity of the peninsula was so slow in taking root was that no mountain barrier separates it from the continental mainland, as Italy is separated by the Alps and the Iberian peninsula by the Pyrenees. There is thus no sharp break of continuity such as is experienced when the Alps are crossed and a new world is disclosed in Italy. The northern limit usually adopted is constituted by the line of the Danube, then the Save, then the small feeder of the latter called the Kulpa, from which an imaginary line is drawn to the port of Fiume. This limit has a certain justification, if not a complete one. The Danube-Save line is easily recognized on a map, and it served for a period as a boundary to the Turkish empire and thus as the frontier of Christendom. For a time also the Save-Kulpa-Fiume section, which has a certain air of unreality, did at least approximate to the frontier between Austria and the Turk. In point of fact, however, a geographically satisfactory frontier in this northwestern section is difficult to draw. Even the Danube-Save line, at least to the west of the Iron Gate of the Danube, has never been a limit so far as peoples are concerned: it bears now little relation to political frontiers. The first point about the Balkan peninsula is thus that on the north there is no real separation between it and central Europe. This physical continuity is accentuated by the notable increase in width of the peninsula towards the north. Thus the distance in a straight line from the mouths of the Danube to Fiume is about 750 mi.; for the sake of comparison it may be noted that the line by which Spain is attached to the continent measures only some 250 mi. from sea to sea, the Pyrenees being continuous throughout and leaving but a small gap at either end.

The second outstanding feature is the peculiar build, which causes the peninsula to fall into two very unequal and very dissimilar parts. To the south a secondary peninsula, with an average width of only about 125 mi., is attached to the main one. Though both sections are highly mountainous, not only is this secondary peninsula of Greece much narrower, but it has a peculiarly dissected coast line, which brings sea influences within easy reach of almost every part. The broad, continental northern section, on the other hand, is largely out of touch with the surrounding seas, not only because of its width, which makes places in the interior over 300 mi. from the nearest coast, but on account of the nature of the shore lines, and, in part, of the direction of the mountains. In climate, in vegetation, in possible crops, it differs profoundly from Greece. No less profound has been the effect of the actual remoteness from the sea routes so freely open to the peoples of the south. It is this division into two parts—one sharing to the full the life of Mediterranean peoples, the other cut off from it—rather than the absence of a definite northern limit, which made the European world so slow to recognize the existence of a Balkan peninsula. Till the peoples of the continental segment awoke, the whole northern area tended to be regarded only as a broader equivalent of Alps or Pyrenees: the real peninsula was the Grecian one.

Structure and Relief.—As just stated, it is the presence within the peninsula of young fold-mountains which has led geographers to recognize it as essentially similar to the other Mediterranean peninsulas. Two separate series of these can be recognized, one, of transverse direction, lying to the east, and the other, which is longitudinal, in the west. The Transylvanian Alps swing round in a great curve, the Danube breaking through at the Iron Gate at the western apex of the curve, and are continued in the Balkan mountains. which have a roughly parallel direction. Breaking off steeply on the shores of the Black sea, the Balkans rise to a maximum height of nearly 8,000 ft., and the most noted of their passes, the Shipka, has a summit level of well over 4,000 feet. At first sight it might seem as if the crest of these mountains should be taken as the northern limit of the peninsula, rather than the line of the Danube. But northwards they sink gradually to a chalky tableland, presenting a marked contrast to the alluvial plains of Walachia beyond the river, and the presence of this tableland means that the northern slopes up to the passes, relatively high though these are, are gentle. The Balkans have indeed proved in practice much less of a barrier to human movement than would appear from the map.

Just as the Balkans are a continuation of the Carpathian branch

of the Alpine chain, so the main chain itself bends down the western side of the peninsula. From the Julian Alps north of Trieste a series of mountains runs in a south-easterly direction close to the coast and parallel with it. These, to which the general name of Dinaric Alps may be given, rise to well over 8,000ft. in the peak of Durmitor; but their significance as a barrier does not depend upon their height. They are characterized by the great development of massive limestones, particularly ex-



A ROUGHLY TRIANGULAR CRUST-BLOCK OF RESISTANT ROCKS FORMS THE CENTRAL UPLAND, WITH YOUNG FOLD-MOUNTAINS TO THE WEST AND TO THE NORTH-EAST. BETWEEN THE TWO, SHOWN BY DOTTED LINES, LIE TRANSITION AREAS, WITHIN WHICH ARE FERTILE BASINS. DUE TO THE SINKING OF FRACTURED MASSES OF ROCK

tensive in the area lying behind the peninsula of Istria. These limestone areas, called karst in German and *carso* in Italian, display to a very marked extent certain peculiar topographical features, dependent on the effect of rain water on their constituent rocks. Thus the surface soil is very thin, bare rock being frequently exposed; running water is usually absent at the surface, most of the rivers sinking, after a short course, into cavities of the rocks; caves and sinks are common, as well as elongated depressions called locally *polyen,* or fields, because only in them as a rule is there sufficient depth of soil to permit of cultivation. The combination of these features makes the karst areas difficult to cross, because continuous river valleys to serve as natural routes are absent as a rule, and, where they occur, as in the case of the Narenta river, the stream tends to flow in steep-sided, canyon-like gorges which form a great obstacle to transverse movement. Further, not only do these lands form a barrier between the sea and the interior, but they can as a rule only support a scanty and scattered population, for the local resources are small.

In places the limestone mountains rise steeply from the shore of the Adriatic, but a certain amount of subsidence has occurred, with the result that numerous islands fringe the coast. Because the mountain folds run parallel to the shore, the islands tend to be elongated in the direction of the coast-line, and the straits and inlets tend to have the same direction. The islands are usually fertile and there is often a strip of productive land fringing the inlets. Water is also easy to obtain, for the streams which were lost on the heights above emerge as full-grown rivers where the rocky hills descend in cliffs to the sea margin, or springs even bubble up on the sea-floor itself. In contrast to the dry and barren lands above, therefore, there is a possibility of cultivation and settlement on the shore. But the coastal areas are too narrow, the difficulties of communicating with the interior too great, to have allowed for the rise of indigenous civilizations here. The scattered towns on this Dalmatian coast represent islets of ancient but alien culture, and have scarcely influenced the interior of the peninsula at all. They themselves arose as colonies, as offshoots, that is to say, of areas enjoying much greater advantages.

The Dinaric Alps may be said to extend to the neighbourhood of the mouth of the Drin. Here the coast changes in direction, trending almost north-to-south, and the mountain belt thins out and draws back from the coast, so that the Albanian lowland intervenes between it and the sea. This strip, which extends south to Valona, shows another contrast to the Dalmatian area further north in that a considerable number of permanent rivers flow from the mountains across the lowland to the sea; here, then, access to the interior becomes at least relatively easy. Another peculiarity is the proximity to south-eastern Italy. Valona is some 80m. distant from Brindisi, the actual Strait of Otranto being only about 50m. wide. The combination of this nearness to an area of old civilization and of natural routes to the hinterland is of great significance.

Valona, with the adjacent sheltering peninsula ending in Cape Linguetta, marks the beginning of a new change. The coast reassumes a south-easterly direction, the fold-mountains become more conspicuous as the Pindus range, which extends throughout the whole of Greece. In the Peloponnesus the mountains tend to acquire a north-to-south direction, finally swinging round to a west-to-east one in Crete.

According to current views of the mechanics of mountain-folding, a crust-block of old and hard rocks is always present, which receives the pressure of the thrust causing the folding. While the younger and softer rocks on its margins buckle up under the stress, it, by hypothesis, can only respond by faulting, with the sinking of certain segments and the uplift of others. Such a crust-block is present in the Balkan peninsula, forming its central core. This has a roughly triangular shape, the apex reaching the Danube east of Belgrade and the broad base approaching the shore of the Aegean sea. That sea is believed to overlie a former extension of the crust-block which has sunk beneath its waters. The numerous Greek islands represent fragments of the surface of this lost land, which have remained above sea-level when the remainder sank. The narrow straits of the Bosporus and Dardanelles are also regarded as flooded parts of the courses of rivers which crossed the old land.

The central core of the peninsula, though it has retained a position above sea-level, has been greatly modified as a result of the formation of the fold-mountains on its margins. The narrowed northern region, constricted between the Dinaric Alps and the curve of the Balkans, is a broken hilly country traversed by a continuous longitudinal depression through which the River Morava flows on its way to the Danube. South of Nish, however, and extending to the Gulf of Salonika is a region of great structural complexity, which seems to have received the full force of the thrust. Faults are innumerable, and closed basins alternate with short and steep highland belts. The basins tend to be elongated in a longitudinal direction. Many have formerly been lakes, and since they are floored with fertile soil, they are fitted to become centres of population; but their isolation from each other has had very important human effects.

As contrasted with this fractured and much subdivided region the south-eastern part of the triangle, that lying between the Balkans and the Aegean, shows relative simplicity. Here the core reaches its greatest height (over 9,500ft. in the Rila Dagh), and here also is the broadest unbroken mass of elevated ground. The

general name of Rhodope Dagh may be given to the whole block, though the separate parts have local names. The Rhodope Upland is separated from the Balkan mountains by a considerable lowland, the Rumelian plain, watered by the River Maritsa. This is one of the most considerable tracts of lowland within the peninsula and is continued, beyond the Maritsa, into an undulating tract extending to the shores of the Sea of Marmara. There is also an interrupted belt of plain between the Rhodope and the Aegean, the total result being to make the south-eastern part of the peninsula much less continuously hilly than the north-west, where lowlands are virtually absent.

Relief and Political Units. — In the above account emphasis has been laid on the distinction between the fold-mountains on the one hand, and the central crust-block on the other. The contrast is a geological one, based on the characters of the constituent rocks in the two cases, and is not visible on a relief map, where land is classified on the basis of its height above sea-level alone. The essentials of structure are worth note because the build of the peninsula has influenced the routes and the areas of settlement within, and the zones of effective contact with adjacent lands outside. But it is the ordinary atlas map which affords the most familiar representation of the area, and it is necessary to correlate the facts shown there with those obtained from the survey of the broad structural features, and particularly to connect the political and administrative units with the general lie of the land.

A map with orographical colouring shows an almost continuous area of high ground on the west, continued into the Grecian peninsula, which is almost wholly mountainous. In the north-west the way in which the high ground within the peninsula passes into the Alps proper means that the Danubian plains have no natural, easy exit to the Adriatic. But, owing to the presence of the broad Gulf of Quarnero, the mountain belt thins out behind the town of Fiume at its head. Beyond this narrowed section lies a tract of undulating country, mostly outside the peninsula as usually defined, for it extends beyond the Save-Kulpa line. This area is a continuation of the plains of the Danube, and, where the rivers Drave and Save converge towards one another, it includes a considerable area of true plain. Though the mountain belt which separates it from the Adriatic is neither wide nor lofty — it does not rise much above 5,000 ft. — yet on account of its karstic nature it forms a very effective barrier. The chief elements of the belt are the Kapela and Velebit mountains, both remarkably waterless and barren. The mainland shore of the Gulf of Quarnero is also inhospitable. This whole area, formerly the kingdom of Croatia-Slavonia, is therefore from the physical standpoint a transition region between Central Europe and the Balkan peninsula. It has little direct relation to the Adriatic, though economic and political causes led to Hungary making great efforts to develop Fiume as a grain port during the later 19th century. The western mountain section is well fitted to serve as a strategic frontier, and did mark the limit of the Turkish advance; but the fact that much of the boundary is formed by the Save river is important. A river line can be organized as a military frontier by a strong state, but it is not a natural barrier to the migration of peoples. In the past, Croatia-Slavonia has been politically, economically and culturally attached to Central Europe, but by its inhabitants it belongs to the Balkan peninsula. North-west of Croatia-Slavonia, in the region where the Dinaric Alps in the larger sense pass into the Julian Alps, lies the former Austrian Crownland of Carniola, a karst area, again lying outside the peninsula proper, but having a considerable Balkan element in its population.

To the south of the Velebit mountains a narrow strip of coast-line, with the mountain crest behind, forms Dalmatia. But the real Dalmatia is an interrupted series of maritime towns, Zara, Sebenico, Trau, Spalato and Ragusa being among the most important. For the reasons already noted these towns have little connection with the interior; their Roman antiquities, the Venetian lion which still decorates some of their old buildings, are visible indications that their position on the shore of the peninsula has had little effect on the life of their inhabitants.

The actual mountain belt, from the borders of Croatia-Slavonia to the confines of Greece, is divided among a series of separate units, forming, in order from north to south, Bosnia, Hercegovina, Montenegro and Albania. In Bosnia the limestone rocks of the coastal area give place to others, including sandstones, which at once allow of the development of deeper soils and of a more normal drainage system. The numerous rivers drain to the Save, and Bosnia can be reached from that river, and thus from the Danubian plains, with relative ease. Other route-lines connect it with the interior of the peninsula. Hercegovina is a karstic area, with only one important river, the Narenta, which flows to the Adriatic. But though a light railway connects Ragusa to Mostar, the capital of Hercegovina, and that city to Sarajevo, the capital of Bosnia, access to the Adriatic is difficult. Montenegro has a narrow strip of coast-line, but is essentially a mountain eyrie, a refuge which withstood invasion in the past as much perhaps because of its worthlessness as of the difficulty of conquest.

Albania, with its malarious lowland and its mountainous hinterland, is a region of much interest. As already seen, it affords the possibility of routes to the interior, and might thus be supposed to be a prize worth having. But the inhabitants, who are mountaineers with little interest in the sea or in sea traffic, have preserved a striking measure of individuality since very early times. The through routes which traverse their lands have never been of great value to them, and their territory is not particularly productive. The strongly manifested individuality of the Albanians has prevented the growth of an indigenous political system and encouraged alien control. Twenty years of experiment in self-government proved insufficient to develop a stable organization. and in 1939 the country came once more under foreign rule.

Broadly then we may say that the whole of the western mountain belt is a region of poverty and aloofness. There is no unity among the different parts, no area to act as a focal point about which a natural crystallization could take place; it is not here that the origin of Balkan problems is to be sought.

We come next to the western part of the crust-block, with its marked contrast between the northern section, draining to the Danube mainly by the Morava, and its complex southern section, draining to the Gulf of Salonika by the Vardar. West of the Morava the country is undulating and lowlands fringe the south bank of the Save. The Western Morava also, a tributary entering the main stream from the west, helps to define a block of land which affords possibilities of settlement. This was the nucleus of the Serbia of the 19th century, with Belgrade, at the junction of Save and Danube, as its capital. East of the Morava the surface is more elevated, the rocks of the crust-block abutting upon those of the Balkan mountains. The complex southern region is Macedonia, with its jumble of peoples, its long history of turmoil and disorder.

Thrace, a name used loosely for the area east of the Mesta river, is functionally the passage way between the southern edge of the crust-block and the sea. The Rhodope upland is continued eastwards, beyond the gap through which the River Maritsa has cut its way, into the Istranja mountains, which descend steeply to the shores of the Black sea. Between this upland tract and the Sea of Marmsra on the one hand and the Aegean on the other, is a considerable belt of low-lying land. Adrianople, on the Maritsa after it breaks through the narrow neck connecting the Rhodope and the Istranja, is the natural centre of this eastern part of Thrace. Further west the coastal lowland is narrowed by the nearness of the Rhodope to the Aegean, and is also interrupted by prolongations of the upland, particularly on the right bank of the Lower Naritsa. This narrowed strip affords a land route from Asia Minor to peninsular Greece; to Macedonia and so to the north and north-west; to Albania and so to the Adriatic coast. With the loss of Adrianople and almost the whole of Thrace to Greece, Turkey in Europe is reduced to the city of Constantinople and a triangular belt of land in its rear, extending from the Istranja mountains and the Black sea to the Sea of Marmara. This area is mostly steppe-like and of no great productivity.

There remains for consideration Bulgaria, which presents some

points of great interest. Post-war Bulgaria has as its northern frontier the Danube, save that where the river takes its great bend to the north, the frontier leaves it, and runs slightly south of east to the Black sea, the steppe-like Dobruja being included in Rumania. Southwards Bulgaria extends to the Rhodope crest, and is thus nearly bisected by the Balkan mountains. Sofia, the capital, lies in a small basin between the Balkan mountains and a north-westerly prolongation of the Rhodope, the basin being drained by the River Isker, which breaks through the Balkans to enter the Danube. South of the Balkan chain, and separated from it by a longitudinal depression, lies a parallel upland, the Anti-Balkans. The intervening depression is watered by the River Tunja, which seems to be making for the Black sea near the port of Burgas, but turns instead sharply south, breaks through the western end of the Istranja, and joins the Maritsa at Adrianople. The Upper Maritsa, on which stands Philippopolis, flows through the wider depression which we have called the Rumelian plain. These two fertile lowlands, with their bounding uplands, form Eastern Rumelia, not united politically to North Bulgaria till 1885. Geographically the important point is that this region, with southern Macedonia, formed the granary of Turkey in Europe, as it did of the earlier Eastern Empire. The Maritsa depression shows certain analogies to the valley of Andalusia in Spain, both in its position between fold-mountains and a crust-block, and in its value to an alien invader. The first Turkish capital Adrianople, is on the margin of the productive belt, but Constantinople is outside it.

Greece within its peninsula, Serbia in the Morava region, Bulgaria astride the Balkan mountains, all became independent states while Turkey still held Thrace, Macedonia, Albania and, at least nominally, a large part of the north-west. That the progressive contraction of Turkish territory led to such bitter and prolonged conflict was largely due to the nature of the routes within the Continental section of the peninsula, and particularly to the difficult access of both Bulgaria and Serbia to open water. Thus the natural route-lines demand careful consideration.

Routes and Lines of Communication. — On the northern, southern and eastern margins of the peninsula respectively are situated the three nodal points of Belgrade, Salonika and Constantinople, all owing their importance to the land and water routes which converge upon them, and all linked together by rail. That all are marginal, and that, with the partial exception of Sofia, no focal point of similar importance exists within, is a highly significant fact.

Belgrade lies where the two inland waterways of the Danube and the Save meet. The Danube is continuously navigable, despite the partial interruption of the Iron Gate, downstream to the Black sea, as well as upstream. The Save, though not a first-class waterway, can be used by steamers up to the Kulpa confluence. Apart from the rivers a number of land-routes converge on Belgrade. Communication is easy northward across the plains to Budapest and so to north-western Europe; the Save valley allows access westward to Zagreb and so to Fiume, or by Ljubljana to Trieste and North Italy. Finally the Morava valley gives an admirable line of entrance to the interior of the peninsula.

Salonika is the only good port on the north coast of the Aegean, and is the best exit to open water for the whole of the interior, Fiume being somewhat remote, and neither the other Adriatic ports nor the Black sea ones being of much value. Its political allocation has been complicated by the fact that two major land-routes and some minor ones converge upon it. The first group consists of the meridianal furrow indicated by the direction of the Morava and Vardar rivers, and the route from Constantinople by the Thracian lowland.

The Morava-Vardar furrow is followed by the railway from Belgrade to Salonika by way of Nish and Skoplje (Uskub). But though the headstreams of the two rivers, despite their contrary direction, actually anastornose in wet weather, it must not be assumed that a continuous valley line extends from the Danube to the Gulf of Salonika. The Morava, upstream from Nish, the Vardar, do nstream from Skoplje, both pass through gorges offering considerable resistance to through communication in pre-railway days. The Morava gorge at Varanje could be avoided by taking off from the river and entering the basin called the Kosovo Polye, north-west of Skoplje. It is worth noting in this connection that the gorge was the Serbian frontier at one stage in the development of that state — a clear indication of the break in the furrow here. Again, the Vardar gorge can be avoided by taking off from the river and following a belt of low ground which leads by Shtip and Strumnitsa to the valley of the Struma river. By this route it is possible to reach either Salonika or the Aegean coast further east, beyond the remarkable Chalcidice peninsula. Here lie the possible port of Orphano and the somewhat more important one of Kavala. But the Struma river rises not far from Sofia, giving that town a line of access to Salonika, or to the Aegean coast at Orphano or Kavala. A railway, indeed, connects Sofia with the line from Constantinople to Salonika, and thus with the latter port.

The fact that Salonika is politically Greek, and not attached either to Yugoslavia, despite the presence of the Morava-Vardar furrow, or to Bulgaria, despite the relative nearness of Sofia, is explicable rather by the strength of a cultural and historical tradition than by purely physical facts. It is an Aegean port of much importance in the modern world, and to the Greeks the idea that control of Aegean trade is their national right is one that admits of no argument. Part of its basis is of course the geographical fact that their somewhat barren land could not support them unless supplemented by the sea trade for which they have always shown natural aptitude.

One other minor land-route which leads to Salonika may be mentioned. As its Latin name of *Via Egnatia* indicates, it had historical significance, and though it is not followed throughout by a railway, nor even by a continuous road in the European sense, it may in the future reacquire value as a thoroughfare. It connects the small port of Durazzo (Roman, Dyrrachium, modern Albanian, Durres) by Okhrida and Monastir to Salonika and so to Constantinople. It thus renders possible a traverse of the peninsula from west to east, and was used for this purpose in Roman times. Its existence, combined with Italian presence in Albania, is an element in the Greek desire to hold Salonika. Monastir has also a connection with Valona, and is itself on a railway line forming a western loop of the main Skoplje-Salonika line.

Constantinople, with a superb natural position where the waterway from the Black to the Aegean sea crosses the land route from Asia Minor to the Balkan peninsula, is connected to Belgrade by a diagonal furrow, certainly as important as the north-to-south one from Belgrade to Salonika. The route follows the Morava valley to Nish, then ascends the Nishava tributary and crosses a pass to the basin of Sofia. From this basin by another pass it reaches the Maritsa valley, and follows this past Philippopolis and Adrianople, till the valley of Ergene tributary enables it to turn east to Constantinople.

Bulgaria, with a line running eastwards from Philippopolis to the Black sea port of Burgas connected across the Balkans to the Danubian tableland route from Sofia to Varna, has a fairly well-developed railway net. The fact that there is no coastal line running from Varna to Constantinople should be noted.

Though the three great routes cross one another within the peninsula, no notable centres, ancient or modern, stand at the points of intersection. The absence of such internal focal points is but a further indication of the minor importance of local traffic, associated with the fact that no great contrasts exist in the products of the different territories. Just as the external states tend to seek to advance into the peninsula by the line of the highways, so each of the units within seeks to hold as much as possible of the main route or routes passing through its lands, both in order to obtain an uninterrupted exit and entrance for its commerce, and to share in the profits of the through traffic.

Of the five separate political units, Greece has been far the most successful in expanding so as to obtain access to all the main routes. The pushing of the Greek frontier into Macedonia and Thrace gives the State hold of the greater part of that section of the west-to-east route which is important because

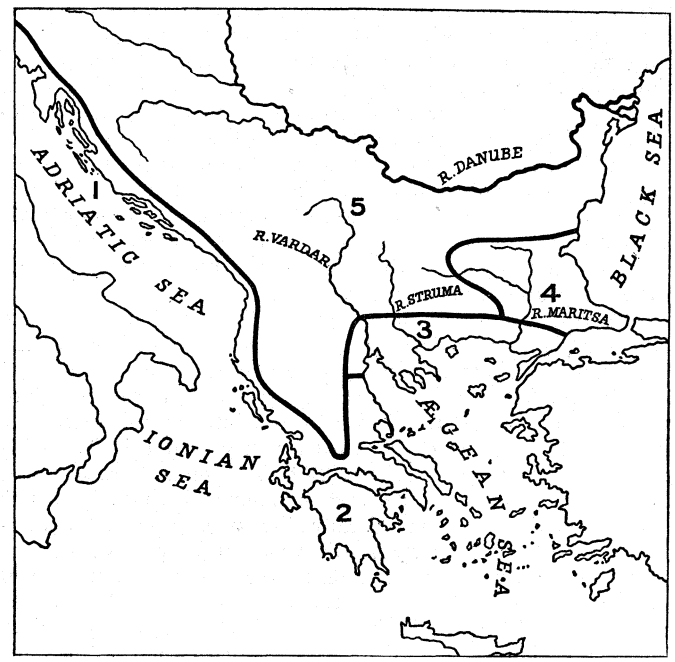
traversed by a railway; Greece also holds a part of the meridianal furrow, thus cutting off Yugoslavia from the Aegean, and a part of the diagonal furrow, thus cutting off Bulgaria similarly from the Aegean. At the same time this division of the highways into parts held by the different states affords a certain security against external penetration, and gives a possibility of internal adjustments. The Belgrade-Constantinople railway passes through the territories of Yugoslavia, of Bulgaria, of Greece and of Turkey; the Belgrade-Salonika one, prolonged from Salonika to Athens, is divided between Yugoslavia and Greece; the potential Durazzo-Constantinople one crosses territory belonging to Albania, Yugoslavia, Greece and Turkey. This gives a certain hope for the future, for it suggests that the five states may learn that they have common interests; in the immediate past the antagonisms rising out of the growth of national consciousness in each have too often been fomented from outside, and the first lesson the Balkan peoples have to learn is the need of living at peace with each other. That Yugoslavia has a free zone at the port of Salonika, and that Greece is linked to the railway system of the rest of Europe only by a line which passes through Yugoslav territory are notable facts; they indicate that the well-being of each state is bound up with that of the others.

Climate.—Next to the relief and the presence of the great highways, the factor which has most deeply influenced human life within the peninsula is the climate, acting mainly through its effect on natural vegetation and cultivated crops. Of the climatic types represented in Europe generally, two, the Mediterranean and the Central European, occur here in pronounced form, but there are also variants and transitional types. The outstanding peculiarity, however, is that the perfectly typical Mediterranean climate has a very limited extension, as compared with the Central European type, which prevails through the greater part of the broad northern section of the peninsula, and even extends into the centre of the northern part of the Greek section. While, therefore, five major climatic regions can be recognized, by far the largest of these is that which is in reality but an extension of the greater region lying to the north. In other words, no notable difference in climate separates the peninsula proper from the adjacent Danubian lands.

The Mediterranean climate is of peculiar interest because it is so closely linked to a particular type of culture showing a very delicate adaptation to local conditions. Though it is not quite true to say that this culture originated in the Balkan peninsula, Crete, which belongs to the region, was of great importance as one of the seats of its early development.

Three essential features differentiate the Mediterranean climate: the winters are warm in relation to latitude, and the greater part of the rain falls during that period; the summers are hot and dry, and one or more months may be practically rainless; throughout the year the skies are clear and there is abundant sunshine, for the winter rains come in heavy showers of short duration. Before these characteristic features can develop, there must be at once shelter from land influences and full exposure to sea ones. Further there must be no great elevation above sea-level, because with increasing height the winter temperatures become lower, the skies are cloudier, and rains occur in summer as well as in winter. The characteristic marked periodicity of rainfall and small temperature range thus become modified, and the wild plants and crops which are a response to these disappear. These conditions mean that the typical climate is best developed on coastal lowlands, particularly on islands and in narrow peninsulas penetrated by long sea-inlets. Two regions within the peninsula show typical Mediterranean climate, but are regarded as distinct from one another because latitude and position bring about differences in the distribution of the rainfall throughout the year, without affecting its marked periodicity.

One of these is made up by the Greek islands. the Peloponnesus, the margins of the northern part of the Greek peninsula, and a narrow strip on the coast of Albania. Even within the region so defined, however, elevation above sea-level, as in the mountains, or an upland girdle, as in the plain of Thessaly, may produce local modifications. We may take Athens and Corfu as representative stations within this region. Athens, on the eastern side of a peninsula, largely sheltered from rain-bearing winds, has a much smaller total rainfall than the island station of Corfu, which faces the wet winds of winter; but despite the difference in the amount of rain in the two places, its distribution is closely similar. At both stations winter temperatures, so far as monthly averages are concerned, do not fall below 48°–50°. This means that a



FROM KENDREW, "CLIMATES OF THE CONTINENTS." BY PERMISSION OF THE CLARENDON PRESS

THE FIVE MAJOR CLIMATIC REGIONS OF THE BALKAN PENINSULA

1. Dalmatian Region has very mild winters with copious rain
2. Greek Region has hot, arid summers and relatively cool, moist winters
3. North Aegean Transition Region has cold winters, hot summers, and rainfall fairly evenly distributed throughout the year
4. Eastern Transition Region has cold winters, moderately hot summers and most rain in winter half-year
5. Balkan Region has most rain during warmer half of the year, cold winters, and moderately hot summers

certain amount of growth of hardy plants, such as grasses, can continue throughout the winter, for about 43° is regarded as the limit below which growth becomes impossible for plants of the temperate belt. Summer temperatures range from 78° to 81° (July averages), which permits of the ripening of sub-tropical fruits. At Athens July and August are practically rainless, and only about 23% of the total fall occurs in the period April to September, so that more than three-quarters of the total falls in the cooler half of the year. More than one-third falls in the two rainy months of November and December. Corfu has a rainfall four times as great as that of Athens, and though only July can be described as practically rainless, only about 20% of the total rainfall occurs in the period April to September. High summer temperatures which cannot be used for crops like cotton and sugar cane because of the summer drought, but are well suited for the ripening and drying of fruits; warm winters which permit some crops to make vegetative growth then, stimulated by the heavy showers: these are the outstanding features.

A narrow strip along the coast of Dalmatia is regarded as forming a second major region. We may take Ragusa as a typical station, bearing in mind, however, that it is the most southerly of the important towns of Dalmatia. The winter temperatures here are closely similar to those experienced in the Greek region, much of Dalmatia being remarkable for its mild winter climate. The summers are not quite so hot as at Athens or Corfu, but the real distinguishing feature is the less marked periodicity of the rainfall. There is now no rainless month, though July continues to be the driest period of the year. Over 30% of the total rainfall occurs during the period April to September, so that summer drought is far less marked; oranges can be grown without irrigation water, and their co-existence with the olive is a distinguish-

ing feature. Not only. however, is the strip with this typical Mediterranean climate very narrow, but changes occur with some rapidity towards the north. Except where, as at Spalato, the form of the coast-line gives shelter, the more northerly places are often exposed to the blast of the *bora,* or cold northerly wind of winter, which is at once a danger to shipping and excludes the more delicate Mediterranean fruit-trees. When Trieste is reached on this eastern Adriatic coast, the somewhat cold winters (January average below 40°), and the fact that the period April to September shows rather more than half the total amount of rain, with a rainfall maximum in October and a secondary one in June, mark the transition from the Mediterranean climate to the Central European one. The northerly Dalmatian towns and the coast of Croatia show stages of the transition. On the whole, it is easier to exaggerate than to under-estimate the significance of this second, or Dalmatian, climatic region. Ragusa, both in its climate and in its natural vegetation, is typically Mediterranean, but a very short journey from the coast brings the traveller into an area of quite different character.

Southern and Eastern Macedonia and Western Thrace fall into a third region, characterized by notable modifications of the Mediterranean climate. Salonika may be selected as a representative station. The winters are cold for the latitude (average January temperature 41°), because of the bitterly cold northerly winds which blow down the Vardar valley, and this feature is accentuated as the coast is left. But the summers are hot, and the range of temperature between summer and winter is greater than at any of the stations already discussed. There is no rainless month, and though July is still the driest period, and November and December the wettest months, there is a much more even distribution of rain throughout the year, the six colder months having very little more rain than the six warmer ones. The colder winters, especially where there is exposure to wind, again limit the distribution of the more delicate Mediterranean fruit-trees, and growth even of hardy plants is checked during winter. On the other hand the high summer temperatures and the fairly heavy summer rainfall, with the possibility of irrigation from the mountain snows, make it possible to grow crops demanding both heat and moisture, but indifferent to winter cold because of their annual nature. Among such are cotton, rice, tobacco, maize, opium poppy; all introducing a different note into the landscape.

As we pass northwards from Salonika into the interior of the peninsula the change from this modified Mediterranean to the true Central European climate is rapid, and is accentuated by the relief. The general features of that climate are the cold winters, the temperatures then showing little relation to latitude, the warm summers, and a rainfall well distributed throughout the year, but with a tendency towards an early summer maximum. Skoplje, in a latitude somewhat lower than that of Ragusa, though in a more elevated position, has mean January temperatures well below freezing-point, and fully 18° lower than those of Ragusa. This means that there is a definite winter stop to agricultural activities, December, January and February being all too cold even for the growth of grass. On the other hand, despite its elevation, the summer temperatures at Skoplje are not more than a few degrees lower than those of Ragusa. The rainfall is fairly well distributed throughout the year, but May, June and October are the rainiest months, the maximum fall coming in May, when temperatures are already fairly high (over 62°). Belgrade, considerably further north, but less elevated than Skoplje, has a very similar temperature range, but November is already a winter month. June instead of May is the rainiest month, and the summer rainy period lasts for the three months of May, June and July, again with a second rainfall maximum in October. Broadly speaking this climate, with summer heat and summer moisture coinciding, is one well suited to maize among cereals, while deciduous trees tend to form the natural plant-cover. The type, with local variations due to height above sea-level and degree of exposure, prevails throughout the greater part of the interior of the peninsula, which thus falls into a fourth or central major climatic region. The total rainfall shows a tendency to increase towards the north-west, in Bosnia and north-western Serbia: it diminishes towards the east.

As a fifth major region may be included Eastern Thrace and the lower grounds of Bulgaria. Over much of this region, especially in Thrace, the total rainfall is very small, giving the landscape a steppe-like appearance, and the winters are very cold, owing to exposure to winds from the Russian plain. But the Maritsa valley allows Mediterranean influences to penetrate into southern Bulgaria, where also the Balkans give a certain amount of shelter from the cold winds of winter. Parts of the valley plains of Bulgaria have in consequence much milder winters than northern Macedonia or Serbia, and as there is a tendency for the winters to be wetter than the summers, the climate is sometimes described as modified Mediterranean. The dry, sunny summers favour wheat rather than maize, and the vine is grown in sheltered places.

To this general division of the whole area into five climatic regions, of which the central one covers by far the greatest area, it may be added that the fact that so much of the surface is elevated introduces numerous modifications in detail. Because of the cold winters of the central area, much of the winter precipitation falls as snow. No mountain within the peninsula rises in the strict sense above the snow-line, but the higher peaks of the Rhodope are only snow-free for about one month in the year, and even the Balkan mountains show some snow till July. This long persistence of parts of the winter snow-cover has much influence on the flow of streams, and thus on the possibility of the use of irrigation water.

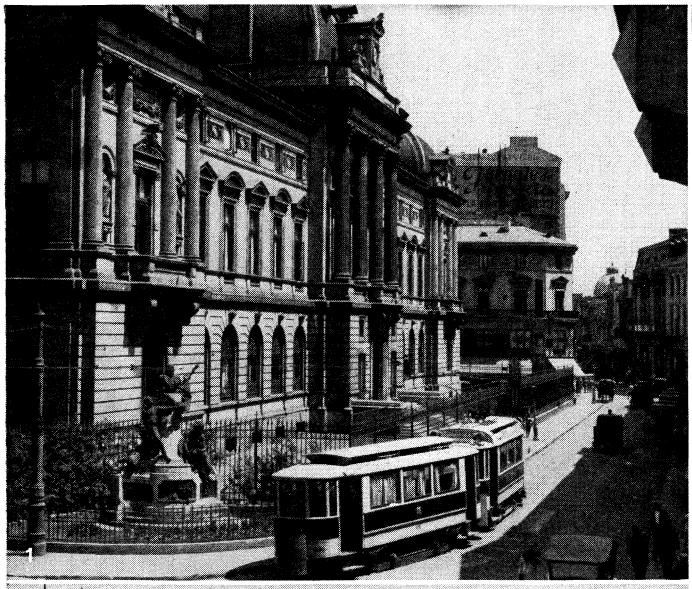
PEOPLES AND TYPES OF CULTURE

What has been said as to the diversity of relief and climate leads one to expect that a great variety of cultural types would occur within the peninsula. Further, the great highways which penetrate it from outside, and the position as a bridge between the steppe-lands of Asia Minor and the similar steppes of central Hungary, and between the Mediterranean shores with their ancient civilization and the derivative civilization of the forest areas of Central Europe, have resulted in a great mingling of racial stocks. In some cases there is definite historical evidence of the entrance and establishment of such new stocks, as of the Slavs, the Bulgars and the Turks. On the other hand, the composition of the population before the great historical migratory movements took place, is much more obscure. But from the purely geographical standpoint the problem of the ethnological origin of the different elements is of little importance. It is certain that a large amount of blending has taken place, and "race" names within the peninsula are used in a very loose sense, often to denote religious and national sympathies rather than physical characteristics. The real point of interest is that the cultures of the different groups show a fairly close relationship to the natural conditions in the areas which they respectively occupy, and the resultant variety emphasizes once again the complexity of the whole region.

Apart from alien elements, such as Armenians and Jews, six stocks seem to be represented in the peninsula, of whom five show national consciousness. These six are the Albanians; the Vlachs or nomadic shepherds; the Greeks; the Serbs, who form the main Slav element, the word Serb being used in a somewhat special sense to designate those South Slavs who belong to the Orthodox Church and use the Cyrillic alphabet, as well as in a general sense to indicate the citizens of the former independent kingdom of Serbia and the marginal areas; the Bulgars; and the Turks.

The Albanians occupy that part of the western mountain belt and its margins which forms the transition region between the mainly limestone and karstic Dinaric Alps in the north, and the Pindus range to the south, and is characterized by the north-to-south direction of the coast-line. The Albanians owe their individuality to the isolated character of their lands, though there is nothing improbable in the statement often made that they are the descendants of the ancient Illyrians, and thus truly indigenous. Their isolation also is a reality, despite the presence of the Via Egnatia and of towns of Roman origin on the coast, because the lowland is marshy and malarious, and much less fitted for

BALKAN PENINSULA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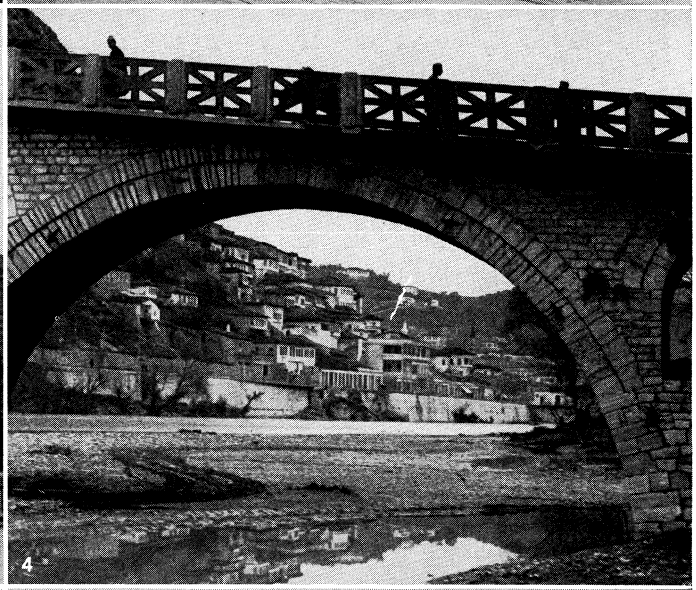
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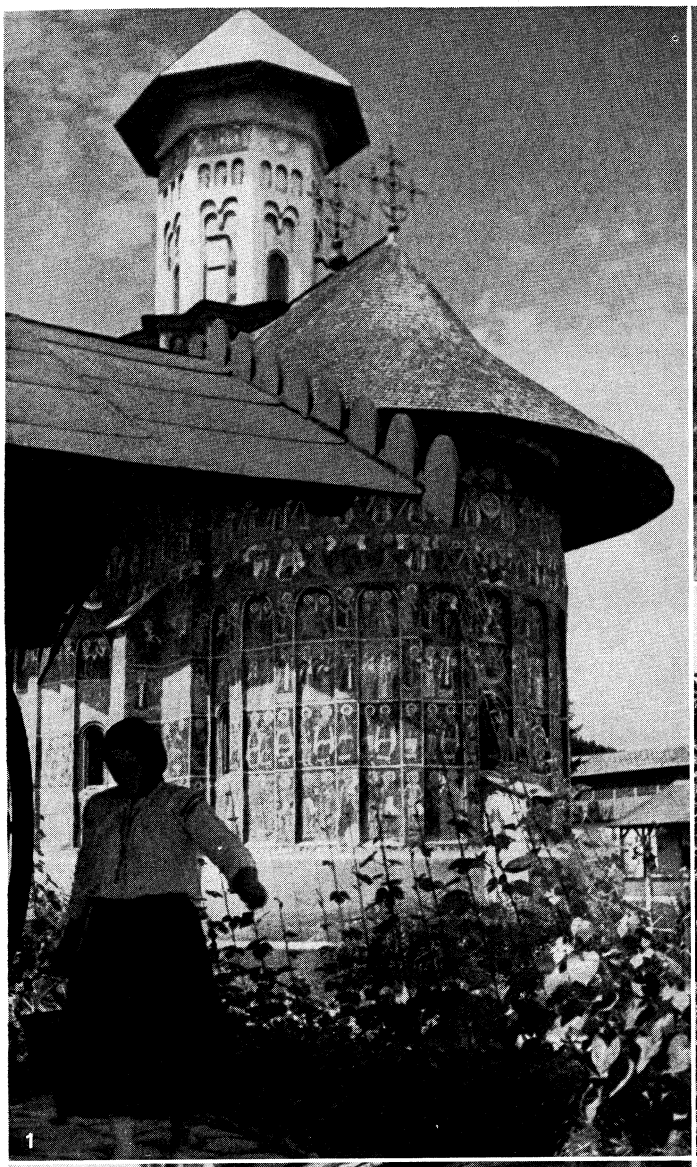
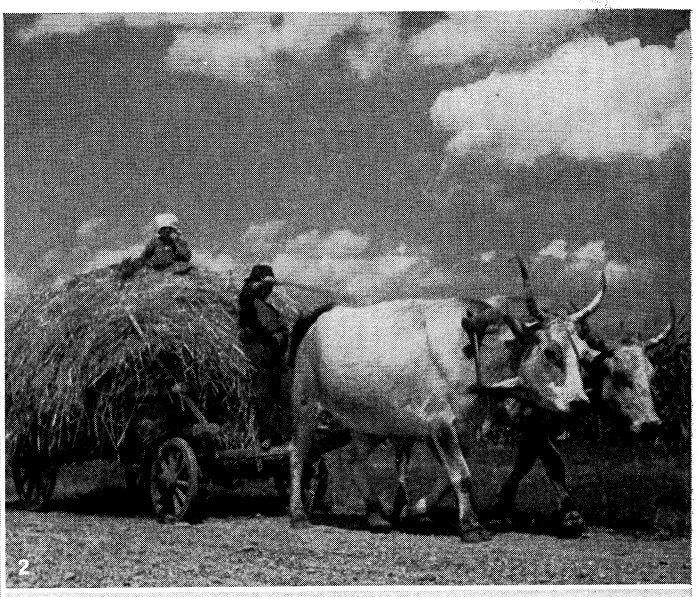
PHOTOGRAPHS, (1, 3, 5, 6) EWING GALLOWAY, (2) BURTON HOLMES FROM EWING GALLOWAY, (4) PIX FROM PUBLIX

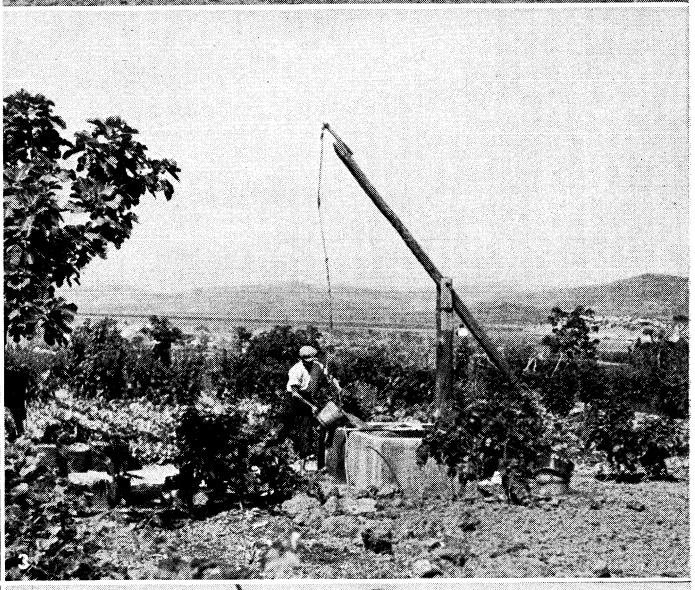
BUILDINGS OF BALKAN CITIES

1. The National Bank of Rumania. Bucharest
2. The royal palace in Belgrade, Yugoslavia
3. The parliament building in Athens, Greece
4. Section of the capital city of Tirana, Albania
5. Market place and buildings in Zagreb, Yugoslavia
6. The Alexander Nevski cathedral in Sofia, Bulgaria

BALKAN PENINSULA







PHOTOGRAPHS, (1) BRITISH COMBINE FROM PUBLIX, (2) PIX FROM PUBLIX, (3, 5) ROEHN FROM MONKMEIER, (4) PIX-HOSMER FROM PUBLIX

COUNTRY AND VILLAGE SCENES IN RUMANIA AND YUGOSLAVIA

1. Typical frescoed church in Bukovina, Rumania
2. Driving home a load of straw in Bukovina
3. Peasant at a draw-well in the Adriatic coastland of Yugoslavia
4. Streetside fruit and vegetable market in a village of South Serbia. Yugoslavia
5. Woman riding home from market near Dubrovnik (Ragusa), Yugoslavia

settlement than the hill country behind, the real home of the Albanian peoples. As they are essentially mountaineers and pastoralists, agriculture plays, or has played in the past, a minor part in their activities, and as is almost always the case with hillmen, conquerors have found them difficult to subdue, but exceedingly useful as material for armies. An Albanian problem did not arise until the subdivision of the peninsula into a number of separate states gave frontier lines a new importance.

It is sometimes stated that the Vlachs are the descendants of the Romanized inhabitants of Dacia and some parts of the peninsula, scattered as the result of the barbarian invasions. In this case, however, perhaps more than in any other, the question of origin is of very minor geographical importance. What is important is that their mode of life shows a peculiarly delicate adjustment to the natural conditions, particularly climate and relief.

From what has been already said as to the winter temperatures in the Mediterranean belt, it is clear that the low grounds there can furnish grazing throughout the colder months, there being no winter check to growth. Similarly, because elevation brings summer rain even in areas where the low grounds have the typical summer drought, there will be summer pastures in the mountains, at heights and on slopes where practically all forms of cultivation are excluded. Again, within the central part of the peninsula, the higher mountains are too cold and have too prolonged a snow-cover to permit of cultivation, but, as in the more familiar parts of the High Alps, will allow of summer grazing. It might be supposed that the low grounds in the Mediterranean area proper would be too valuable to be left in rough pasture. But in many cases, as notably in the Basin of Thessaly and parts of Macedonia and Western Thrace, there are considerable tracts too swampy and ill-drained to permit of cultivation. The pools and stagnant water serve as breeding places for mosquitoes, and these in many areas are heavily infected with the malarial parasite, so that such low-lying basins are veritable death-traps in the warmer season. Further, even where they have been drained, or have sufficiently effective natural drainage to permit of cereal cultivation, fallowed lands yield a large amount of herbage, and the sojourn of flocks is a means of restoring the fertility diminished by previous cropping. Because of these conditions a particular type of pastoral nomadism can be practised, the name of transhumance being given to indicate its differences alike from the large-scale movements carried on by the true Nomads of the Asiatic steppes, and the much more limited movements to progressively higher pastures in summer time practised by many pastoralists in hilly regions.

The Vlachs carry on no cultivation, not even of fodder crops; they do not even store fodder for the cooler season, as this is unnecessary. The whole group moves with the flocks, not merely the herdsmen, and though there are habitations in both the summer and winter pastures, it is the mountain or summer village which seems to form the true home. Sheep are the chief animals reared, and it has to be noted as a subsidiary cause of the vertical movements that these animals are very intolerant of the summer heat in Mediterranean lowlands. Although the Pindus region is that in which the greatest number of Vlachs occurs, and which seems to be particularly suitable to their mode of life, they are fairly widely distributed throughout the south and south-east of the broader part of the peninsula, especially during the summer season.

Out of their fundamental pastoral occupation there arise some interesting variants. Since they rear horses and donkeys to serve as pack animals during their movements, and are naturally well acquainted uith paths and routes, they frequently act as carriers in the parts where modern means of transport are lacking. From this another occupation, that of peddling, develops by an easy transition. This again brings contact with village life which leads many to take the further step of adopting settled occupations, retail trading and innkeeping being favourites; their distinctive characteristics are then largely lost.

The fact that their numbers have been steadily diminishing for many years is apparently due mainly to this process of assimilation, which turns them into "Greeks" or "Serbs" according to the dominant nationality in the area of settlement, rather than to an actual drop in numbers. Obviously also the demarcation of internal frontiers, with frontier posts and custom stations, must act as a check to their movements, while the spread of intensive agriculture in the lowlands of Mediterranean climate, with the draining of marshes and reclaiming of waste lands, is an even more serious interference with their characteristic mode of life. The absence of any national consciousness makes their submergence in the general population easy, and culturally they may be said to be in process of disappearing with the disappearance of the conditions to which they were adapted.

The Greeks regard themselves as the descendants of the Classical Greeks, and though ethnologically this is more than doubtful, for much mingling of blood has occurred, the belief is of some importance as helping to give a sense of differentness from Serbs and Bulgars. Greek consciousness of nationality antedated the foundation of the Greek State, and, in marked contrast to the Bulgars, who were long submerged by the conquering Turk, the Greeks succeeded in maintaining themselves as a people. In this they resemble the Albanians, though the cause was very different in the two cases. Owing to their commercial aptitudes and maritime instincts they interpenetrated the Turkish State, and the Turks were constrained to tolerate them, for they could carry on occupations for which the overlords showed no capacity. It seems unnecessary to regard these specific attributes as "racial" in the ethnological sense, for they arose out of long adaptation to a particular and highly peculiar set of natural conditions, and there is little reason to think that the possibility of such an adaptation is limited to one stock. But it has to be noted that the Greek success in making themselves indispensable to the Turk is an element in the origin of those group hatreds which have been the scourge of the recent history of the peninsula; for the Greeks, like the Albanians, often appeared to the other peoples as agents of the Turkish oppressor.

So far as natural vegetation and modes of cultivation are concerned, the Greek peninsula and islands do not differ notably from other Mediterranean lands. Except at considerable elevations high forest is absent, and is replaced by evergreen scrub. Cultivation is of the garden type with olive, vine, fig and other fruit-bearing trees predominating. The amount of land which can be put under cereal cultivation is small, and the goat is the main stock animal. Fishing is an important accessory occupation, and everywhere movement is easier by sea than overland. One result of the relative poverty of the land, the ease of communication by water, and the Greek instinct for trade, was that the Greeks were widely distributed both within the peninsula and outside it, particularly in Asia Minor but also on other Mediterranean coasts. In 1913 it was believed that there were nearly as many Greeks outside the motherland as within it, and till their expulsion from Asia Minor in the post-war period, they formed an important element in the population there. This Greek infiltration of lands within reach of the Aegean is one of the causes of the bitter conflicts for the possession of Macedonia and Thrace.

Serbs and Bulgars differ notably from the three groups already discussed and resemble each other in being mainly cultivating peasants, dwelling in lands suitable by climate and relief for self-sufficing agriculture, with cereal production on a considerable scale, and the possibility of a surplus of cereals and agricultural produce generally. This meant that neither group could evade the Turk as Albanians, Vlachs and a proportion of the Greeks could do. They became the *rayah*, the toiling cattle of the conquerors, and bore the burden of the conquest. The antagonism between them has its origin in the conditions under which national states arose, rather than in racial or cultural differences.

The Bulgars were in the direct line of the Turkish advance, and further, their lands, whether in Eastern Rumelia, as the Maritsa plains were called later, or in Thrace and Macedonia, afforded little opportunity for escape. Again, for the reasons already discussed, as well as because of the former extension of the Byzantine empire, the lands they occupied were not only productive,

but could yield a considerable variety of products. As an entity they disappeared for centuries, and, as we have seen, the beginning of the Bulgarian State was in the area of relatively extreme climate north of the Balkan mountains.

In a sense the Serbs were more fortunate in that opportunities of escape presented themselves, to the north into the Danubian plains, and to the west and north-west into the mountain belt. At the same time the extent of the area over which the movements could be carried on, and the diversity of the lands into which they brought the refugees, led to marked cultural differentiation among the various groups, with the loss of community of feeling among them.

In addition to possibilities of escape from the peninsula there were certain areas within it where a measure of security could be obtained from the worst exactions of the oppressor. One of these was the barren, karstic area of Montenegro, which was, however, too poor to serve as a centre about which a new national grouping could form. Another was the region called by the Serbs the Shumadia. This is the platform sloping gently to the Save and the Danube, lying mainly between the lower Morava and the Drina, and in part cut off to the south by the highlands lying west of Nish. This region corresponds to the northern part of the central crust-block, and is crossed by the open valleys of streams draining to the Morava and the Save. A point of special importance is that the whole region was originally clothed with deciduous forest, oaks and beech predominating. The soils are generally fertile, having been enriched by the forest humus, there is a copious summer rainfall, and water is abundant, both in the form of springs and of streams, so that there is not the limitation of settlement to particular areas, so characteristic of the largely waterless karst regions.

In its essential features the area resembles the forest tracts which formerly covered much of Central Europe. But whereas in western Europe forest clearing began early, here the primaeval woods persisted in large part till the beginning of the 19th century. This is in itself an indication that there was little settlement, and indeed occupation on any scale hardly began before the 18th century. Away from the highways of the Morava and the Drina there were large tracts of untouched woodlands, eminently suitable to serve as refuges for fugitives—Robin Hood bands; it was from these that modern Serbia arose.

It may be noted that the early home of the Slav peoples, so far as is known, was similar wooded land on the outer slopes of the Carpathians, and the Slavs have generally shown a preference for this type of country. It allows of mixed agriculture, and affords a considerable variety of resources, both natural and produced by human effort. Further, the Slav patriarchal organization, the *zadruga* or family group, makes colonization of such lands relatively easy. One of the social effects of the Turkish conquest was the strengthening, or even perhaps the re-birth, of this kind of organization. It had been largely lost during the pre-Turkish period when a great Serbia existed, but with the loss of the natural leaders there was something like a return to more primitive conditions. Small groups established themselves in the forest, grew by accretion of fresh refugees, and ultimately coalesced to form a peasant state.

The type of culture was a reflection of the conditions existing in the temperate deciduous forest belt wherever it occurs. Clearings in the forest were made to allow of cereal production, and the arduous nature of the task made additions to the man power of the group welcome. The climate is only moderately suited for wheat, but the hardier cereals, such as barley, rye and oats, do well, and maize, introduced from America, proves to be exceedingly well suited to the climate, with its combination of summer warmth and summer moisture. It is still the main bread plant of the Serbs. As in North America, also, the fact that maize is a pioneer's crop, not needing the care and labour of wheat production, and easily grown on roughly cleared land, was of great importance. The uncleared forest, with its wealth of nuts, particularly acorns and beech mast, made it possible to rear hardy breeds of pigs on a great scale, though, as in Europe generally, this primitive method has long since given place to stall feeding, maize being largely used for the purpose. Cattle could also be pastured in the lighter parts of the forest, though here, in marked contrast to the Pindus region, fodder had to be stored for the cold winters. Though in places the vine can be grown, its place is taken largely by hardier fruit-bearing trees, especially the plum (prune). It should be noted that there is a certain analogy between the products of the two plants. In both the fruits can be eaten fresh, or preserved by drying for winter use or export, or fermented to yield alcoholic drinks, plum brandy replacing wine. With the more recent growth of sugar beet, plum preserves are also made on a considerable scale in Serbia.

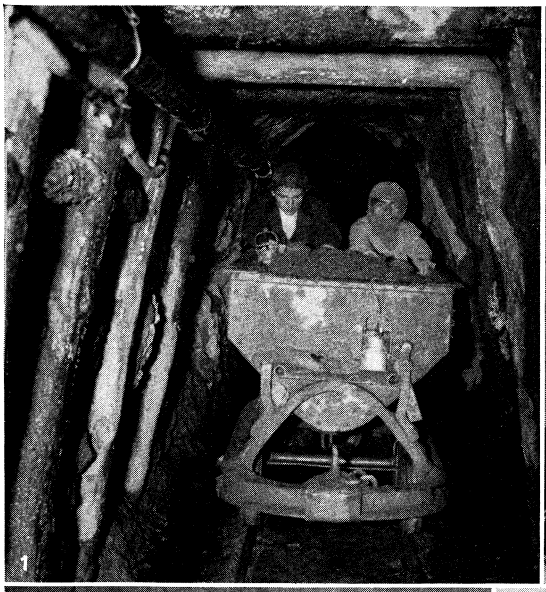
In addition to such possibilities of varied food production, the Shumadia yielded abundant wood for house-building and fuel, while the wild animal life gave a certain amount of food, as well as furs and skins. As against such advantages, the conditions which made the rise of an independent Serbia possible checked social development, so that the Serbs of Serbia remained primitive and backward as compared with the Croats and Slovenes, who had fuller cultural contacts with more advanced peoples; to some extent this was also true of the extra-peninsular Serbs in the Banat region. Further, the fact that Serbian agriculture arose as it were de *novo,* makes it less advanced than that of Bulgaria, where there was a pre-existing Byzantine tradition.

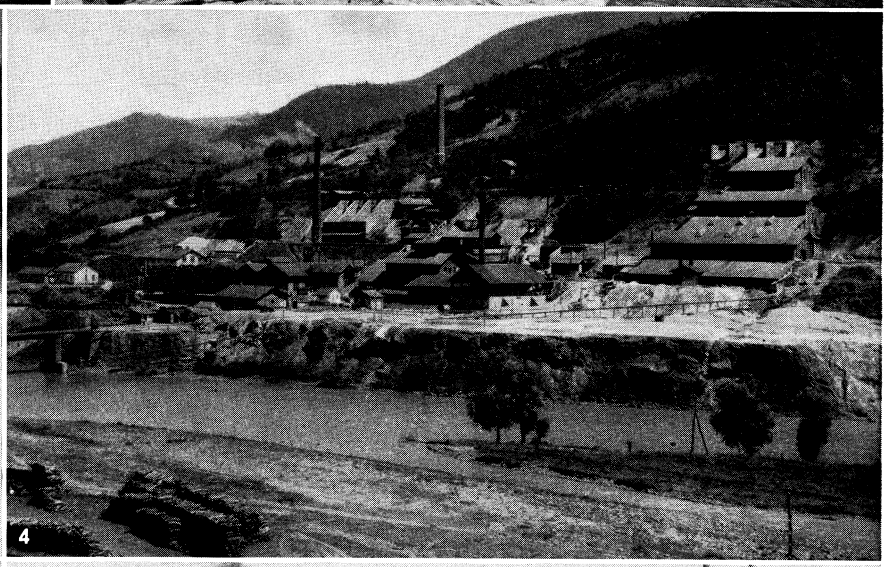
Outside of Serbia the Dalmatian Serbs, technically Croats because they are Catholics and use the Latin alphabet, tended to acquire the Mediterranean type of culture, their crop plants being very different from those of the interior, and influences from the adjacent Italian peninsula being strong. In Bosnia, which in its climate, its forests, and its cultivated plants is very similar to Serbia, development was checked by the more intense Turkish control, due to the easy access from the Save and from Macedonia. Many of the original Slav landowners here adopted the religion of the Turkish conquerors in order to keep their lands, and became indistinguishable from Turks. The peasants were practically serfs, and not only under direct Turkish rule, but under the Austrian protectorate, and after the Austrian annexation, agriculture was in a very backward state. The taxes paid in kind both to the landowner and to the sultan, as well as to the tax-farmer, were so crushing that no stimulus to increase production existed.

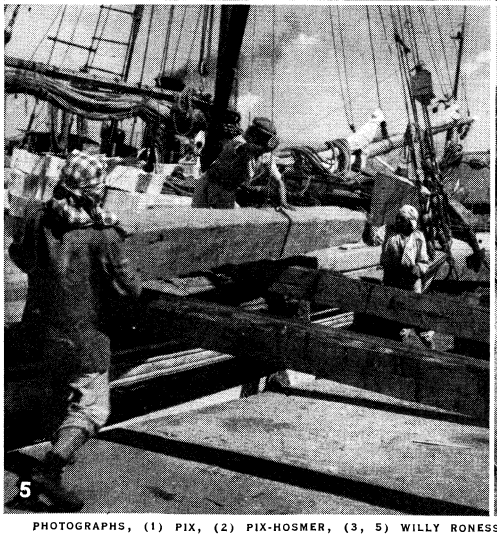
In northern Macedonia there was a certain blending of Serbs and Bulgars, though it is generally believed that the population of Macedonia is mainly. Bulgar in origin. Here the conditions were even worse than in Turkish Bosnia, the peasants being merely "cattle." The diversity of relief and climate, the multiplicity of contacts in all directions, combined with the nearness to the Turkish centre, made the development of a definite national spirit impossible. Even before the Balkan wars of 1912–13, all three neighbouring States, Greece, Serbia and Bulgaria, were endeavouring to "assimilate" the Macedonians. Those wars, followed by the World War, excluded Bulgaria from the district politically, but the social contacts between Bulgaria and Macedonia remain strong.

Of the sixth element in the peninsula, the conquering Turk, it is not necessary to say much. True Osmali Turks, as distinct from Muslim Bulgars, Albanians and Serbs, were probably never numerous. Within the peninsula they suffered from the demoralization which seems always to occur when a ruling class is separated by racial stock, religion and tradition from the producers of raw material. They became parasitic on the peasant cultivators, and both parties suffered in consequence.

The Separate States.—It thus appears that within the Balkan peninsula there are three focal regions, each with a certain topographical, climatic and cultural individuality, fitting them to become political units, with which the names of Serbia, Bulgaria and Greece are associated. But all three are marginal as regards the peninsula as a whole, and are linked to each other and to the neighbouring, extra-peninsular lands by areas of transition, whose political destiny has been the sport of historical accident. Serbia is now merged in the much larger and culturally heterogeneous State of Yugoslavia, or the Serb-Croat-Slovene State, which in addition to extensive territories outside the peninsula includes







PHOTOGRAPHS, (1) PIX, (2) PIX-HOSMER, (3, 5) WILLY RONESS-PIX, (4, 6) EWING GALLOWAY

BALKAN COMMERCE, INDUSTRY AND HANDICRAFT

1. A copper mine near Ribuk'a, Albania. The Italians began to exploit the country's mineral resources after the occupation of 1939
2. Products of coppersmiths on display in Prizren, South Serbia, Yugoslavia
3. Lace vendor on a square at Dubrovnik (Ragusa), Yugoslavia. Lace-making is a specialty of the district
4. Copper mine and smelter on the Isker river, Bulgaria, in the mountainous region north of Sofia
5. Longshoremen at work in the port of Patras, Greece, at the mouth of the Gulf of Corinth
6. Tank trains at the oil fields of Pioesti, centre of the petroleum district in Rumania

BALKAN PENINSULA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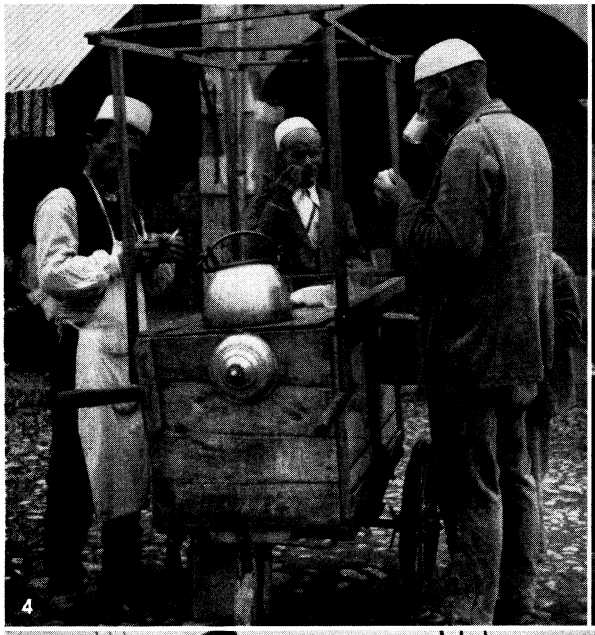
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PHOTOGRAPHS, (1, 6) PIX, (2) EWING GALLOWAY, (3, 4) WILLY RONESS-PIX, (5, 7) PIX-HOSMER

BALKAN PEOPLES

1. aced do-Rumanian peasant woman and child from the Pindus mountains in Greece. After World War I, many of these folk were repatriated by Rumania and settled in the Dobruja. The tattooed cross on the forehead is a custom dating back to the time of Turkish rule
2. Peasant family of Varna, Bulgaria. seaport on the Black sea
3. Greek labourer carrying stones for a building at Delphi
4. Albanian peasants, with their typical white fez, drinking refreshments in a village street
5. Natives of Bosnia bargaining for moccasins in Jajce, Yugoslavia
6. Rumanian peasants at a common threshing ground outside a village in Bukovina
7. Decorative scarves, often topped by baskets, are worn by the women of Croatia

within it Bosnia, Hercegovina, Montenegro. Dalmatia and part of Macedonia. Greece has been enlarged by the addition of parts of Macedonia and a large part of Thrace. Despite the diversity of its lands, however, it is more homogeneous than Yugoslavia, for there have always been two strands in its social polity, made up by the gardener-cultivators of its limited fertile tracts, and the traders and seafarers who have found the homeland in the narrower sense too small for their energies. Before the World War Bulgaria, among purely Balkan states, seemed to offer the best prospects for economic advancements; but the loss of territory to her neighbours proved a serious handicap. Albania after two decades of more or less independent existence once again fell under foreign domination; and the new Turkish state has preferred to emphasize its Asiatic rather than its European affinities. The last few years have, however, seen a general improvement in oolitical relations between the various states.

See Newbigin, *Geographical Aspects* of *Balkan Problems* (1915); Cvijić, *La Péninsule Balkanique* (1918); Ancel, *Peuples* et *Nations des Balkans* (1926), and the separate articles on the political units.

(M. I. N.)

HISTORY

The great Slavonic immigration began in the 3rd century A.D. and continued through the following four centuries. At the start of this movement the Byzantine empire was in actual or nominal possession of all the regions south of the Danube; the greater part of the native Thraco-Illyrian population of the interior had been romanized and spoke Latin. The Thracians, the progenitors of the Vlachs, took refuge in the mountainous districts and became nomad shepherds. In Albania the aboriginal Illyrian element maintained itself, and afterwards forced back the immigrants, occupying much of western Macedonia and northern Greece. The Greeks were driven to the seacoast, the islands and the fortified towns of the Balkan peninsula. In the 6th century the Slavs penetrated to the Morea. In the 7th the Serbo-Croats invaded the north-western regions (Croatia. Serbia, Bosnia, Hercegovina, Montenegro and Northern Albania), where they expelled or assimilated the Illyrian population and appropriated the old Roman colonies on the Adriatic coast. At the .end of the 7th century the Bulgars crossed the Danube and subjected Moesia and Thrace, but were assimilated by the conquered Slavonic population. Under their tsar Simeon (893–927) their empire extended from the Adriatic to the Black sea. In 971 the "first Bulgarian empire" was overthrown by the emperor John Zimisces. A Slavonic "Western Bulgaria" in Macedonia survived the fall, and soon attained considerable dimensions, but was crushed in 1014 by the Byzantine empire, which now ruled almost all the Balkans. In the 10th century the Vlachs reappeared as an independent power in southern Macedonia and the Pindus district, which were known as "Great Walachia." The Serbs first attained unity under Stephen Nemanya (1169–95), the founder of the Nemanyich dynasty. A new Bulgarian empire was founded at Trnovo in 1186 under the brothers Peter and Ivan Asên, who led a revolt of Vlachs and Bulgass against the Greeks. In 1204 Constantinople was captured by the Latins of the Fourth Crusade; the Venetians acquired several maritime towns and islands, and Frankish feudal dynasties were established in Salonika, Athens, Achaea and elsewhere. Greek rule survived in the despotate of Epirus. Constantinople was recaptured in 1261 by Michael VIII. Palaeoiogus, but most of the feudal Latin states survived till the Turkish conquest; the Venetian possessions several centuries longer. In 1230 Theodore of Epirus, who had conquered Albania, Great Walachia and Macedonia, was overthrown at Klokotnitza by Ivan Asên II., of Bulgaria (1218–41), who extended his sway over most of the peninsula. After his death the Bulgarian power declined, and was extinguished at the battle of Velbuzhd (1330) by the Serbians under Stephen Urosh III. Stephen Dushan of Serbia (1331–55) ruled over Albania, Macedonia. Epirus, Thessaly and northern Greece. The Serbian incursion was followed by a great Albanian emigration to the southern regions of the peninsula. After Dushan's death his empire disappeared, and Serbia fell a prey to anarchy. For a short time the Bosnian king Stephen Tvrtko (1353–91), became the principal power in the west of the peninsula. The internecine feuds of the various states prepared the way for the Ottoman invasion. In 1356 the Turks seized Gallipoli; in 1361 Murad I. established his capital at Adrianople; in 1389 the Serbians and their allies were routed at Kosovo. Bulgaria and Great Walachia were finally subdued in 1393. The despotate of Epirus succumbed in 1449, the duchy of Athens in 1456; in 1453 Constantinople fell; the greater part of Bosnia submittrd in 1463; the heroic resistance of the Albanians under Skanderbeg collapsed with the fall of Croia (1466), and Venetian supremacy in Upper Albania ended with the capture of Scutari (1478). Only Montenegro and the Italian city-states on the Adriatic coast escaped subjection. Under the Turkish régime numbers of Slavs, especially the ruling classes and the Bogumils in Bosnia and Bulgaria, were converted to Islam and henceforward they felt themselves to be Turks. Colonies of true Turks were planted in North and South Bulgaria, and in Macedonia. Southern Albania became predominantly Mohammedan, the northern districts remaining Christian. The Ottoman power declined after the unsuccessful siege of Vienna (1683). In the 18th century parts of the Balkans were practically independent fiefs. In the 19th the subject nations, which had generally retained their language, religion and characteristics, recovered their independence. The independence of Greece was acknowledged in 1839, that of Serbia (as a tributary principality) in 1830. The Ionian Islands were ceded by Great Britain to Greece in 1864. In 1878 the Treaty of San Stefano created a great Bulgaria extending from the Danube to the Aegean, and from the Black sea to the river Drin in Albania, her Aegean coastline extending to the walls of Salonika. Serbia and Montenegro were so enlarged as to become almost contiguous. The treaty of Berlin, ho ever, limited Bulgaria to the country between the Danube and the Balkans, while making Eastern Rumelia into an autonomous province. The proposed Montenegrin frontier was curtailed; Serbia received Nish, Pirot and Vranje on the east instead of the Ibar valley on the west; the Dobruja, somewhat enlarged, was ceded to Rumania. Austria-Hungary occupied Bosnia and Hercegovina, sending troops into Novi-Pazar under a subsequent convention with Turkey. The complete independence of Serbia, Rumania and Montenegro was recognized. Greece was given Epirus and Thessaly, but was only able to occupy Thessaly and Arta (1881). Rumania was proclaimed a kingdom in that year, Serbia in 1882. In 1880 Dulcigno was surrendered to Montenegro in compensation for the districts of Plava and Gusinye, restored to Turkey. In 1886 the informal union of Eastern Rumelia with Bulgaria was sanctioned by Europe, Tumrush and Krjali being given back to the Sultan. In 1897 Crete was withdrawn from Turkish administration. In 1908 Bosnia and Hercegovina were annexed to the Dual Monarchy and Bulgaria was proclaimed an indrpendent kingdom.

In 1913 the Balkan League of Greece, Serbia, Bulgaria and Montenegro attacked and defeated Turkey, this war being followed by a second between Bulgaria and her late allies. Greece received Crete and the Aegean Islands (except the Dodecanese); Rumania the Southern Dobruja; Bulgaria the Aegean coastline as far as Dedeagatch; and Serbia received all Macedonia west of the Vardar. Serbia and Montenegro partitioned the Sanjak of Novi-Pazar, and an independent Albania was created, extending from above Scutari to north of Yannina. After the World War, Bulgaria lost the coast of Thrace to Greece, and a strip along her south-east frontier to Serbia; and Turkey was confined to the province of Eastern Thrace. A Serb-Croat-Slovene kingdom was constituted comprising Serbia, Montenegro, Bosnia, Herzegovina, and other Yugo (=South) Slav regions of Austria and Hungary, together with north-western Macedonia and a portion of Albania. Italy received the extreme north-west coast of the Balkan Peninsula up to and including Fiume, and in addition, certain of the Adriatic Islands. Population exchanges on a large scale were carried out in order to stabilize the new frontiers. The Greek population of Asia Minor was forcibly expelled, and many Vlachs migrated to Rumania In 1939 an Italian army occupied Albania without encountering much resistance, and the country was placed under the sovereignty of the King of Italy

BIBLIOGRAPHY.—See bibliographies appended to the separate articles dealing with the political divisions of the Peninsula. *See* also "Odysseus," *Turkey in Europe* (1900), a work of exceptional interest and value; *The Balkan Question*, ed. L. Villari (1905); W. Miller, *Travels and Politics in the Near East* (1898); L. Lamouche, *La Péninsule balkanique* (1899); *The Balkans:* a history by N. Forbes, A. Toynbee, B. Mitranu and G. Hogarth (Oxford, 1913); J. A. R. Marriott, *The Eastern Question* (1924). For geology *see* F. Toula, "Materialien zu einer Geologie der Balkan-halbinsel," *Jahr. k.-k. geol. Reichsanst.* (Vienna, vol. xxxiii. 1883), pp. 61–114; A. Bittnel, M. Neumayr, etc. *Denks. k. Akad. Wiss. Wien. math.-nat. Cl.*, vol. xl. (1880); A. Philippson, *Der Peloponnes* (1892); J. Cvijić, "Die Tektonik del Balkanhalbinsel," *C. R. IX. Cong. géol. inter. Vienne*, pp. 347–370 (1904). For the condition of the Peninsula before the Treaty of Berlin, *see* E. Riiffer, *Die Balkanlzalbinsel und ihre Völker* (Bautzen, 1869); Mackenzie and Irby, *Travels in the Slavonic Provinces of Turkey* (1866); and A. Boué, *La Turquie d'Europe* (1840). *W.* Miller, *The Balkans* (1896), sketches the history of Bulgaria, Montenegro, Rumania and Serbia. *See* also Sir *E.* Hertslet, *The Map of Europe by Treaty*, esp. vol. iv. (1875–1891); J. D. Bourchier, "A Balkan Confederation," in the *Fortnightly Review* (September 1891); *The Balkan Review* (1919–24); *Balkan-Revue* (Berlin, 1914 *seq.*); *Eastern Europe* (1921 *seq.*); the Austrian and Russian staff maps, and the ethnographical maps of Kiepert and Peucker. (J. D. B.; X.)

BALKAN WARS, 1912-13. This article gives an account of the campaigns of Bulgaria, Serbia, Greece and Montenegro, as allies, against Turkey, in 1912 and 1913, and also of the brief struggle that followed between the former allies, with Turkey and Rumania intervening, in the summer of 1913. When war broke out, all Macedonia, Albania and Epirus still formed part of the Ottoman Empire.

The Balkan League.—Military alliances, directed against Turkey, had been adjusted between Bulgaria and Serbia, and between Bulgaria and Greece during the early part of 1912; and the state of Macedonia, under Ottoman rule, served as an excuse for them to order mobilization on Sept. 30 and Oct. 1. War was declared as soon as their armies were on their war footing, and active operations at once followed, Montenegro, which had no formal agreement with the others, actually starting the hostilities. The Turkish regular forces in Europe at the time comprised 12 divisions of very weak establishment in Thrace, and 12 similar divisions stationed at various points in the extensive Ottoman territories further to the west; organization of a sort also existed for about doubling the number of divisions on mobilization; but the actual numbers available during the opening and decisive weeks of the struggle did not exceed about 100,000 combatants in Thrace and about 140,000 in the western theatres. Large military forces, it is true, existed in Turkey in Asia; but, owing to the activities of the Greek fleet, these could not be transferred to any part of European Turkey other than Thrace.

Against this, Bulgaria possessed nine very strong regular divisions, numbering about 180,000 combatants, with two strong reserve divisions formed after mobilization. Serbia promptly placed five somewhat weaker regular divisions in the field, making up a total of about 80,000 combatants, with five well-organized reserve divisions ready to follow. Greece could muster four regular divisions of somewhat weak establishment, the combatants at the start numbering perhaps 50,000, with four reserve divisions to be set up on mobilization. The Montenegrin Army on the other hand was wholly on a militia basis and ill-suited for fighting except among its own mountains or immediately outside its own frontiers. Thus the allies, at the outset, enjoyed the advantage in numbers; and, thanks to their reserve formations being much the better organized, they retained and indeed increased this advantage during the weeks of hostilities that followed.

I. THE THREE THEATRES OF WAR

Owing to the geographical situation, there were bound to be three practically distinct main theatres of war when the struggle began, viz.: on the Turko-Bulgarian frontier of Thrace, on the frontier between Macedonia and the allied Powers, Bulgaria and Serbia, and on the frontier between Greece and Turkey. Under a military understanding between Bulgaria and Serbia, six of the nine Bulgarian regular divisions were to have been allotted to the eastern theatre of war, while the remaining three co-operated with the Serbian Army in operations directed against Macedonia. But Bulgaria altered this arrangement at the last moment, retaining eight divisions for the east and employing only the remaining one in the western theatre, and this, moreover, as it turned out, moved independently toward Salonika. It was, from the purely military point of view, a sound decision, as the Turks could not be reinforced in Macedonia from Anatolia, whereas they could be so reinforced in Thrace; but the action of Bulgaria in the matter tended to cause somewhat strained relations between that kingdom and Serbia at the very start.

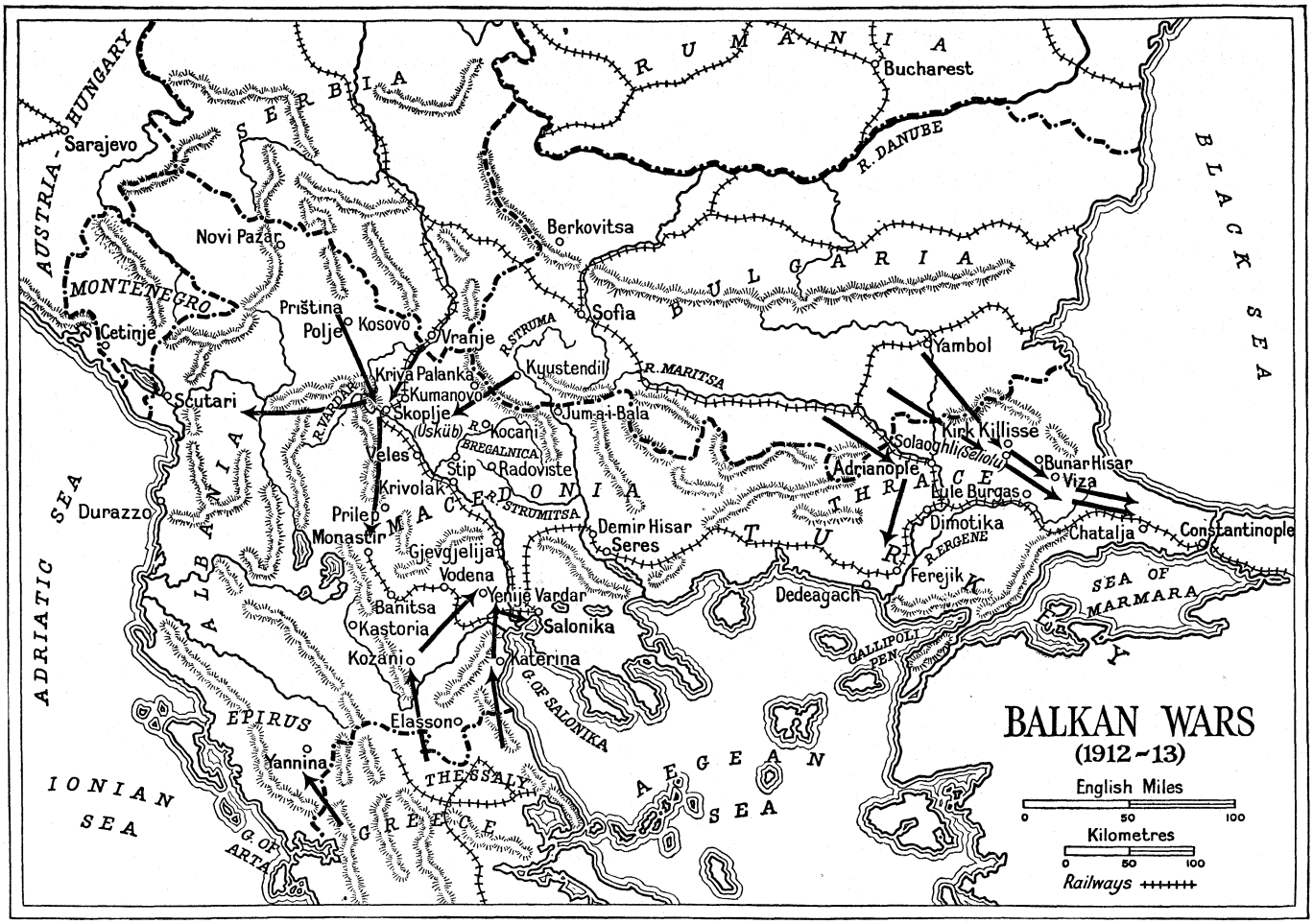
Campaign in Thrace.—The Bulgarian staff organized its eight regular divisions, destined for Thrace, with the two newly formed reserve divisions, as three armies, the 2nd Army on the right of Maritsa, prepared to move on Adrianople, the 1st Army in the centre more to the east, and the 3rd Army on the left about Yambol, prepared to move on Kirk Kilisse. On the declaration of war, on Oct. 17, the three armies advanced and they passed the frontier on the 18th and 19th to the north-west and north of Adrianople, and on the 22nd to the north-west and north of Kirk Kilisse.

Adrianople was a great entrenched camp, composed of many forts and works, fairly well armed; Kirk Kilisse was also provided with some works, but they were not of an efficient character. The 2nd Army advanced against Adrianople and to the west of it, with a view to investment, while the 1st Army followed a line more to the east and from the 22nd to the 24th was engaged with the enemy about Seliolu, the battle ending in its complete victory. On that same day the 3rd Army entered Kirk Kilisse, after some severe fighting, capturing an immense booty. The Turkish field forces had originally been formed up about the Ergene; but they had been ordered north to take the offensive, and had thus brought on the encounter battles at Seliolu and Kirk Kilisse, in which they were heavily defeated. They retreated in confusion to the line Lule Burgas—Bunar Hisar, the victorious Bulgarians, owing to having outrun supplies, losing touch with them and therefore giving them time to reorganize to some extent.

On discovering the direction of their opponents' retreat, the Bulgarian 1st and 3rd Armies found themselves, in the first instance, called upon to make a wheel to the left. Severe fighting took place on the 28th, 29th, and 30th in the country between Lule Burgas and Viza in which both sides suffered heavily and which ended in the Turkish right near Viza becoming seriously endangered; Nazim Pasha, the Ottoman commander-in-chief, thereupon ordered a general retreat, and his troops fell back to the Chatalja lines, covering Constantinople. The victors were too exhausted to pursue, so that all touch with the defeated army was lost for the moment. In the meantime, the Bulgarian 2nd Army had invested Adrianople, and some troops were pushed on to Dimotika and to Dédéagatch on the Aegean sea.

After a few days, the 1st and 3rd Bulgarian armies, being reinforced and having their lines of communications in working order, advanced towards the Chatalja lines and after a brief pause delivered an assault upon them on Nov. 17. The attack was repulsed at all points with heavy loss, and the Bulgarian command, sobered by this untoward experience, refrained from making a second attempt. The remains of the Ottoman field forces in the country to the west of the lower Maritsa had in the meantime been surrounded and compelled to surrender at Ferejik. Operations in Thrace now came to a standstill for a fortnight, and then. on Dec. 3, an armistice was signed between Bulgaria, Serbia and Montenegro on the one hand, and Turkey on the other, Greece being no party to it for reasons which will appear later. The Bulgarian campaign in Thrace had been brilliantly successful, although Adrianople remained in Ottoman hands; but the operations of the allies in the west had been no less triumphant.

Macedonia and the West.—The Serbian authorities had been very happy in their mobilization arrangements, and by the time that war was declared, they were already in a position to concentrate their five reserve divisions, as well as their five regular divisions, close to the Turkish frontier. Their 1st Army, of five divisions, was about Vranje; their 3rd Army, of four divisions, was further to the west, north of Priština; their 2nd Army, of one division, with the Bulgarian 7th Division was about Kyustendil



THE MAIN THEATRES OF THE FIRST BALKAN WAR, OCT. 1912–MAY 1313

Prior to hostilities the Ottoman Empire included Macedonia, Albania, and Epirus, so that with Serbia, Bulgaria, Greece and Montenegro allied against them, the Turks were forced by the geographical situation to fight three distinct campaigns. Within six months they were beaten on all fronts. The map shows the lines of advance of the Allies in the early stages of the campaign. The Bulgars marched against Adrianople, Kirk Killisse and Chatalja, threatening Lule Burgas and Constantinople. The Serbs supported by one Bulgarian Division attacked the lines of the River Vardar, and enveloped Scutari and Monastir, while the Greeks concentrated against Salonika, towards which the Bulgarian Division, which had been sent to the support of the Serbs, also advanced by way of the Struma valley

in Bulgaria. The plan was for the 1st and 3rd Armies to advance southward into Kosovo Polje and on Üsküb, while the and Army came in from the east and from Kyustendil, ready to operate against the right flank of the Turkish forces known to be assembled at Üsküb and to the north of it. The action of the Bulgarian staff in sending only the one division to this theatre, instead of three divisions as previously agreed upon, necessarily weakened the effect of the threat of the and Army against the Ottoman communications, and the 7th Bulgarian Division in fact afforded practically no help at all, being bent on an eccentric march on Salonika via the Struma valley.

All three Serbian armies crossed the Ottoman frontier on Oct. 19 and 20 through the mountains, meeting with slight resistance. The Turkish forces were necessarily much dispersed in view of the vast area of the territory to be guarded; but an army of five weak divisions in the Vardar valley had been moving northwards towards the Serbian frontier, and most of it reached Kumanovo on the 22nd. The head of the Serbian 1st Army had arrived within a few miles of that place on the same day and had taken up a position, where it was attacked by the Turks on the following day but succeeded in holding its ground. The remainder of the 1st Army came up on the 24th and a general action ensued in which the Ottoman troops were signally defeated. They fled southwards, evacuating Üsküb and withdrawing the detachments posted further to the north-west which had been opposing the advance of the 3rd Serbian Army from about Priština. The victors, however, hardly realized how complete had been their success and, hampered as they were by the difficulties of the country and the delays in bringing up their impedimenta from beyond the frontier, they failed to take full advantage of it. It was not till the 29th that their three armies had joined hands and were prepared for further advance.

The disorganized Turks had for the most part withdrawn partly down the Vardar, and partly from Veles by Prilep towards Monastir; and on becoming aware of this the Serbian staff made an entirely new disposition of available forces. The 2nd Army was sent off eastwards to aid the Bulgarians before Adrianople; part of the 3rd Army moved westwards into Albania; the 1st Army, reinforced, moved southwards to co-operate with the Greeks in disposing of the Turks known to be gathered about Salonika and Monastir. The sanjak of Novi Pazar had in the meantime been occupied by Serbian and Montenegrin detachments, and Montenegrin forces had advanced against Scutari, but they had failed to make any impression on its defences. Although some unimportant Ottoman detachments were still to be found in northern Albania, the whole of that portion of Turkey in Europe lying north of a line stretching from about Stip on the east, to just north of Scutari on the west, was by the end of October, for all practical purposes, in the hands of the allies, while the 7th Bulgarian Division was moving down the Struma valley and approaching Demir Hisar.

Greece and Salonika.—In the meantime, the Greek military forces had not been idle. The main army, under command of Crown Prince Constantine, had been concentrated in northern Thessaly when war was declared. A smaller force was assembling near the Gulf of Arta, destined for offensive operations in Epirus.

The Ottoman military authorities had only told off four weak divisions, partly regular and partly reserve, to guard against hostile invasion in this southern theatre of war, and the task of the Greek troops in the region immediately north of Thessaly, at the outset, proved a simple one. The Crown Prince crossed the frontier on Oct. 18, occupied Elasson next day, and on the 23rd routed the Turks a little further to the north, his left occupying Kozani on the 25th. His right advanced at the same time, and on the 28th occupied Katerina on the shores of the Gulf of Salonika, where an advanced maritime base was established.

The Turkish forces defeated near Elasson had for the most part retired on Monastir, where there was a considerable concentration of troops, owing to the army which had been defeated by the Serbs at Kumanovo having for the most part fallen back over the mountains towards this town. But Constantine, aware that the Bulgarians were on the move for Salonika, and determined for political reasons to get to that city first, merely pushed out one division north-westwards to guard his left flank, while with the bulk of his troops he advanced to Vodena. His position there was not wholly comfortable, for the Serbian forces were still a long way from Monastir and a Turkish army of three or four divisions had taken up position at Yenije Vardar so as to cover Salonika against hostile advance from the west. He attacked this position on Nov. 2 and 3, but was repulsed, and his flank guard was at the same time defeated at Banitsa and Kastoris by Ottoman troops that had been pushed south from Monastir. Two days later, however, a fresh attack upon Yenije Vardar proved successful, whereupon the Turks opposed to him there retired into Salonika, which he occupied on Nov. 9, 29,000 of the enemy laying down their arms.

On the following day the Bulgarian 7th Division arrived and claimed the city for Bulgaria; but an agreement on the subject was patched up and the Crown Prince now divided his army in two, half remaining east of the Vardar, and the remainder moving westwards to co-operate with the Serbian forces in dealing with the enemy forces gathered about Monastir.

II. THE TURKISH COLLAPSE

Part of the Serbian 1st Army had advanced to Prilep on Nov. 5 and had then halted for the remainder to come up in line, for Prince Alexander, who was in command, hoped to fight a decisive battle before Monastir with the whole of the troops that could be made available. The Turks had taken up a strong position north of the town and there they proposed to stand their ground In the circumstances, Prince Alexander, whose impedimenta took time to cross the hills out of the Vardar valley, was not prepared to commit his army to the attack before the 14th. The date was subsequently deferred to the 18th, his plan being to deliver a frontal assault, while at the same time turning both of the enemy's flanks.

As it happened, however, the isolated Serbian division told off to operate against the Ottoman left, delivered a premature night attack on the 15th, and had then to resist resolute Turkish counter-attacks during the succeeding two days, unsupported; but it managed to keep the enemy at bay, and when the battle was finally launched on the 18th, the Serbians were completely successful. The Turkish Army broke up. Half of it was killed, wounded, or captured; the other half made its way, in units or small parties, to the only friendly stronghold now left open—Yannina, in Epirus (Scutari was closely invested by this time). The victory of Monastir proved to be decisive, and all that remained for the allies to do in the western theatre of war was to march through Albania to the sea, occupying various points for police purposes, to reduce the two fortresses of Yannina and Scutari, and to take steps to meet the possibility of Austro-Hungarian intervention. Serbia and Montenegro therefore joined in the armistice that was signed on Dec. 3, as already mentioned, between Bulgaria and Turkey.

The Greek government, anxious to complete the occupation of Epirus and the capture of Yannina, were not parties to this suspension of hostilities. The operations north of the Gulf of Arta, in difficult country, had made somewhat slow progress at first; but on Nov. 10 Greek troops had arrived near Yannina, and within a few days a loose blockade had been established, which had not, however, prevented some of the Turkish fugitive detachments from entering the place after the battle of Monastir. A great part of the Hellenic field army was brought round by sea from Salonika during the winter, so as to ensure the fall of the fortress as soon as the weather should again become favourable for active operations.

Adrianople.—Negotiations between the belligerents were set on foot in London shortly after the armistice; but these were abruptly terminated on news arriving of a military coup *d'état* having been carried out on Jan. 23 at Constantinople, in which the existing government was overthrown and Nazim Pasha, the commander-in-chief, was murdered. The military government that had been set up denounced the armistice within a few days, and hostilities were resumed on Feb. 3, although Ottoman field armies had ceased to exist in Europe except within the Chatalja lines and the Gallipoli peninsula. The story of the second phase of this war is merely the final instalment of the sieges of Adrianople, Yannina, and Scutari. An effort was, it is true, made by the Turkish field forces in Thrace to debouch from the lines of Chatalja and Bulair with a view to relieving Adrianople, and this led to heavy fighting locally; but the Bulgarians held their own on both fronts, so Adrianople was perforce left to its fate by the Ottoman military authorities.

The terms of the armistice had not admitted of the revictualling of this extensive stronghold, which remained blockaded during the truce, and by the time that hostilities came to be resumed the garrison was already finding itself short of certain supplies. The investing forces at this time were composed of the Bulgarian 2nd Army, which had taken up the duty in the first instance, and of the Serbian 2nd Army, which had been transferred from the western theatre of war after the victory of Kumanovo. But although it soon became evident from attempts at sorties and increased desertion that the garrison was weakening, lack of transport and of artillery delayed preparations for an assault till the middle of March, and by that time the besiegers had been reinforced by three Bulgarian divisions which it was found possible to transfer from their former position before the Chatalja lines.

The fortifications around the city of Adrianople consisted of a number of substantial, but very conspicuous, forts, with a girdle of infantry redoubts further out, the whole forming an extensive perimeter; but the only really modern works were a certain number of batteries, distributed in the intervals. The infantry redoubts, moreover, were open at the gorge—a serious source of weakness. The garrison at the time of the assault numbered about 50,000, and the allies chose the eastern side of the fortress for attack. A preliminary intensive bombardment of the works was carried out on March 24, and that night the whole of the advanced line on the eastern side was stormed. On the following night an assault was delivered upon the main position; but this was brought to a standstill by the Turkish wire, except at a point where one of the forts was captured by a single regiment. Although the commander of the regiment found himself at dawn to be isolated, he promptly struck out right and left against the rear of the works on either hand, and he thus cleared the way for unit after unit that had been held up by the frontal wire, so that within a few hours the whole line of eastern defences was in Bulgarian hands Attacks were also being delivered at other points, and about midday on the 26th, the Turkish commandant surrendered unconditionally. The assault had cost the allies about 9,500 casualties.

Scutari.—Yannina had fallen three weeks earlier to a successful general assault delivered by the Greek troops under the Crown Prince. This took place on March 5 and the Turkish garrison, numbering about 30,000 wounded and unwounded, surrendered next day; at the end of March only Scutari remained to be taken. The Turkish commandant of this latter fortress had refused to recognize the armistice because its terms did not provide for his revictualling; but little actual fighting took place during the months of December and January. On Feb. 7, however, a determined assault on important defences on the eastern side of the stronghold, which was only partially successful was made by

the Montenegrins; another was delivered next day, which made no progress. But on the 9th, the trenches were carried after a fierce combat, and the besiegers thereby gained a footing within the Ottoman line of defense. They found. however, that they could advance no farther at this point.

A Serbian contingent had arrived shortly before this to take part in the siege, and the activities of the allies were now transferred to the south-western side of the fortress—its western side rested on Lake Scutari. Not until March 31 and April 1, however, was an assault attempted in this quarter, and then the undertaking failed. The Serbian general took over the chief command after this rebuff, but jealousies, military and political, speedily arose, and on April 16 he and his forces took their departure. The Montenegrins had now to take over the whole of the besieging line, and the stronghold seemed safe from further assaults in consequence, but it nevertheless suddenly capitulated on April 22. The Great Powers had, however, decided that the place was to belong to the new State of Albania, and, under pressure from them, the victors were obliged on May 6 to evacuate it.

III. THE SECOND BALKAN WAR

Negotiations with a view to bringing the contest to an end had by this time been in progress for some weeks, and peace was signed in London on May 30. Under its terms, Turkey in Europe was, with the exception of the country lying close to Constantinople and to the Gallipoli peninsula, partitioned between the victors, Bulgaria acquiring the lion's share. But the Balkan League was on the point of explosion, the Great Powers were trying to establish an independent Albania, Rumania in alarm at Bulgaria's aggrandizement was preparing to intervene, and a portion of northern Macedonia and Kosovo Polye remained in dispute between that kingdom and Serbia. Bulgaria also coveted Salonika, and had during April and May transferred her military forces from Thrace to the vicinity of the old Serbian frontier and of the borders of Macedonia, in preparation for making good her claims in the west. A state of tension consequently existed throughout the month of June, and at last, on the 30th, without warning or declaration of war, Bulgaria assumed the offensive against both Serbia and Greece.

The Bulgarian staff had arranged their forces as five armies, the 1st Army facing the Serbian frontier between Vidin and Berkovitsa, the jth Army on its left, the 3rd Army about Kiustendil, the 4th Army about Kŏcani and Radovište, and the 2nd Army between Strumitsa and Seres facing the Greeks. The Serbian forces were disposed in three armies, the 2nd Army guarding the old Serbo-Bulgarian frontier, the 1st Army in the centre about Kumanovo and Kriva Palanka, and the 3rd Army on its right about the Bregalnica; the Greek forces were holding a front between Gjevgjelija on the lower Vardar and the mouth of the river Struma.

The Bulgarian offensive, benefiting by surprise, was in the first instance successful. Their 4th Army broke in between the allies, reached the Vardar at Krivolak, and with the aid of the 3rd Army thrust back the Serbian front for some distance between that point and Kriva Palanka; their 2nd Army at the same time drove the Greek advanced troops in all along the front. But the allies were disposed in considerable depth, the Bulgarian soldiery had little heart for fighting once it became apparent that their antagonists meant to resist, by the night of July 1 the offensive had already died down, and it was then the turn for the Serbian and Greek troops to counter-attack.

Pressing forward on July 2, the Serbian 1st Army drove a wedge through the Bulgarian line in the direction of Kyustendil, and on the two following days hustled the defenders in a south-easterly direction; the Serbian 3rd Army was in the meantime effectually checking any further advance on the part of the enemy about the upper Bregalnica. The Greek Army had brought up its reserves, and on the 3rd and 4th it counter-attacked, forced the Bulgarian 2nd Army back all along the line, and by the 7th had effectually outflanked the enemy's left. The result of these operations in the south was that the Bulgarian 2nd Army found itself obliged to retreat northwards up the narrow Struma valley, running the risk of being cut off by Serbian forces should these, advancing from Kočani and Kriva Palanka, succeed in occupying Jum'a-i-Bala. So, in view of the critical position of affairs, the Bulgarians made a desperate effort to retrieve the situation by initiating a fresh offensive. Their 1st and 5th Armies moved forward by several routes to threaten old Serbia, only to be repulsed at all points by the Serbian 2nd and 1st Armies. The Bulgarian 3rd and 4th Armies at the same time advanced against the Serbian 3rd Army in the direction of the upper Bregalnica, and this latter effort achieved some measure of success; but it also had been definitely checked by July 10.

A brief pause ensued. Then, on the 15th, both Serbians and Greeks began pressing slowly forward. Bulgaria was by this time in a sorry plight, for Rumania had declared war and had begun an unopposed march on Sofia, while the Turks had issued from Chatalja and Bulair and had re-occupied Adrianople. By transferring their 1st Army from the north to the hills east of Jum'a-i-Bala, and attacking the Greeks in the Struma valley with this and their 2nd Army, the Bulgarian staff made a final attempt to stem the pressure. But the venture came to nothing, and on July 31 the aggressors in this second campaign, surrounded by hostile columns that were converging on their capital from every quarter, sued for peace. This was signed at Bucharest on Aug. 10.

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BALKASH, a lake of Asiatic Russia, in the Kazak, A S.S.R., between the provinces of Semipalatinsk and Kurgai in 45° to 47° N. and 73° to 79° E., about 1,000m. to the east of Lake Aral. It is also called in Kirghiz *Ala-Tenghiz,* and in Chinese, Se-hai. It has an area of nearly 7,200sq.m., and lies at an altitude of goo feet. It is a broad crescent about 440m. long from west-south-west to east-north-east with concave side southwards; its width varies from 32 to 53 miles. On the north-west it is bordered by a dreary plateau, the Famine Steppe (*Bakpak-dala*). The south-east shore, on the contrary, is low, and bears traces of having extended formerly as far as the Sasyk-kul and the Ala-kul. The Kirghiz in 1903 declared that its surface had been rising steadily during the preceding ten years, though prior to that, from 1859, it was dropping. The chief feeder of the lake is the Ili, from the Khantengri group of the Tian-shan mountains. The Karatal, the Asku and the Lepsa also enter from the south-east, and the Ayaguz from the north-east. The first three rivers make their way with difficulty through sands and reeds, which at a quite recent time were covered by the lake. Although it has no outlet, its waters are fresh. It freezes generally from November to April. Its greatest depth is, as far as we know, not more than 36 feet. The fauna of the lake and of its tributaries, explored by Nikolsky, is more akin to the fauna of the rivers of the Tarim basin than to that of the Aral; it also does not contain the common frog. It seems therefore probable that Lake Balkash stood formerly in communication through lake Ebi Nor and lake Telli Nor with the lake that formerly filled the Lukchun depression (in 89" E. long. and 42" N. lat.) but researches show that a connection with Lake Aral—at least in recent times—was improbable. The lake has been investigated by L. S. Berg (*see Petermann's Mitteilungen,* 1903). See also Halbfass, Die *Seen* der Erde (1922).

BALKH (some think anc. Bactra or *Zariaspa*), Afghan city, about 100 m. E. of Andkhui and some 46 m. S. of the Oxus, sit-

uated on the right bank of the Balkh river, 1,200 ft. above the sea. It comprises about 500 houses of Afghan settlers, a colony of Jews and a small bazaar, set in the midst of a waste of ruins and débris. The outer walls (mostly in utter disrepair) are about 6½ to 7 m. in perimeter, and on the south-eastern borders are set high on a mound or rampart, indicating a Mongol origin. The walled and moated fort and citadel to the north-east are built above the town on a barren mound. The Masjid Sabz, with its green-tiled dome, is said to be the tomb of a Khwaja, Abul Narsi Parsar. The earlier Buddhist constructions have proved more durable than the Mohammedan buildings. The Top-i-Rustam is 50 yards in diameter at the base and 30 yards at the top, circular and about 50 ft. high. It is possible that in these ruins we may recognize the Nan Vihara of the Chinese traveller Hsiian Tsang. There are the remains of many other topes (or stupas) in the neighbourhood. The mounds of ruins on the road to Mazar-i-Sharif probably represent a city older than those on which is Balkh. Zariaspa and Bactra were probably distinct sites and may not have been identical with Balkh. The city is guarded by a few policemen; there is a garrison at Deb-Dahdi. The gardens to the north-east contain a caravanserai. The natives speak of it as the Mother of Cities. Its foundation is mythically ascribed to Kaiomurs, the Persian Romulus; and it is at least certain that, at a very early date, it was the rival of Ecbatana, Nineveh and Babylon. For a long time the city and country were the central seat of the Zoroastrian religion, the founder of which is said to have died within the walls. The most remarkable convent was the *Nau Behar, Nava Bihara* or New Convent, which possessed a very costly statue of Buddha. A curious notice of this building is found in the Arabian geographer Yāqūt. Arab travellers of the 10th and 12th centuries mention the town. There were several important commercial routes from the city, stretching as far east as India and China. In 1220 Jenghiz Khan sacked Balkh, butchered its inhabitants and levelled all the buildings capable of defence — treatment to which it was again subjected in the 14th century by Timur. Notwithstanding this, however, Marco Polo can still, in the following century, describe it as "a noble city and a great." Balkh formed the government of Aurangzeb in his youth. In 1736 it was conquered by Nadir Shah. Under the Durani monarchy it fell into the hands of the Afghans; it was conquered by Shah Murad of Kunduz in 1820, and for some time was subject to the khan of Bokhara. In 1850 Mahommed Akram Khan, Barakzai, captured Balkh, and from that time it remained under Afghan rule.

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BALL, ALBERT (1896–1917), English airman, was born at Nottingham on Aug. 21, 1896, son of an estate agent. He entered the army in 1914 and passed into the Air Service in Oct. 1915, going out to France on Feb. 18, 1916. He proved to be one of the most daring aviators on the British side, and his activity during the operations on the Somme in the summer of that year helped to establish the superiority of the British air service there. On May 3, 1917, he destroyed 39 enemy machines, making a new record. Four days later on May 7, 1917, he was brought down by a squadron led by the German airman, von Richthofen. Ball received many war honours, including the posthumous award of the Victoria Cross.

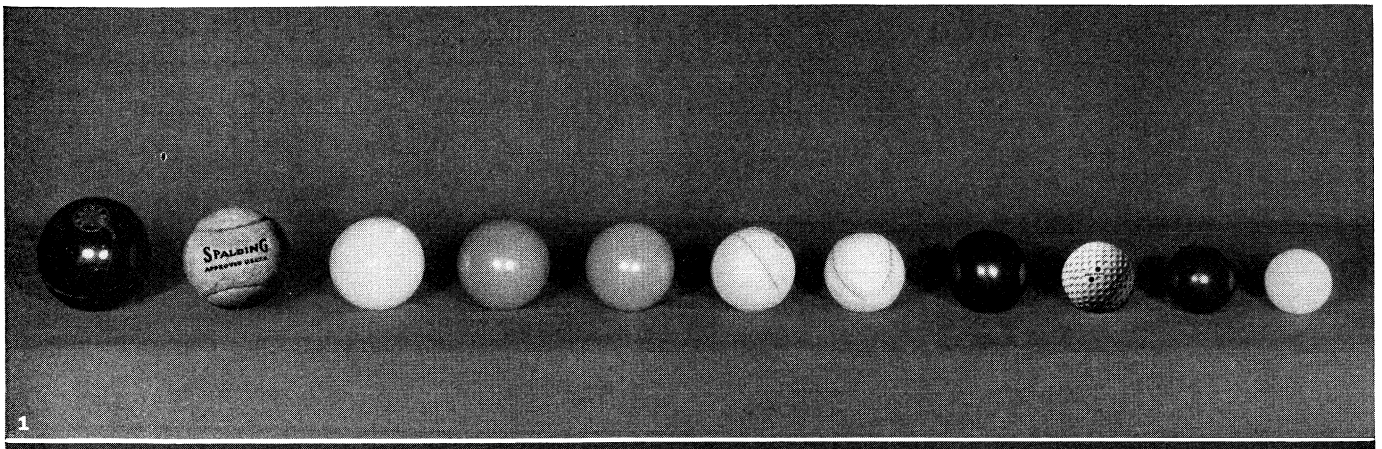
BALL, SIR ALEXANDER JOHN, BART. (1759–1809), British rear-admiral and governor of Malta, came of a Gloucestershire family. He entered the navy, and in 1778 was promoted lieutenant. Three years later began a close association with Rodney, and, two days after his chief's crowning victory of April 12 1782, Ball was promoted commander, and in 1783 he became captain. At this time he spent a year in France with the double purpose of learning the language and living economically. Nelson, then a captain, was at this time, by no means favourably impressed by his future friend and comrade, and spoke of him as a "great coxcomb." It was not until 1790 that Ball received a command. From that year, however, he was continuously employed. In 1798 he rendered assistance to Nelson's ship in heavy weather, and from that time the two were close friends. Ball served under Nelson in the battle of the Nile, and his ship, the "Alexander," was the particular opponent of Brueys' flagship, "L'Orient," which blew up. Two months later he was ordered to the blockade of Malta, which was kept up without a break for the next two years. After the fall of Malta, Ball practically retired from the service, in spite of Nelson's urgent entreaty that he should continue afloat, and from 1801 (when he was made a baronet) to 1809 he was governor of Malta, where he endeared himself to the people by his regard for their interests, and his opposition to the policy of treating the island as a conquered dependency. He died on Oct. 20 1809, and was buried in Malta. Sir Alexander Ball befriended Coleridge and is highly praised by him in *The Friend,* "The Third Landing Place."

BALL, JOHN (d. 1381), an English priest who took a prominent part in the peasant revolt in 1381. Little is known of his early years, but he lived probably at York and afterwards at Colchester. He gained considerable fame as a preacher by expounding the doctrines of John Wycliffe, but especially by his insistence on the principle of social equality. These utterances brought him into collision with the archbishop of Canterbury, and on three occasions he was committed to prison. He appears also to have been excommunicated, and in 1366 all persons were forbidden to hear him preach. His opinions, however, were not moderated, nor his popularity diminished by these measures, and his words had a considerable effect in stirring up the rising which broke out in June 1381. Ball was then in prison at Maidstone; but he was quickly released by the Kentish rebels, to whom he preached at Blackheath from the text, "When Adam delved and Eva span, Who was then the gentleman?" He urged his hearers to attack the principal lords of the kingdom and the lawyers; and he was afterwards among those who rushed into the Tower of London to seize Simon of Sudbury, archbishop of Canterbury. When the rebels dispersed Ball fled to the midland counties, but was taken prisoner at Coventry and executed in the presence of Richard II., on July 15, 1381. Ball, who was called by Froissart "the mad priest of Kent," seems to have possessed the gift of rhyme. He undoubtedly voiced the feelings of the lower orders of society at that time.

See Thomas Walsingham, *Historia Anglicana,* ed. by *H.* T. Riley (1863–64); Henry Knighton, *Chronicon,* ed. by J. R. Lumby (1880–95); Jean Froissart, *Chroniques,* ed. by S. Luce and G. Raynaud (1869–97); C. E. Maurice, *Lives of English Popular Leaders in the Middle Ages* (1875); C. Oman, *The Great Revolt of 1381* (1906); William Morris, *A Dream of John Ball* (1888).

BALL, JOHN (1818–1889), Irish politician, naturalist and Alpine traveller, eldest son of an Irish judge, Nicholas Ball, was born at Dublin on Aug. 20, 1818. He was educated at the Roman Catholic college at Oscott near Birmingham, and at Christ's college, Cambridge. He was botanist, Irish civil servant (1846), Liberal M.P. for Carlow (1852), and under-secretary for the Colonies (1885–87). He was first president of the Alpine club (founded 1857), and it is for his work as an Alpinist that he is chiefly remembered, his well-known Alpine ***Guide*** (1863–68) being the result of innumerable climbs and journeys and of careful observation recorded in a clear and often entertaining style. He also travelled in Morocco (1871) and South America (1882), and recorded his observations in books which were recognized as having a scientific value. He died in London on Oct. 21, 1889.

BALL, THOMAS (1819–1911) American sculptor, was born at Charlestown (Mass.) on June 3, 1819. After starting, self-taught, as a portrait-painter he turned his attention in 1851 to sculpture, his earliest work being a bust of Jenny Lind. At 35 he went to Florence for study. There, with an interval of work in Boston (Mass.) (1857–65) he remained until 1897, when he returned to America and lived in Montclair (N.J.) with a studio in New York city. His work includes many early cabinet busts of musicians (he was an accomplished musician himself, and was the first in America to sing *Elijah*). The equestrian statue of Washington in the Boston public gardens is probably his best work. Josiah Quincy in City Hall square, Boston; Charles Sumner in the public gardens of Boston; Daniel Webster in Central park, New York city; the Lincoln Emancipation group at Wash-



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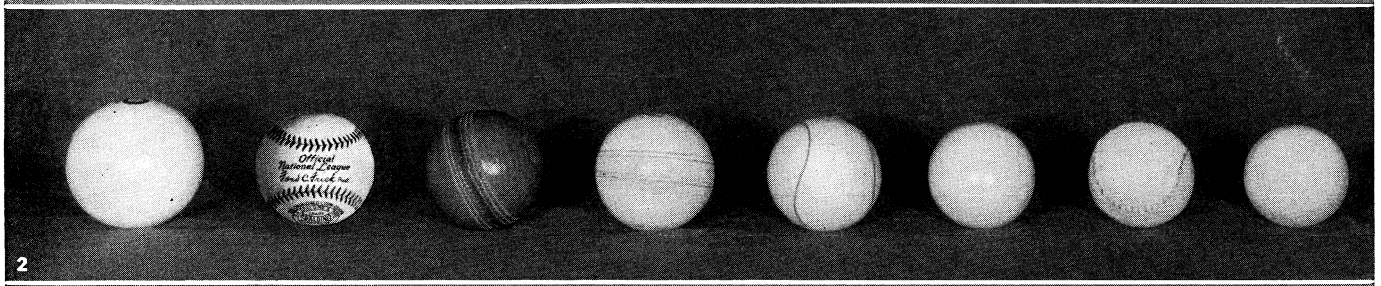

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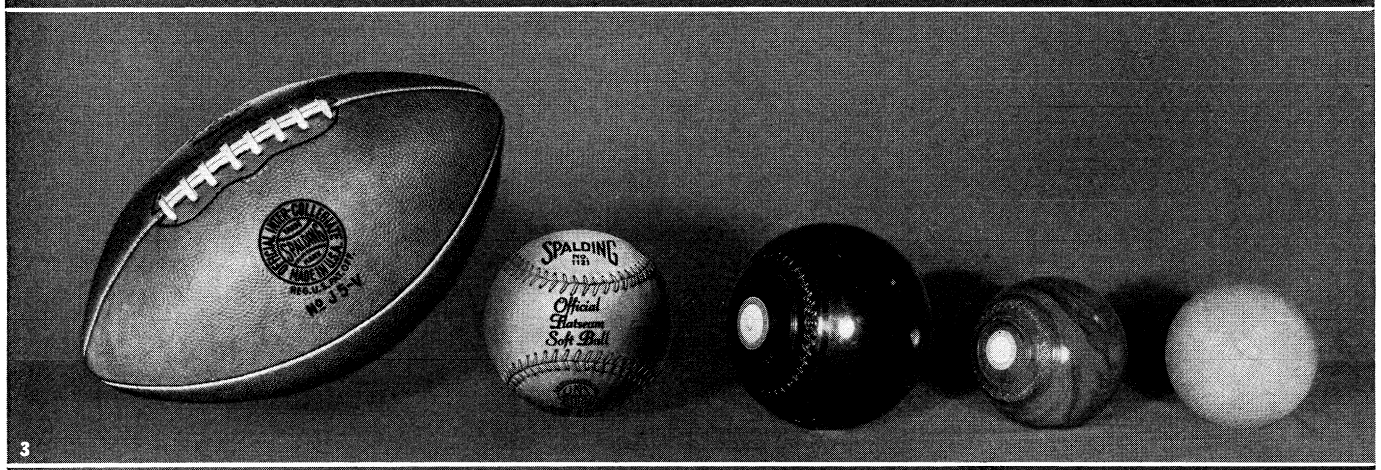

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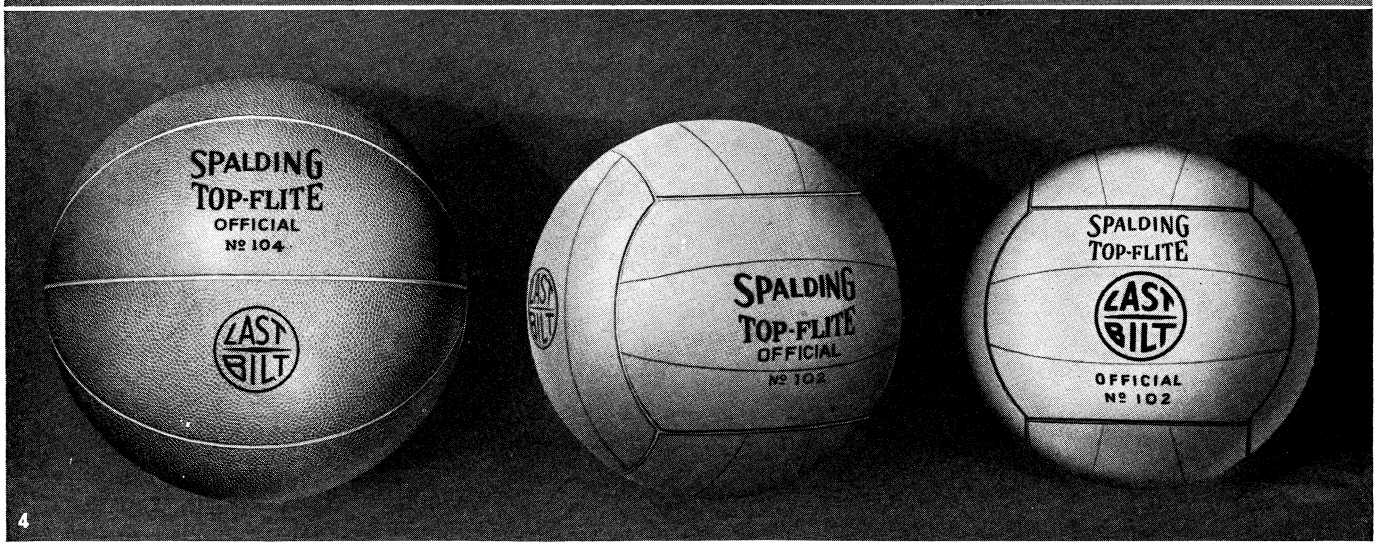

4

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BALLS USED IN POPULAR SPORTS, VARYING GREATLY IN SIZE AND CHARACTER

1. Left to right: Lacrosse; tennis; billiard; snooker; bagatelle; Eton fives; Rugby fives; large squash rackets; golf; small squash rackets; table tennis
2. Left to right: No. 1 (equestrian) polo: baseball: cricket; hockey; lawn tennis; lawn bowls jack; rounders; rubber stoolball
3. Left to right: Football; softball; crown green bowl; crown green jack; croquet ball
4. Left to right: Basketball; soccer ball; volley ball

ington; Edwin Forrest as "Coriolanus," in the Actors' home, Philadelphia, and the Washington monument in Methuen (Mass.) are other examples which have had a marked influence on monumental art in the United States and especially in New England. In 1891 he published an autobiographical volume, My *Three Score Years and Ten*. He died at Montclair on Dec. 11, 1911.

BALL. A rounded body, hollow or solid, preferably with a smooth surface, soinetimcs indented with an even pattern. (Mid. Eng. *bal. Cf. bale,* of Teutonic origin. Lat. *follis.* Gr. πάλλα).

Sometimes applied to such rounded protuberances as the root of the thumb and big toe, or as the "ball" joint of a bone fitting into the "socket" of another bone.

Also used (from late Lat. *ballare,* whence "ballad" and "ballet," or from Fr. *bal)* to mean a large gathering of people invited to join in dancing.

The ball (in its strict sense) has probably contributed more than anything else to the pleasures, pastimes, and sports of mankind, in length of time or in enjoyment. The rounded pebbles of the shore, the shapes of fruit and seeds, may each in turn have provided the prehistoric child with his primaeval rolling plaything. as it gave the palaeolithic warrior the missile for his hand or sling or throwing-stick. The ball is mentioned in the earliest literatures we know. Though the Hebrews were the least athletic of races, Isaiah must have been sure of his simile being understood when he wrote: "He will surely turn and toss thee like a ball"; and some form of ball-game is portrayed on early Egyptian monuments, as it is to-day enjoyed by primitive barbarous tribes. Homer was appealing to a sympathetic audience when he described how the Princess Nausicaa and her maidens "fell to playing at ball" in Scheria (which is Corfu), that far-off land of the Phaeacians washed by the utmost tides of ocean (Od. vi. 100); and again, when the wanderer reaches her father's palace, we hear how Halios and Laodamas played a ball-game, accompanied with dancing, before Alcinous and Odysseus (Od. vii. 370).

When we reach "historic" times, we find the Greeks keeping their bodies supple for sterner contests by ball-play (σφαῖραι); and in the Roman baths an apartment called *Sphaeristerium* was set apart for similar exercises. There are traces in later Greek authorities of ball-games not yet organized, but fully appreciated, in such words as ἀπόρραξις, which means patting the ball on the ground from the open hand; οὐρανία, flinging the ball skywards to be caught again; φαινίνδα, an odd expression which seems to indicate the skill of making a feint when the ball was thrown by one player to be caught by another; or ἐπίσκυρος an obscure name which suggests, if lines of players were engaged, some vague origins of football, though we hear nothing of any goals. It is curious that these words, and others, seem usually to retain, even in Roman times, their Greek origin; as in the *harpastum,* which may be an ancient prototype of the "scrimmage" in rugby football; or the *trigon,* in which three players stood in a triangle and struck the ball from one to the other with a kind of gauntlet on the arm, as may still be seen in Italy. This was a notable advance, and the leather ball used, filled with air, was called *follis,* a larger type than the *pila,* used in games of catch with the hand only, and different from the *paganica,* a heavy ball stuffed with feathers after the type of Scotland's ancient golf balls.

These early games seem to us naturally to be rather undefined, and it was only when skill was developed along certain lines with the ball alone, and in a more valuable direction by the use of various implements for striking it, that we reach the specialization resulting in our modern multiplicity. The picture given with this article shows how many differences from the simple type have now arisen. Only one of the "balls" in constant use to-day is not round, and that is used for rugby and American football; which is strange for the free use of a ball by hands and feet (with no additional implement) must have been one of the earliest developments in ball-games. Association football, however, has rejected primitive simplicities by the introduction of forbidding the use (or even the touch) of the hands. When the ball is made so much heavier for its size that it only leaves the ground with difficulty—as in bowls—the reverse restriction appears, and feet are not allowed. Directly an implement is added, the ball decreases in size: for hockey and cricket the ball is $5\frac{5}{8}$oz. and $9\frac{1}{8}$in. round; the polo-ball of light willow has a diameter of $3\frac{1}{2}$in.; lacrosse has a ball only $2\frac{3}{4}$in. in diameter, lighter still. The accuracy of the balls so far mentioned bears a certain relation to the area of play as well as to the fact that only one ball is used. But directly the area is restricted and more than one ball is used by the same player to make his score, very much greater accuracy is necessary; and the fact that a billiard-cue strikes its ball with the smallest surface of any implement employed in ball games necessitates exact measurements, greater comparative weight, and delicate manufacture. The ivory billiard-ball, with a diameter of $2\frac{1}{16}$in. weighs $4\frac{2}{3}$ ounces.

The player's use of a ball with an implement is very much complicated when another player, similarly equipped, tries to use the same ball for different purposes. Hence came the rich family of games which is distinguished by different forms of the racket, such as real tennis, lawn tennis, rackets, pelota, or squash rackets. The primitive rounders was perhaps the first ball-game in which one player tried, with the ball, to defeat another player who had the implement. Hence descended the American baseball and the English cricket.

BALLABILE, a musical term, now seldom used, signifying that a given work, or section of a work, as in an opera, is suitable for dancing purposes. From the Ital. *ballare,* to dance; and literally therefore "danceable."

BALLAD, the name given to a type of verse of unknown authorship, dealing with episode or simple motif rather than sustained theme, written in a stanzaic form more or less fixed and suitable for oral transmission, and in its expression and treatment showing little or nothing of the finesse of deliberate art. This is not an attempt at definition, for that is hard indeed, if not impossible. The familiar hints as to the character of the ballad, that it is "short," "adapted for singing," "simple in plot and metrical structure," and more emphatically, that it is "impersonal," help us to identify the *genre.* For practical purposes it is that kind of verse preserved in Sir Walter Scott's *Minstrelsy of the Scottish Border* and in Prof. Child's *English and Scottish Popular Ballads.* All the English material we have, and are likely to get, will be found in the latter. By general consent these Scottish and English ballads, and mainly the former, are the best and the most typical.

At the outset, two warnings may be given. First, that there is danger of laying stress on the lexicographical association of the *word* (back to late Latin *ballare,* to dance) and of finding for the known form a tradition originating in the dance. This is said not to anticipate any consideration of the communal dance theory but as a reminder of the misnaming and loose attribution of which our dictionaries and literary histories can offer so many examples. Secondly, that the extended use of the term, as shown in the nondescript varieties of later verse so-called, or in its technical application in music, is out of place in the present account.

Interest in the form and history of the ballad was awakened late. The Robin Hood gests issued by the first printers, the broadsides of the 17th century, and the collection of written and printed texts by Pepys and others are but evidence of business intelligence or the "curiosity" of the antiquary. When Sidney is moved by "the old song of Percy and Douglas," he cannot forget the incivility of the style and what a Pindar might have made of it; and when Addison, in the *Spectator,* praises the "perfection of simplicity," he is merely thanking "our poet" (not a prehistoric choral crowd) for relief from the "wrong artificial taste" of his day. As this sense of contrast grew throughout the 18th century, collectors like Percy and the poetical experts in "imitation" gave the public what it wanted to swell the protest against classical complacency, but the interest was that of a new fashion and adventure in art. Now and then there are hints of more serious critical concern—in the method of editors such as Herd and Ritson—but it is not till the beginning of the 19th century, when Scott published his *Minstrelsy of the Scottish Border* (1802–03) and in the edition of 1830 his "Introductory Remarks on Popular Poetry," that the foundation of the study of the ballads was truly laid in Great Britain. In the romantic fervour of the period there was encouragement to increase the number of ballads by search or by faking, and it was by the growth of this material, and especially by the

discovery of different texts, oral or written, that the desire to judge the comparative merits and discover the earliest and purest versions was aroused. From this to the vexed questions of origin and transmission was a logical and immediate move.

The Question of Authorship. — From the early stages of the great dispute argument was concerned with three, perhaps four, obvious differencesbetween the ballads and the verse of individual and known writers. There was the consideration that the ballads had been transmitted orally, apparently from a distant past, and that this method had continued after the introduction of printing, and even to the 19th century; secondly, that all are anonymous; thirdly, that in the matter of diction and metre they show a simplicity and unkempt art which separates them from all traditional literary expression, and, especially, that their metrical form, with its suggestion of dance-movement and choral song, is strangely at variance with each and every kind of professional unshared craftsmanship; and fourthly — though this was not pressed at first — that the existence of analogues in foreign literatures, close in subject rather than in form, seems to point to some ancient *genre* to which the familiar tests of literary origin do not apply.

Percy, his opponent Ritson, Scott, and indeed all the collectors and editors were of opinion, notwithstanding disagreement on minor points, that the ballads were the work of the minstrels and were derived from earlier and more "literary" work. "The editor is convinced," Scott wrote in the preface to "Lord Thomas and Fair Annie" in the *Minstrelsy*, "that the farther our researches are extended, the more we shall see ground to believe that the romantic ballads of later times are, for the most part, abridgments of the ancient metrical romances, narrated in a smoother stanza and more modern language." And again, in the Introduction to the same edition, he refers to, but declines to discuss, the question whether the ballads were composed by minstrels "professing the joint arts of poetry and music" or were "the occasional effusions of some self-taught bard." This view of a literary and recent origin was readily accepted: in Scott alone there is a hint that it might yet be defended, critically and historically.

In Germany, on the other hand, where Percy's *Reliques* had affected, even more powerfully than in England, the trend of national literature, we find a remarkable critical reaction at the very time when Scott gave a fresh start and direction to the minstrel-theory. It first declares itself in A. W. Schlegel's essay on Biirger (1800) in the statement that ballads were not made *for* the people, but "in a certain manner (*gewissermassen*) by the people as a whole" (*das Volk* im *Ganzen*) (*Werke*, ed. Böcking, viii. 80); that they represent primitive unsophisticated art, the counterpart of the work of the "artist" of later literature, and so illustrate that duality in process and product which is fundamental to the aesthetic theory of Schlegel and others. It was left to the brothers Grimm, in their *Altdeutsche Wälder* (1813), to advance to a generalization in which, hazily and with no hint of evidence, the early Folk in its communal strength actually assumes the function of poet. This called for protest from Schlegel in 1815 (*Werke*, ed. Bocking, xii. and esp. pp. 385–386) in which, while emphasizing the double principle of nature and art, he insisted that the latter must have its due. With this modification and Jacob Grimm's later claim (in 1851) for the source of poetry and music in the imaginative and personal emotion of the poet (*Kleinere Schriften*, 1864, *I.* p. 296) the early German view had become so confused that if a case was to be made out for it better evidence and argument must be found.

Professor Child's Theory. — It was not till the publication of Prof. Child's collection that a better ordered attack upon the upholders of a "literary" origin was begun, or could have been begun. His main purpose was as collector and editor, but once, in *Johnson's Universal Cyclopaedia* (New York, 1893), he offered views, which, however, he would not allow to be "regarded as final." Statements such as that ballads "do not write themselves," as William Grimm had said, and that, "though a man and not a people has composed them, still the author counts for nothing" call for interpretation. Yet it is clear in his summing up that Child never surrendered the individualist and literary position.

The most whole-hearted supporter of the communal theory has been Prof. F. B. Gummere, who in his account of the "rise of poetry as a social institution" claims the ballad as evidence of a co-operative folk-intelligence, first expressing itself in dance and choral song. His views attracted Andrew Lang who sought to strengthen them by reference to the folk-lore of savage and illiterate peoples. Prof. Kittredge, while declining Lang's revel in ethnological analogies, restates the communal arguments with a definiteness not to be found in Child's scattered observations. He allows an initial creation by an individual author but holds that "the processes of oral tradition amount to a second act of composition" —"a collective composition" — "of an inextricably complicated character," which is not to be identified with the corruption by scribes and editors of a classical text; that the original author is not a professional poet or minstrel but a member of the folk, and that the composition is not a solitary act but oral improvisation before an audience "in close emotional contact." When he describes, by picturesque stages, "the supposedly inconceivable phenomenon of a unanimous throng composing poetry with one voice" he has passed far from Child's conclusion "that the ballad is not originally the product or the property of the lower orders of the people." Thus elaborated, the tentative statements of Schlegel and the Grimms have been accepted by many as commonplaces of literary history.

Earlier writers had no occasion to prove their faith in the "poet," whether minstrel or not, or, like Scott, they declined to consider a defence; but the later working out of the Folk-theory has called forth a considered reply by the supporters of a literary origin, to whom the question of the place of the minstrel, whether as author or as transmitter, has lost its former importance. In 1895 W. J. Courthope protested against the "vague idea" that "as the ballad is before all things popular in its character, it was evolved in some mysterious manner out of the genius and traditions of the people themselves" (*Hist. of Eng. Poetry*, 1. p. 445), that the ballad "was usually a précis of a romance" by a selection of "the salient points" and that it developed "certain poetical features of its own" by reason of this relationship. This view was endorsed by T. F. Henderson, who concluded that "the lyric-epic did not originate amongst what is usually termed the folk," that the *carole* sung to concerted movement was, by Scottish and Danish evidence, the concern of high-born folk, and that its later history with the common people is a tale of decadence. The present writer, in 1900, discussed the relationship of the ballad to the romance and romance-poem, in respect of subject and prosodic development, and ventured to describe it "as part of the literary débris of the middle ages." Others added their support, and, indeed, recent opinion has more and more inclined to oppose the claims of the folklorists. The latest attack on the positions held by Profs. Gummere and Kittredge was made in 1921 by their countrywoman Prof. Louise Pound. If it be unfair to claim the late Prof. W. P. Ker as a sworn partisan of the "literary" theorists, one may still find in the concentrated learning of his paper read before the British Academy in 1909 much to disconcert their opponents — on the value of the European analogues, on the looseness of the term "communal authorship," on "Who are the People?" and the variety of answers to be given. Though he declares that the ballads "are not merely a limb of the great mediaeval body of romance" or "mere versified folklore," he holds to the literary quality and tradition, and his somewhat whimsical conclusion that the ballad stands apart, a thing by itself, an "Idea" in the Platonic sense, strengthens rather than weakens the belief in that tradition.

Communal Versus Individual Authorship. — The main points which appear most persistently in discussion of the problem of the ballads may be here summarized. The following notes incline to show that the theory of a communal origin fails in its challenge of that of individual and "literary" authorship; but no criticism can be dogmatic, when the evidence is, as it must remain, incomplete.

1. *Age.* The form is not found anywhere before the 15th century (*Judas* in Child's collection is not a ballad); and if older examples are yet to he discovered, they cannot be earlier than the appearance of rhyme or before the 11th century. The smallness of the

corpus is significant. The opinion that the ballads are later than the romance-poems, and, again, than the romance—that they are a perpetuation or recovery of the vital parts (episodes) of these decayed forms—coincides with what is known of the general curtailment in literary form everywhere, and in all kinds, in the 15th century. The application of "Homeric theory" tests as to the priority of ballad or epic leads to nothing, for there is evidence in many cases to show that the ballads (*e.g.*, on the subject of Robin Hood) are later than the cyclic texts of the romances. The choice of historical matter does not affect argument either way, for (i.) in few cases is the treatment contemporary, and (ii.) it is open to both "literary" and so-called "popular" art to work over traditional material.

2. *Transmission.* The assumption, suggested by oral transmission over a wide area and in a variety of versions, that the form must be primitive and may be studied to-day in the expression of illiterate people and even of savages, is not supported by examination of the ballads as we know them, even in their simplest form; and it would force the conclusion that they were at their best when made and recited at a period farthest from "literary" influence. The admitted degeneracies due to oral repetition by the "people" are not good testimony to an original popular talent in ballad-making. Oral dissemination, which was most active when printing was a limited agency, proves nothing as to origin. All efforts to obtain an "authentic" or *Ur* text by the elimination of popular or editorial meddling must fail, as has been shown in Prof. Brandl's redaction of *Willie of Winsburie*, which does not encourage appreciation of the art of the tribal syndicate. In the investigation of the partial fakings and full "imitations" of the 18th and 19th centuries, this critical method, aided by external evidence, may be more successful. Research has found no proofs that the spread of the ballad throughout Europe had been helped by the Crusades *(pace* Child in his *Cyclopaedia* art.) or by the gypsies whose itineraries begin in the 15th century.

3. *Anonymity.* The fact that there are no clues to authorship has encouraged belief in the folk-theory, and in recent years the anonymity of the trench and march songs and chanties of the World War has been cited in analogy. But to state that these "were composed nobody remembers by whom" does not mean that they were not composed by somebody. Such a criterion is as irrelevant as it would be if applied in cases of unknown authorship where individual workmanship is readily admitted.

4. *Sources.* The view that the "choral throng" was the first author overlooks such difficulties as the following: (i.) The earliest ballads, which deal with such subjects as religion and herostory, do not indicate dance or communal singing as likely media for their preparation. The narrative character precludes the conception of them *as an accompaniment* of the dance, as might be allowed in the case of the simple lyric; for though corporate singing and dancing may produce chanties, jingles, and the like, it cannot tell a story as the ballad does. On the other hand, it is possible, though the evidence is scanty, that dance and song were added later to assist in oral perpetuation. Only in this sense can the term "communal" be applied, and here again it is associated with textual degeneracy. (ii.) There is good testimony, especially in Scotland and Denmark, that the ballads were the concern of the "upper classes," and that if they were danced to, as in the *caroles,* the words, as in the later masque, had been supplied for the entertainment. The recital of pieces in the *Complaynt of Scotlande* excludes all suggestion of extempore or corporate genesis. To say that the ballads are "not aristocratic" is historically false and inadequate as a description of a *genre* concerned with the simple motives of general human interest, for whose expression, with the precision familiar in the ballads, a higher rather than a ruder art is requisite.

No one will maintain, as has been charged against some of the opponents of the communal theory, that *all* ballads are derived from earlier literary material and are to be explained, as so many can be, as parcellings of the longer romance-poems and the still longer romances, for some may be first drafts dealing with a simple motif, or may be directly inspired by *märchen,* or may be imaginary or misplaced accretions to accepted story.

5. *Impersonal Character.* The impersonal manner of the ballads, which is one of the stronger claims for a folk-origin, is inherent to a kind which is essentially narrative. It cannot be assumed that because the single and personal note (the "I" of the lyric) is absent, the explanation is to be found in the co-operation of a "throng" which has neither the opportunity nor the willingness to allow self-expression by any of its members; and it is easy to recall hundreds of impersonal poems by individual writers.

6. *Metre.* Even if it were allowed that the form is not too deliberate to be extemporized by the Folk, it would be difficult to explain away certain evidences of relationship with the metrical scheme of the romance-poem. No summary of this technical matter can be attempted here and the reader is referred to the bibliography. The main claim of the folk-lorists is based on the *refrain,* which is considered as a primitive aid in the building up of an extemporized song and as a reminder of the recurring movements of the dance. Yet, here again, the practice of the most sophisticated art bids us pause.

7. *Diction.* It may be largely a question of taste to decide between the primitive and artificial characteristics of the diction; and the investigation is often complicated by the interference of both the unlettered reciter and the literary reviser. The variations in a piece redelivered in different circumstances, with unequal care, by many unequally sensitive to expression, may give an appearance of folk-simplicity. It is difficult to reserve the *clichés* of words (*e.g.*, "three"), inversion, and other familiar devices in the ballads to the untutored crowd.

8. *Unique Character.* Emphasis has been put by some on the unique character of the ballad—that it achieves by its choice of material and its method results outside the range of other forms, and is, as stated above, the expression of an "Idea" in the Platonic sense. Few may care to dispute this, but some may hint (i.) that every literary form is unique, in its general effect or in some of its constituent qualities, and (ii.) that this acknowledgment puts the ballad in a category beyond the unconsidered writing of an unliterary "throng."

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United States.—American ballads current long enough to be called folk-songs continue, for the most part, inherited patterns or develop variations of them. A text brought to some region of the United States, or originating there, may, in the course of time, roam to remote corners, taking on multiple forms.

Some of the American traditional pieces now made available by collectors are those of the southern Appalachians, including songs from Kentucky, Tennessee, the Virginias and the Carolinas, and those from New England, the West and the South-west. In addition to the immigrant ballads that first interested collectors, anthologists have now gathered the "logger" or "shanty-boy" songs of Maine and Michigan, songs of pioneer conditions and characters of the West and the South-west, songs of miners and "hobos" and similar pieces. Of interest also are songs of French-Canada, Spanish-Mexico, and of the Negroes and the Indians.

Many of the English and Scottish ballads of the romantic and legendary type have immigrated to the United States. As they

persist or roam westward they are likely to lose their archaic flavour and aristocratic touches, to drop their supernatural elements, and to accommodate themselves to New World settings. Many or most of the American traditional songs of the 19th century derived from Old World originals. By the 20th century indigenous songs, developing shifting texts, take their places alongside those entering from without, like the European "Lord Randal" and "The Two Sisters." Some indigenous pieces may be dated with fair certainty, while the history of others has already been lost. A considerable number of them were floated by itinerant bands of singers and old-time minstrel troupes or travelling entertainers, or were taken about the country in popular plays. Many often gained currency in "broadsides" or popular "songsters," or were sold at booths in fairs or in the wake of circuses. A frequent source of preservation is the manuscript book. Some widely current indigenous songs in oral tradition are "Springfield Mountain," "Young Charlotte," "Jesse James," "Casey Jones," and the piece emerging, perhaps, from bar-room currency, known variously as "Frankie and Johnny," "Frances and Albert," etc. Traditional song has survived best in isolated regions or out of the way places, sung to the music of the violin, accordion, mouth organ, cabinet organ or banjo. For many pieces, Irish popular songs served as models or were locally adapted. Other models were songs popular on the stage or even well-known hymns. Sometimes the original airs are retained but often the same piece is sung to various airs in many parts of the country.

A rough classification of American ballad material includes death-bed confession pieces, songs of local murders and disasters, of criminals and rovers, of occupational pursuits, narratives of faithless or murderous lovers, lovers' reunions and occasional comedy pieces. Alongside story pieces or ballads proper in oral currency are religious songs, pseudo-negro songs, "western" songs, temperance songs, game and nursery songs, nonsense songs, and many varieties of sentimental pieces.

It seems unlikely that the legacy of the present period to traditional song will be very great. The competition of the phonograph and the radio has lessened the amount of singing for entertainment among groups that in the past have done most to preserve older song. Lyrics today contain little violence and few tragic situations. Story pieces and pieces with striking refrains have the best chance of survival. In music the word ballad signifies a vocal setting of a ballad, or a purely instrumental setting inspired by a ballad. There are also choral ballads.

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BALLADE, the technical name of a complicated and fixed form of verse, arranged on a precise system. An earlier form of the word "ballad," it afterwards came to be applied to an entirely distinct kind of verse. In its regular condition a ballade consists of three stanzas and an envoi; there is a refrain which is repeated at the close of each stanza and of the envoi. The entire poem should contain but three or four rhymes, as the case may be, and these must be reproduced with exactitude in each section. These rules were laid down by Henri de Croi, whose *L'Art et science de rhétorique* was first printed in 1493, and he added that if the refrain consists of eight syllables, the ballade must be written in huitains (eight-line stanzas), if of ten syllables in dizains (ten-line), and so on. The form can best be studied in an example. Take Andrew Lang's "Ballade to Theocritus, in Winter," for instance, which begins:

Ah! leave the smoke, the wealth, the roar
Of London, and the bustling street,
For still, by the Sicilian shore,
The murmur of the Muse is sweet.
Still, still, the suns of summer greet
The mountain-grave of Helikê,
And shepherds still their songs repeat
Where breaks the blue Sicilian sea.

The rhymes of this first stanza are exactly repeated in the second and third stanzas, and the refrain is repeated in the closing line of each. Then comes the "envoi," in which the rhymes of the second half of each stanza are repeated, and which is again brought to an end with the refrain. For example, Lang's ballade ends:

Master—when rain, and snow and sleet
And northern winds are wild, to thee
We come, we rest in thy retreat,
Where breaks the blue Sicilian sea.

The ballade may be said to have reached its most elaborate and highly finished form in the 14th century. It arose from the *canzone di ballo* of the Italians, but it is in Provençal literature that the ballade first takes a modern form. It was in France, however, and not until the reign of Charles V., that the ballade as we understand it began to flourish; instantly it became popular. Machault, Froissart, Eustache Deschamps and Christine de Pisan were among the poets who cultivated the ballade most abundantly. Later, those of Alain Chartier and Henri Baude were famous, while the form was chosen by François Villon for some of the most admirable and extraordinary poems which the middle ages have handed down to us. Somewhat later Clément Marot composed ballades of great precision of form, and the fashion culminated in the 17th century with those of Madame Deshoulières, Sarrazin, Voiture and La Fontaine. Attacked by Moliére and by Boileau, who wrote:

La ballade asservie à ses vieilles maximes,
Souvent doit tout son lustre au caprice des rimes,

the ballade went entirely out of fashion for zoo years, when it was resuscitated in the middle of the 19th century by Théodore de Banville, who published in 1873 a volume of *Trente-six ballades joyeuses*, which has found many imitators. The ballade, a typically French form, has been extensively employed in no other language, except in English. In the 1 jth and 16th centuries many ballades were written, with more or less close attention to the French rules, by the leading English poets, and in particular by Chaucer, by Gower (whose surviving ballades, however, are all in French) and by Lydgate.

The absence of an envoi will be noticed in Chaucer's, as in most of the mediaeval English, ballades. After the 16th century original ballades were no more written in English until the latter part of the 19th, when they were re-introduced, almost simultaneously, by Algernon Charles Swinburne, Austin Dobson, Andrew Lang, Edmund Gosse and W. E. Henley. Dobson's "The prodigals" (1876) was one of the earliest examples of a correct English specimen. In 1880 Andrew Lang published a volume of *Ballades in Blue China*, which found innumerable imitators. G. K. Chesterton in the twentieth century cultivated the form with success.

BALLAD OPERA, a simple type of opera peculiar to England. where it had its origin in the 18th century, the story being usually in the nature of a burlesque or extravaganza, while the music, confined mainly to detached numbers interspersed among the spoken dialogue, was drawn from pre-existing popular ballads to which the words of the lyrics were adapted. The most famous of all such works was Gay's "Beggar's Opera," but many others enjoyed hardly less popularity. Save for occasional revivals, the type is now extinct. (*See* MUSICAL COMEDY.)

BALLANCE, JOHN (1839–1893), New Zealand statesman, eldest son of Samuel Ballance, farmer, of Glenavy, Antrim, Ulster, was born on March 27, 1839. He migrated to New Zealand, and founded the *Wanganui Herald,* of which he became editor and remained chief owner for the rest of his life. During the fighting with the Maori chief Titokowaru, in 1867, Ballance helped to raise a troop of volunteer horse, in which he received a commission. He entered the colony's parliament in 1875 and, with one interval (1881–84), sat there till his death. Ballance was a member of three ministries, that of Sir George Grey (1877–79); that of Sir Robert Stout (1884–87); and that of which he himself was premier (1891–93). His alliance with Grey ended with a notorious

and very painful quarrel. In the Stout government his portfolios were those of lands and native affairs; but it was at the treasury that his prudent and successful finance made the chief mark. As native minister his policy was pacific and humane, and in his last years he contrived to adjust equitably certain long-standing difficulties relating to reserved lands on the west coast of the North Island. He was resolutely opposed to the sale of crown lands for cash, and advocated with effect their disposal by perpetual lease. His system of state-aided "village settlements," by which small farms were allotted to peasants holding by lease from the crown, and money lent them to make a beginning of building and cultivation, was on the whole successful. But his best achievement was the imposition, in 1891, of the progressive land-tax and progressive income-tax. As premier he brought together the strong experimental and progressive party which long held office in New Zealand.

BALLANCHE, PIERRE SIMON (1776–1847), French man of letters, was born at Lyons, where the horrors of the siege led him to devote himself to an examination of the nature of society, a work which brought him into connection with the literary circle of Châteaubriand and Madame Récamier. His great work is the *Palingénésie,* divided into three parts, *L'orphée, La formule, La ville des expiations.* The first deals with the prehistoric period of the world, before the rise of religion; the second, which like the third was never completed, was to deduce a universal law from known historical facts; the third to sketch the ultimate state of human perfection. A collected edition of his works in nine volumes was begun in 1830, but only four appeared. In 1833 a second edition in six volumes was published.

Ballanche belonged to the theocratical school which, in opposition to the rationalism of the preceding age, emphasized the principle of authority, placing revelation above reason and order above freedom and progress; but he endeavoured to unite what was valuable in these opposed systems. With the theocratists he held that individualism was impracticable since man exists only in and through society and he agreed with them that the origin of society was to be explained, not by human desire and efforts, but by a direct revelation from God. Lastly, he reduced the problem of the origin of society to that of the origin of language, and held that language was a divine gift. At this point he parts company with the theocratists, and in this very revelation of language finds a germ of progress. In the primitive state speech and thought were identical; but gradually the two separated, language becoming spoken, written, and finally printed. Thus the primitive unity and the original social order gave place to new institutions upon which thought acts, and in and through which it even draws nearer to a final unity, a *palingenesis.* Scattered throughout the works of Ballanche are many valuable ideas on the connection of events which makes possible a philosophy of history. Besides the *Palingénésie,* Ballanche wrote a poem on the siege at Lyons (unpublished); *Du sentiment considéré dans la litte'rature et dans les arts* (1801); *Antigone,* a prose poem (1814); *Essai sur les institutions sociales* (1818), intended as a prelude to his great work; *Le Vieillard et le jeune homme,* a philosophical dialogue (1819); *L'Homme sans nom,* a novel (1820).

See Ampère, *Ballanche* (1848); Ste Beuve, *Portraits contemporains,* vol. ii.; Damiron, *Philosophie de XIX^e siècle;* Gaston Frainnet, *Essai sur la philos. de P. S. Ballanche* (1903, containing unpublished letters, portraits and full bibliography); C. Huit, *La Vie et les ôeuvres de Ballanche* (1904).

BALLANTINE, WILLIAM (1812–1887), born in London on Jan. 3, 1812, the son of a London police-magistrate, was educated at St. Paul's school, called to the bar in 1834, and created a serjeant-at-law in 1856. He began in early life a varied acquaintance with dramatic and literary society, and his experience, pushing character and acute intellect obtained for him a large practice, both in civil and criminal cases. He was most skilful in cross-examination and in forensic strategy; but he did not attempt flights of eloquence. Among his great cases were the prosecution of the murderer Franz Müller in 1864, the prosecution of Madame Rachel (1868), the divorce suit *Mordaunt* v. *Mordaunt* (1870), his advocacy of the Tichborne claimant in the civil suit, 1871–72, and his defence of the gaekwar of Baroda in 1875. He died at Margate on Jan. 9, 1887, having published his *Reminiscences.* His private life was Bohemian; and having earned large sums, he died very poor.

See his *Some Experiences of a Barrister's Life* (5th ed. 1882) and a continuation of it, *The Old World and the New* (1884); also the article TICHBORNE CLAIMANT.

BAELANTYNE, ROBERT MICHAEL (1825–1894), Scottish writer of fiction, was born in Edinburgh, and came of the same family as the famous printers and publishers. When 16 years of age he went to Canada and was for six years in the service of the Hudson's Bay Company. He returned to Scotland in 1847, and next year published his first book, *Hudson's Bay: or, Life in the Wilds of North America.* In 1856 he began the series of excellent stories of adventure for the young with which his name is popularly associated. *The Young Fur-Traders* (1856), *The Coral Island* (1857), *The World of Ice* (1859), *Ungava: a Tale of Eskimo Land* (1857), *The Dog Crusoe* (1860), and other books, to the number of upwards of 100, followed.

See his *Personal Reminiscences of Book-making* (1893).

BALLARAT, a city of Grenville county, Victoria, Australia, consisting of 3 municipalities: Ballarat city, Ballarat East, Sebastopol. It lies at an elevation of 1,416 ft. on the plateau which here forms the "Great Divide." Close by, on the east, a sharp rise leads up a further 500 ft. to the Warrenheip plateau (mainly volcanic: Mt. Warrenheip: 2,463 ft.). The climate is bracing—temperate in summer and rather cold in winter (av. temp. *c.* 56° F); the average annual rainfall is 26.8 in. The intensely folded (Ordovician) slates and sandstones which form the country rock were highly mineralized. Gold was discovered in 1851 and Ballarat quickly became one of the foremost mining towns of Australia, its early history being marred by one of the few incidents involving bloodshed in the mining history of Australia. The surface (alluvial) deposits were soon worked out and thereafter reef-mining prevailed. The steady quality of the ore permitted mining to considerable depths (2,000 ft. and over) and gold to the value of over £70,000,000 has been obtained. The fields are now, apparently, nearly exhausted. The clays derived from the ancient rocks of the uneven and sparsely-timbered uplands afford good farmlands while the volcanic soils of the Warrenheip plateau are exceptionally fertile. Potatoes and oats are extensively grown and mixed farming is carried on. The wools of the district have always had a high reputation. Ballarat (pop. 1933, 35,681) is the largest inland city in Australia. It possesses fine gardens, pleasure parks (including Lake Wendouree) and public buildings. A market and commercial centre for a wide and prosperous area, Ballarat has also railway engineering works, woollen mills, etc., a good electric service (trams, light, etc.) and water supply, and is a noted summer resort for residents of Melbourne (74 miles by rail).

BALLAST, in shipping, heavy material, such as gravel, stone or metal, placed in the hold of a vessel in order to immerse her sufficiently to give adequate stability. In botany "ballast-plants" are so called because they have been introduced into countries in which they are not indigenous through their seeds being carried in such ballast. A ship "in ballast" is one which carries no paying cargo. In modern vessels the place of ballast is taken by water-tanks which are filled more or less as required to trim the ship. The term is also applied to materials like gravel, broken glass, burnt clay, etc., used to form the bed in which the sleepers or ties of a railway track are laid, and also to the sand which a balloonist takes up with him, in order that, by throwing portions of it out of the car from time to time, he may lighten his balloon when he desires to rise to a higher level. In building, ballast describes the heavy material used as a matrix in making concrete.

BALLATER (Gaelic for "the town on a sloping hill"), village and police burgh, parish of Glenmuick, Aberdeenshire, Scotland, 670ft. above sea, on the left bank of the Dee, here crossed by a fine bridge, 43¼m. by rail W. by S. of Aberdeen. Pop. (1931) 1,198. It is the terminus of the Deeside railway and the station for Balmoral, 8m. to the west. Founded in 1770 to provide accommodation for the visitors to the mineral wells of Pannanich,

1½m. to the east, it has since become a popular summer resort. Ballatrich farm, where Byron spent part of his boyhood, lies some 4m. to the east.

BALL BEARINGS, machine bearings in which friction is lessened by arranging loose steel balls to revolve in channels or races. Sometimes the balls run between coned surfaces. The balls and their races are manufactured with precision of high-grade hardened steel. For heavy work, rollers are sometimes used instead of balls. *(See* BEARINGS.)

BALLET, a performance in which dancing, music and pantomime are involved. The present acceptation of the word ballet is a theatrical representation in which a story is told only by gesture, accompanied by music.

This variety of theatrical representation by means of dancing, mimicry and orchestral music, had its origin in the pantomimic performances of ancient Rome. The earliest form of the modern ballet was the interpretation of a theatrical plot by means of dancing combined with speech, and even with song. In this form it was well known to the princely courts of Italy. In France, where it preserved its essentially artistic formation, it is closely associated with the history of the opera; but in England it came much later than the opera, for it was not introduced until the 18th century, and in the first Italian operas given in London there was no ballet. Catherine de Medici introduced these entertainments into France and spent large sums of money on devising performances to distract her son's attention from the affairs of the state. Baltasarini, otherwise known as Beaujoyeulx, was the composer of a famous entertainment given by Catherine in 1581 called the *Ballet Comique de la Reyne*. This marks an era in the history of the opera and ballet, for we find here for the first time dance and music arranged for the display of coherent dramatic ideas. Henry IV., Louis XIII. and Louis XIV. were all lovers of the ballet and performed various characters in them, and Richelieu used the ballet as an instrument for the expression of political purposes. Lully was the first to make an art of the composition of ballet music and he was the first to insist on the admission of women as ballet dancers, feminine characters having hitherto been assumed by men dressed as women. When Louis XIV. became too fat to dance, the ballet at court became unpopular. It was then adopted in the colleges at prize distributions and other occasions, when the ballets of Lully and Quinault were commonly performed.

The most notable personage in the history of the ballet is Jean Georges Noverre. He revived the ballet as Gluck revived the opera. His literary productions on dancing, published in 1760, are in style so vivacious that even to-day they are well worth reading, and at the same time they are indicative of the aesthetics of 18th century dancing. They ran into many editions and were translated into several languages. Noverre freed the dance from the starched rigidity of the farthingale, constructed in his libretti plots of great dramatic movement, and introduced into dance compositions the whole gamut of dramatic expression. He wrote ballets in abundance that were accounted heroic or lyric according to their subject. He ended the supremacy of the leaders of the ballet and with it their purely artistic setting in the dance, creating instead a composite work of art in which painting, for decorations and costumes and music (Mozart composed his ballet *Les Petits Riens*) found a place as active auxiliaries of dancing. Noverre was the last as well as the most notable representative of classical ballet dancing, for this elegant art disappeared at the outbreak of the French Revolution. In the great opera houses of Europe, *corps de ballet* still persisted; but the technique of these gradually lost its clear-cut perfection. In Russia alone was the great tradition of the old ballet carefully preserved, especially in the Royal opera houses of St. Petersburg and Moscow.

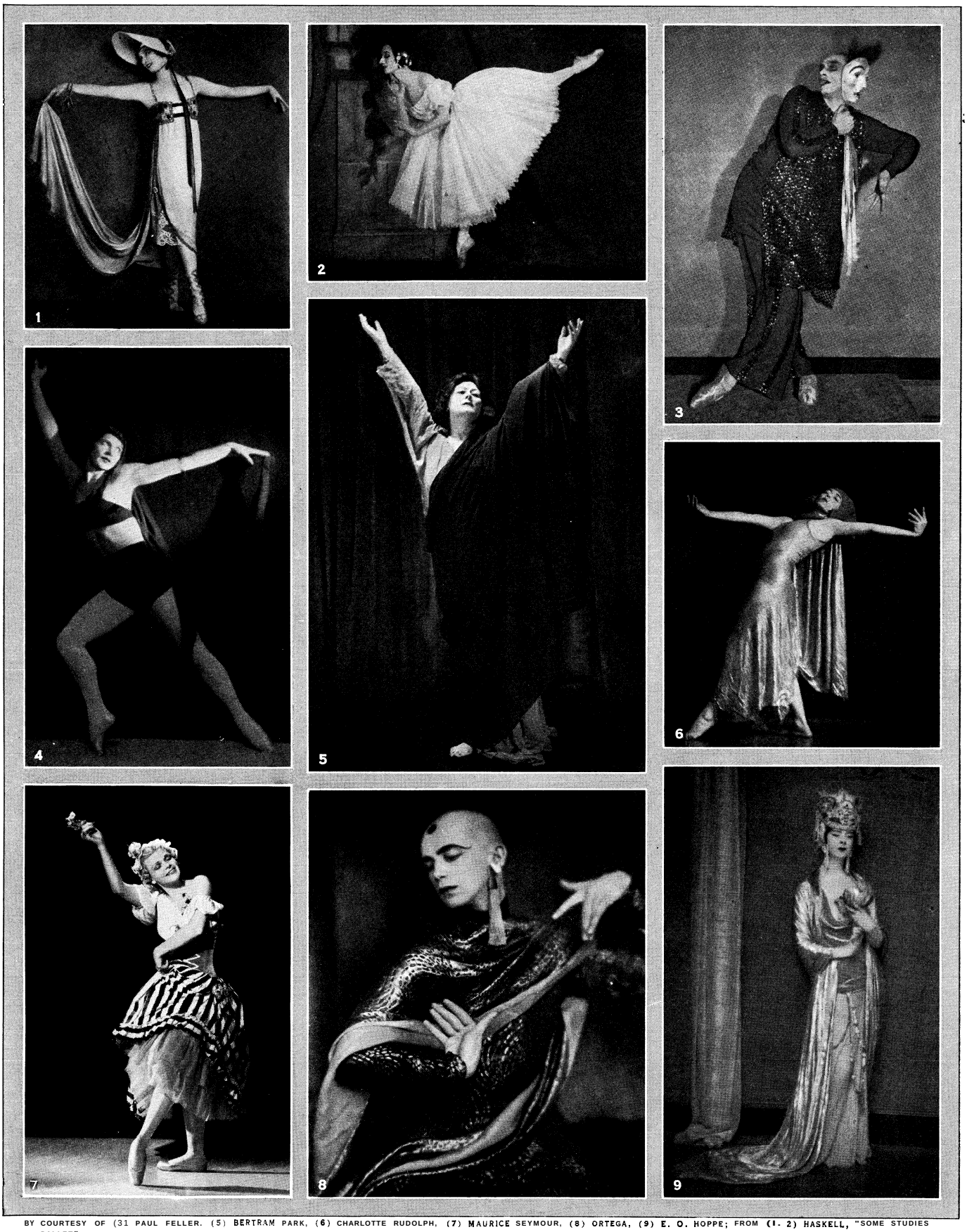
At the beginning of the 20th century a new convention for stage dancing, initiated in America and perfected by an American, Isadora Duncan (*q.v.*), appeared in Europe. In this new form the *maillot*, the padded shoes and the ballet skirts gave way to bare feet, classic tunic and flowing drapery. There was no dancing *sur les pointes*, but stately movement from one deliberate Greek pose to another, to the accompaniment of music always carefully chosen from the works of Chopin, Gluck or some equally famous master. It had the air of being easy and natural, but was really the outcome of much thought and long training. Miss Duncan's figure was lithe and supple, her sense of rhythm was good, and she had acquired the certainty of balance that marks the first-rate dancer. Neither her dancing nor her theories were taken seriously till she arrived in St. Petersburg in 1907, where the two conventions met, the classical and the classic, each at the highest point of its development. Reacting one upon the other, a new form emerged, the Fokine ballet, which combined the virtues of the two schools and quickly superseded both.

Fokine was strongly influenced by the theories of Isadora Duncan, and it was in accordance with her teaching that the best composers and painters were brought in to write and decorate the new ballets, and that the ballets themselves were cut down to one act of such a length that three or four could be played in one evening. Though the old technique was by no means abandoned, it was modified by the addition of many of the Duncanesque movements; and the bare feet and Greek tunic began to alternate with the traditional uniform. Within a year of his appointment Fokine managed to sweep away the accumulated traditions of two centuries, and the ballet was at last free to express itself in any form that the dramatic subject demanded. The Russian ballet remained practically unknown outside its own country till 1909, when a company from the Marinsky theatre of St. Petersburg appeared at the Chatelet theatre in Paris. Serge' Diaghilev (1872–1929), to whom the management of this season had been entrusted, was known in Russia as one of the younger leaders of the renaissance of Russian art He was one of the warmest supporters of Isadora Duncan during her visit to St. Petersburg, and an equally staunch supporter of Michel Fokine when he began to put her theories into practice.

The choreography of all the ballets was the work of Michel Fokine. He was the great eclectic, the master of the composite ballet, who used the methods of Duncan and of the Russian folk dancers each in its proper environment with equal success. He was the inventor of the modern ballet, and from his creations practically all the later developments can be traced. As a dancer Fokine was graceful and accomplished, but lacked the genius of his successor, Vaslav Nijinsky, who took command for the season of 1913. Nijinsky was influenced by Emile Jaques-Dalcroze, a Swiss exponent of musical calisthenics, in accordance with whose theories the dancing in Debussy's *Jeux* was made to synchronise exactly with the beat of the music; while in Stravinsky's *Le Sacre* du *Printemps* the movement became a sort of rhythmic counterpoint in opposition to it. As a dancer, Nijinsky ranks among the greatest in history, and his premature retirement was an irreparable loss to the ballet.

Léonide Massine, who first appeared in 1914 in Strauss's *Légende de Joseph*, produced his first ballets in 1917. His work was a development of the Fokine ballet, sharpened by contact with Andalusian forms, which he studied closely before the production of De Falla's *Tricorne*. The best example of his invention at this time was seen in *Le Rossignol* (1920) and in his use of mass movements as foreshadowed by Nijinsky in *Le Sacre du Printemps*. As a dancer he is alert and certain in his balance, with a marked sense of rhythm. Among the more notable names are those of Tamara Karsavina, a dancer of perfect technique and compelling grace, who between 1910 and 1914 created most of the principal roles. Anna Pavlova danced with the company in 1909 and 1911. Her technique, perfect even to the most trifling detail, and the persuasive charm of her personality, won her a world-wide reputation. She was the brightest star in the Russian ballet and was the last personification of the lovely art of the old ballet. Among the men, in addition to the three maîtres de ballet, have been Adolf Bolm, Woizikovsky, Idzikovsky and latterly Lifar. Diaghilev knew how to enhance his gifts and accomplishments as a dancer by securing the services of the most distinguished painters of his day as decorators and costume designers. Chief among these was Leon Bakst, and others were Picasso, Derain and Benois. Diaghilev also secured the co-operation of leading modern composers—of Ravel, Richard Strauss, Poulenc, Milhaud and above all, of Stravinsky. Among the most remark-

BALLET

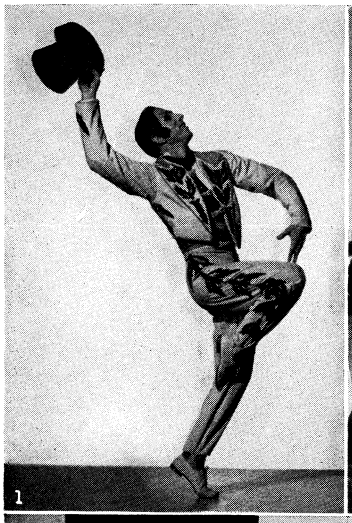


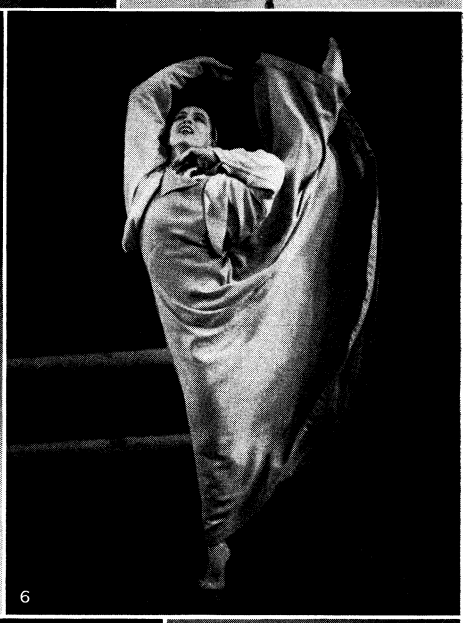
BY COURTESY OF (3) PAUL FELLER, (5) BERTRAM PARK, (6) CHARLOTTE RUDOLPH, (7) MAURICE SEYMOUR, (8) ORTEGA, (9) E. O. HOPPE; FROM (1, 2) HASKELL, "SOME STUDIES IN BALLET"; PHOTOGRAPH, (4) WIDE WORLD PHOTOS

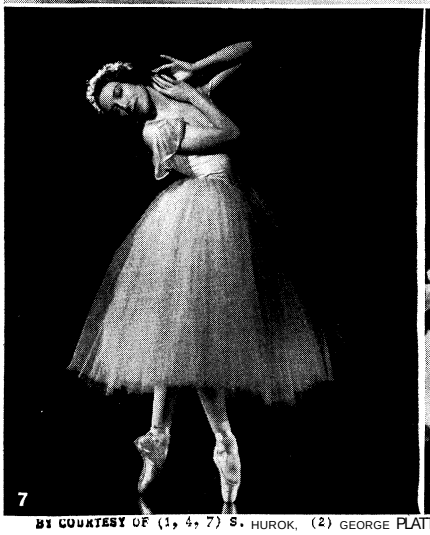
CHARACTERISTIC POSES OF MODERN DANCERS

1. Mme. Pavlova in a pose from "La Gavotte Pavlova," which was one of her most popular dances. 2. Mme. Pavlova in one of her famous "toe poses." 3. Harald Kreutzberg as the clown in the ballet "Don Morte," by Friedrich Wilckens. 4. Vera Nemchinova in her divertissement, "The Wind," by Rimsky-Korsakov. 5. Isadora Duncan as she appeared in the west door of the Parthenon. 6. Mary Wigman, in the dance-poem "Die Feier." 7. Catherine Littlefield in "Viennese Waltz." 8. Harald Kreutzberg as master of ceremonies in "Turandot." 9. Ruth St. Denis, who has distinguished herself in her Oriental dances

BALLET







BY COURTESY OF (1, 4, 7) S. HUROK, (2) GEORGE PLATT LYNES, (3, 5) MAURICE SEYMOUR, (6) BARBARA MORGAN, (8) RICHARD TUCKER, (9) ARNOLD HASKELL

POSES FROM THE MODERN BALLETS IN WHICH THE STORY IS TOLD ONLY BY GESTURE, ACCOMPANIED BY MUSIC

1. Leonide Massine in "Gaîté Parisienne"
2. The American Ballet Caravan in "Billy the Kid"
3. Alexandra Danilova of the Ballet Russe de Monte Carlo
4. Mia Slavenska of the Ballet Russe de Monte Carlo
5. Danilova in a characteristic pose
6. Martha Graham in "Frontier"
7. Alicia Markova, English ballerina of the Ballet Russe de Monte Carlo
8. Ballets Jooss in "A Ball in Old Vienna"
9. Fokina as Medusa in an interpretative dance

able ballets, which he produced in every capital city in the world, were: *Czmarosiana, Carnaval* (Schumann), *L'Oiseau de feu, Le Spectre de la Rose, Petrouchka, Sacre du Printemps, Tricorne* and *Les Biches.*

The 20th century has seen, besides the stimulus given to the old ballet by Diaghilev and his artistes through Isadora Duncan's reforms, and by Dalcroze through his system of eurhythmics, the rise of a new development in dancing With the death of Diaghilev in 1929, activity ceased in the Russian ballet until 1932, when fragments of the old troupe, along with young dancers recruited from the Paris schools of the ballerinas Egorova, Preobajinska, and Kchessinska, united under the guidance of De Basil for the formation of the Monte Carlo ballets. Their perforinances until the year 1938 were remarkable first of all for Massine's important choreographies based on symphonies *Les Presages* (Tschaikowsky 5th), *Choreartium* (Brahms 4th), *Symphonie Fantastique* (Berlioz). This period showed the development and recognition of the ballerinas Alexandra Danilova, Irina Baronova, and Tamara Toumanova, as well as the male dancers David Lichine, Yurek Shabelevsky, and Roland Geurard, ably carrying on the tradition of great dancing.

After 1930 England had a resident ballet company of its own—the Vic-Wells group, ably headed by Ninette de Valois. At first drawing much of their inspiration from the Russian school, they then began an almost nationalistic movement, developing vital young choreographers such as Frederic Ashton and Miss de Valois herself, who sought inspiration from English painters and English music. Some of their best known ballets are *The Rake's Progress* (de Valois), *The Haunted Ballroom* (Ashton), *Horoscope, Checkmate* (de Valois), *Wedding Bouquet* (Ashton)

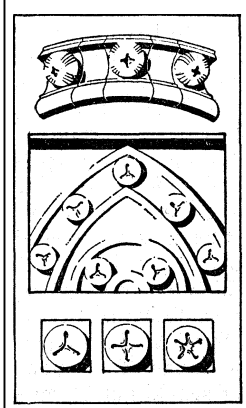
In practically every European opera house is maintained a corps de ballet principally for the traditional dances demanded by the opera scores, but in some instances this group appears on separate evenings giving complete ballet programs Copenhagen. Budapest, Leningrad, Milan, Vienna. and of course Paris are all noted for the beauty and excellence of their ballet productions.

In America, several companies have made their contributions to repertory Ballet Caravan, a group of eighteen under the direction of Lincoln Kirstein, has created such Americanisms as *Filling Statiorc* (Christianson), *Billy the Kid, Yankee Clipper* (Eugene Loring). Ruth Page, with her Chicago group, has added *Frankie arid Johnny, Hear Ye— Hear Ye*, and *The Gold Standard.* The Littlefield-Philadelphia Ballet (official ballet of the Chicago Opera Co) is best known for its *Barn Dance, Terminal, Cafe Society,* and *Ladies' Better Dresses.* In spite of the Americanism of these productions, all three of these companies are soundly based on the classical school and foundation of ballet, and include many of the abstract classical pieces in their repertories. While the French and Russian devotees of modern music wrote their ballets for Diaghilev, latterly musicians like Bartok, Hindemith and Toch have frequently composed dance music. It is apparent from later developments in the modern dance that a merging of the style and technique of the old ballet with the capability of expression of the new, is gradually taking place. Thus the question of aesthetics is less pressing than that of technique. Whereas the old ballet relied almost entirely on foot-and-leg aork, the modern dance requires the whole body as its medium of expression. Therefore it presupposes application to gymnastics for suppleness; the old ballet required stiffness, especially of the back. The rigid set pose of the old ballet is giving way to the continuous flowing movement of the modern dance. There is no doubt that the new dancing, with its possibilities of strong emotional expression, particularly in the display of mass movement, can be made the medium of the deepest artistic effects; and that this mass movement will be more truly a cultural expression of the basic experiences of life than was the elegant art of the old ballet. *(See* also DANCE; PANTOMIME.)

BIBLIOGRAPHY.—One of the most complete hooks on the ballet is by the Jesuit, Claude François Menestrier, *Des ballets ancienne et modernes,* 12mo (1682). He was the inventor of a ballet for Louis XIV, in 1685; and in his book he analyses about fifty of the early Italian and French ballets. See also Noverre, *Lettres sur la danse,* 1760 and 1804. In the last complete edition are to be found the libretti of many of his most notable ballets. H. Niedeken, *Noverre in his Relation to Music, Munich.* Important also are Cahusac's *La Danse ancienne et moderne ou traité historique de la Danse,* 1754; Weiter Castel-Blaze, *La danse et les ballets* (1832) and *Les Origines de l'opéra (1869)* the comprehensive work by Aoskar Bie, Der Tanz. **(C. LD.)**

BALL-FLOWER, an architectural ornament in the form of a ball inserted in the cup of a flower, which came into use in the latter part of the 13th, and was in great vogue in the early part of the 14th century. It is generally placed in rows at equal distances in the hollow of a moulding.

BALLIA, a town and district of British India, in the Benares division of the United Provinces. The town is on the left bank of the Ganges, below the confluence of the lesser Sarju. It is really an aggregation of rural villages. Population 16,400.



FROM VIOLLET-LE-DUC
TYPES OF BALL-FLOWER
The two upper figures show the use of the form as a moulding decoration

The district of Ballia, constituted in 1879, occupies an angle at the junction of Gogra and Ganges, being bordered by two districts of Bihar. It contains an area of 1,231 square miles. Owing to great pressure of population on the soil and its general productiveness, land in Ballia, for agricultural purposes merely, has a market value higher than in almost any other district in the province. In 1931 the population was 913,090. The principal crops are rice, barley and other food-grains, pulse and sugar-cane. Sugar is the only manufacture.

BALLIN, ALBERT (1857–1918), German shipowner, was born in Hamburg Aug. 1j, 1857. Educated for a mercantile career, his first notable achievement was the organization of the emigrant traffic on the Carr line. He then took over the management of the passenger traffic on the Hamburg-Amerika line, becoming, in 1886, director and shortly afterwards director-general of that enterprise. Under Ballin's leadership the Hamburg-Amerika line expanded steadily, acquiring numerous other shipping companies and increasing its capital tenfold. By negotiating agreements with other shipping companies, Ballin practically reorganized Germany's shipping trade; and he was the author of the German-American shipping agreement of 1902. He died suddenly in Hamburg Nov. 9, 1918.

See P. F. Stubmann, *Ballin: Leben* und *Werk eines deutschen Reeders (1926).*

BALLINA, urban district, Co. Mayo, Eire, on the river Moy, and on the Killala branch of the Great Southern railway Pop. (1936) 5,728. In the suburb of Ardnaree is the Roman Catholic cathedral (diocese of Killala), with an east window of Munich glass, and the ruins of an Augustinian abbey (1427) adjoining. There is a Roman Catholic diocesan college and the Protestant parish church is also in Ardnaree. A convent was erected in 1867. In trade and population Ballina is the first town in the county. The salmon-fishery and fish-curing are important branches of its trade; and it has also breweries and flour-mills and manufactures snuff and coarse linen. In 1798 Ballina was entered by the French.

BALLINASLOE, town, Co. Galway, Eire, 91 mi. W. of Dublin, on the Great Southern Ry. Pop. of urban district (1936) 5,834. The town contains remains of a castle of Elizabethan date. Industries include brewing, flour-milling, tanning, hat-making and carriage-building. Trade is assisted by water-communication through the Grand canal to the Shannon. The town is widely celebrated for its great annual cattle-fair held in October. Adjoining the town is Garbally castle, into the demesne of which the great fair extends from the town.

BALLISTIC GALVANOMETER, a galvanometer *(q.v.)* with a small damping factor and therefore a long period of oscillation.

BALLISTICS. Ballistics is that branch of Applied Physics which deals with the motion of projectiles and the conditions governing that motion. In practice the subject is confined to military projectiles, such as rifle bullets, artillery shells and

aeroplane bombs. There are two principal divisions of the subject, Interior Ballistics, which deals with the motion of the projectile while still in the gun, and Exterior Ballistics, which deals with the motion in free air. Obviously the former has no application to bombs. Subsidiary topics are Ballistics of Penetration, which deals with the motion of a projectile in penetrating armour or other dense media, and Fragmentation, which deals with the breaking up of an explosive projectile by its own bursting charge. (See AMMUNITION and ARMOUR PLATES.)

INTERIOR BALLISTICS

The high velocity imparted to a projectile as it leaves the muzzle of a gun appears, to the unaided senses to have been acquired instantaneously. Actually the acquisition of this velocity, although very rapid, has a history which may be studied in great detail either theoretically or experimentally. The energy necessary to produce the velocity is furnished by the "combustion" or "burning" of a propellant. The combustion of 'a propellant is an explosion; that is it differs from ordinary burning in that it takes place without requiring the presence of air. It resembles ordinary burning, however, in that it is a chemical reaction taking place only on the surfaces of the powder grains. In this it differs from the detonation of a high explosive which proceeds as a wave through the body of the explosive and is incomparably more rapid. The actual rate of burning of a propelling charge is very carefully regulated by the design of the powder grains both in shape and size. The reader should not be misled by the word grain, since a grain may be nearly an inch in diameter, and the word may even be applied to the long pieces of British cordite or French strip powder. Even among the smallest grains, such as those used in small arms, the size and shape of the grain is carefully regulated, the latter commonly being that of a hollow cylinder.

The general character of the phenomena taking place in a gun when it is fired is as follows. The powder is located in the *chamber,* which is a somewhat enlarged part of the bore near the breech. (See ORDNANCE.) The front of the chamber is formed by the base of the projectile and is more or less effectively sealed in the case of artillery by the driving *band* or rotating *band.* This is, a band of copper or other relatively soft metal encircling the projectile near the base. Its main purpose is to engage the rifling and so impart a spin to the projectile as it moves forward, the sealing of the chamber being subsidiary. When the powder is ignited it begins to generate gas and causes the pressure in the chamber to rise. When the pressure has reached a value sufficient to overcome initial band resistance, usually of the order of 1,000lb./in.², the projectile begins to move, thus starting to increase the volume available for powder and gases. The rate of burning is so rapid, however, that the pressure continues to rise until the projectile has moved a distance of the order of one or two calibres. The greatly accelerated motion of the projectile finally increases the volume available for the powder and gases more rapidly than the powder gas is generated, and the pressure then reaches a maximum and begins to decrease. The combustion of the powder may be complete shortly after this or may continue until the projectile nearly or quite reaches the muzzle. In any case the pressure continues to decrease but the projectile velocity continues to increase. As soon as the base of the projectile passes the muzzle there is an escape of gas and a more rapid fall in pressure, and the projectile receives only a slight further acceleration, so that it reaches its maximum velocity a very short distance beyond the muzzle. These phenomena take place in a time interval that varies from a value such as ·0014sec. for a calibre 0.30 rifle to ·06sec. or more for a 16in gun.

R. H. KENT, "THE FLIGHT OF PROJECTILE," JOURNAL OF THE FRANKLIN INSTITUTE, 1938. (RECORD FROM ABERDEEN PROVING GROUND.)

FIG. 1. PRESSURE VS. TIME FOR TWO ROUNDS IN A 155 MM. GUN (Read from right to left.) These are two actual records in the same gun. The upper indicates the pressure waves or surges of powder gas back and forth resulting in irregularities in variation in pressure. The lower shows a smaoth curve resulting from improved design of charge.

Basic Equations. — The study of interior ballistics is usually made to depend on three basic equations The first is the energy equation, which states that the energy developed by the combustion of the propelling charge is equal to that appearing in certain other forms of kinetic and potential energy. The second is the equation of motion of the projectile, which states that its acceleration is proportional to the force acting on it. The third is the equation of the law of burning, which gives the rate at which the burning surfaces of the powder grains recede as a result of the combustion of the ponder. Of almost equal importance with these three is the granulation function, which gives the volume of a powder grain consumed when a given thickness is burned from the surface. The development of the subject is carried out by reducing these laws to a system of differential equations, whose integration gives the relations connecting time, powder pressure, projectile travel and projectile velocity.

Energy Equation. — The energy E_c released by the chemical reaction of that part of the charge which has burned previously to any particular instant, must be accounted for in three ways: E_k, the mechanical kinetic energy of projectile, gun and charge; E_g, the energy of the powder gases due to their high temperature; and E_f, the energy dissipated by friction and direct heat losses. The energy equation may hence be written

$$E_c = E_k + E_g + E_f.$$

It remains to reduce this to the form of a differential equation To do this it is necessary to find suitable expressions for each of the terms.

As regards the term E_c it will be assumed that a unit weight of a specified powder liberates by its "combustion" a definite quantity of energy, n', and that this may be measured either in mechanical work that the resulting gas could do by expanding adiabatically to infinite volume and zero pressure, or in heat units that the gas would give up by cooling to absolute zero. It is obvious that neither of these processes can be carried out even approximately; but the absolute zero of temperature or pressure merely provides the most convenient energy level to reckon from. The quantity n' is called the specific energy of the powder and depends on its chemical composition and its temperature when fired. In certain cases where the pressure or temperature is unusually high the value of n' may depend somewhat on the pressure at which the combustion takes place; but in general this dependence is negligible. If the weight of the charge is c and the fraction which at any instant has been burned is G, then $cn'G$ is the energy released by the combustion proper. If, however, the gases originally generated undergo any further reaction upon cooling, this reaction will liberate an additional amount of energy (see CHEMICAL ACTION and THERMOCHEMISTRY) and mill produce a slight progressive increase in the value of n'.

The value of E_k is the sum of the kinetic energies of the projectile, gun and charge, the last including the powder gases and the unburned powder. The kinetic energy of the projectile includes that of rotation as well as translation. Of all these the energy of translation of the projectile is the principal component and is far greater than all the rest combined. In gravitational units it is equal to $pv^2/2g$, where p is the mass of the projectile, v its velocity and g the acceleration of gravity. By the principle of the conservation of momentum it is easy to show that the other components of the kinetic energy bear a ratio to this principal one which is very nearly constant for any given

round. Hence the combined kinetic energies may be written $E_k = p'v^2/2g$ where p' is called the reduced weight of the projectile, and is easily formulated as a mass slightly greater than that of the projectile alone.

The value of E, at any instant depends upon the fraction of the charge which has up to that instant been converted into gases, upon the chemical composition of these gases, and upon their pressure, temperature and volume, the last three being connected by the characteristic equation or equation of state (see LIQUEFACTION OF GASES) of the powder gas mixture. The composition of the powder gases depends of course upon that of the powder, and nearly all powders consist exclusively of compounds of the four elements, hydrogen, oxygen, nitrogen and carbon. (*See* EXPLOSIVES.) The composition depends also upon the equilibrium constants of the possible reactions among the powder gases, as was pointed out in discussing E_c, so that it varies with the (approximately adiabatic) cooling and expansion of the gases as the projectile moves forward. In all cases the principal constituents are the five gases, CO, CO_2, H_2O, H_2, and N_2. For the powder gases from nitrocellulose powders, which have a relatively low combustion temperature (2600°–2700°C.), or the NH powders, which are still cooler, and for any powder gases after moderate expansion, the presence of other gases is negligible. In the hotter gases from such powders as cordite before much expansion has taken place, there may be appreciable quantities of OH, NO, O_2, H, O, N, and possibly others, their combined concentration not exceeding 10% of the whole in any ordinary case. When only the five common gases are present, their relative amounts are completely determined by the amounts of the elements and the value of the equilibrium constant for the water gas reaction $CO+H_2O \rightleftarrows CO_2+H_2$, this constant depending mainly on temperature and very slightly on pressure.

The equation of state of each of the powder gasesmay bewritten

$$P(V-nB)=nRT, \tag{1}$$

where P, V and T are respectively the pressure, volume and absolute temperature of the gas, n is the number of gram-molecules present and R is an absolute constant. The quantity B is called the co-volume. It may be regarded as defined by equation (1); but for the high temperatures and pressures occurring in the powder gases B is nearly constant for each gas and there is a tendency for the slight variations of B in the individual gases to compensate each other in the powder gas mixture, so that (1) may be regarded as a very satisfactory equation for the mixture with B constant if n is replaced by Σ n, the sum of the numbers of gram molecules of all the gases. It is also an empirical fact that ΣnB for the powder gas mixture bears a nearly constant ratio to the volume of the solid powder, the ratio for nitrocellulose powders being very close to $3/2$. If covolume of unit weight of gas is called b we may replace ΣnB by bcG. It is then easy to show that the energy of the powder gases may be written

$$E_g = (V - bcG)/\beta$$

where

$$\frac{1}{\beta}=\frac{\Sigma n\int_0^T C_v dT}{RT\Sigma n}. \tag{2}$$

Here C_v is the molecular heat at constant volume, which is known for each gas as a function of T, the function being determined at moderate temperatures experimentally, and at higher temperatures by quantum theory (*q.v.*) from spectroscopic data. (Molecular heat is specific heat with the gram-molecule as unit of mass.) The dependence of E_g upon temperature and gas composition is thus confined to the factor β whose evaluation does not require a very accurate determination of the gas composition. With the latter known we may write

$$T=P(V-bcG)/R\Sigma n \tag{3}$$

Our knowledge of E_f is less satisfactory than that of any other term. The work of Crow and Grimshaw (see *Bibliography*) has included investigation of the thermal part. The frictional part may be further subdivided into band resistance and gas friction. The latter has been neglected until comparatively recently, but is probably of considerable importance in small arms. So little has been known about E_f that its analytic expression has been dictated mainly by convenience. Thus French writers frequently incorporate its effect in p'. In America an equivalent practice has been followed except that a separate provision has been made in the initial conditions for the increased band resistance at starting. With this provision we write $E_f = e_p E_k$ and assume e_p to be constant for the round.

The energy equation then will appear in the form

$$cGn' = \frac{(1+e_p)p'v^2}{2g}+\frac{P(V-bcG)}{\beta}. \tag{4}$$

It is customary to reduce this to the form of a differential equation with the time t as independent variable, and one of the dependent variables equal to u, the projectile travel with respect to the bore. This makes

$$v=\frac{1}{1+e}\frac{du}{dt'} \tag{5}$$

where e is the ratio of recoil velocity to projectile velocity. Also if C is the chamber volume and A the cross-sectional area of the bore, $C+Au$ will be the volume of powder and gases. If ϵ is the specific volume of the powder, the volume of the unburned powder is $c\epsilon(1-G)$ and hence

$$V=Au+C-c\epsilon(1-G). \tag{6}$$

Equation of Motion. — The evaluation of P is effected most conveniently by reducing the equation of motion to an energy form. Since the work done in pushing the projectile along the bore is equal to E_k+E_f, we may write

$$A\int_0^u P du=\frac{(1+e_p)p'v^2}{2g}$$

Differentiating this gives

$$AP\frac{du}{dt}=\frac{(1+e_p)p'v}{g}\frac{dv}{dt},$$

and hence

$$P=\frac{p'(1+e_p)}{gA(1+e)^2}\frac{d^2u}{dt^2}. \tag{7}$$

The substitution in (4) of the values of v, V, and P from (5), (6) and (7), reduces it to a differential equation of the second order in u with auxiliary variables β and G. The value of β can be found from (2) and (3). Only G then remains to be evaluated.

Law of Burning. — To evaluate G it is necessary to formulate certain assumptions. These are that all grains in the charge and all parts of the surface of each grain are ignited simultaneously. that the burning takes place by parallel layers (Piobert's Law, 1840), and that the linear rate of regression of the surface of a grain is a known function of the pressure. Most experimental evidence, but not all, tends to justify Piobert's Law. Ignition is probably almost simultaneous for a well designed charge (cf. Fig. 1). The law of burning that has been most commonly used is Vieille's Law (1893) which states that the linear rate of burning is proportional to some power of the pressure. The exponent of this power, however, has been given a variety of values lying between 0·5 and 1·0. There is little physical justification for a law of this form. All recent investigation points to a rate of the form a_0+a_1P where a_0 and a_1 are constants.

There still remains the determination of G in terms of the thickness burned from the surface. This is a purely geometric problem, involving only the size and shape of the grain. In fact if we replace the linear thickness burned by z the fraction of the web burned (where the web is the least linear dimension of the grain), the form of G as a function of z depends only on the shape of the grain, and is readily evaluated by elementary methods Most of the commonly used shapes of grain are degressive, *i.e.*, dG/dz decreases as z increases. The simple hollow cylinder has dG/dz nearly constant, and is said to be of constant emission. Powder for American artillery is usually progressive, *i.e.*, dG/dz

increases with z. This is accomplished by making the grains multiperforated, that is, provided with several cylindrical perforations (usually seven) all parallel to the axis. As the grains burn the areas of these surfaces increase in the aggregate more rapidly than the area of the outer surface diminishes. In this powder when the web is burned through, the grain is not completely consumed, but breaks up into "slivers" whose burning is of course degressive.

From the law of burning G is a known function of z, and z satisfies a differential equation of the form

$$\frac{dz}{dt} = \frac{f(P)}{w} \tag{8}$$

where w denotes the web thickness.

Treatment of the Equations. — Equation (8) and the second order equation derived from (4), together with the various auxiliary relations which have been developed, form a self contained system of which a solution is uniquely determined by a set of initial conditions. These include $u=o$ when $t=o$, and P equal to the pressure necessary to overcome the initial band resistance. This requires that the burning should have proceeded to an appreciable extent, so that z and G will not be initially zero. The solution of the system of equations can be carried out in any particular case by the process of numerical integration, or mechanical integration, both of which are discussed in the section on *Exterior Ballistics*. The achievement of any general theory by this method would, however, involve an entirely prohibitive amount of labour, since solutions would be needed for all possible combinations of a large series of values of each of the parameters, c, C, p, A, n', and various others having an appreciable effect. It is possible, however, to make a transformation of variables such that the number and effect of the independent parameters is very greatly reduced. This may be done in a variety of ways. For example, the travel u may be replaced by the *expansion ratio* $(C+Au)/C$. This clearly eliminates the great variation due to the difference in the size of guns. The two parameters c and C are often replaced by their ratio which, if measured in metric units, is called the density of loading. Changes of variables and combinations of parameters may be selected which will reduce the number of parameters and the effects of those that remain to such an extent that all possible cases may be computed and exhibited in a table or set of charts of reasonable extent.

The relations connecting the various parameters and variables of the original equations which become identified in this way is known as the theory of ballistic similitudes. It has been largely cultivated by French writers, but the most important single contribution is that of Rŏggla's diagrams (see *Bibliography*). The method of using such a set of diagrams or tables is as follows The known quantities, such, for example, as the dimensions of the gun, weight of projectile, weight of charge, etc., are combined by certain simple formulas to give arguments for entering the tables or charts The entries thus obtained are then combined with the known quantities to give the desired data, such as muzzle velocity, maximum pressure, time of travel, pressure or velocity at any point, etc. The short algebraic manipulations preceding and following the entries in the tables or charts make possible the condensation of the latter to an enormous extent, with a corresponding saving in labour both in preparing and in using them.

Empirical Factors. — Both in the tables or charts and in the formulas which are used with them, there are certain approximations, some explicit, some tacit. For example the factor e_p used in expressing the energy dissipated is likely to be poorly determined. Of course, the aim is always to reduce these doubtful influences to a minimum. Until they are eliminated it remains necessary to introduce empirical factors in order to "fit the firings." The principle upon which an empirical factor is introduced is that, whatever the nature of the unknown influence may be, it varies slowly and regularly. The value of such a factor for one firing, can therefore be estimated with considerable accuracy if its value is known for one or more firings under reasonably similar conditions. In this way, every available element of theory is utilized; but the final result is amended in the most plausible way to agree with observed facts for which the theory is not quite adequate. Two such empirical factors are commonly necessary in interior ballistics, one for muzzle velocity and one for maximum pressure, since these two are both routine measurements.

Experimental Data. — The foregoing discussion has been almost wholly theoretical. Experiment is needed both to verify and to complete the theory. For example, it was said that burning takes place by parallel layers and the linear rate has the form a_0+a_1P. Besides the need for justifying such statements, it is necessary to determine the values of a_0 and a_1 for a particular powder and to determine what these coefficients depend on. These are specifically ballistic problems. General physical theory may shed light on them; but concrete results must be obtained by observations actually performed on explosives. On the other hand, specific heats of gases, equations of state, heats of formation, equilibrium constants, etc., are matters of general interest in physics and chemistry, and fairly full information on these things may be found in general scientific literature. The distinction is not fundamental; but it is convenient here for the purpose of limiting the kinds of experimental data discussed.

There are two principal types of experimental firings in interior ballistics, those in a gun and those in a *closed chamber*. This latter is a vessel similar to the chamber of a gun except that it is permanently closed where the gun chamber is only temporarily closed by the projectile. If a charge of powder is fired in such a vessel, one may investigate the law of burning of the powder and certain features of the gas laws without the complication due to the change of volume of the gases and particularly the unknown passive resistance. Noble and Abel (1870) carried out the first extensive closed chamber experiments. They obtained extremely important results in spite of the fact that their instrument for measuring pressure gave them only the maximum pressure. and not a time record.

The measurement of pressures is not peculiar to ballistics; but there are certain distinctive features about methods suitable for the measurements of pressures whose complete rise and fall may last only a few ten-thousandths of a second and be accompanied by temperatures well above 3000°C. The commonest and simplest device for this purpose is the *copper crusher gauge*. This consists of a housing in which a freely moving steel piston has its outer end exposed to the powder gas pressure and its inner end compresses a small copper cylinder, which is replaced after each measurement. The outer end of the piston is provided with a copper obturating cup to prevent the leakage of gas into the housing The pressure is determined by measuring the length of the copper cylinder before and after using, and interpreting this in terms of powder gas pressure by an empirical calibration. One or more gauges of this sort may be placed loose in the chamber of a gun along with the powder or may be inserted in recesses made for the purpose in the chamber wall. Such a gauge records only the maximum pressure; but this is sufficient for routine purposes of proof firing of guns or acceptance tests of powder. It furnished the only pressure data in the pioneer work of Noble and Abel, and crusher gauge records are useful in ballistics even yet, because they exist in such large numbers over such a variety of conditions, that they may be made to furnish a statistical check on any proposed theory.

In the work of Noble and Abel, the maximum pressures furnished the following items of information. When combustion is complete, equation (3) becomes

$$P(V-bc)=RT\Sigma n. \tag{9}$$

For a given kind of powder Σn is proportional to c, and the combustion temperature T_c is independent of c Hence $f=RT_c\Sigma n/c$ is a quantity characteristic of the powder. It is called its *force* and is a quantity which may be used instead of specific energy in a modified form of the energy equation. Equation (9) may then be written $P(V-bc)=cf$, or

$$\frac{V}{c}-b=\frac{f}{P}.$$

Since V, b and f are constants, this is a linear equation in $1/c$ and $1/P$, with constant coefficients, of which V is known. If the ex-

periment is performed with various charges of the same kind of powder in the same chamber, plotting $1/P$ against $1/c$ should give a straight line from nhich b and f can be immediately determined. If the plotted points actually lie on a straight line the hypotheses used are measurably verified. If they do not, one must seek experimental errors before abandoning the theory. For example, cooling of the gas by the walls of the chamber may lower its temperature so that the theoretical maximum pressure is never reached, and this cooling will modify the results more with a small charge than with a large one. This question of a "cooling correction" has persisted as a difficulty in interpreting experiments in interior ballistics to the present day (1940). The most effective way of dealing with it is the use of closed chambers of different sizes, the larger the better.

Experiments giving only the maximum pressure throw no light on the law of burning. In *1893* Vieille modified the crusher gauge so as to bring one end of the piston outside the chamber and so allow a recording stylus to be attached to it. This permitted a time record of the rise in pressure. This apparatus is subject to various errors including a lag due to the inertia of its moving parts. The Petavel gauge (1905) uses the elastic deformation of steel instead of the plastic deformation of copper and greatly diminishes this defect. The piezo-electric gauge devised by Sir J. J. Thomson (1917) makes use of the electric charge developed on crystals of tourmaline or quartz by application of pressure. This gauge may be used to record pressures in guns as well as closed chambers, since the recording apparatus (a cathode ray oscillograph) is connected to the gauge itself only by wires, and hence is not affected by the motion of recoil. The pressure records in Fig. 1 were made by a piezo-electric gauge. It is clear that a time record of the pressure in a closed chamber affords a very substantial check on any law of burning. When this has been established, pressure records in a gun, in conjunction with chronograph records of projectile travel, check various other parts of the theory.

EXTERIOR BALLISTICS

After the projectile has moved a short distance from the muzzle, so that it is free from the muzzle blast, it is acted on by only two forces, gravity and air resistance. Under the influence of these two, its centre of mass describes a certain curve in space called its *trajectory*. The determination of a trajectory, which is the principal problem of exterior ballistics, includes not only a knowledge of the curve, but of the time relation also, that is, it is necessary to determine the co-ordinates as functions of the time t.

A trajectory derived on the assumption that air resistance can be neglected is called a vacuum trajectory. *(See* MECHANICS.) Its chief utility in practical ballistics is to serve as a limiting case. Only very rarely can it be regarded as a useful approximation to an actual trajectory.

All modern military projectiles have roughly the shape of an elongated cylinder with a more or less pointed "nose." For satisfactory flight such projectiles must be maintained "nose on," *i.e.*, their axis of figure must remain nearly tangent to the trajectory. With respect to this requirement, they are classified as *spin stabilized* and *fin stabilized*. The former are maintained nose on by a rapid spin imparted to them by the rifling or system of helical grooves in the bore of the gun. Their stability is very closely related to that of a top. The latter are stabilized by the attachment to the rear end of fins or vanes upon which the air exerts a restoring force when the projectile axis departs from tangency to the trajectory. Fin stabilized projectiles include all aeroplane bombs and certain mortar projectiles. All others are spin stabilized.

Differential Equations of Motion.—The general form for the equations of motion for the centre of mass of any moving body may be written

$$\frac{dx}{dt}=v_x, \quad \frac{dy}{dt}=v_y, \quad \frac{dz}{dt}=v_z, \tag{10}$$

$$m\frac{dv_x}{dt}=P_x, \quad n\,\frac{dv}{dt}=P_y, \quad m\frac{dv_z}{dt}=P_z \tag{11}$$

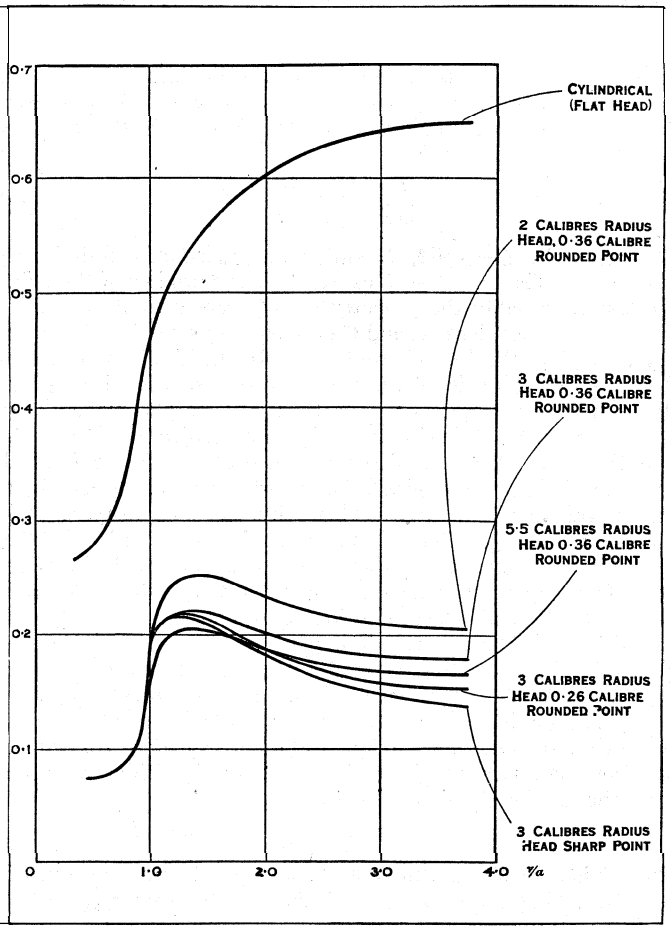
where x, y and z are the rectangular co-ordinates of the centre of mass, v_x, v_y and v_z, the corresponding components of its velocity v, and P_x, P,, P_z, the components of the resultant of all the forces acting. In ballistics the origin is taken at the point of departure, the x axis horizontally forward in the plane of fire, the y axis vertically upward, and the z axis to the right.

The complete determination of the system of forces acting on a rapidly spinning or oscillating projectile is relatively difficult and complicated. It depends not only on the characteristics of the air, the size and shape of the projectile, and the motion of the centre of mass, but also on the angular position and angular velocity of the axis of the projectile, which in turn depend on the previous action of the force system. Thus there are introduced other differential equations besides (10) and (11) which must be handled in connection with these. For many practical purposes, however, the assumption is made, and is usually sufficiently accurate except for determining deflections, that the only force necessary to consider besides gravity is the *drag*, which is that component of the total force due to air resistance whose direction is exactly opposite to that of the projectile's motion through the air. If this force is called D, and if there is no wind, the three components of D are $-Dv_x/v$, $-Dv_y/v$ and $-Dv_z/v$. It is readily seen that on these assumptions v_z and P_z will remain equal to zero, and that $P_x=-Dv_x/v$ and $P_y=-Dv_y/v-gm$. If E denotes D/mv, equations (11) become

$$\frac{dv_x}{dt}=-Ev_x, \quad \frac{dv_y}{dt}=-Ev_y-g \tag{12}$$

Here E may be called the *relative retardation* since it is the ratio of the retardation to the velocity. It remains to determine the laws governing the value of D or of E.

Considerations of dimensions *(see* UNITS, DIMENSIONS OF)



FROM DRYSDALE, "MECHANICAL PROPERTIES OF FLUIDS" (BLACKIE & SON)

FIG. 2.— THE DRAG COEFFICIENT FOR 10 CM. PROJECTILES
Showing how it varies with velocity. The effect of small changes in the shape of head can be seen in the curves. Note the effect at high velocity

verified in considerable part by experiment, lead to the form

$$D = K_D \rho d^2 v^2, \qquad (13)$$

nhere p is air density, d is projectile diameter, and K_D is called the drag *coefficient,* and is readily seen to be of zero dimensions. This means that its numerical value does not depend on the units used for mass, length, time, etc. The drag coefficient is a function of v/a, where a is the velocity of sound in air. This argument v/a is also of zero dimensions. The form of the function K_D depends notably upon the shape of the projectile, as is illustrated in Fig, 2. The various drag coefficients whose graphs are there given, are based on the Krupp experiments of 1912. Similar ones for other shapes have been developed elsewhere. One particular drag coefficient, however, known as the Gâvre function dominated ballistic practice for many years. This resembles rather closely the curve in Fig. 2 for a two calibre ogive. This function was formulated in 1898 by the French Commission d'Expérience de GBvre and was based on an exhaustive study of previous firings in many countries. Since, however, nearly all of these firings had been done with projectiles approximating to the particular shape mentioned, the GBvre function applied only to this shape, but was used by ballisticians for a long period for projectiles of all shapes.

Ballistic Coefficient. — When the differential equations for a particular trajectory are desired there are certain sources of inaccuracy connected with substituting the value of D from (13), in addition to the observational errors connected with any experimentally determined quantities. Only in rare cases will the shape of the projectile agree exactly with one of those for which a drag coefficient has been determined. Of course that one will be selected which is the best approximation; but the error due to the discrepancy may be appreciable. Moreover, on any actual trajectory the projectile has some yaw, *i.e.,* its axis is not exactly tangent to the trajectory, whereas the drag coefficients are determined for a yaw as nearly as possible equal to zero. As a result of yaw the magnitude of the drag is changed, and there may also be introduced an appreciable effect of a component of resistance perpendicular to the drag. To meet these conditions there is introduced into (13) a factor i called a form factor. On this basis we may write

$$E = \frac{D}{mv} = \frac{K_D i \rho d^2 v}{m} = \frac{GH}{C} \qquad (14)$$

where $H = \rho/\rho_0$, $C = m/id^2$, $G = v\rho_0 K_D$, and ρ_0 is standard air density at sea level. The form GH/C expresses E as a product of three factors having roughly the property that G depends only on velocity, H only on air density, and C only on the projectile. The quantity C is called the ballistic *coefficient.* In the ideal case it is constant for a given projectile. In nearly every case it is taken as constant for a given trajectory, even if it is necessary to make it vary between different trajectories for the same projectile. The variation is possible because of the presence of the factor i, which functions in exterior ballistics in the same way as the empirical factors mentioned in interior ballistics. The quantity G is in practice frequently taken as a function of v only and is tabulated for convenience against v^2, there being a separate table for G derived from each experimental drag coefficient such as shown in Fig. 2. (The significance of a in the argument v/a will be discussed later.) The quantity H is proportional to the air density. This depends somewhat on weather variations, but much more upon altitude above sea level, especially for firings from large guns. The method for treating density is to adopt a particular type of air structure as standard and obtain standard trajectories based on that. Other trajectories are then dealt with as variations from these. For standard air structure,

$$H = e^{-hy}, \qquad (15)$$

where h is a constant, commonly taken equal to 0·0001036 if y is in metres. This gives a good approximation to average conditions up to an altitude of 10 kilometres.

Trajectory Computation. — Under standard atmospheric conditions, which include the density law just stated, and the absence of wind, the computation of a trajectory consists in finding a particular solution of the system of differential and auxiliary equations (or their equivalent) which consist of (10), (12), (14) and (15), where C is given some constant value, G is a tabular function of v^2 and $v^2 = v_x^2 + v_y^2$. These equations are very far from representing all the physical facts which are known about the motion of projectiles. They represent, however, an approximation, which from 1914 to the present (1940) has been generally regarded as sufficiently accurate for the preparation of firing tables except for deflections. A great variety of transformations have been applied to these equations for the purpose of facilitating the solution. Among the most obvious of these is the selection of a variable other than t as independent variable. This may be a variable already present, such as x or v_x, or some new variable. Among new variables θ, m and v_x are often used, where $m = v_y/v_x = \tan\theta$. Such alternative systems of differential equations may be derived independently or by transformations of those given here. The suitability of a transformation depends on the ultimate method of solution contemplated and sometimes upon the type of initial conditions.

Prior to 1914 the usual purpose sought was to reduce the equations to a form susceptible of one of the classical methods of solution such as in terms of elementary functions, or series, or at worst, quadratures, or to a form which by a slight alteration would make one of these methods applicable. No such method capable of general application was found; but the method of Siacci (1880) is highly effective for trajectories where the direction of motion remains within a few degrees of the horizontal. This method uses a constant multiple of v_x as independent variable, makes an alteration in the differential equations, which is very small under the conditions noted, and achieves a complete solution of the equations thus modified in terms of four independent quadratures. A table of one argument giving the results of these four quadrature~which are called the primary Siacci functions, provides for the convenient solution of a great variety of trajectory problems, provided the projectile has the shape corresponding to the drag coefficient used in the quadratures and the Siacci restriction on angle applies.

In the general case the methods of attack on the differential equations are graphical, numerical and mechanical. These methods are of a general nature and not peculiar to the equations of ballistics. The graphical method for solving differential equations in general has been developed by various mathematicians. Application to the ballistic equations has been made by Cranz; but the method has not been very widely used. More recently mechanical methods of solution have been developed; but up to 1940 their use is much restricted because the necessary machines are few and costly. These are of t o types. One is a machine specially designed to solve the ballistic equations. A recent example of this is the Flugbahn-Rechengerat proposed by Fiisgen in 1937. The other is the Bush Differential Analyzer (see MATHEMATICAL INSTRUMENTS and PRODUCT INTEGRAPH) which is designed to furnish solutions of a very general class of systems of differential equations, and may be used to obtain those of the ballistic equations.

Numerical Integration. — Since 1917 the principal method of trajectory computation when the Siacci method is not applicable has been some form of numerical integration. The term "short arc method" is sometimes applied to any form of numerical integration, and sometimes confined to the particular form of the method used in France. The term, however, is descriptive of the general method since it proceeds along the trajectory by short arcs. The essence of the method is the assumption that each variable in the equations can be represented with sufficient accuracy in a short enough interval by a polynomial in the independent variable whose degree is usually not greater than the fourth. On this assumption it is easy to derive a formula expressing the difference in the function over a particular interval, in terms of several consecutive values of the derivative, or for convenience, one value and several orders of differences. If, then, the value of the function is known at one point it can be computed by this means at a point slightly farther along. If all the dependent variables are computed in this way at the new point, they may be

substituted in the differential equations to evaluate the derivatives at the new point. The new values of these will either verify or revise the values originally used for the derivatives. If they are revised the process is repeated until no further revision occurs. The whole procedure is then repeated for the next interval, and so on. It remains to explain how this process can be started, since it calls for the use of "several consecutive values of the derivative." Probably the simplest way is to start the integration with such small intervals that the polynomial approximation is linear. For example if the body of the computation is to use an interval of one second, one could begin with values of t equal to $\frac{1}{4}$, $\frac{1}{2}$, 1, $\frac{3}{2}$, 2, 3, . . ., or even prefix $t=\frac{1}{8}$. The process of numerical integration is laborious but has the great merit that it is applicable to any system of differential equations and so exerts no restriction on the physical hypotheses made in setting up the differential equations.

In the United States the method of numerical integration has been applied most commonly to the differential equations in the form in which they are derived in this article, the form developed for the whole process being due to Moulton In Great Britain and France essentially the same method has been applied to equations which may be derived from these by a change of variables, but some accounts of these methods have not separated the explanation of the change of variable from that of the method of integration. In the British method the independent variable is t, but m and $1/v_x$ are introduced as dependent variables. In the notation used here the equations in these variables are

$$\frac{dm}{dt}=\frac{-g}{v_x}, \quad \frac{d}{dt}\left(\frac{1}{v_x}\right)=\frac{E}{v_x}, \quad v_y=mv_x,$$

with the equations for x and y unchanged. The particular merit of this form of the equations is the smoothness at the beginning. The quantity m has its variation slowest near the muzzle. This makes it possible to start with longer steps than in the American method. The latter, however, requires less labour of computation per step.

Considerably prior to 1917 a highly specialized form of short arc method was developed in France by Garnier and Haag, and later modified by Marcus. In 1919 a somewhat similar form was used in the preparation of the **A.** L. V. F. Tables, a very comprehensive collection of trajectory results. The trajectory method for this table was essentially the use of an independent variable

$$\xi=\int_0^\theta \sec^3\theta d\theta,$$

and a set of differential equations

$$\frac{d}{d\xi}\left(\frac{1}{v_x^2}\right)=\frac{-2E}{gv}, \quad \frac{ds}{d\xi}=\frac{-v_x^2}{g}$$

where s is arc length and hence $dx/ds=\cos\theta$ and $dy/ds=\sin\theta$. In this method, in order to expedite the integration process, a special device was used which depends on the particular equations.

Differential Variations.—Unless mechanical integration is used the computation of a trajectory is so laborious that every device is sought to keep the number of trajectories as small as possible and extract the maximum amount of information from each one computed. To this end the method of differential variations was developed. By this, from a single trajectory one may infer with a high degree of approximation the values belonging to a large number of others provided the determining conditions for these do not differ too widely from those of the original. In this connection the conditions of the original trajectory are called standard and those of the inferred trajectories non-standard. Thus a trajectory is computed with a particular muzzle velocity, angle of departure, and ballistic coefficient, with standard density, standard temperature and no wind. Any variation from these conditions is called non-standard. If we denote by x and y the co-ordinates on the standard trajectory at any time t, and by $x+\xi$ and $y+\eta$ the co-ordinates on the non-standard trajectory at the same time, then for the former, (10) and (12) may be combined as

$$x''=-\mathrm{E}x', \quad y''=-Ey'-g, \tag{16}$$

and the corresponding equations for the latter will be

$$x''+\xi''=-(E+\Delta E)(x'+\xi'), \quad y''=-(E+\Delta E)(y'+\eta')-\mathrm{g}, \tag{17}$$

where $E+\mathrm{AE}$ is the new value of E obtained when x', y' and y are replaced by $x'+\xi', y'+\eta'$ and $y+\eta$. If $\xi, \eta, \Delta E$, etc., are regarded as small quantities in the sense that the product of any two of them can be neglected, then expanding (17) and simplifying by subtracting (16) and dropping second order terms, will yield

$$\xi''=-E\xi'-x'\Delta E, \quad \eta''=-E\eta'-y'\Delta E. \tag{18}$$

It can be shown that ΔE may be expressed linearly in terms of ξ', η' and η. This makes it possible to reduce (18) to a system of four linear differential equations of the first order in which the independent variable is t, and the coefficients are functions of t which are known by means of the standard trajectory. Two well-known mathematical theories are then available. One of these, employed by Moulton, proceeds from the fact that the general solution of such a system is linearly dependent on a "fundamental set" of particular solutions. This is applicable to differential variations of anti-aircraft trajectories, where the variations are needed at all points of the trajectory. The other theory is that of the *adjoint system*, developed by Bliss and Gronwall. This is an extremely efficient method for finding range variations, that is, displacements of the point of fall, due to all possible causes Since range variations are the only ones of importance in ground fire, the second method is preferable for this case. In each method it is necessary to find one or more particular solutions of a system of equations by numerical integration; but the labour is much less than that of computing the large number of new trajectories otherwise necessary.

Of course in order to apply either of these theories it is necessary to know what change in the differential equations or in the initial conditions is made by the introduction of any particular non-standard conditions. A change in muzzle velocity or angle of departure affects the initial conditions. Thus for a change Δv in muzzle velocity, $\xi_0'=\Delta v\cos\phi$ and $\eta_0'=\Delta v\sin\phi$, but for a change $\Delta\phi$ in angle of departure, $\xi_0'=-v_0\Delta\phi\sin\phi$ and $\eta_0'=v_0\Delta\phi\cos\phi$. For these two cases there is no change in the differential equations. For the other cases $\xi_0'=\eta_0'=0$; but there is a change in the differential equations. Of course in all cases $\xi_0=\eta_0=0$. The change in the equations due to a change in ballistic coefficient is explicit from (14). A change in density obtained by multiplying the standard density by a constant factor is also seen from (14) to be equivalent to multiplying C by the reciprocal factor. In discussing the drag coefficient K_D it was stated that its argument is v/a where a is the velocity of sound in air. The variation in the factor $1/a$ was then ignored. It must be considered in connection with temperatures. It is known that the velocity of sound in air is proportional to the square root of the absolute temperature. A change in temperature therefore alters K_D and hence G by changing the value of a and hence of the argument v/a.

In discussing the effect of wind on a trajectory it is convenient to resolve the wind vector into two components, the *range wind* in the plane of fire and the *cross wind* perpendicular to this. Since the air resistance is clearly dependent on the velocity of the projectile with regard to the air, the presence of a range wind of velocity w requires that in (16) x' shall be replaced by $x'-w$ both where it occurs explicitly and also in the formation of E. Cross wind will be discussed under deflections. The effect of the rotation of the earth need be considered only in the case of large guns. It can be shown that this effect replaces (16) by the equations,

$$x''=-Ex'-Ky', \quad y''=-Ey'-g+Kx',$$

and makes a corresponding change in (17), where $\mathrm{K}=2\Omega\cos\mathrm{L}\sin\alpha$, L is latitude, α is azimuth of fire measured from the north and Ω is the earth's rotational velocity in radians per second.

For a standard trajectory, the formal assumption is made that $z=0$. Any deflection is on this basis a differential variation. There are deflections due to cross wind and to the rotation of the earth, the treatment of which calls for the use of a differential equation in z similar to those given for x and y. In the case of a spin-stabilized projectile, the standard trajectory has a small deflection called *drift*. (*v. infra*)

The foregoing discussion has outlined the kinds of computations necessary in the preparation of a firing table. Such a table includes (a) a range elevation relation or table giving, for the particular gun in question, the elevation necessary to reach any range under standard conditions, and (b) a series of tables of differential effects each of which gives the effects on range or deflection of some particular departure from standard conditions, such as a decrease in muzzle velocity of 50ft./sec., an increase of 1% in air density or a cross wind of 10mi./hr. In the case of density, wind and temperature, the effects are given on the basis of the non-standard condition being constant for the whole trajectory. This is never the case in practice. All these conditions show variation with altitude, that of the wind being specially large. **A** method of dealing with this variation is the following.

Weighting Factors.—With either system for differential variations it is possible to find the effect of a non-standard condition beginning

at an arbitrary point of the trajectory. In the method of the adjoint system, this is especially easy. In fact it requires no additional work whatever except in the case of temperature, and in that case merely recording the intermediate sums in performing a quadrature. Thus in the case of a range wind or cross wind for example it is possible to write the effects of unit wind blowing in the last 5 seconds of the trajectory, in the last 10 seconds, and so on. If this effect is expressed as a fraction of the effect of the wind on the whole trajectory, it constitutes a *weighting factor* for that part of the trajectory. Clearly any part of the trajectory whatever can be expressed as the difference of two parts of this kind. If then different winds blow in different parts of the trajectory the total result is that of a weighted mean of the different values where the weights are furnished by the weighting factors thus derived. Such a weighted mean is called a *ballistic mnge wind* or *ballistic cross wind*. There is a similar meaning for *ballistic density* and *ballistic temperature*. These then are the factors which should be applied to the effects of unit wind, density variation or temperature variation to obtain the actual effect.

Range Firings and Their Reduction.—Standard trajectories for a given weapon can be computed only if appropriate values of C for the projectile are known. These are obtained from *range firings*, that is, firings at various angles of elevation (and for a zoned weapon, various muzzle velocities) in which the range, all firing conditions, and all weather conditions are carefully observed. The method of obtaining the value of C from such a firing is essentially that of trial and error, but the application of differential variations usually makes one trial sufficient. With the muzzle velocity and angle of departure of the range firing and an estimated C there is computed a standard trajectory and a set of differential variations. The observed range is then corrected for the weather conditions, etc., by means of the differential variations and the corrected result compared with the computed range. The discrepancy is attributed to error in C, of which the magnitude can he found by means of the differential variation for density, provided the discrepancy is not too great. In the latter case, the procedure must be repeated with an improved value of C for the trial. The final value of C for each range-firing point is then plotted and a smooth curve drawn which gives the values of C to be used for the firing table.

The Projectile as a Rigid Body.—The simplified hypothesis employed in deriving equations (12) is reasonably adequate for treating the topics dealt with up to this point. This hypothesis, that the drag is the only component of air-resistance, is virtually correct for small values of the *angle of yaw*, that is, the angle between the projectile axis and the tangent to the trajectory. A much more comprehensive theory is necessary to determine under what circumstances this angle remains small (*i.e.*, when is the projectile *stable)* and to account for the phenomenon of drift in spin-stabilized projectiles No account of that theory can be given here, but only a few words of description of the phenomena involved. The disturbance due to launching may produce a relatively large initial yaw. This produces a correspondingly large *cross wind force* or component of air resistance perpendicular to the drag and in the *plane of yaw*, which is the plane containing the projectile axis and the tangent to the trajectory. In the case of a spinning projectile, however, the plane of yaw rotates very rapidly at this stage. Consequently the direction of the cross wind force is repeatedly reversed and produces relatively little lateral displacement, so that the actual trajectory has merely a slight "corkscrew" shape winding around the smooth curve given by the simpler hypothesis. For a well-designed projectile, the initial yaw is quickly damped out; but as soon as the curvature of the trajectory due to gravity becomes appreciable a slight yaw due to this cause is introduced. The immediate effect of this is for the nose of the projectile to point above the trajectory. Because of gyroscopic action, however, the plane of yaw precesses slowly to the right if the spin is to the right. This introduces a cross wind force which continues to act to the right and so produces the drift.

Experimental Data.—The most fundamental data of exterior ballistics to be derived from experiments are the various drag functions. The finding of the value of one of these at a particular point requires the simultaneous determination of a velocity and a retardation. This can be done by a record of the times at which a projectile passes three or more points. This record may be made electrically by the projectile in a variety of ways, such as making or breaking an electric circuit, producing a current in a solenoid, etc. Data on the yaw of the projectile may be obtained by observing the shape of the hole it makes when fired through a cardboard, or by spark photographs, *i.e.*, shadow pictures made of the projectile in flight by the light of an electric spark of very short duration.

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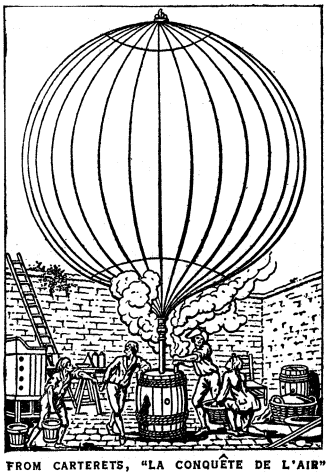
BALLOON, a bag of impermeable material which, when inflated with gas lighter than air, rises from the ground.

Invention of the Balloon.—The first practical balloon was invented by Joseph Michel Montgolfier (1740–1810) and Jacques Étienne Montgolfier (1745–99), of Annonay, a town about 40m. from Lyons The brothers had observed the suspension of clouds in the atmosphere, and it occurred to them that if they could enclose any vapour of the nature of a cloud in a large and very light bag, it might rise and carry the bag with it into the air. Towards the end of 1782 they inflated bags with smoke from a fire placed underneath, and found that either the smoke or some vapour emitted from the fire did ascend and carry the bag with it. Being thus assured of the correctness of their views, they determined to have a public ascent of a balloon on a large scale. They accordingly invited the States of Vivarais, then assembled at Annonay, to witness their aerostatic experiment; and on June 5, 1783, in the presence of a considerable concourse of spectators, a linen globe of 105ft. in circumference was inflated over a fire fed with small bundles of chopped straw. When released it rapidly rose to a great height, and descended, at the expiration of ten minutes at the distance of about $1\frac{1}{2}$ miles. This was the discovery of the balloon The brothers Montgolfier imagined that the bag rose because of the levity of the smoke or other vapour given forth by the burning straw; and it was not till some time later that it was recognized that the ascending power was due merely to the lightness of the heated air compared to an equal volume of air at a lower temperature. In this balloon no source of heat was taken, so that the air inside rapidly cooled, and the balloon soon descended.

The news of the experiment at Annonay attracted so much attention at Paris that Barthélemy Faujas de Saint-Fond (1741–1819), afterwards professor of geology at the Musée d'Histoire Naturelle, set on foot a subscription for paying the expense of repeating the experiment. The balloon was constructed by two brothers of the name of Robert, under the superintendence of the physicist, J. A. C Charles. The first suggestion was to copy the process of Montgolfier, but Charles proposed the application of hydrogen gas, which was adopted. The filling of the balloon, which was made of thin silk varnished with a solution of elastic gum, and was about 13ft. in diameter, was begun on Aug. 23, 1783, in the Place des Victoires. Bulletins were issued daily of the progress of the inflation; and the crowd was so great that on the 26th the balloon was moved secretly by night to the Champ de Mars, a distance of two miles. On the next day an immense concourse of people covered the Champ de Mars, and every spot from which a view could be obtained was crowded About five o'clock a cannon was discharged as the signal for the ascent, and the balloon when liberated rose to the height of about 3,000ft. with great rapidity. A shower of rain which began to fall directly after it had left the earth in no way checked its progress; and the excitement was so great, that thousands of well-dressed spectators, many of them ladies, stood exposed, watching it intently the whole time it was in sight, and were drenched to the skin. The balloon, after remaining in the air for about three-quarters of an hour, fell in a field near Gonesse, about 15m. off, and terrified the peasantry so much that it was torn into shreds by them.



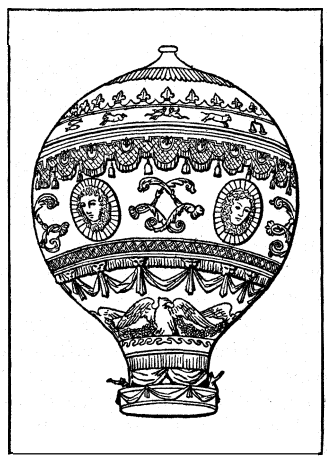
FROM CARTERETS, "LA CONQUÊTE DE L'AIR"

FIG I.—A D 1780 CHARLES' AND ROBERT S BALLOON. THE FIRST PASSENGER BALLOON TO BE INFLATED WITH HYDROGEN GAS

On Sept. 19, 1783, Joseph Montgolfier repeated the Annonay experiment at Versailles, in the presence of the king, the queen, the court and an immense number of spectators. The inflation was begun at one o'clock and completed in eleven minutes, when

the balloon rose to the height of about 1,500ft., and descended after eight minutes, at a distance of about 2m., in the wood of Vaucresson. Suspended below the balloon, in a cage, had been placed a sheep, a cock and a duck, which were thus the first aerial travellers. They were quite uninjured, except the cock, which had its right wing hurt in consequence of a kick it had received from the sheep; but this took place before the ascent. The balloon, which was painted with ornaments in oil colours, had a very showy appearance (fig. 2).

The First Balloonist.— The first human being who ascended in a balloon was Jean François Pilâtre de Rozier (1756–85), a native of Metz, who was appointed superintendent of the natural history collections of Louis XVI. On Oct. 15, 1783, and following days, he made several ascents (generally alone, but once with a companion, Girond de Villette) in a captive fire-balloon (*i.e.*, attached by ropes to the ground), and demonstrated that there was no difficulty in taking up fuel and feeding the fire, which was kindled in a brazier suspended under the balloon, when in the air. The way being thus prepared for aerial navigation, on Nov. 21, 1783, Pilâtre de Rozier and the marquis d'Arlandes first trusted themselves to a free fire-balloon. The experiment was made from the Jardin du Château de la Muette, in the Bois de Boulogne. A large fire-balloon was inflated at about two o'clock, rose to a height of about 3,000 ft., and passing over the Invalides and the École Militaire, descended beyond the Boulevards, about 9,000yds. from the place of ascent, having been between 20 and 25 minutes in the air.



FROM FOUVIELLE, "HISTOIRE DE LA NAVIGATION AERIENNE"

FIG. 2.—MONTGOLFIER'S GAS BALLOON. 1783

Inflated with hydrogen gas, this balloon rose 1,500 feet

Only ten days later, Dec. 1, 1783, J. A. C. Charles ascended from Paris in a balloon inflated with hydrogen gas. The balloon, as in the case of the small one of the same kind previously launched from the Champ de Mars, was constructed by the brothers Robert. one of whom took part in the ascent. It was 27ft. in diameter, and the car was suspended from a hoop surrounding the middle of the balloon, and fastened to a net, which covered the upper hemisphere. The balloon ascended very gently from the Tuileries at a quarter to two o'clock, and, after remaining for some time at an elevation of about 2,000ft., it descended in about two hours at Nesle, a small town about 27m. from Paris, when Robert left the car, and Charles made a second ascent by himself.

All the features of the modern balloon as now used are more or less due to Charles, who invented the valve at the top, suspended the car from a hoop, which was itself attached to the balloon by netting, etc. With regard to his use of hydrogen gas, there are anticipations that must be noticed. As early as 1766 Henry Cavendish showed that this gas was at least seven times lighter than ordinary air, and it immediately occurred to Dr. Joseph Black, of Edinburgh, that a thin bag filled with hydrogen gas would rise to the ceiling of a room. He provided, accordingly, the allantois of a calf, with a view of showing at a public lecture such a curious experiment; but for some reason it seems to have failed, and Black did not repeat it, thus allowing a great discovery, almost within his reach, to escape him. Several years afterwards a similar idea occurred to Tiberius Cavallo, who found that bladders, even when carefully scraped, are too heavy, and that China paper is permeable to the gas. But in 1782, the year before the invention of the Montgolfiers, he succeeded in elevating soap-bubbles by inflating them with hydrogen gas.

Spread **of** Ballooning.— Researches on the use of gas for inflating balloons seem to have been carried on at Philadelphia nearly simultaneously with the experiments of the Montgolfiers; and when the news of the latter reached America, D. Rittenhouse and F. Hopkinson, members of the Philosophical Society at Philadelphia, constructed a machine consisting of 47 small hydrogen gas-balloons attached to a car or cage. After several preliminary experiments, in which animals were let up to a certain height by a rope, a carpenter, one James Wilcox, was induced to enter the car for a small sum of money; the ropes were cut, and he remained in the air about ten minutes, and only then effected his descent by making incisions in a number of the balloons, through fear of falling into the river which he was approaching

Although the news of the Annonay and subsequent experiments in France rapidly spread all over Europe and formed a topic of general discussion, it was not till five months after the Montgolfiers had first publicly sent a balloon into the air that any aerostatic experiment was made in England. In Nov. 1783 Count Francesco Zambecarri (1756–1812), an Italian who happened to be in London, made a balloon of oil-silk, 10ft. in diameter and weighing 11lb. It was publicly shown for several days, and on the 25th it was three-quarters filled with hydrogen gas and launched from the Artillery ground at one o'clock. It descended after two hours and a half near Petworth, in Sussex, 48m. from London. This was the first balloon that ascended from English ground. On Feb. 22, 1784, a hydrogen-gas balloon, 5ft. in diameter, was let up from Sandwich, in Kent, and descended at Warneton, in French Flanders, 75m. distant. This was the first balloon that crossed the Channel. The first person who rose into the air from British ground appears to have been J. Tytler, who contributed largely to, and indeed appears to have been virtually editor of, the second edition (1778–83) of the *Encyclopædia Britannica.* He ascended from the Comely Gardens, Edinburgh, on Aug. 27, 1784, in a fire-balloon of his own construction. He descended on the road to Restalrig, about half-a-mile from the place where he rose.

Lunardi, 1784.—But it was Vincent Lunardi who practically introduced aerostation into Great Britain. Though Tytler had the precedence by a few days, still his attempts and partial success were all but unknown; whereas Lunardi's experiments excited an enormous amount of enthusiasm in London. He was secretary to Prince Caramanico, the Neapolitan ambassador, and his published letters to his guardian, the chevalier Compagni, written while he was carrying out his project, and detailing all the difficulties, etc., he met with as they occurred, give an interesting and vivid account of the whole matter. His balloon was 33ft. in circumference (fig. 3), and was exposed to the public view at the Lyceum in the Strand, where it was visited by upwards of 20,000 people. He originally intended to ascend from Chelsea Hospital, but the conduct of a crowd at a garden at Chelsea, which destroyed the fire-balloon of a Frenchman named de Moret, who announced an ascent on Aug. 11 but was unable to keep his word, led to the withdrawal of the leave that had been granted. Ultimately he was permitted to ascend from the Artillery ground, and on Sept. 15, 1784, the inflation with hydrogen gas took place.

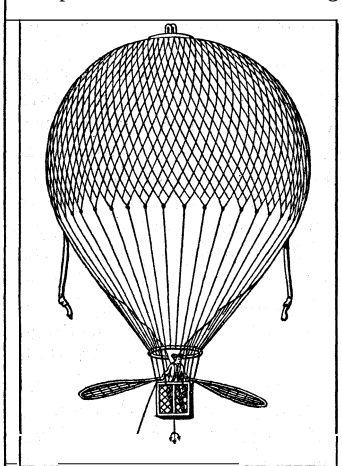


FIG. 3.—LUNARDI'S BALLOON
The balloon used in 1784, by Vincent Lunardi in his successful ascents from London, Edinburgh and Glasgow

It was intended that an English gentleman named Biggin should accompany Lunardi; but the crowd becoming impatient, the latter judged it prudent to ascend with the balloon only partially full rather than risk a longer delay, and accordingly Mr. Biggin was obliged to leave the car. Lunardi therefore ascended alone, in presence of the prince of Wales and an enormous crowd of spectators. He took up with him a pigeon, a dog and a cat, and the balloon was provided with oars, by means of which he hoped to

raise or lower it at pleasure. Shortly after starting the pigeon escaped, and one of the oars became broken and fell to the ground. In about an hour arid a half he descended at South Mimms, in Hertfordshire, and landed the cat, which had suffered from the cold; he then ascended again, and descended, after the lapse of about three-quarters of an hour, at Standon, near Ware, where he had great difficulty in inducing the peasants to come

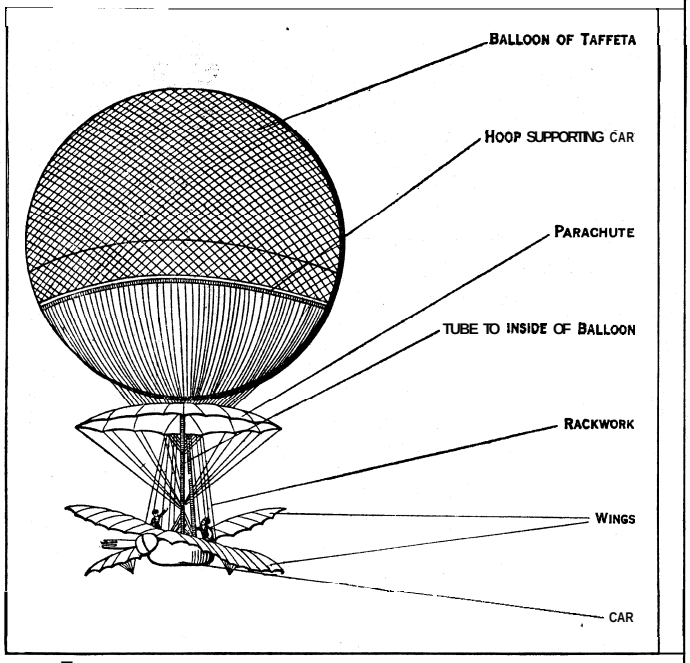


FIG. 4.—THE BALLOON OF BLANCHARD AND JEFFRIES. 1785
Structure of the balloon in which Blanchard and Jeffries made the first flight across the English channel

to his assistance; but at length a young woman, taking hold of one of the cords, urged the men to follow her example, which they then did. The excitement caused by this ascent was immense, and Lunardi became famous. In the following year Lunardi made several successful ascents from Kelso, Edinburgh and Glasgow (in one of which he traversed a distance of 110m.); these he described in a second series of letters.

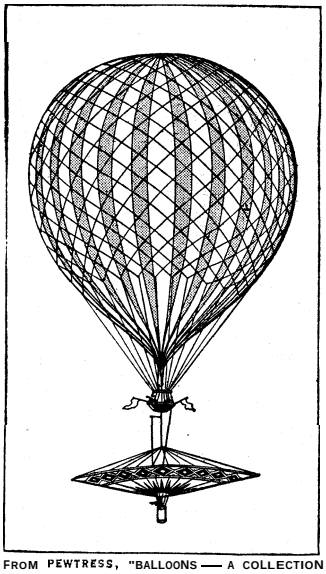
Crossing the English Channel.— The first balloon voyage across the English Channel was accomplished by Jean Pierre Blanchard (1753–1809) and Dr. J. Jeffries, an American physician, on Jan. 7, 1785. In the preceding year, on March 2, Blanchard, who was one of the most celebrated of the earlier aeronauts, made his first voyage from Paris in a balloon 27ft. in diameter (fig. 4), and descended at Billancourt near Sèvres. Just as the balloon was about to start a young man jumped into the car and drawing his sword declared his determination to ascend with Blanchard. He was ultimately removed by force. It has sometimes been incorrectly stated that he was Napoleon Bonaparte; his name in reality was Dupont de Chambon. In their Channel crossing Blanchard and his companion, who started from Dover, when about one-third across found themselves descending, and threw out every available thing from the boat or car. When about three-quarters across they were descending again, and had to throw out not only the anchor and cords, but also to strip and throw away part of their clothing, after which they found they were rising, and their last resource, viz., to cut away the car, was rendered unnecessary. As they approached the shore the balloon rose, describing a magnificent arch high over the land. They descended in the forest of Guinnes.

On June 15, 1785, Pilâtre de Rozier made-an attempt to repeat the exploit of Blanchard and Jeffries in the reverse direction, and cross from Boulogne to England. For this purpose he contrived a double balloon, which he expected would combine the advantages of both kinds—a fire-balloon, 10ft. in diameter, being placed underneath a gas-balloon of 37ft. in diameter, so that by increasing or diminishing the fire in the former it might be possible to ascend or descend without waste of gas. Rozier was accompanied by P. A. Romain, and for rather less than half an hour after the aerostat ascended all seemed to be going on well, when suddenly the whole apparatus was seen in flames, and the unfortunate adventurers came to the ground from the supposed height of more than 3,000ft. Rozier was killed on the spot and Romain only survived about ten minutes. A monument was erected on the place where they fell, which was near the sea-shore, about 4m. from the starting point.

Early Large Balloons.— The largest balloon on record (if the contemporary accounts are correct) ascended from Lyons on Jan. 19, 1784. It was more than 100ft. in diameter, about 130ft. in height, and when distended had a capacity, it is said, of over 500,000 cubic feet. It was called the "Flesselles" (probably from the name of its proprietor), and after having been inflated from a straw fire in 17 minutes, it rose with seven persons in the car to the height of about 3,000ft., but descended again after the lapse of about a quarter of an hour from the time of starting, in consequence of a rent in the upper part.

Another large fire-balloon, 68ft. in diameter, was constructed by the chevalier Paul Andreani, of Milan, and on Feb. 25 he ascended in it from Milan, remaining in the air for about 20 minutes. This is usually regarded as the first ascent in Italy (but see Monck Mason's *Aeronautica,* p. 247).

On Nov. 7, 1836, at half-past one o'clock, a large balloon containing about 85,000 cu ft. of gas ascended from Vauxhall Gardens, London, carrying Robert Holland, M.P., Monck Mason and Charles Green, and descended about two leagues from Weilburg, in the duchy of Nassau, at half-past seven the next morning, having thus traversed a distance of about 500m. in 18 hours; Liége was passed in the course of the night, and Coblentz in the early morning. In consequence of this journey the balloon became famous as the "Nassau Balloon" (fig. 5) Charles Green (1785–1870), who constructed it and subsequently became its owner, was the most celebrated of English aeronauts, and made an extraordinary number of ascents. His first, made from the Green Park, London, on July 19, 1821, at the coronation of George IV., was distinguished for the fact that for the first time coal-gas was used instead of hydrogen for inflating the balloon. In 1828 he made an equestrian ascent from the Eagle Tavern, City Road, London, seated on his favourite pony. Such ascents have since been repeated; in 1852 Mme. Poitevin made one from Cremorne Gardens, but was prevented from giving a second performance by police interference, on account of certain public criticism. It was in descending from the "Nassau Balloon" in a parachute that Robert Cocking was killed in 1837. Green was the inventor of the guide rope, which consists of a long rope trailing below the car. Its function is to reduce the waste of gas and ballast required to keep the balloon at a proper altitude. When a balloon sinks so low that a good deal of the guide rope rests on the ground, it is relieved of so much weight and therefore tends to rise; if on the other hand it rises so that most of the rope is lifted off the ground, it has to bear a greater weight and tends to sink.



FROM PEWTRESS, "BALLOONS — A COLLECTION OF CUTTINGS,,

FIG. 5.—THE GREAT NASSAU BALLOON, WHICH CREATED A SENSATION WHEN IT TRAVERSED 500 MILES IN 18 HOURS, 1836

In 1863 A. Nadar, a Paris photographer, constructed "Le Géant," which was the largest gas-balloon made up to that time and contained over 200,000 cu.ft. of gas. Underneath it was placed a smaller balloon. called a compensator, the object of which was to prevent loss of gas during the voyage. The car had two stories, and was, in fact, a model of a cottage in wicker-

work, 8ft. in height by 13ft. in length, containing a small printing office, a photographic department, a refreshment room, a lavatory, etc. The first ascent took place at five o'clock on Sunday, Oct. 4, 1863, from the Champ de Mars. There were 13 persons in the car, including one lady, the princess de la Tour D'Auvergne, and the two aeronauts Louis and Jules Godard. In spite of the elaborate preparations that had been made and the stores and provisions that were taken up, the balloon descended at nine o'clock at Meaux, the early descent being rendered necessary, it was said, by an accident to the valve-line. At a second ascent, made a fortnight later, there were nine passengers, including Mme. Nadar.

Directly after Nadar's two ascents, Eugene Godard constructed a fire-balloon of nearly 500,000 cu.ft. capacity — more than double that of Nadar's and only slightly less than that attributed to the "Flesselles" of 1783. The air was heated by an 18ft. stove, weighing, with the chimney, 980 lb. This furnace was fed by straw; and the "car" consisted of a gallery surrounding it. Two ascents of this balloon, the first fire-balloon seen in London, were made from Cremorne Gardens in July 1864. After the first journey the balloon descended at Greenwich, and after the second at Walthamstow, where it was injured by being blown against a tree.

In the summer of 1873 the proprietors of the New York *Daily* Graphic, reviving a project discussed by Green in 1840, determined to construct a very large balloon, and enable the American aeronaut, John Wise, to realize his favourite scheme of crossing the Atlantic ocean to Europe, by taking advantage of the current from west to east which was believed by many to exist constantly at heights above 10,000 feet. The project came to nothing owing to the quality of the material of which the balloon was made. When it was being inflated in Sept. 1873 a rent was observed after 325,000 cu.ft. of gas had been put in, and the whole rapidly collapsed. The size was said to be such as to contain 400,000 cu.ft. so that it would lift a weight of 14,000 pounds. Only two voyages exceeding 1,000m. are on record — that of John Wise from St. Louis to Henderson (N.Y.), 1,120m., in 1859, and that of Count Henry de la Vaulx from Paris to Korosticheff in Russia, 1,193m., in 1900. On July 11, 1897, Salomon Andrée, with two companions, Strendberg and Fränkel, ascended from Spitsbergen in a daring attempt to reach the North Pole, about 600m. distant. One carrier pigeon, apparently liberated 48 hours after the start, was shot, and two floating buoys with messages were found, but nothing more was heard of the explorers.

Scientific Work. — At an early date the balloon was applied to scientific purposes. So far back as 1784, Dr. Jeffries made an ascent from London in which he carried out barometric, thermometric and hygrometric observations, also collecting samples of the air at different heights. In 1803 the St. Petersburg [Leningrad] Academy of Sciences, entertaining the opinion that the experiments made on mountain-sides by J. A. Deluc, H. B. de Saussure, A. von Humboldt and others must give results different from those made in free air at the same heights, resolved to arrange a balloon ascent. Accordingly, on Jan. 30, 1804, Sacharof, a member of the academy, ascended in a gas-balloon, in company with a French aeronaut, É. G. Robertson, who at one time gave conjuring entertainments in Paris. The ascent was made at a quarter-past seven, and the descent effected at a quarter to eleven. The height reached was less than 1½ miles. The experiments were not very systematically made, and the chief results were the filling and bringing down of several flasks of air collected at different elevations, and the supposed observation that the magnetic dip was altered. A telescope fixed in the bottom of the car and pointing vertically downwards enabled the travellers to ascertain exactly the spot over which they were floating at any moment. Sacharof found that, on shouting downwards through his speaking trumpet, the echo from the earth was quite distinct, and at his height was audible after an interval of about ten seconds.

Some of the results reported by Robertson appearing doubtful, Laplace proposed to the members of the French Academy of Sciences that the funds placed by the Government at their disposal for the prosecution of useful experiments should be utilized in sending up balloons to test their accuracy. The proposition was supported by J. A. C. Chaptal, the chemist, who was then minister of the interior, and accordingly the necessary arrangements were speedily effected. The principal object of this ascent was to determine whether the magnetic force experienced any appreciable diminution at heights above the earth's surface. On Aug. 24, 1804, Gay-Lussac and Biot ascended from the Conservatoire des Arts at ten o'clock in the morning. Their magnetic experiments were incommoded by the rotation of the balloon, but they found that, up to the height of 13,000ft., the time of vibration of a magnet was appreciably the same as on the earth's surface. They found also that the air became drier as they ascended. The height reached was about 13,000ft., and the temperature declined from 63" to 51°. The descent was effected at Meriville, 18 leagues from Paris.

In a second experiment, which was made on Sept. 16, 1804, Gay-Lussac ascended alone. The balloon left the Conservatoire des Arts at 9.40 A.M., and descended at 3.45 P.M. between Rouen and Dieppe. The chief result obtained was that the magnetic force, like gravitation, did not experience any sensible variation at heights from the earth's surface to which we can attain. Gay-Lussac also brought down air collected at the height of nearly 23,000ft., and on analysis it appeared that its composition was the same as that of air collected at the earth's surface. At the time of leaving the earth the thermometer stood at 82°, and at the highest point reached (23,000ft.) it was 14·9°. Gay-Lussac remarked that at his highest point there were still clouds above him.

From 1804 to 1850 there is no record of any scientific ascents in balloons having been undertaken. In the latter year J. A. Bixio (1808–65) and J. A. Barral (1819–84) made two ascents of this kind. In the first they ascended from the Paris observatory on June 29, 1850, at 10.27 A.M., the balloon being inflated with hydrogen gas. The day was a rough one, and the ascent took place without any previous attempt having been made to test the ascensional force of the balloon. When liberated it rose with great rapidity, and becoming fully inflated it pressed upon the network, bulging out at the top and bottom. The ropes by which the car was suspended being too short, the balloon soon covered the travellers like an immense hood. In endeavouring to secure the valve rope they made a rent in the balloon, and the gas escaped so close to their faces as almost to suffocate them. Finding that they were descending then too rapidly, they threw overboard everything available, including their coats and only excepting the instruments. The ground was reached at 10.45 A.M., near Lagny. Of course no observations were made. Their second ascent was made on July 27 and was remarkable on account of the extreme cold met with.

In July 1852 the committee of the Kew Observatory resolved to institute a series of balloon ascents, with the view of investigating such meteorological and physical phenomena as require the presence of an observer at a great height in the atmosphere. John Welsh (1824–59) of the Kew Observatory was the observer, and the great "Nassau Balloon" was employed, with Green himself as the aeronaut. Four ascents were made in 1852, viz, on Aug. 17 and 26, Oct. 31 and Nov. 10. The heights attained were 19,510, 19,100, 12,640 and 22,930ft., and the lowest temperatures met with in the four ascents were 8·7° (19,380ft.), 12·4° (18,370ft.), 16·4° (12,640ft.) and 10·j° (22,370ft.). The decline of temperature was very regular. A siphon barometer, dry and wet bulb thermometers, aspirated and free, and a Regnault hygrometer were taken up. Some air collected at a considerable height was found on analysis not to differ appreciably in its composition from air collected near the ground. For the original observations see *Phil.* Trans. 1853, pp. 311–346.

Glaisher's Ascent. — At the meeting of the British Association for the Advancement of Science held at Aberdeen in 1859, a committee was appointed for the purpose of making observations in the higher strata of the atmosphere by means of the balloon. For two years nothing was effected, owing to the want both of an observer and of a suitable balloon. After its reappointment at the Manchester meeting of 1861, the committee communicated with Henry Tracey Coxwell (1819–1900), an aeronaut who had

made a good many ascents, and he agreed to construct a new balloon, of 90,000 cu.ft. capacity, on the condition that the committee would undertake to use it, and pay £25 for each high ascent made especially on its behalf, defraying also the cost of gas, etc., so that the expense of each high ascent amounted to nearly £50. An observer being still wanted, James Glaisher, a member of the committee, offered himself to take the observations, and accordingly the first ascent was made on July 17, 1862, from the gas-works at Wolverhampton, this town being chosen on account of its central position in the country. Altogether, Glaisher made 28 ascents, the last being on May 26, 1866. Of these only seven were specially high ascents, the greatest height attained being 37,000ft. at Wolverhampton (Sept. 5, 1862), but there is some doubt as to this record.

The primary object of the ascents was to determine the temperature of the air, and its hygrometrical state at different elevations to as great a height as could be reached; and the secondary objects were: (1) to determine the temperature of the dew-point by Daniell's and Regnault's hygrometers, as well as by the dry and wet bulb thermometers, and to compare the results; (2) to compare the readings of an aneroid barometer with those of a mercurial barometer up to the height of 5m.; (3) to determine the electrical state of the air; (4) the oxygenic condition of the atmosphere, and (5) the time of vibration of a magnet; (6) to collect air at different elevations; (7) to note the height and kind of clouds, their density and thickness; (8) to determine the rate and direction of different currents in the atmosphere; and (9) to make observations on sound. The instruments used included an electrometer. In one or two of the ascents a camera was taken up.

With regard to physiological observations, Glaisher found that the frequency of his pulse increased with elevation, as also did the number of inspirations. The number of his pulsations was generally 76 per minute before starting, about 90 at 10,000ft., 100 at 20,000ft., and 110 at higher elevations. But a good deal depended on the temperament of the individual. This was also the case in respect to colour: at 10,000ft. the faces of some would be a glowing purple, whilst others would be scarcely affected; at 4m. high Glaisher found the pulsations of his heart distinctly audible, and his breathing was very much affected, so that panting was produced by the slightest exertion; at 29,000ft. he became insensible. In reference to the propagation of sound, it was at all times found that sounds from the earth were more or less audible according to the amount of moisture in the air. When in clouds at 4m. high a railway train was heard; but when clouds were far below, no sound ever reached the ear at this elevation. The discharge of a gun was heard at 10,000 feet. The barking of a dog was heard at the height of 2m., while the shouting of a multitude of people was not audible at heights exceeding 4,000ft. In his ascent of Sept. 5, 1862, Glaisher considered that he reached a height of 37,000ft. But that figure was based, not on actual record, but on the circumstances that at 29,000ft., when he became insensible, the balloon was rising 1,000ft. a minute, and that when he recovered consciousness 13 minutes later it was falling 2,000ft. a minute, and the accuracy of his conclusions has been questioned.

Few scientific men have imitated Glaisher in making high ascents for meteorological observations. In 1867 and 1868 Camille Flammarion made eight or nine ascents from Paris for scientific purposes. The heights attained were not great, but the general result was to confirm the observations of Glaisher (for an account see Voyages *aériens,* Paris, 1870, or Travels *in the* **Air,** London, 1871, in which also some ascents by W. de Fonvielle are noticed). On April 15, 1875, H. T. Sivel, J. E. Crocé-Spinelli and Gaston Tissandier ascended from Paris in the balloon "Zenith," and reached a height of 27,950ft.; but only Tissandier came down alive, his two companions being asphyxiated This put an end to such attempts for a time. But Dr. A. Berson and Lieut. Gross attained 25,840ft. on May 11, 1894; Berson, ascending alone from Strassfurt on Dec. 4, 1894, attained about 31,500ft. and recorded a temperature of −54°; and Berson and Stanley Spencer are stated by the latter to have attained 27,500ft. on Sept. 15, 1898, when they ascended in a hydrogen balloon from the Crystal Palace, the thermometer registering −29°. On July 31, 1901, Berson and R. J. Siiring ascending at Berlin, actually noted a barometric reading corresponding to a height of 34,500ft., and possibly rose 1,000 or 1,500ft. higher, though in spite of oxygen inhalations they were unconscious during the highest portion of the ascent.

The personal danger attending high ascents led Gustave Hermite and Besançon in Nov. 1892, to inaugurate the sending up of unmanned balloons (*ballons sondes*) equipped with automatic recording instruments. Valuable meteorological records have thus been obtained.

For the development of navigable balloons and the construction of airships, see AIRSHIP. See also METEOROLOGY.

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BALLOONS IN WAR. The first use of the balloon by the military appears to date from the period of the French revolutionary wars. Following experiments at Meudon, a corps of aeronauts (originally designated "aerostats") was formed and sent to Manberg, then under siege by Dutch and Austrian forces. The hydrogen-filled globe used was 30 ft. in diameter, and with a crew of two and 130 lb. of ballast, managed to rise to a height of 1,800 feet. The moral effect on the enemy was enormous. Imagining (quite incorrectly), that their every movement stood revealed to its observers, the Austrians became completely demoralized, and promptly lifted the siege. Transported, still inflated, to Charleroi where the French were on the offensive, it so dismayed the enemy garrison as to result in their speedy surrender. It later figured at Fleurus, then at Brussels, Liége, Aix-la-Chapelle and on the Rhine and Danube. A second corps of aerostats was formed for service in Egypt but never got into action as its apparatus suffered damage en route. In 1800, both corps were abolished. Later (1812), the Prussians employed balloons against the French, but without material result. At Solferino one of the Godard brothers made an ascent, but too late to affect the fortunes of the day.

In the American Civil War (1861–65), observation balloons saw use at the hands of the Federal troops, and certain of the ascents were recorded for posterity in the famous Brady collection of photographs of that conflict. Again, in the Spanish-American War (1898), a balloon accompanied Shafter's expeditionary force but, hovering as it did, low over the heads of friendly troops, enemy fire directed against it effected heavy casualties among the former, and its use was discontinued.

The British commenced to give real consideration to the balloon as an instrument of war in the late '70s and early '80s, conducting numerous experiments with specimens sent up at Woolwich Arsenal In some of these the basket carried a battery of eight cameras spaced equidistantly about its perimeter, thus making possible the photographing of the entire terrain overlooked, and apparently constituting the first serious effort at military aerial photography. In the earlier of these tests, communication from balloon to ground was effected by writing messages in crayon on the surface of a long, open-ended pasteboard tube weighted at one end by a rifle bullet. When this was ready for delivery, the tip of a small cord reaching from balloon basket to ground was detached from its fastening, passed lengthwise through the tube and reattached to its connections, the cylinder forthwith sliding down it to the earth. In later experiments, however, balloon and ground were connected by telegraph (not by telephone) wires enclosed in the retaining cable and paid out from specially constructed carts, a two-way system for the exchange of intelligence thus being established.

Soon thereafter (1880s), the ballaon saw war service in the French campaign against Tongking, and likewise accompanied the British Bechuanaland expedition of that period. Thereafter we do not hear of it, save in the Spanish-American War as above mentioned, until employed in a modest way by the Japanese in the Russo-Japanese conflict of 1904.

Here an airship was used, stabilized by a specially built fin in an effort to keep it from rotating in a high wind, a disagreeable feature present in all the spherical-type balloons up to then employed.

With the advent of the World War of 1914–18, every major nation began to pay the war balloon more attention. Germany produced the Drachen "kite balloon," a type conventionally termed "sausage." This embodied a bag, cylindrical in shape, and endowed with stability by the attachment of two small sails plus a large air-containing sac, located at its rear end, to act as a rudder and keep it heading into the wind. Such a balloon can function in a blow of 50 m.p.h., whereas the spherical type is helpless when wind velocity exceeds 20 m.p.h. But it must be flown at a considerable inclination to the horizon in order to attain the "kiting" effect without which it is useless. So inclined, it presents a large proportion of its surface area to the wind, thus unduly straining its cables and frequently causing them to snap. To eliminate these drawbacks, the French Capt. Caquot designed a streamlined type with three tails, one vertical and two lateral, attached at intervals of 120° for proper stabilization. This model, as used by the British army during the World War of 1914–18 (subsequently developed types embody the same basic design), had a length of 91 ft., a cubic capacity of 91,000 cu.ft., and could operate at heights to 6,000 ft.; a smaller naval model of similar general characteristics functioned up to about half this altitude.

British observation balloons proved markedly effective at Gallipoli where, sent up from vessels especially equipped to handle them, they "spotted" the effects of naval gunfire, reporting via their telephone cables and causing the enemy to withhold reprisal so long as they were aloft —for fear of revealing to them the positions of his batteries.

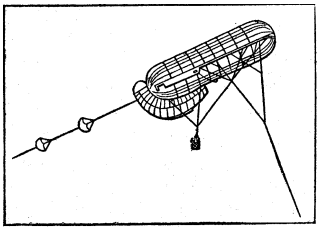

FIG. 1.—DRACHEN KITE BALLOON Used for observation purposes by both Allied and German armies at the beginning of the World War of 1914–18

Likewise on land, after warfare had become stabilized on the Western Front, sausages were in constant use for like purposes. And though always subject to attack by enemy aeroplanes, and not infrequently the victims of these, their crews usually lived to fly again, being ever prepared to bail out in their parachutes at an instant's notice.

Another use of the war balloon now instituted, and later greatly elaborated, was the setting up of "balloon barrages." As originally developed, these involved the release to a maximum height of 10,000 ft., of batteries of three kite balloons of 40.000 cu.ft. capacity each, one at the centre, and one at either end, of a horizontally floating cable 1,000 ft. in length. From this was suspended at regular intervals a series of steel wires trailing earthward like flexible teeth in an enormous comb. An attacking aeroplane was thus forced either to rise above this obstruction—to a height from which no bomb could at that period be accurately aimed—or, dive below it—and risk the effects of point-blank anti-aircraft fire.

With the advent of the European War in 1939, the balloon barrage, its ceiling now increased to 15,000 ft.. assumed new importance, especially in the defence of the city of London. Though constantly the object of aeroplane assault, these devices appear to have rendered yeoman service as an adjunct to the anti-aircraft gun and the friendly fighter plane. But they proved vulnerable to the forces of nature, and many were reported to have parted their moorings and floated off as the result of a heavy storm which visited England on Sept. 17, 1940. Similar "sausages" towed singly by destroyers or merchant vessels, served in the defence of convoys passing through the English Channel, rendering hazardous any attempt by hostile air raiders to carry out dive-bombing operations. The same type of balloon manned by one or more observers in a basket below, and similarly towed, has proven useful for spotting waiting submarines and notifying accompanying vessels of their positions.

Other Types.—The propaganda balloon, a small sphere of 5,000 cu.ft. capacity, was designed for liberation over enemy territory, there to release as it progressed, printed propaganda for the edification of the inhabitants. An automatic device keeps it at a uniform height until all attached ballast is exhausted. Its use has, however, become infrequent, since the aeroplane has proven an even better medium for the purpose intended.

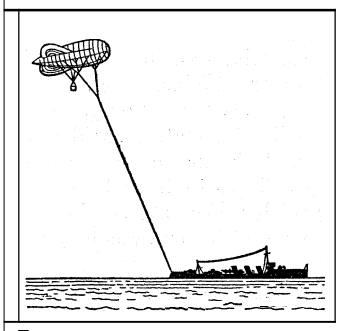

FIG. 2.—A CAPTIVE CAQUOT BALLOON TOWED BY A DESTROYER Ships with an observation balloon of this type in attendance were effective in anti-submarine warfare

Materials of Fabrication.—Silk and cotton cloth both figure in the construction of gas-containing envelopes for balloons. But the former does not ordinarily enter into the manufacture of the war balloon, in the production of which rubberized cotton in one or more of several different grades is conventionally employed. Fabric for captive balloons (U.S. Army) is constructed of two plies of such cloth, the outer biased, and the inner straight. Its weight is 8.6 oz. per square yard, and its tensile strength 50 lb. per square inch. Nets and rigging are commonly of Italian hemp, which is soft, very pliable, of high tensile strength and easily spliced.

(C. GD.)

BALLOT: *see* ELECTORAL SYSTEMS.

BALEOU, HOSEA (1771–1852), American Universalist clergyman, was born in Richmond, N.H., April 30, 1771. Self-educated, he early devoted himself to the ministry, and after preaching at various places, became pastor of the Second Universalist Church in Boston from December 1817 until his death there, June 7, 1852. He founded and edited *The Universalist Magazine* (1819; later called *The Trumpet)* and *The Universalist Expositor* (1831; later *The Universalist Quarterly Review);* and wrote many sermons, hymns, and polemic theological works. He is best known for *Notes on the Parables* (1804), *A Treatise on Atonement* (1805), and *Examination of the Doctrine of a Future Retribution* (1834); in these, especially the second, he showed himself the principal American expositor of Universalism. From the theology of John Murray, who like Ballou has been called "the father of American Universalism," he differed in that he divested Universalism of every trace of Calvinism and opposed legalism and trinitarian views.

His grand-nephew, HOSEA BALLOU (1796–1861), born in Guilford, Vt., Oct. 18, 1796, after long service in the ministry, was in 1853 elected first president of Tufts College at Medford, serving in that office until the time of his death at Somerville, Mass., May 27, 1861. He was associated with the elder Hosea Ballou in editing *The Universalist Quarterly Review* and wrote the *Ancient History of Universalism* (1829).

For the first Hosea Ballou consult the biography by Thomas Whittemore (4 vol., 1854–55) and that by O. F. Safford (1889); and J. C. Adams, *Hosea Ballou* and *the Gospel Renaissance* (1904).

BALLSTON SPA, a village of New York, U.S.A., 7 mi. S. of Saratoga Springs, on the main line of the Delaware and Hudson railroad; the county seat of Saratoga county. The population in 1940 was 4,443. Ballston Spa has long been a health resort. It lies among the foothills of the Adirondack mountains, and has many fine chalybeate and other springs, rising more than 700 ft. through solid rock. The village's factories manufacture a variety of products. The village was settled about 1787 by the grandfather of Stephen A. Douglas, and was incorporated in 1855. It was named after the Rev. Eliphalet Ball, an early settler. Its daily paper, the *Journal,* was established in 1798. The Saratoga county law library is there.

BALLYCASTLE, urban district, Co. Antrim, Northern Ireland, on a bay of the same name opposite Rathlin island. Population 1,986. It is connected with the Northern Counties (Midland) railway at Ballymoney by the Ballycastle light railway. The town consists of two divisions, about a quarter of a mile apart and connected by a fine avenue. Much money has been expended upon the pier and harbour, but the violence of the sea overthrew the one and the other became filled with sand. To the east of the town are the remains of Bonamargy abbey. Coal-seams, formerly extensively worked, appear in the cliffs towards Fair Head, and the fisheries are important.

BALLYMENA, a town in Co. Antrim, Northern Ireland, on the small river Braid an affluent of the Maine, 2 mi. above their junction. Pop. of urban district (1937) 12,928. It is 33 mi. N.N.W. of Belfast on the Northern Counties (Midland) railway. Branch lines run to Larne and Parkmore on the east coast. The town owes its prosperity chiefly to its linen trade, introduced in 1733. Brown linen is a specialty. Iron ore is mined in the neighbourhood. Gracehill, a Moravian settlement, was founded in 1746.

BALLYMONEY, town, Co. Antrim, Northern Ireland, 53 mi. N.N.W. from Belfast and a junction on the Northern Counties (Midland) railway. Population of urban district 3,168. The trade includes brewing, distilling and tanning, besides the linen manufacture common to the whole county. Soap, candles and tobacco are also manufactured, and the town is a centre for local agricultural trade.

BALLYMOTE, town, Co. Sligo, Eire, 14 mi. S. of Sligo by the Great Southern railway. Population (1936) 738. It has some agricultural trade. There are remains of a castle, built by Richard de Burgh, in 1300, and the scene of hostilities in 1641 and 1652; and also of a 13th century Franciscan foundation. This was a celebrated seat of learning where the *Book of Ballymote* (*c.* 1391), a miscellaneous collection in prose and verse of historical, genealogical and romantic writings, was written. There are also, near the town, ruins of a house of the Knights of St. John (1303).

BALLYSHANNON, town, Co. Donegal, Eire, at the mouth of the Erne; on the Bundoran branch of the Great Northern railway. Pop. (1936) 2,223. The river is here crossed by a bridge which connects the town with the suburb of The Port. Below the bridge the river forms a cascade, where salmon are trapped in large numbers. The fisheries are of great value, and there is an export trade to England in salmon. The harbour is a small exposed creek of Donegal bay, and is only accessible to small vessels owing to a bar. Previous to the Union Ballyshannon returned two members to the Irish parliament and it was incorporated by James I. There are slight remains of a castle of the O'Donnells, earls of Tyrconnell, where the English were defeated in 1597. There are numerous raths or encampments in the vicinity and other remains. Coolmore, 3 mi. northwest, is a bathing-resort.

BALM, fragrant herbs, mostly of the mint family (*Labiatae*). The bee balm (*Melissa officinalis*), of Eurasia, has opposite, ovate, crenulated leaves, which are wrinkled above, and small white or rose-spotted flowers. It is often grown in gardens and has become naturalized in the south of England and in North America. The name is from the Greek μέλισσα, the plant being visited by bees.

Bastard balm is an allied plant, *Melittis Melissophyllum*, a southern European species, found in the south and southwest of England. Balm of Gilead is a resin derived from the plant, *Commiphora meccanensis*, a member of the family *Burseraceae*. In America balm is often applied to various plants of the genus *Monarda*.

BALMACEDA, JOSE MANUEL (1838–1891), president of the republic of Chile, was born in Santiago in 1838, of wealthy parents. In his early days he was chiefly concerned in industrial and agricultural enterprise. In 186j he was one of the representatives of the Chilean government at the general South American congress at Lima, and after his return obtained distinction as an orator in the national assembly. After some diplomatic missions abroad, he became successively minister of foreign affairs and of the interior under the presidency of Señor Santa Maria, and, in the latter capacity carried compulsory civil marriage and several other laws obnoxious to the clergy.

In 1886 he was elected president; but, in spite of his great capacity, his imperious temper soon had him irreconcilably at variance with the majority of the national representatives, and on Jan. 1, 1891, he sought to terminate an intolerable situation by refusing to convoke the assembly and ordering the continued collection of the taxes on his own authority. This led to the Chilean Civil War of 1891, which ended in the overthrow of Balmaceda. He committed suicide on Sept. 18, 1891, the anniversary of his elevation to the presidency.

BALMAIN, a town of Cumberland county, N.S.W., Australia, on the western shore of Darling Harbour, Port Jackson, 2 m. by water from Sydney and suburban to it. Pop. (1933) 28,268. Sawmills, iron foundries, chemicals, glass and soap works, shipbuilding yards and a coconut-oil factory in connection with the soap-manufacture at Port Sunlight, England, are among the chief industrial establishments. Balmain became a municipality in 1860.

BALMERINO, JAMES ELPHINSTONE, 1ST BARON (*c.* 1553–1612), Scottish politician, was the third son of Robert, 3rd Lord Elphinstone (d. 1602). Rising to power under James VI. he became a judge and a royal secretary; he accompanied the king to London in 1603 and was made Lord Balmerino, or Balmerinoch, in 1604. In 1605 he became president of the court of session. In 1599, on the king's behalf, but without the king's knowledge, he had sent a letter to Clement VIII. in which he addressed the pope in very cordial terms. A copy of this letter having been seen by Elizabeth, the English queen asked James for an explanation, whereupon both the king and the secretary declared it was a forgery. There the matter rested until 1608, when the existence of the letter was again referred to during some controversy between James and Cardinal Bellarmine. Interrogated afresh Balmerino admitted that he had written the compromising letter, that he had surreptitiously obtained the king's signature, and that afterwards he had added the full titles of the pope. In March 1609 he was tried, attainted, and sentenced to death, but after a brief imprisonment he was released.

Balmerino's elder son JOHN (d. 1649) was permitted to take his father's title in 1613. In 1634 he was imprisoned for his opposition to Charles I. in Scotland, and by a bare majority of the jury he was found guilty of '(leasing-making" and was sentenced to death. But popular sympathy was strongly in his favour; the poet Drummond of Hawthornden and others interceded for him, and after much hesitation Charles pardoned him.

ARTHUR (1688–1746), 6th Lord Balmerino, joined the partisans of James Edward, the Old Pretender, after the battle of Sheriffmuir in Nov. 1715, and then lived for some time in exile, returning to Scotland in 1733 when his father had secured for him a pardon. He was one of the first to join Charles Edward in 1745; he marched with the Jacobites to Derby, fought at Falkirk and was captured at Culloden. Tried for treason in Westminster Hall he was found guilty, and was beheaded Aug. 11, 1746, behaving both at his trial and at his execution with great constancy and courage. On his death without issue the titles which he bore became extinct.

BALMES, JAIME LUCIANO (1810–1848), Spanish ecclesiastic, political writer and philosopher, was born at Vich in Catalonia, on Aug. 28, 1810, and died there on July 9, 1848. Having attacked the regent Espartero he was exiled. On his return he founded and edited the El *Pensamiento* de *la Nacion*, a Catholic weekly; but his fame rests on El *Protestantismo comparado con el Catolicismo en sus relaciones con la Civilisacion Europea* (1842–44, 6th ed. 1879; Eng. trans. 1849), an able defence of Catholicism as the spirit of obedience or order, against Protestantism, the spirit of revolt; it belongs to apologetics, and is not a history. His philosophical works are the *Filosofia Fondamental* (1846) Eng. trans. by H. F. Brownson (New York, 1856), and the *Curso* de *Filosoja Elemental* (1847), which he translated into Latin.

See A. de Blanche-Raffin, *Jacques Balmès*, sa *vie et ses ouvrages* (1849); and E. Bullón Fernández, Jaime Balmès y sus oberas (1903).

BALMONT, CONSTANTINE (1867–), Russian author, was born June 3, 1867, at Gumishche, in the province of Vladimir, in Central Russia. A student of Elizabethan drama and of Shelley, he first became known as the translator of the latter and the apostle of his ideas. His extensive travels in South Africa, Mexico, New Zealand and Spain account for the exotic vein in his poetry. He produced his best work during the 'nineties and the early years of the present century. The very titles of the voluines published during this period—Under *the Northern Sky* (1894), *Silence* (1898), In *Boundless Space* (1895), *The Burning Buildings* (1900), *Only Love* (1903), *Let us be like the Sun* (1903)—indicate the stages of his development from pure aestheticism to an aggressive and partly anarchical Nietzschean poetry, which brought him immense popularity and made him the acknowledged head of a younger generation of Russian symbolists. This vogue has long since passed, but he remained one of the finest of modern Russian lyric poets. *The Liturgy of Beauty* (1905), *Evil Charms* (1906), *The Bird of Flame* (1907) are representative of his later work. He has also written several volumes of prose. In 1918, shortly after the outbreak of the Bolshevik revolution, he went to live in Paris.

BALMORAL CASTLE (Gaelic, "the majestic dwelling"), private residence of the British sovereign, parish of Crathie and Braemar, Aberdeenshire, Scotland, on the right bank of the Dee (here spanned by a fine suspension bridge), 8m. W. of Ballater and at a height of 900ft. above the sea. It was sold by the Farquharsons of Inverey to Sir Robert Gordon and by his trustees to Albert Prince Consort who bequeathed it to Queen Victoria. The castle is in granite in Scots baronial style, with an east tower (100ft.) commanding a superb view. Memorial cairns to members of the Royal Family have been erected on Craig Gowan (1,319ft.). The parish church of Crathie (1903), replacing the kirk of 1806, is 1½m. to the west, and about 1m. farther west stands Abergeldie Castle, another Highland royal residence, an ancient building to which modern additions have been made, inhabited by King Edward VII. when prince of Wales, and after his accession to the throne used as a shooting-lodge.

BALNAVES, HENRY (1512?–1579), Scottish politician and reformer, was educated at St. Andrews, and afterwards at Cologne, where he adopted Protestant views. In 1538 he was appointed a lord of session, and in Jan. 1543 the regent Arran made him secretary of state. In the following November, when the regent went over to the priestly party, Balnaves was imprisoned in Blackness castle, and after his release by Hertford in May 1544 became a paid agent of the English Government. He took no part in the murder of Beaton, but helped to defend the castle of St. Andrews, and on its surrender was taken prisoner to Rouen. During his exile Balnaves wrote *The Confession of Faith*, which was found, with a preface by Knox, among his papers and published at Edinburgh in 1584.

In 1557 he returned to Scotland, and took an active part in the rising of 1559. In 1563 he was restored to his office as lord of the session, and four years later was one of Bothwell's judges for the murder of Darnley. He died in 1579 at Edinburgh.

See *Letters and Papers of Henry VIII.* (1540–45); Bain's and Thorp's *Cal. of Scottish State-Papers;* English *Domestic and Foreign Cals.; Acts of Engl. Privy Council; Reg. P.C.,* Scotland; *Reg. Great Seal of Scotland; Hamilton Papers; Border Papers;* Knos, *Works;* Burnet, *Reformation;* Froude, *Hist.*

BALNEOTHERAPEUTICS, medical treatment by internal and external use of mineral waters, the principal constituents of which are sodium, magnesium, calcium and iron, in the form of chlorides, sulphates, sulphides and carbonates. Other substances occasionally present are arsenic, lithium, potassium, manganese, bromine, iodine, etc. The chief gases in solution are oxygen, nitrogen, carbonic acid and sulphuretted hydrogen. Argon and helium occur in some of the "simple thermal" and "thermal sulphur waters," while others contain minute quantities of radium. In the employment of the various mineral waters, many of the spas adopt special means by which they increase or modify their influence. Of these the "pine-needle" bath has the greatest repute; it is made by adding a decoction of the needles or young shoots of firs and pines. Fir wood oil (a mixture of ethereal oils) or the tincture of an alcoholic extract acts equally well. Similar effects follow the addition to the bath of aromatic herbs, such as camomile, thyme, etc. Astringent baths are prepared in a similar way from decoctions of oak bark, walnut leaves, etc. Mud baths are chiefly prepared from muddy deposits found in the neighbourhood of the springs, as at St. Amand. They act like a large poultice applied to the surface of the body, and in addition to the influence of the temperature, they exert a considerable mechanical effect. The pulse is accelerated some 6 to 12 beats a minute, the respiration number rises, and the patient is thrown into a profuse perspiration. They have very great value in gouty and rheumatic conditions and in some of the special troubles of women.

In advising balneotherapeutic treatment in any case, all the conditions and habits of the patient—pecuniary, physical and psychical—must be considered, as the spa must be fitted to the patient, not the patient to the spa. After rheumatic fever, if the joints remain painful and the heart is dilated, the thermal gaseous saline water of Nauheim, augmented by Schott's resistance movements, will often appear to work wonders. Chronic rheumatism, where there is much exudation round a joint or incipient stiffness of a joint, may be relieved by hot thermal treatment, especially when combined with various forms of massage and exercises. Simple thermal waters, hot sulphur springs and hot muriated waters are all successful in different cases. Chronic muscular rheumatism can also be benefited in a similar manner. Diseases of the nervous system are on the whole treated by these means with small success. Mental diseases other than very mild cases of depression should be considered inapplicable. Neurasthenics are sometimes treated at chalybeate or thermal muriated saline spas; but such treatment is entirely secondary to the general management of the case. Neuralgic affections and the later stages of neuritis, especially when dependent on gout or rheumatism, are often relieved or cured. Abdominal venosity (abdominal plethora), a feature of obesity, glycosuria, etc., are extremely well fitted for this form of treatment. The alkaline sulphated waters, the bitter waters and the common salt waters can all be prescribed, and after a short course can be supplemented with various forms of active and passive exercises. Diseases of the respiratory organs are far more suited for climatic treatment than for treatment by baths. In the anaemia dependent on malarial infection, the muriated or alkaline sulphated waters at spas of considerable elevation and combined with iron and arsenic are often beneficial. Gravel and stone, if of the uric acid variety, can be treated with the alkaline waters, but the case must be under constant observation lest the urine become too alkaline and a deposition of phosphates take place on the already formed uric acid stone. Gout is so variable both in cause and effect that much discrimination is required in its treatment. Where the patient is of "full habit," with portal stagnation, the sulphated alkaline or mild bitter waters are indicated, especially those of Carlsbad and Marienbad; but the use of these strong waters must be followed by a long rest under strict hygienic conditions. Where this is impossible, a milder course must be advised, as at Homburg, Kissingen, Harrogate, Wiesbaden, Baden-Baden, etc. For very delicate patients, and where time is limited, the simple thermal waters are preferable.

For radiant heat and light baths and electric baths of all kinds, *see* ELECTROTHERAPY; and for compressed air baths, AEROTHERAPEUTICS. *(See also* BATHS; THERAPEUTICS, and the articles on diseases.)

BALOCHI LANGUAGE, the speech of the Baloches of Baluchistan, is older than Old Persian, the court language of the Achaemenides, as shown by the close relationship between it and the language of the Avesta. It is not a bastard Persian dialect. It has borrowed and is still borrowing numerous words from modern Arabic, modern Persian and from the modern Indian Prakrits.

The Alphabet.— The few Baloches who are able to write invariably use the Persian characters. There are altogether 35 letters. As a rule these are sounded as in Urdū. There are two exceptions. The Ar. *tha* or *thai* when not initial has the sound of

th in our words "health," "wealth," etc. In the same way the Ar. *thal* or *zāl* at the beginning of a word has the simple sound of our *z,* but when not initial it is sounded as *th* in the Eng words "mother," "brother," etc. It thus follows the rule just given for the letter *tha* or *thai.*

The Grammar.— There are no articles and no genders. Males are masculine and females feminine. Lifeless objects possess no gender.

There is only one declension, and all nouns and pronouns may be said to be declined alike. The gen. case sing. may end in *egh, egha, ena,* or in *ī.* Which is used depends on euphony and on the class of word. The dat. case sing. ends in *rd, ār, ar,* or in *dra.* The acc. case sing. is generally the same as the dat. Most nouns form their pl. by adding *āñ* to the sing. The gen. case pl. may end in *ānī,* or in *egh,* the dat. in *āñra, ānar* or *dr.* The accusative case does not greatly differ from the dative, Prepositions govern the noun in the oblique case (form *ā*) and postpositions govern the noun in the genitive case.

The adjective generally precedes its noun but may follow it. The comparative is formed by adding *-tir,* superlatives by words such as *sake* (very).

The numerals are regular and follow the Persian closely. The ordinals are formed by the addition of the syllable *mi* to the cardinals *e.g., chidr,* four, *chidr-umi,* fourth.

The pronouns are defective and slightly irregular. Their declension on the whole follows that of the substantive. Thus, *ma,* I; *ma-i, ma-igh,* of me; *ma-na,* to me: *mi,* we; *mā-ī, mā-īgh,* of us; *mā-r, mā-ra,* to us. *Thau,* though; *tha-ī, tha-igh,* of thee; *tha-ra,* to thee: *shwā,* you; *shwd-i, shwd-igh,* of you; *shwā-r, shwā-ra,* to you. There is no personal pronoun of the third person. The demonstratives *esh* and *āñ* take its place. Pronominal suffixes are used.

The particle *kih* takes the place of a rel, pronoun, just as it does in Persian.

The verb has two bases—the present or simple root and the past—formed from the present and usually ending in *-agh.* Some verbs are irregular in the past participles, which, in transitive verbs, are passive in signification, thus requiring the agent or oblique case. Consonantal changes accompany the past tenses. Who? is represented by *khai,* and whose? by *kha-ī* or *kha-igh.*

All verbs except a very few end in *agh.* Thus: *thashagh,* to run; *thash-āñ,* I may run; *thash-āñ.* I shall run, *thashagh-āñ,* I am running; *thashagh-ethāñ,* I was running; *thakhtagh-āñ,* I have run; *thakhtagh-ethāñ,* I had run; *thakhtath-āñ,* had I run; *thash-okh,* the runner. The verb substantive, used also as an auxiliary verb, is irregular.

The particles offer no difficulty.

There are slight differences to be expected among the numerous tribes. The literal translation shows the simplicity of the language. *Thau ba-kho ravagh-el?,* thou to—where going—art? *Ma wath-i logh-a ravagh-āñ,* I myself—of the—house—to going—am. *Tha-i logh 'sh-edha dir eñ,* thee—of the—house from—here far is? *Inna, ma-i logh nazikh eñ* no, me—of the—house near is. *Āñ mar azh kho ākhta,* that man from where came? *Ma-na kal n-el?,* me—to information not—is. *Tha-ra kal* bi, thee—to information must—be. *Āñ pha chih edha akhta,* he for why here came? *Ma rav-añ azh āñ-hīa phol khan-āñ, I* will go, from him enquiry will—make. *Āñ chih gushagh-e,* he what saying—is? *Āñ hachī phasav nah deagh-e,* he any reply not giving—is.

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The student should consult the *Linguistic Survey of India* (1921), vol. x., pp. 327 *sqq.* for further details and specimens of the language and its dialects. (G. W. GI.)

BALQUHIDDER (Gaelic, "the farm in the back-lying country"), village and parish, Perthshire, Scotland. Pop. of parish (1931) 619. The village lies 3m W. of the station of the same name on the L.M.S. railway from Callander to Oban, and 27¾m. N W. of Stirling, at the east end of Loch Voil. The Maclaurins held the district from the 9th century till their Macgregor neighbours slew the chief and ousted the clan in 1558. Rob Roy died here in 1734 and his grave in the old kirkyard is marked by a stone with rude carving, executed probably centuries before his time. Another ancient stone is said to cover the grave of Angus, the Columban missionary, who first did Christian work in this part of the Highlands.

BALRAMPUR, a town of British India near the river Rapti, in the Gonda district of the United Provinces. Pop. (1931) 16,723. It gives its name to one of the largest *talukdari* estates in the province. The then rajah Sir Drigbijai Singh, K.C.S.I., was conspicuously loyal during the Mutiny, and was rewarded with accessions of territory and hereditary privileges. His adopted son and heir maintained the family tradition of princely charities and wise management of his great estates.

The handsome palace is the only feature of importance in the town.

BALSA, the name given to a tree *(Ochroma lagopus)* of the bombax family (Bombacaceae), called also corkwood, native to tropical South America and noted for its exceedingly light wood (Span. *balsa,* a raft or float). The wood resembles clear white pine (*Pinus Strobus*) or basswood (*Tilia americana*) and has a velvety feel. Well-seasoned commercial balsa wood, which weighs only 7 lb. to 8 lb. per cu.ft., is the lightest wood known. Because of this extreme buoyancy, about twice that of cork, it is admirably adapted for making floats for life lines and life-preservers. Its resiliency makes it an excellent shock-absorbing material for packing pianos, finely finished furniture and similar articles, and also for foundation pads for machinery.

On account of its insulating properties, it is extensively used for lining incubators, refrigerators and cold-storage rooms. Its lightness combined with high insulating power renders it extremely valuable as a material for constructing the various containers used in dry-ice transportation. It is also employed in the construction of passenger compartments for aeroplanes. *(See* CORKWOOD; DRY-ICE.)

BALSAM, a term properly limited to such resins or oleo-resins as contain benzoic acid or cinnamic acid or both. Those balsams which conform to this definition make up a distinct class, allied by their composition, properties, and uses. Those found in commerce are the balsam of Peru, balsam of Tolu, liquid storax, and liquidambar. *Balsam of Peru* is the produce of a lofty leguminous tree, *Myroxylon pereirae,* growing within a limited area in El Salvador, Central America, and introduced into Ceylon. It is a thick deep brown or black, viscid oleo-resin having a fragrant balsamic odour. It is used in perfumery. Though contained in the pharmacopoeias it has no special medicinal virtues. *Balsam of Tolu* is produced from M. *balsamum.* It is brown, thicker than Peru balsam, and becomes solid on keeping. It also is a product of equatorial America. It is used in perfumery and as a constituent in cough syrups and lozenges. *Liquid storax* or *Styrax preparatus* is *a* balsam yielded by *Liquidambar orientalis,* a native of Asia Minor. It is a soft resinous substance, with a pleasing balsamic odour, especially after it has been kept for some time. It is used in medicine as an external application in some parasitic skin diseases, and internally as an expectorant. An analogous substance is derived from *Altingia excelsa* in Java. *Liquidambar balsam* is derived from *Liquidambar styraciflua,* a tree found in the United States and Mexico. It contains cinnamic acid, but not benzoic acid.

Of so-called balsams, entirely destitute of cinnamic and benzoic constituents, the following are found in commerce: *Mecca balsam* or *Balm of Gilead,* from *Commiphora opobalsamum,* a tree growing in Arabia and Abyssinia. When fresh it is a viscid fluid, with a penetrating odour, but it solidifies with age. For *balsam of copaiba* see COPAIBA. Under the name of *wood oil,* or *Gurjun balsam,* an oleo-resin is procured in India and the Eastern Archipelago from several species of *Dipterocarpus,* chiefly D. *turbinatus,* which has the odour and properties of copaiba and has been used for the same purposes. Wood oil is also used as a varnish in India and forms an effective protection against the attacks of white ants. *Canada balsam* or *Canada turpentine* is the oleo-resin yielded by *Abies balsanzea,* a tree that grows in Canada and the northern parts of the United States. It is transparent, somewhat fluid when first run, but thickening considerably with age, possessed of a

delicate yellow colour and a mild terebinthous odour. It contains 24% of essential oil, 60% of resin soluble in alcohol, and 16% of resin soluble only in ether. Its chief uses are for mounting preparations for the microscope and as a cement for glass in optical work.

The garden balsam is an annual plant, *Impatiens balsamina*, family Balsaminaceae, and the balsam apple is the fruit of *Momordica balsamina*, family Cucurbitaceae.

BALSHAM, HUGH DE (d. 1286), English churchman, appears first as sub-prior of the monastic cathedral of Ely. On the death of William of Kilkenny in 12 j6 the monks elected him bishop of Ely, to the annoyance of Henry III., who had the temporalities given to John de Waleran. The election was confirmed by the pope in 1257 and Hugh set to work to repair the harm done by the intruder. In 1280 the bishop obtained a charter allowing him to replace the secular brethren residing in his hospital of St. John at Cambridge by "studious scholars"; a second charter four years later entirely differentiated these scholars from the brethren of the hospital, and for them Hugh de Balsham founded and endowed the college of Peterhouse at Cambridge.

BALTA, the chief town of the autonomous Moldavian S.S.R. Lat. 47° 55' N., Long. 29" 35' E. Pop. (1926) 21,374. It is linked by road and rail with Odessa and Kiev and has annual fairs, mainly dealing in cattle, horses, grain and hide. It has tallow-melting, soap boiling, tile-making and brewing industries. The town was formerly the residence of the Podolian voivode and was almost destroyed by the Russians in 1780, but after the peace of Jassy, 1792, when the Dniester was recognized as a frontier, Balta became definitely a Russian town.

BALTARD, LOUIS PIERRE (1764–1846), French architect and engraver, was born in Paris on July 9, 1764, and died there on Jan. 22, 1846. He was selected to prepare the plans for some of the largest public edifices in Paris. His reputation, however, is chiefly based on his great skill in engraving. Among the best known of his plates are the drawings of Paris, *Paris et ses monuments* (1803), the engravings for Denon's *Égypte*, the illustrations of Napoleon's wars (La *Colonne de la grande armée*), and those contained in the series entitled the *Grand prix de l'architecture*. His son Victor Baltard (1805–1874) designed the Paris Halles in 1851.

BALTIC, THE. A famous London Exchange; a market for the purchase and sale of cereals. Its full name is The Baltic Mercantile and Shipping Exchange. Shipowners and others interested in cargoes, as well as brokers, find it necessary to become members of this institution.

Originally, when merchants trading with Baltic ports foregathered for business, they met at a London coffee house; the exact date as to when it was first used cannot be traced, but in a newspaper published in 1744 an advertisement was published stating that the Baltic Coffee House would be removed to Threadneedle street. To-day the name "Baltic" is something of a misnomer, for, although it is quite true that some of the business transacted on the Exchange is connected with produce from the countries surrounding the Baltic Sea, its members deal in commodities from every other part of the world. In the old days, the members of the Baltic Coffee House were limited to 300; today the membership of The Baltic is about 2,000.

Large transactions in wheat, maize, barley and other products take place every day. Every transaction is by word of mouth; no written contracts or notes pass between the buyers or sellers, or brokers and shipowners. Nevertheless, it is very seldom that any difficulties arise that cannot be adjusted, the contracts being completed on the return of the members to their offices.

BALTIC SEA, a sea extending between 54° and 66" N. lat. and 9° and 30° E. long. surrounded by Sweden, Denmark, Germany, Poland, Lithuania, Latvia. Estonia. Russia and Finland (German *Ostsee;* Russ. *Baltiyskoe More*). The main axis runs approximately south-west to north-east and the distance from Kiel to Haparanda is 1,700 kilometres. It connects with the North sea by a channel between south Scandinavia and Denmark; the part north and west of the Skaw is called the Skagerrak and resembles the North sea, the part south of this line is the Kattegat and is the outer part of the Baltic. At its southern end the Kattegat is blocked by the Danish islands save for the Sound, the Great Belt and the Little Belt which communicate with the Baltic proper. There are several deep areas, the Arcona (50 metres) north of Rügen, the deep (105 metres) east of Bornholm, separated by the Middlebank from the Gottland (249 metres) which extends north-eastwards to the Gulf of Finland. Beyond the Middlebank, to the south-east, is the Danzig deep (113 metres). Along the Swedish coast a deep channel runs northward from outside the island of Öland; this is entirely cut off to the south and east by a bank which sweeps eastward and northward from near Karlskrona, and on which the island of Gottland stands, but it communicates at its northern end with the Gottland deep, and near the junction opposite Landsort is the deepest part of the Baltic (420 metres). On the east is the large shallow Gulf of Riga, not more than 46 metres deep. Lat. 60" N. marks the boundary between the Baltic proper and the Gulf of Bothnia and on it lie the Aland islands, to the west of which (Alands Haf) the sea is deep (237 metres) whereas to the east it is shallow. In the Gulf of Bothnia depths of more than zoo metres are reached, but north of the Nord Kvarken, situated on a submarine ridge, depths of only 100 metres or less are found in Bothnia-Wick. The most recent estimate of the area is 422,300km., including the Kattegat, and the mean depth is 55 metres.

Bottom Deposits.—In the deeper hollows in the south part of the Baltic the bottom consists almost invariably of either soft brown or grey mud or hard clay, while on the shallow banks and near the low coasts fine sand, of white, yellow or brown colour with small pebbles, is usually found. There are several areas of stony bottom, some of which are dangerous to ships, *e.g.* "Adlergrund" (only 6 metres) between Bornholm and Riigen. These are clearly remains of glacial moraines and they greatly hinder trawling. They may be compared with the Borkum bank in the North sea.

Coast Changes.—At some period during, or between the cold phases of, the Pleistocene ice age an arm of the sea extended across Sweden, submerging a great part of the littoral up to the Gulf of Bothnia, and including the present lakes Vener, Hjelmar and Mâlar. During this period the waters of the northern Baltic were sufficiently salt for oysters to flourish. Subsequent upheaval restricted direct communication with the open sea to the Danish channels, and the Baltic waters became fresher; the oyster disappeared, but a number of cold salt-water fishes and crustaceans, and even seals, became acclimatized. The Baltic was next elevated into a vast freshwater lake, the *Ancylus* lake of *G.* de Geer (named from the remains of the mollusc *Ancylus fluviatilis),* which is supposed to have included the whole of the present Baltic area and a large part of Finland, with Lake Ladoga. Then followed a subsidence, which not only re-established communication through the Danish channels, but allowed the Baltic to become sufficiently salt for such forms as *Littorina littorea* (Littorina period). At this time the Gulf of Bothnia must have suffered greater depression than the Baltic proper, for the deposits of that epoch show a thickness of 100 metres near Hernosand, but only 25 metres in the neighbourhood of Gottland. After this period of subsidence the process of elevation set in which gave the Baltic its present form and physical condition, and appears to be still in progress. The Gulf of Bothnia has been more strongly uplifted than the Baltic proper, just as previously it sank more. Hogbom (1913) showed, through the drawing of isobasic lines (lines of equal elevation), that the centre of the movement is in the Nord Kvarken and that the German Baltic coast has probably not moved up or down since the end of the ice age. Witting (1918) calculated a reduction of depth of about 0·2cm. per annum near Gottland, about 0·5cm. near Stockholm, 1cm. or more in the Bothnia Wick. This last has put out of use the former harbours of Vaasa, Kokkola (Gamla Karleby) and Raahe (Brahestad).

Coasts.—The coast of the Baltic is rocky only in the island-studded region at the head of the Baltic basin proper—a submerged lake-district—and the littoral generally is typically morainic. From Slesvig Nord eastwards to Liibeck bay the coast is pierced by a number of narrow openings or *Fohrden,* the result

of encroachment of the sea caused by subsidence. East of Liibeck, as far as the mouth of the Oder, these give place to *Bodden,* ramified openings studded with islands. Beyond the Oder the coast-line is unbroken as far as the Gulf of Danzig. It is then cut into by the estuaries of the Vistula, the Pregel and the Memel. Here the westerly winds have full play, and the coast is rimmed by a continuous line of dunes, which cut off the two great lagoons of the *Frisches Haff* and *Kurisches Haff* by sandspits or *Nehrungen.*

Baltic Levels.—If we start from a point in the North sea we find that the surface in the Kattegat is 10cm. higher, between Rügen and Bornholm 22cm., near Stockholm 31cm., and near Haparanda, as well as near Viipuri (Viborg) and Leningrad, 38cm. and more higher. The westerly winds tend to press the water eastwards but another factor is the large contribution of river water, which is lighter than sea water so that for equilibrium the surface in the Baltic must be above that of the North sea. The mean annual range of level is 11–15cm., the highest point being reached on the average at the end of summer, August being often rainy, the lowest point is usually noted in spring which is usually dry and attended by south-east winds which drive some of the water towards the North sea. Occasional north-east gales in winter, with snow and ice, are apt to cause devastating storm-floods on the south Baltic coasts. On Nov. 12–13, 1872, a great storm flood occurred, also in Nov. 1899 when the level of the sea was raised by 3–4 metres and enormous losses resulted. The tidal range at the Skaw is 0.28 metres, near Kiel only 0·07 metres, near Swinemunde 0·01 metres and near Memel 0·005 metres, so that the Baltic may be called tideless.

"The Freshwater Drainage Area."—This is estimated by Spethmann (1912) at 1,657,000km.; the most extensive river basin is that of the Neva, those of Vistula and Oder follow in size. The Baltic receives much more water by rainfall, discharge of rivers, etc., than it loses by evaporation; hence an enormous surplus must be got rid of by an outflowing current which is named the "Baltic Stream." This must be a surface current, because it originates from a redundancy of fresh water. On account of the earth's rotation, the main part of the Baltic stream must keep close to the coast of the Scandinavian peninsula. It must be a periodic stream, because the discharge of the rivers into the Baltic varies with the season of the year. In spring and summer the water from the Baltic is sufficiently abundant to cover the whole surface of the Kattegat and Skagerrak, but in winter the sources of the Baltic current are for a great part dried up by the freezing of the land water. From near Stockholm this Baltic stream flows south, along the south Swedish coast it goes west, and in the Sound and the Belts its direction is northwards. The fresher Baltic water can be traced far into the North sea especially along the Norway coasts even as far as North Cape. In the Baltic proper it includes the surface waters down to a depth of 30 to 50cm. and has a salinity of 6–8‰. Under this is a thin almost stagnant layer at a depth of 50–60cm., very cold even in summer (36·5°–39°). Beneath this, again, the water is warmer and more salt and belongs to an undercurrent coming in from the North sea. Salinities for this undercurrent are 30‰ in the Kattegat, 20‰ in the Great Belt, 13‰ in the Gottland deep. It flows quite irregularly into the Baltic and is inhabited by marine organisms which use up its oxygen content to such an extent that free carbon dioxide has been found in the mid and east Baltic. This is probably a factor of the poverty of the Baltic sea floor in fish-life.

Climate.—Climatic influences of the Baltic on neighbouring lands are slight and unusual. The relatively fresh surface water freezes over large coastal stretches and the melting of this ice in spring retards rise in temperature seriously, as compared with the rise over inland areas. The air over the Baltic in winter is only 2°–3½° warmer, in summer only 2°–3½° colder than that over the neighbouring lands. The sea near Haparanda has a mean January temperature of +14°, between Stockholm and the Aland island 28·5°, near Bornholm 32°, while the corresponding July temperatures are 57" (Haparanda), 61° (Aland island), 61·5° (Bornholm). This shows that differences between north and south are very great in winter but almost vanish in summer. On the west and south coasts of Sweden navigation is impeded by ice only in severe winters and then it is usually drift ice, compact sea-ice being very rare at present, as it has been through the 19th century.

Formerly, however, the south Baltic including the Kattegat and Skagerrak froze on several occasions; it was possible to go from Norway to Jutland over the ice in 1294, to cross similarly from Denmark to Pomerania in 1323, 1349, 1459 and 1545. In 1659 Charles X. of Sweden marched 20,000 men across the Sound and the Belts to Jutland, and the Sound last froze in 1740. O. Pettersson thinks that the salinity of Baltic waters was formerly much lower than now and that this promoted freezing. Unless strong icebreakers keep channels open, navigation between Stockholm and Visby stops between the end of December and about April 10. In very severe winters the Aland sea is covered with thick ice available for traffic. The south part of the Gulf of Bothnia is covered with ice every winter along the coasts, but rarely, if ever, in its central part. Navigation is interrupted by drifting ice from about the middle of November to the beginning of May, though the port of Hernosand has been known to remain in some years open during the whole winter. The northern part of the Gulf of Bothnia is frozen every winter for 120 to 210 days (near Haparanda). In the Gulf of Finland the sea is closed to navigation by ice for about 150 days in the year; but navigation is rendered possible throughout the winter by the use of ice-breakers, except in a very severe winter such as was, for example, 1925–26.

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